



Accredited Grade "A" by NAAC
(3rd Cycle)

SAURASHTRA UNIVERSITY

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નં.એકે/બીએસ/ ૪૮૬ /૨૦૨૧

તા ૨૭-૬-૨૦૨૧
માઇક્રોબાયોલોજી

પરિપત્ર:-

આથી સૌરાષ્ટ્ર યુનિવર્સિટીની વિજ્ઞાન વિદ્યાશાખા હેઠળની સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓને સવિનય જણાવવાનું કે, ચેરમેનશ્રી, માઇક્રોબાયોલોજી વિષયની અભ્યાસ સમિતિ તથા ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખાએ અધિકાર મંડળોની બહાલીની અપેક્ષાએ બી.એસ.સી. માઇક્રોબાયોલોજીનો સેમેસ્ટર 'પ' અને ૬'નો સુધારેલ અભ્યાસક્રમ જુન-૨૦૨૧થી અમલમાં આવે તે રીતે મંજૂર કરવા માન. કુલપતિશ્રીને ભલામણ કરેલ. તદઅન્વયે ઉક્ત બી.એસ.સી. માઇક્રોબાયોલોજી વિષયનો સેમેસ્ટર 'પ' અને ૬'નો સુધારેલ અભ્યાસક્રમ અધિકાર મંડળોની બહાલીની અપેક્ષાએ જુન-૨૦૨૧થી અમલમાં આવે તે રીતે માન.કુલપતિશ્રીએ મંજૂર કરેલ છે. જેથી સર્વે સંબંધિતોને તેનો તે મુજબ અમલ કરવા વિનંતી.

(ઉક્ત અભ્યાસક્રમ સૌરાષ્ટ્ર યુનિવર્સિટીની website:- saurashtrauniversity.edu → student → ug syllabus પર ઉપલબ્ધ છે.)

સહી/-

(ડો. જે. એચ. સોની)

I/C. કુલસચિવ

બિડાણ :- ઉક્ત અભ્યાસક્રમ (સોફ્ટ કોપી)

પ્રતિ,

(૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સર્વે સંલગ્ન કોલેજોના આચાર્યશ્રીઓ તરફ...

નકલ જાણ અર્થે સાદર રવાના:-

૧. માન. કુલપતિશ્રી/ માન. ઉપકુલપતિશ્રી/કુલસચિવશ્રીના અંગત સચિવશ્રી

નકલ રવાના (યોગ્ય કાર્યવાહી અર્થે) :-

૧. ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨. પરીક્ષા નિયામકશ્રી (ઈ-મેઈલનાં માધ્યમથી)
૩. પી.જી.ટી.આર.વિભાગ
૪. ડાયરેક્ટરશ્રી, કોમ્પ્યુટર સેન્ટર(વેબસાઈટ ઉપર પ્રસિધ્ધ કરવા અર્થે)

SAURASHTRA UNIVERSITY

Accredited at "A" Level by NAAC (CGPA 3.05)?????



COURSE STRUCTURE & SYLLABUS FOR UNDERGRADUATE PROGRAMME IN

MICROBIOLOGY



(CORE COURSE FOR SEMESTER V&VI)

(As per Choice Based Credit System as recommended by UGC)

Effective from June - 2021

PREFACE

Timely revision of the Curriculum to encompass new knowledge and information is a prime criterion of IQAC – NAAC and prime need for the college educational systems affiliated to Universities. Under Choice Based Credit system, as advocated by University Grants Commission, a student must be offered latest courses with societal, environmental and economic implications

Microbiology is a foundation subject for Biotechnology, Genetic engineering, Molecular biology, Biochemistry, Bioinformatics and Medical Microbiology and hence holds the central position in the curriculum of these subjects. Looking to the rapid inventions and technological developments in the field of Microbiology as well as keeping in view the recommendations of UGC and Saurashtra University, this syllabus has been formulated by the combined and coordinated efforts of all the faculty members of all the Microbiology Departments of Colleges affiliated to Saurashtra University.

Composition of Curriculum for a particular subject requires following criteria to be considered:

1. Guidelines and Model curriculum given by the UGC and the University
2. Regional needs and Present National and International trends in the subject
3. Geographical parameters of the University and its demographic property
4. Relationship with other related subjects
5. Financial and statutory provisions of the State government
6. Resources of Educational needs.

The content of a syllabus should be such that it maintains continuity with the course content of higher secondary class and post graduate course. The present curriculum is made keeping this in mind and is an effort to impart fundamental knowledge of the subject needed at this level. The curriculum is designed as per the guidelines for Choice Based Credit System and reflects the total credit, teaching hours and question paper style of the paper. The units of the syllabus are well defined and the scope of each is given in detail. A list of reference books is provided at the end of each course. Microbiology being an experimental science, sufficient emphasis is given in the syllabus for training in laboratory skills and instrumentation. Following objectives have been considered while formulation of the curriculum:

1. To provide an updated, feasible and modern syllabus to the students, with equal emphasis on Knowledge and skill, to build up their valuable college educational and job-oriented carrier.
2. To frame syllabus in accordance with the semester system and CBCS system and in consultation with all stake holders.
3. Establishment of 10 Paper statuses up to Graduate level in the Saurashtra University

The authorities of Saurashtra University and the Dean of Science Faculty provided valuable guidelines and facilities for the same for which, the Board of Studies for Microbiology expresses its heartfelt gratitude. The Board wishes all the students pursuing Microbiology a very bright future.



(Dr. Neepa Pandhi)
Chairman, Board of Studies, Microbiology
Saurashtra University, Rajkot (Gujarat)
Date :21st June 2019

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SAURASHTRA UNIVERSITY - FACULTY OF SCIENCE

CBCS BASED COURSE STRUCTURE FOR SEMESTER 1 TO 6 & SYLLABUS FOR SEMESTER 5&6 FOR UNDERGRADUATE PROGRAMME IN MICROBIOLOGY TO BE EFFECTIVE FROM JUNE 2019 AND JUNE 2021 RESPECTIVELY

No	Diploma/ Graduate/ Post Graduate	Semester	Title Of Paper	Paper No.	Credits	Internal Marks	External Marks	Practical & Viva Marks	Total Marks	Unique Code No. of Paper							
										Year	Facult	Subjec	Course Group	Level	Semest er	Paper No.	Option
1	Graduate	01	Fundamentals of Microbiology	MB 101	6	30	70	50	150	2019	03	05	-	01	01	01	-
2	Graduate	02	Basics of Biochemistry & Microbial Control	MB 201	6	30	70	50	150	2019	03	05	-	01	02	02	-
3	Graduate	03	Microbial Diversity	MB 301	6	30	70	50	150	2020	03	05	-	01	03	03	-
4	Graduate	04	Applied & Environmental Microbiology	MB 401	6	30	70	50	150	2020	03	05	-	01	04	04	-
5	Graduate	05	Immunology	MB 501	6	30	70	50	150	2021	03	05	-	01	05	05	-
6	Graduate	05	Bacterial Metabolism	MB 502	6	30	70	50	150	2021	03	05	-	01	05	06	-
7	Graduate	05	Molecular Biology and Genetic Engineering	MB 503	6	30	70	50	150	2021	03	05	-	01	05	07	-
8	Graduate	06	Fermentation Technology	MB 601	6	30	70	50	150	2021	03	05	-	01	06	08	-
9	Graduate	06	Bio - Analytical Techniques	MB 602	6	30	70	50	150	2021	03	05	-	01	06	09	-
10	Graduate	06	Clinical and Diagnostic Microbiology	MB 603	6	30	70	50	150	2021	03	05	-	01	06	10	-
11	Graduate	06	Research /Review/Survey Project	-----	4	-----	-----	100	100	2021	03	05	-	01	06	11	-

COURSE STRUCTURE FOR UG PROGRAM AND CREDIT SYSTEM

SKELETON OF COMPLETE COURSE CONTENT OF UNDER GRADUATE MICROBIOLOGY (SEMESTER I TO VI)

SEMESTER	PAPER NO. & CODE	TITLE OF THE PAPER	CREDIT
I	MB-101 (Theory)	Fundamentals of Microbiology	6
	MB-101 (Practical)	-do-	3
II	MB-201 (Theory)	Basics of Biochemistry and Microbial Control	6
	MB-201 (Practical)	-do-	3
III	MB-301 (Theory)	Microbial Diversity	6
	MB-301 (Practical)	-do-	3
IV	MB-401 (Theory)	Applied and Environmental Microbiology	6
	MB-401 (Practical)	-do-	3
V	MB-501 (Theory)	Immunology	6
	MB-501 (Practical)	-do-	3
	MB-502 (Theory)	Bacterial Metabolism	6
	MB-502 (Practical)	-do-	3
	MB-503 (Theory)	Molecular Biology and Genetic Engineering	6
	MB-503 (Practical)	-do-	3
VI	MB-601 (Theory)	Fermentation Technology	6
	MB-601 (Practical)	-do-	3
	MB-602 (Theory)	Bio-Analytical Techniques	6
	MB-602 (Practical)	-do-	3
	MB-603 (Theory)	Clinical and Diagnostic Microbiology	6
	MB-603 (Practical)	-do-	3
	Research/Review/Survey Project	A Compulsory component of the syllabus	4

SYLLABUS FORMAT OF SEMESTER 5 AND 6

Stream	Paper	Unit	Title of Unit	Credit	Lectures	Marks		
						External	Internal	
B.Sc. Sem-5 (UG) Paper- 501	MB-501 IMMUNOLOGY THEORY CREDIT (06)	1	IMMUNITY AND IMMUNE SYSTEM	1.2	12	70	14	30
		2	ANTIGEN AND ANTIBODY	1.2	12		14	
		3	IMMUNE RESPONSE	1.2	12		14	
		4	DYSFUNCTIONAL IMMUNITY	1.2	12		14	
		5	NORMAL FLORA AND INFECTION	1.2	12		14	
	Total				06	60	100	
	MB501 IMMUNOLOGY PRACTICAL CREDIT (03)		HAEMATOLOGY AND SEROLOGY		03	30	35	15
Total				03	30	50		
B.Sc. Sem-5 (UG) Paper- 502	MB- 502 BACTERIAL METABOLISM THEORY CREDIT (06)	1	INTRODUCTION TO METABOLISM, BIOENERGATICS AND ENZYME KINETICS	1.2	12	70	14	30
		2	HETEROTROPHIC MODE OF METABOLISM	1.2	12		14	
		3	ENERGY GENERATION AND ANABOLISM	1.2	12		14	
		4	SELECTED ASPECTS OF METABOLISM IN SPECIFIC MICROBIOAL SYSTEMS	1.2	12		14	
		5	MEMBRANE BIOLOGY	1.2	12		14	
	Total				06	60	100	
	MB502 BACTERIAL METABOLISM PRACTICAL CREDIT (03)		ENZYME KINETICS		03	30	35	15
Total				03	30	50		

Stream	Paper	Unit	Title of Unit	Credit	Lectures	Marks		
						External	Internal	
B.Sc. Sem-5 (UG) Paper- 503	MB- 503 MOLECULAR BIOLOGY AND GENETIC ENGINEERING THEORY CREDIT (06)	1	FUNDAMENTALS OF GENETICS	1.2	12	70	14	30
		2	GENE EXPRESSION AND REGULATION	1.2	12		14	
		3	GENETRANSFER AND RECOMBINATION	1.2	12		14	
		4	MUTATION AND DNA REPAIR	1.2	12		14	
		5	GENETIC ENGINEERING AND PROTEIN ENGINEERING	1.2	12		14	
	Total			06	60	100		
	MB503 MOLECULAR BIOLOGY AND GENETIC ENGINEERING PRACTICAL CREDIT (03)		BASIC MOLECULAR BIOLOGY AND GENETIC ENGINEERING		03	30	35	15
Total			03	30	50			
B.Sc. Sem-6 (UG) Paper- 601	MB- 601 FERMENTATION TECHNOLOGY THEORY CREDIT (06)	1	FERMENTATION TECHNOLOGY AND INDUSTRIALLY IMPORTANT MICROORGANISMS	1.2	12	70	14	30
		2	FERMENTATION MEDIA FORMULATION	1.2	12		14	
		3	FERMENTOR DESIGN AND ASEPTIC OPERATION	1.2	12		14	
		4	OVERVIEW OF DOWN STREAM PROCESS	1.2	12		14	
		5	STUDY OF SELECTED FERMENTATION PROCESSES	1.2	12		14	
	Total			06	60	100		
	MB601 FERMENTATION TECHNOLOGY PRACTICAL CREDIT (03)		FERMENTATION PROCESS AND ANALYSIS		03	30	35	15
Total			03	30	50			

Stream	Paper	Unit	Title of Unit	Credit	Lectures	Marks		
						External	Internal	
B.Sc. Sem-6 (UG) Paper- 602	MB-602 BIO- ANALYTICAL TECHNIQUES CREDIT (06)	1	BASIC BIOANALYTICAL TECHNIQUES IN BIOSCIENCES	1.2	12	70	14	30
		2	PRINCIPLES AND THEORIES OF CHROMATOGRAPHY	1.2	12		14	
		3	MOLECULAR TECHNIQUES AND BIOSENSOR TECHNOLOGY	1.2	12		14	
		4	MODERN ANALYTICAL TECHNIQUES	1.2	12		14	
		5	BIOINFORMATICS	1.2	12		14	
	Total				06	60	100	
	MB-602 BIO-ANALYTICAL TECHNIQUES PRACTICAL CREDIT (03)		ANALYSIS OF BIOMOLECULES		03	30	35	15
Total				03	30	50		
B.Sc. Sem-6 (UG) Paper- 603	MB- 603 CLINICAL NAD DIAGNOSTIC MICROBIOLOGY THEORY CREDIT (06)	1	HAEMATOLOGY	1.2	12	70	14	30
		2	SEROLOGY	1.2	12		14	
		3	CONVENTIONAL AND ADVANSED DIAGNOSTIC TECHNIQUES	1.2	12		14	
		4	EPIDEMIOLOGY AND MICROBIAL AGENTS OF DISEASES (BACTERIA AND FUNGI)	1.2	12		14	
		5	MICROBIAL AGENT OF DISEASES (VIRUS) AND PROPHYLAXIX	1.2	12		14	
	Total				06	60	100	
	MB-603 CLINICAL NAD DIAGNOSTIC MICROBIOLOGY PRACTICAL CREDIT (03)		VARIOUS DIAGNOSTIC TECHNIQUES		03	30	35	15
Total				03	30	50		

GENERAL INSTRUCTIONS

- 1) The Medium of Instruction will be English for Theory and practical course
- 2) There will be 6 Lectures / Week / Theory Paper / Semester.
- 3) Each Lecture (Period) will be of 55 Mins. (1 Period = 55 Mins).
- 4) There will be 3 Practical / Week / Paper / Batch. Each Practical will be of 3 Periods (1 Period 55 Mins.).
- 5) Each Semester Theory Paper will be of FIVE Units. There will be 60 Hrs. of Theory teaching / Paper / Semester.
- 6) Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks. So, Total Marks of Theory and Practical for each Paper will be 150. (100+50 = 150)
- 7) A Research / Review / Survey project is a compulsory part of the curriculum which carries 4 credit and 100 marks. The work will be evaluated at the end of the semester along with Practical examination in the form of Viva voce and the submission of the thesis / project report.

Instructions to the Candidates for Practical Examination:

- 1) The practical examination will be conducted for THREE (3) days.
- 2) The Time duration of practical examination will be of SIX (6) hrs on all the three days
- 3) All the students have to remain present at the examination centre 15 minutes before the scheduled time for examination.
- 4) Students have to carry with them Certified journal, I-card or examination receipt, Slide box, Apron and all other necessary requirements for examination.
- 5) Candidate should not leave the laboratory without the permission of examiner.
- 6) Use of calculator is allowed but the use of Mobile phones is strictly prohibited.
- 7) The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

SKELETON OF THEORY EXAMINATION (EXTERNAL)

QUESTION 1 – UNIT 1		
Q 1 A	Objective type questions	4 Marks
Q 1 B	Answer in brief(Any 1 out of 2)	2 Marks
Q 1 C	Answer in detail(Any 1 out of 2)	3 Marks
Q 1 D	Write a note on(Any 1 out of 2)	5 Marks
QUESTION 2 – UNIT 2		
Q 2 A	Answer in brief(Any 1 out of 2)	4 Marks
Q 2 B	Answer in brief(Any 1 out of 2)	2 Marks
Q 2 C	Answer in detail(Any 1 out of 2)	3 Marks
Q 2 D	Write a note on(Any 1 out of 2)	5 Marks
QUESTION 3 – UNIT 3		
Q 3 A	Objective type questions	4 Marks
Q 3 B	Answer in brief(Any 1 out of 2)	2 Marks
Q 3 C	Answer in detail(Any 1 out of 2)	3 Marks
Q 3 D	Write a note on(Any 1 out of 2)	5 Marks
QUESTION 4 – UNIT 4		
Q 4 A	Objective type questions	4 Marks
Q 4 B	Answer in brief(Any 1 out of 2)	2 Marks
Q 4 C	Answer in detail(Any 1 out of 2)	3 Marks
Q 4 D	Write a note on(Any 1 out of 2)	5 Marks
QUESTION 5 – UNIT 5		
Q 5 A	Objective type questions	4 Marks
Q 5 B	Answer in brief(Any 1 out of 2)	2 Marks
Q 5 C	Answer in detail(Any 1 out of 2)	3 Marks
Q 5 D	Write a note on(Any 1 out of 2)	5 Marks
TOTAL MARKS : 70 TOTAL TIME : 2½ HOURS		

SKELETON OF PRACTICAL EXAMINATION (EXTERNAL)

SEMESTER – V and VI:

SECTION- I: EXAMINER –I
(EXTERNAL)

Ex. No.	Detail of Exercise	Marks	Day to begin the exercise
1	Perform any one from the given list of exercises as per the instruction of the examiner exercise	20	1 st Day
5	Viva-voce	10	1 st / 2 nd Day
6	Certified Journal	10	1 st / 2 nd Day
Total Marks			40

SECTION- II: EXAMINER –II
(INTERNAL)

Ex. No.	Detail of Exercise	Marks	Day to begin the exercise
2	Perform any one from the given list of exercises as per the instruction of the examiner exercise	25	1 st / 2 nd Day
3	Perform any one from the given list of exercises as per the instruction of the examiner exercise	25	1 st / 2 nd Day
3	Spotting	10	1 st / 2 nd Day
4	Viva-voce	05	1 st / 2 nd Day
Total Marks			65

**INTERNAL EVALUATION FOR SEMESTER V & VI
(THEORY)**

No.	Pattern of Internal Evaluation	Marks
1	Assignment	10
	MCQ Test	10
	Seminar/Presentation	10
OR		
2	MCQ Test	30
OR		
3	Assignment	10
	MCQ Test	20
OR		
4	Seminar/Presentation	10
	MCQ Test	20

**INTERNAL EVALUATION FOR SEMESTER V & VI
(PRACTICAL)**

No.	Pattern of Internal Evaluation	Marks
1	Reagent Preparation/Calculation	15
2	Practical Performance/Test	15
3	Viva	15

**LIST OF INSTRUMENTS FOR
MICROBIOLOGY SEMESTER 5 AND 6**

No.	Name of Instrument
1	Compound Microscopes
2	Autoclave
3	Incubator
4	Hot air oven
5	Vortex mixer
6	Water bath
7	Heating mantle
8	Magnetic stirrer
9	UV chamber
10	Inoculation chamber
11	pH meter
12	Colony counter
13	Refrigerator
14	Bunsen burner
15	Micrometer (stage and ocular)
16	Colorimeter
17	Membrane filter set
18	Centrifuge
19	Electronic shaker Incubator
20	Electronic Analytical Balance
21	Double-pan Analytical Balance
22	Spectrophotometer
23	Computers
24	Water distillation system
25	Haemocytometers
26	Inspissator

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-501:IMMUNOLOGY
(THEORY)

Unit 1: IMMUNITY AND IMMUNE SYSTEM
(Credit-1.2, Teaching Hours-12, Marks-14)

- 1.1 Types of immunity: Natural, Acquired, herd, Innate, specific.
- 1.2 Structure, functions and properties of Immune Cells: – Stem cell, T cell, B cell, NKcell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cells.
- 1.3 Structure, functions and properties of Immune Organs: – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.
- 1.4 Properties of immune system: Discrimination, Specificity, Memory, Transferability & Diversity.
- 1.5 Introduction to Immune response.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C.Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 2: ANTIGEN AND ANTIBODY
(Credit-1.2, Teaching Hours-12, Marks-14)

A. Antigen

- 2.1 Definition & types of microbial antigens.
- 2.2 Factors influencing Immunogenicity& Adjuvant, Epitopes and Haptens.

B. Antibody

- 2.3 Basic structure of Antibody& Immunoglobulin classes and their Biological functions.
- 2.4 Antibody Diversity and Clonal Selection Theory.
- 2.5 Overview of Monoclonal Antibody and polyclonal antibody.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.

2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., & Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija. (2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 3: IMMUNE RESPONSE

(Credit-1.2, Teaching Hours-12, Marks-14)

- 3.1 Structure and properties of class I and II MHC.
- 3.2 Antigen processing and presentation. (Endogenous and Exogenous pathways)
- 3.3 Generation of Humoral Immune Response (Plasma and Memory cells).
- 3.4 Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co-stimulatory signals)
- 3.5 Cytokines, Phagocytosis, Inflammation, Opsonisation and Complement system: overview.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., & Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija. (2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 4: DYSFUNCTIONAL IMMUNITY

(Credit-1.2, Teaching Hours-12, Marks-14)

- 4.1 Immunodeficiency Diseases
- 4.2 Hypersensitivity
- 4.3 Autoimmune diseases
- 4.4 Overview of Tumor immunity
- 4.5 Overview of Transplantation immunity

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's

microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.

4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 5: NORMAL FLORA AND INFECTION

(Credit-1.2, Teaching Hours-12, Marks-14)

- 5.1 Normal flora of healthy human host: Introduction & types.
- 5.2 Host –microbe interactions: Process of Infection, Pathogenicity and Virulence.
- 5.3 Microbial adherence: Penetration of epithelial cell layers and events in infection following penetration.
- 5.4 Microbial virulence factors.
- 5.5 Vaccines: Conventional and Modern approaches.

REFERENCE BOOKS

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-501:IMMUNOLOGY
(PRACTICAL)

1. Microscopic observation and Identification of blood cells
2. Total count of RBC
3. Total count of WBC
4. Differential count of WBC
5. Isolation of normal flora of skin
6. Isolation of normal flora of mouth
7. Understanding of the medical problems (**Case Study**)

REFERENCE BOOKS

1. Talwar, G. P., & Gupta, S. K. (1992). A Handbook of Practical and Clinical Immunology. New Delhi: CBS Publishers & Distributors.
2. Medical Laboratory Technology – Vol – I, II, III – Mukherji K.L. 2nd edition. Tata McGraw-Hill Education.
3. Godkar, P. B., & Godkar, P. D. (2005). Text Book of Medical Laboratory Technology: Basic Histopathologic Techniques and the Laboratory Requirements. Bhalani Publishing House.
4. Cappuccino, J. G., & Welsh, C. Microbiology: A laboratory manual. 5th -12th edition. Benjamin Cummings Black & White & Pearson.
5. Experimental Microbiology (volume 1 & 2) by Rakesh Patel. 3rd Edition. Aditya Publishers.
6. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-502: BACTERIAL METABOLISM
(THEORY)

UNIT 1: INTRODUCTION TO METABOLISM, BIOENERGETICS AND ENZYME KINETICS
(Credit- 1.2, Teaching Hours-12, Marks-14)

- 1.1 General Overview of metabolism: Primary & Secondary metabolites & their significance
- 1.2 Bioenergetics : The concept of free energy, Determination of ΔG & Energy rich compounds
- 1.3 Energy metabolism: Role of ATP in metabolism, Role of reducing power in metabolism, Role of precursor metabolites in metabolism
- 1.4 Non Regulatory Enzymes : Derivation of the Michaelis - Menten Equation
- 1.5 Regulatory Enzymes : Allosteric Enzymes - Conformational changes in Regulatory Enzymes

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry by Conn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.

UNIT 2: HETEROTROPHIC MODE OF METABOLISM
(Credit-1.2, Teaching Hours-12, Marks-14)

- 2.1 Glycolysis and its regulation
- 2.2 The Pentose phosphate pathway & The Entner - Doudroff pathway
- 2.3 The Citric acid cycle and its regulation & The Glyoxylate cycle
- 2.4 Protein Catabolism: General reactions of amino acids catabolism, Stickland Reaction, Lipid Catabolism:
Oxidation of Fatty Acids, Beta- Oxidation of Fatty Acids

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry by Conn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.

UNIT 3: ENERGY GENERATION AND ANABOLISM

(Credit-1.2, Teaching Hours-12, Marks-14)

3.1 Different modes of ATP generation

3.2 Electron transport chain: Introduction, Components of ETC and energy yield

3.3 Anaerobic Respiration

3.4 Peptidoglycan Biosynthesis

3.5 Bacterial photosynthesis

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry by Conn E.E. and Stumpe P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Biochemistry by Jeremy M. Berg, Lubert Stryer, John Tymoczko, Gregory Gatto. 5th - 9th Edition. W.H. Freeman and Company, New York.
6. Biochemistry by Donald Voet & Judith G. Voet. 4th edition. John Wiley & Sons.

UNIT 4: SELECTED ASPECTS OF METABOLISM IN SPECIFIC MICROBIOAL SYSTEMS

(Credit-1.2, Teaching Hours-12, Marks-14)

4.1 Chemo - autotrophs : Nitrifying Bacteria and Iron bacteria

4.2 Chemo - autotrophs : Sulfur Oxidizers and Hydrogen Bacteria

4.3 The lactic acid bacteria: Patterns of carbohydrate fermentation in lactic acid bacteria

4.4 The Enteric group and related Eubacteria : Fermentative patterns of Gram negative Eubacteria

4.5 Archaeobacteria: Energy metabolism and Carbon- Assimilation in Methanogens,
photophosphorylation in Halobacterium

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA
2. General microbiology by Stanier R.Y. 5th edition. McMillan.
3. Bacterial Physiology and Metabolism by B. H. Kim & G. M. Gadd. 1st edition .Cambridge University Press.
4. Brock Biology of Microorganisms by Michael T. Madigan, John M. Martinko. 11th – 15th edition. Pearson.
5. Microbial physiology by A. G. Moat, J. W. Foster & M. P. Spector. 4th edition. John Wiley & Sons.

UNIT 5: MEMBRANE BIOLOGY

(Credit-1.2, Teaching Hours-12, Marks-14)

- 5.1 Structure of cell membrane: Fluid Mosaic Model
- 5.2 Passive transport: Simple & Facilitated Diffusion
- 5.3 Active transport
- 5.4 Specific Transport Systems: Mechanosensitive channels, Chemiosmotic-driven transport, Iron transport, thephosphotransferase system
- 5.5 Overview of Quorum sensing & Signal Transduction

REFERENCE BOOKS

1. The physiology and Biochemistry of Prokaryotes by David white. 2ndedition. OUP USA
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5thedition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5thedition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Bacterial Physiology and Metabolism by B. H. Kim & G. M. Gadd. 1stedition.Cambridge University Press.

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-502:BACTERIAL METABOLISM
(PRACTICAL)

1. Study effect of temperature on amylase activity
2. Study effect on amylase activity
3. Study effect of enzyme concentration on amylase activity
4. Determination of V_{max} and K_m for amylase enzyme by performing substrate concentration curve with M-M and line weaver Burk plot
5. Isolation and characterization of lactic acid bacteria from suitable sources.
6. Study of Diauxic growth curve in *E. coli*
7. Preparation of Winogradsky column (Demonstration)

REFERENCE BOOKS

- 1 Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. AdityaPublishers.

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)

MB-503:MOLECULAR BIOLOGY AND GENETIC ENGINEERING
(THEORY)

UNIT 1: FUNDAMENTALS OF GENETICS

(Credit-1.2, Teaching Hours-12, Marks-14)

- 1.1 History of genetics and central dogma of life
- 1.2 Mendelian Laws of inheritance
- 1.3 DNA is the universal genetic material & experimental evidences
- 1.4 Gene structure and architecture in Prokaryotes and Eukaryotes
- 1.5 Prokaryotic DNA Replication: experiment, machineries, Mechanism & models

REFERENCE BOOKS

1. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Francis Group. UK.
2. Krebs, J. E., Goldstein, E. S. et al., Lewin's Genes XII (any recent Edition), Jones and Bartlett Publishers, Inc., USA.
3. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
6. Verma P.S. & Agarwal V.K., Cell Biology, Genetics, Molecular Biology, Evolution & Ecology - Reprint Edn. 2006 edition. S Chand publications

UNIT 2: GENE EXPRESSION AND REGULATION

(Credit-1.2, Teaching Hours-12, Marks-14)

- 2.1 Prokaryotic Transcription: machineries and mechanism
- 2.2 Post transcriptional modifications of RNA: overview of splicing, capping, polyadenylation & editing
- 2.3 Genetic code, prokaryotic Translation (machineries and mechanism) and post translational modifications
- 2.4 An overview of Levels and modes of regulation of gene expression.
- 2.5 The Operon Models: Regulation of lactose utilization – The lac operon & Regulation of tryptophan biosynthesis – The trp operon

REFERENCE BOOKS

1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Francis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria – 4th Edition. ASM Press, USA.
4. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
5. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
6. Prescott, Healey and Klein., Microbiology - 5th - 10th Edition, Tata-McGraw Hill publications, Delhi.
7. Verma P.S. & Agarwal V.K., Cell Biology, Genetics, Molecular Biology, Evolution & Ecology - Reprint Edn. 2006 edition. S Chand publications

UNIT 3: GENE TRANSFER AND RECOMBINATION

(Credit-1.2, Teaching Hours-12, Marks-14)

- 3.1 Types of Recombination: Homologous recombination, Site specific recombination, illegitimate recombination
- 3.2 Transformation: 1. Natural transformation - competence, DNA uptake, role of natural transformation, 2. artificial induced competence & electroporation
- 3.3 Transduction: Generalized transduction, specialized transduction and Abortive transduction
- 3.4 Conjugation: Mechanism of DNA transfer in Gram positive and Gram negative bacteria
- 3.5 Transposable genetic elements

REFERENCE BOOKS

1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Francis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria – 4th Edition. ASM Press, USA.
4. Gardner, M. J. Simmons, D. P. Snustad, PRINCIPLES OF GENETICS- 8th Edition. John Wiley & Sons.
5. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
6. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
7. Prescott, Healey and Klein., Microbiology - 5th - 10th Edition, Tata-McGraw Hill publications, Delhi.

UNIT 4: MUTATION AND DNA REPAIR

(Credit-1.2, Teaching Hours-12, Marks-14)

- 4.1 Types of mutation- Spontaneous mutations and Induced mutations
- 4.2 Biochemical basis of mutation and mutation Reversion
- 4.3 Physical, Chemical and Biological Mutagenesis; Ames test
- 4.4 Experimental evidence of mutation: fluctuation analysis, mutation rate, Phenotypic and Phenomiclag
- 4.5 DNA repair mechanisms - Mismatch repair, Excision repair, Photo reactivation,

REFERENCE BOOKS

1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Francis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria – 4th Edition. ASM Press, USA.
4. Gardner, M. J. Simmons, D. P. Snustad, PRINCIPLES OF GENETICS- 8th Edition. John Wiley & Sons publication.
5. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
6. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
7. Prescott, Healey and Klein., Microbiology - 5th - 10th Edition, Tata-McGraw Hill publications, Delhi.

UNIT 5: GENETIC ENGINEERING AND PROTEIN ENGINEERING

(Credit-1.2, Teaching Hours-12, Marks-14)

5.1 Genetic engineering: aims and applications

5.2 Genetic manipulations of prokaryotes:

- a. Isolation of DNA
- b. Vectors of rDNA Technology – plasmid (pBR322 & pUC), Bacteriophage (lambda phage & M13), Cosmid, Phagemid, BACs, YACs
- c. Insertion of DNA molecules into a vector
- d. Transformation methods and Growth
- e. Detection of Recombinant- Colony Hybridization

5.3 Genetic manipulations of eukaryotes: Genetic manipulation of plant cells (*Agrobacterium* mediated) and animal cells

5.4 Site directed mutagenesis

5.5 Molecular Chaperon

REFERENCE BOOKS

- 1 Trevan, M.D., et al., Biotechnology -The Biological Principles . Tata Mcgraw Hill Publishing Co Ltd.
- 2 Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Francis Group. UK.
- 3 John Cronan, et al., Microbial Genetics - 2nd Edition. Narosa publications.
- 4 Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.
- 5 T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.
- 6 S. B. Primrose, R. Twyman & B. Old, Principles of Gene Manipulation .6th Edition. Wiley-Blackwell publications

SAURASHTRA UNIVERSITY, RAJKOT

SYLLABUS FOR MICROBIOLOGY SEMESTER - V
(With effect from June 2021)
MB-503:MOLECULAR BIOLOGY AND GENETIC ENGINEERING
(PRACTICAL)

1. Isolation of genomic DNA from bacteria (only demonstration experiment)
2. Estimation of DNA by DPA method
3. Conjugation in *E. coli* by plate method
4. Isolation of plasmid (Only demonstration experiment)
5. Transformation of plasmid in bacteria
6. Isolation of RNA (only demonstration experiment)
7. Estimation of RNA by Orcinol method
8. Isolation of Lactose non fermenter mutant of *E. coli* by physical mutagenesis
9. Isolation of antibiotic resistant bacteria by gradient-plate method.
10. Isolation of streptomycin resistant mutants by Replica plating technique.
11. The Ames test: For detecting potential carcinogen (only demonstration experiment)

REFERENCE BOOKS

1. Trevan, M.D., et al., Biotechnology -The Biological Principles . Tata Mcgraw Hill Publishing Co Ltd.
2. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Fransis Group. UK.
3. Prescott, Healey and Klein., Microbiology-9 or 10th Edition, Tata-McGraw Hill publications, Delhi
4. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
5. John Cronan, et al., Microbial Genetics - 2nd Edition. Narosa publications.
6. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.
7. T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.
8. Sandy B. Primrose, Richard Twyman & Bob Old, Principles of Gene Manipulation – 6th Edition. Wiley-Blackwell publications

SAURASHTRA UNIVERSITY, RAJKOT
SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
(With effect from June 2021)
MB-601: FERMENTATION TECHNOLOGY
(THEORY)

UNIT 1 BASICS OF FERMENTATION TECHNOLOGY & INDUSTRIALLY IMPORTANT MICROORGANISMS
(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)

- 1.1 Basic Concept of fermentation technology & historical development of industrial microbiology
- 1.2 Range of Fermentation Processes & its Component parts
- 1.3 Primary & Secondary Screening of industrial important microbes & culture collection centre
- 1.4 Isolation & improvements of industrial important microbes
- 1.5 Fermentation economics

REFERENCE BOOKS

1. Principles of Fermentation Technology by Stanbury & Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited
3. A text book of Industrial Microbiology by Wulf Crueger & Anneliese Crueger. 2nd edition. Sinauer Associates Inc., U.S.
4. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications
5. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey. Asiatech Publishers Inc.

UNIT 2 FORMULATION OF FERMENTATION MEDIA
(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)

- 2.1 Introduction to Media and its Types
- 2.2 Media formulation
- 2.3 Raw materials: Crude Carbon and Nitrogen sources, Minerals, Precursors, Growth Regulators, Buffers, Antifoam agents
- 2.4 Inoculum and Production medium
- 2.5 Media Optimization

REFERENCE BOOKS

1. Principles of Fermentation Technology by Stanbury & Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited

3. A text book of Industrial Microbiology by WulfCruieger&AnnelieseCruieger. 2nd edition. Sinauer Associates Inc.,U.S.
4. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications
5. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey. Asiatech Publishers Inc.

UNIT 3 DESIGN AND ASEPTIC OPERATION **(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

- 3.1 Introduction and basic functions of fermenter: criteria and design
- 3.2 Types of bioreactors
- 3.3 Aeration and Agitation – Types and importance of agitators & aerators
- 3.4 Sterilization process in fermentation industries: Introduction of Del factor, an overview of Fermentor sterilization & Medium sterilization
- 3.5 Fermentation process: Batch Fermentation, Continuous fermentation and their comparative advantages and disadvantages

REFERENCE BOOKS

1. Principles of Fermentation Technology by Stanbury& Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. A text book of Industrial Microbiology by WulfCruieger&AnnelieseCruieger. 2nd edition. Sinauer Associates Inc.,U.S.
3. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications

UNIT 4 OVERVIEW: DOWNSTREAM PROCESSES **(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

- 4.1 Methods of Cell separation: Broth conditioning, Precipitation, Sedimentation, Centrifugation, Filtration
- 4.2 Centrifugation and filtration
- 4.3 Techniques of Cell Disruption: Mechanical and Non mechanical methods
- 4.4 Product Recovery: Liquid liquid extraction, Solvent recovery, Two Phase aqueous extraction, Super critical fluid extraction
- 4.5 Physical, Chemical and Biological assay of fermentation products

REFERENCE BOOKS

1. Principles of Fermentation Technology by Stanbury& Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited

3. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition. Sinauer Associates Inc.,U.S.
4. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications

UNIT 5 STUDIES OF SELECTIVE FERMENTATION PROCESSES
(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)

- 5.1 Production of organic solvents: Ethyl alcohol
- 5.2 Production of enzymes & vitamins: Amylases and Riboflavin
- 5.3 Production of antibiotics: Penicillin
- 5.4 Production of amino acids & organic acids: Lysine and Citric acid
- 5.5 Introduction to methods of immobilizations – Whole cell and/or enzyme: Applications of immobilization

REFERENCE BOOKS

1. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited
2. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition. Sinauer Associates Inc.,U.S.
3. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications
4. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey. Asiatech Publishers Inc.
5. Trevan, M.D., et al., Biotechnology -The Biological Principles. Tata Mcgraw Hill Publishing Co Ltd.

SYLLABUS FOR MICROBIOLOGY SEMESTER - VI

(With effect from June 2021)

MB-601: FERMENTATION TECHNOLOGY

(PRACTICAL)

- 1 Primary screening of industrially important microorganisms capable of producing: Antibiotics, Organic acids, amylases
- 2 Bioassay of streptomycin using *E.coli*.
- 3 Laboratory fermentation & estimation of Ethyl Alcohol by *Saccharomyces*
- 4 Laboratory fermentation & estimation of amylase by *Bacillus spp.*
- 5 Sterility testing of fermentation products (Demo)
- 6 Immobilization of yeast cells by Ca- alginate entrapment method & Determination of viability of immobilized cells by invertase activity

REFERENCE BOOKS

1. Microbiology- A laboratory Manual by James G. Chappuccino & Natalie Sherman. 4th edition. Pearson Benjamin Cummings
- 2 Handbook Bacteriological Techniques by F.J. Baker. 2nd edition. Butterworth & Co Publishers Ltd.
- 3 Introduction to Microbial Techniques By Gunasekaran
- 4 Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. Aditya Publishers.

SAURASHTRA UNIVERSITY, RAJKOT

SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
(With effect from June 2021)
MB 602: BIO-ANALYTICAL TECHNIQUES
(THEORY)

UNIT 1: Basic Analytical Techniques in Biosciences
(Credit-1.2, Teaching Hours-12, Marks-14)

- 1.1 Concept Of Good Laboratory Practices and Quality Management
- 1.2 Applications of Radioisotopes in Biosciences

Principle, Instrumentation and applications of following spectroscopy techniques:

- 1.3 Colorimetry and UV- Visible Spectrophotometry
- 1.4 Mass spectroscopy, IR spectroscopy and NMR spectroscopy
- 1.5 Atomic Spectroscopy: Atomic Absorption/Emission Spectrometer

REFERENCE BOOKS

- 1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
- 2. Wilson, K., Walker, J. M., Hofmann, A., & Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.
- 3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
- 4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications.
- 5. Upadhyay, A., Upadhyay, K., & Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.

Unit 2: Principles and Theories of Chromatography
(Credit-1.2, Teaching Hours-12, Marks-14)

- 2.1 Introduction to Chromatography – Partition & adsorption; planner & column
- Principle, working and applications of following chromatography techniques**
- 2.2 Paper and Thin Layer Chromatography
 - 2.2 Affinity and Ion Exchange Chromatography
 - 2.3 Size Exclusion Chromatography and Gas Chromatography
 - 2.4 High Performance Liquid Chromatography (HPLC) and FPLC
 - 2.5 Concept and applications of GC-MS and LC-MS

REFERENCE BOOKS

- 1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
- 2. Wilson, K., Walker, J. M., Hofmann, A., & Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.

3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications.
5. Upadhyay, A., Upadhyay, K., & Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.

Unit 3: Molecular Techniques and Biosensor Technology **(Credit-1.2, Teaching Hours-12, Marks-14)**

- 3.1 Electrophoresis: Basic principle, components and applications of Paper electrophoresis & Agarose gel electrophoresis
- 3.2 PFGE: Principle, working and applications of Native gel electrophoresis & SDS-PAGE
- 3.3 An overview of 2D-PAGEs (concept of isoelectric focusing) & Capillary electrophoresis
- 3.4 Introduction to Autoradiography & Flow cytometry
- 3.5 Overview of Biosensor Technology

REFERENCE BOOKS

1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
2. Wilson, K., Walker, J. M., Hofmann, A., & Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.
3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications.
5. Upadhyay, A., Upadhyay, K., & Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.

Unit 4. Modern Bioanalytical Techniques **(Credit-1.2, Teaching Hours-12, Marks-14)**

- 4.1 DNA sequencing: Principles and Methods, Automated DNA sequence Analyzer
- 4.2 Blotting techniques and FISH
- 4.3 RFLP, RAPD, VNTR, STR and SNP analysis
- 4.4 Chemical synthesis of DNA
- 4.5 PCR Technology: Principle, Methods, Primer design (overview and Features) and Applications.

REFERENCE BOOKS

1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
2. Wilson, K., Walker, J. M., Hofmann, A., & Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.
3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and

Applications.

5. Upadhyay, A., Upadhyay, K., & Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.
6. Trevan, M.D., et al., Biotechnology -The Biological Principles. Tata Mcgraw Hill Publishing Co Ltd.
7. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor & Francis Group. UK.
8. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.
9. T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.
10. Sandy B. Primrose, Richard Twyman & Bob Old, Principles of Gene Manipulation – 6th Edition. Wiley-Blackwell publications

Unit 5: Bioinformatics

(Credit-1.2, Teaching Hours-12, Marks-14)

5.1 Introduction and Importance of Bioinformatics

5.2 Database and DBMS: Primary and Secondary Biological Databases, Structure Databases, Miscellaneous Database

5.3 Information Retrieval from Biological Database: ENTREZ, SRS and DBGET

5.4 Sequence Alignment tools: BLAST and FASTA

5.5 Construction of Phylogenetic tree using computer

REFERENCE BOOKS

1. Hodgman, T. C., French, A., & Westhead, D. R. (2010). Bioinformatics. Abingdon: Taylor & Francis.
2. Attwood, T. K., & Parry-Smith, D. J. (1998). Introduction to bioinformatics. Harlow. Pearson.
3. Baxevanis, A. D., & Ouellette, B. F. F. (2001). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley Intersciences, New York.

SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
(With effect from June 2021)
MB-602: Bio-Analytical Techniques
(PRACTICAL)

1. Determination of absorbance maxima of KMnO_4
2. Separation of carbohydrates / amino acids by ascending paper chromatography.
3. Separation of amino acids by circular paper chromatography.
4. Separation of amino acids by Thin layer chromatography.
5. Separation of nucleic acid by agarose gel electrophoresis.
6. Separation of proteins by SDS PAGE (Demonstration).
7. Retrieval of DNA/gene sequence of bacterial species from NCBI.
8. Demonstration of BLAST analysis.

REFERENCE BOOKS

1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques, Ane Books, Delhi

SYLLABUS FOR MICROBIOLOGY SEMESTER - VI

(With effect from June 2021)

MB-603: CLINICAL DIAGNOSTIC MICROBIOLOGY

(THEORY)

Unit1: Hematology

(Credit-1.2, Teaching Hours-12, Marks-14)

- 1.1. Hematopoiesis
- 1.2. Discovery of human blood group system, ABO and Rh system
- 1.3. Hemostasis
- 1.4. Introduction to blood banking & Separation and storage of blood components
- 1.5. Principle, significance and procedure of blood transfusion

REFERENCE BOOKS

1. Michael, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., & Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.

Unit 2: Serology

(Credit-1.2, Teaching Hours-12, Marks-14)

- 2.1 In vitro antigen: antibody reaction: Precipitin test (in fluid and gel) and Complement fixation test.
- 2.2 Agglutination test (Hemagglutination, Bacterial Agglutination, Passive Agglutination and agglutination inhibition)
- 2.3 Special Serological tests: Fluorescent antibody technique, Nuefeld-Quellung reaction, Detection of heterophile antibody and Virus neutralizing antibody.
- 2.4 Evaluation of Virulence: Antifibrinolysin & Antistreptolysin.
- 2.5 Overview of Intracutaneous diagnostic test

REFERENCE BOOKS

1. Michael, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.

4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., & Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.

Unit 3: Conventional and Advanced Diagnostic Techniques (Credit-1.2, Teaching Hours-12, Marks-14)

A. Conventional techniques.

3.1 Methods of specimen collection.

3.2 Identification of microbes from specimen: Microscopy, Rapid methods of identification and Molecular methods.

B. Advanced techniques.

3.3 Immuno-electrophoresis and Immunofluorescence.

3.4 Radioimmunoassay, ELISA, Western Blot.

3.5 Detection of pathogen by PCR, Immunohistochemistry and Immunotherapy.

REFERENCE BOOKS

1. MICHAEL, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., & Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.
7. Dey NC, Dey TK, Sinha D. Medical Bacteriology Including Medical Mycology and AIDS; New Central Book Agency, Kolkata.
8. Lydyard, P., Whelan, A., & Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
9. S. C. Parija. (2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 4: Epidemiology and Microbial Agents of Disease (Bacteria & Fungi)

(Credit-1.2, Teaching Hours-12, Marks-14)

4.1 Epidemiology of infectious disease: Markers, concepts and tools

Bacteria – Pathogenicity, diagnosis, treatment and prevention

4.2 Gram negative Bacteria– *Treponema and Salmonella*

4.3 Gram positive Bacteria – *Streptococci and Mycobacterium*

Fungi - Pathogenicity, diagnosis, treatment and prevention

4.4 *Malassezia furfur, Tineapedis and Sporotrichum schenckii*

4.5 *Cryptococcus neoformans* and *Candida albicans*

REFERENCE BOOKS

1. MICHAEL, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., & Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.
7. Dey NC, Dey TK, Sinha D. Medical Bacteriology Including Medical Mycology and AIDS; New Central Book Agency, Kolkata.
8. Lydyard, P., Whelan, A., & Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
9. S. C. Parija. (2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

Unit 5: Microbial Agents of Disease (Protozoa and Virus), and Prophylaxis

(Credit-1.2, Teaching Hours-12, Marks-14)

5.1 Protozoa: Pathogenicity, diagnosis, treatment and prevention of *Plasmodium spp.* & *Entamoeba histolytica*

Viruses – Pathogenicity, diagnosis, treatment and prevention.

5.2 Air borne infections: Influenza & Mumps.

5.3 Food-Water borne infection: Hepatitis virus & Rota virus.

5.4 Viral Zoonosis: Rabies virus & Swine Flu.

5.5 Direct contact: HIV & Herpes virus.

REFERENCE BOOKS

1. MICHAEL, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., & Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology. 7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., & Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.
7. Dey NC, Dey TK, Sinha D. Medical Bacteriology Including Medical Mycology and AIDS; New Central Book Agency, Kolkata.
8. Lydyard, P., Whelan, A., & Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
9. S. C. Parija. (2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

SYLLABUS FOR MICROBIOLOGY SEMESTER - VI

(With effect from June 2021)

MB-603: CLINICAL DIAGNOSTIC MICROBIOLOGY

(PRACTICAL)

1. Antibiotic susceptibility of the pathogens isolated from the clinical specimen
2. Study of Agglutination by
 - a. Blood grouping
 - b. Serodiagnosis of enteric fever by Widal test
 - c. Serodiagnosis of syphilis by RPR Test
3. Haemoglobin estimation by Sahli's method
4. Bleeding time by filter paper technique and clotting time by capillary method
5. Erythrocyte Sedimentation Rate (ESR-demonstration)
6. Blood sugar estimation by GOD / POD method
7. Determination of Serum bilirubin
8. Determination of Serum Cholesterol
9. Physical, chemical and microscopic analysis of urine
10. Screening of Thalassemia by NESTROFT
11. Total count of platelets

REFERENCE BOOKS

1. Talwar, G. P., & Gupta, S. K. (1992). A Handbook of Practical and Clinical Immunology. New Delhi: CBS Publishers & Distributors.
2. Medical Laboratory Technology – Vol – I, II, III – Mukherji K.L. 2nd edition. Tata McGraw-Hill Education.
3. Godkar, P. B., & Godkar, P. D. (2005). Text Book of Medical Laboratory Technology: Basic Histopathologic Techniques and the Laboratory Requirements. Bhalani Publishing House.
4. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India
5. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India