

BHAVNAGAR UNIVERSITY

BHAVNAGAR

(NACC Accreditation Grade “B”)

CREDIT AND SEMESTER SYSTEM

SYLLABUS

BACHELOR OF SCIENCE (B.Sc.)

MICROBIOLOGY

(In Force From Academic Year: 2011-2012)

तमसो मा ज्योतिर्गमय



B.Sc.

Credit and Semester System Syllabus

NAME OF THE SUBJECT: MICROBIOLOGY

SEMESTER: 3rd

SR. NO.	PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT+INT*=TOTAL	PASSING STANDARD EXT+INT=TOTAL	TOTAL TEACHING HOURS	UNIVERSITY EXAM. HOURS	CREDITS
1	MI-301	Introduction to Microbiology	70 + 30* = 100	28 + 12 = 40	15 Weeks x 03 Hours = 45	03	03
2	MI-302	Introduction to Physiology & Biochemistry	70 + 30* = 100	28 + 12 = 40	15 Weeks x 03 Hours = 45	03	03
3	MI-303	Introduction to Environmental Microbiology	70 + 30* = 100	28 + 12 = 40	15 Weeks x 03 Hours = 45	03	03
4	MI-304	Practicals in Microbiology	90 + 00 = 90 (External Only)	36 + 00 + 36	15 Weeks x 09 Hours = 135	09	09

* <u>INTERNAL</u>	<u>MARKS</u>
ASSIGNMENT	10
TEST	10
SEMINAR	10

Note:

- Practical examinations shall be of two day (6 hrs/day, total 12 hrs)
- Total exercises to be performed by each candidate will be as Practical Examinational Scheme:



B.Sc.

Credit and Semester System Syllabus

NAME OF THE SUBJECT: MICROBIOLOGY

SEMESTER: 4th

SR. NO.	PAPER NO	NAME OF THE PAPER	TOTAL MARKS EXT+INT*=TOTAL	PASSING STANDARD EXT+INT=TOTAL	TOTAL TEACHING HOURS	UNIVERSITY EXAM. HOURS	CREDITS
1	MI-401	Nutrition and Microbial Diversity.	70 + 30* = 100	28 + 12 = 40	15 Weeks x 03 Hours = 45	02	03
2	MI-402	Microbial Metabolism.	70 + 30* = 100	28 + 12 = 40	15 Weeks x 03 Hours = 45	02	03
3	MI-403	Applied Microbiology	70 + 30* = 100	28 + 12 = 40	15 Weeks x 03 Hours = 45	02	03
4	MI-404	Practicals in Microbiology	90 + 00 = 90 (External Only)	36 + 00 + 36	15 Weeks x 09 Hours = 135	12	09

* <u>INTERNAL</u>	<u>MARKS</u>
ASSIGNMENT	10
TEST	10
SEMINAR	10

Note:

- Practical examinations shall be of two day (6 hrs/day, total 12 hrs)
- Total exercises to be performed by each candidate will be as Practical Examinational Scheme:



B.Sc. (Microbiology) SEMESTER – III

PREAMBLE:

1. There shall be three theory papers each of 100 marks (70 marks based on external examination and 30 marks based on internal examination).
2. Practical examination will be of 150 marks, based on external university examination.
3. There shall be three lectures (1 hour each) per theory paper per week and practicals of three lecture hours per day for three days in a week.
4. It is compulsory to pass in internal as well as external examinations independently.
5. There shall be Two Semesters in Academic Year.(Semester-1&2)
6. Proposed syllabus has been framed as per guidelines suggested by U. G. C.

PRACTICAL EXAMINATIONAL SCHEME:

Marks

1. Staining techniques.	25
2. Biochemistry: Qualitative analysis	25
3. General Exercise	25
4. Spotting	20
5. Identification of fungi (Cultural and microscopic characteristics)	10
6. Computer based experiments	15
7. Journal and slides	10
8. Viva-Voce: I	10
9. Viva-Voce: II	10

Grand total: 150

TWO EXAMINERS:

A

Ex. No.	Marks
1	25
3	25
5	10
7	10
8	10
Total	80

B

Ex. No.	Marks
2	25
4	20
6	15
9	10
-	-
Total	70

THREE EXAMINERS:

A

Ex. No.	Marks
1	25
4	20
7	10
Total	55

B

Ex. No.	Marks
2	25
5	10
8	10
Total	45

C

Ex. No.	Marks
3	25
6	15
9	10
Total	50

Note:

1. The viva-voce will be illustrative of theoretical portion of the syllabus.
2. The candidate is required to bring for inspection his/her practical journal duly signed and certified by Head of the Department at the time of practical examination daily.
3. The candidate is required to submit permanent slides prepared during the course of study during practical examination



B.Sc. (MICROBIOLOGY)
SEMESTER – III

Paper No. MI-301: Introduction to Microbiology:

Credit: 03

Total Marks: 100

Marks: Semester End Examination: 70

Continues Internal Evaluation: 30

UNIT	DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
Unit – I	<p><u>History and Scope of Microbiology:</u></p> <ol style="list-style-type: none"> History of Microbiology <ol style="list-style-type: none"> Discovery of animalcules Spontaneous generation disputes Germ theory of diseases Germ theory of fermentation Golden period of microbiology Scope of Microbiology <ol style="list-style-type: none"> Distribution of microorganisms in nature Pure and applied areas of microbiology <p>Microbiology and future of mankind</p>	15	23
Unit – II	<p><u>Microbial study techniques:</u></p> <ol style="list-style-type: none"> Microscopes and microscopies <ol style="list-style-type: none"> Simple and compound microscope Electron microscope: TEM (methods for sample preparation) and SEM Phase contrast Microscopy Fluorescence Microscopy. Microbial Study Techniques <ol style="list-style-type: none"> Smear preparation and fixation. Wet mounting. Micrometry Microphotography (Documentation). Dyes, Stains and Staining <ol style="list-style-type: none"> Types and applications of staining. Principles of staining techniques. Applications of simple, negative and differential staining Bacterial cytological staining procedures. <p>Applications of dyes and stain in the field of microbiology</p>	15	24
Unit – III	<p><u>Morphology and Fine structure of bacteria:</u></p> <ol style="list-style-type: none"> The size, shape and arrangement of bacterial cells. Bacterial cell structure composition and functions <ol style="list-style-type: none"> External: Cell wall, Pili (fimbriae) and flagella Capsule and sheaths, Prosthecae Internal: Cytoplasmic membrane, Protoplast and spheroplast, Protoplasm, protoplasmic inclusions and vacuoles <p>Sporulation in bacteria (endospore and cyst production) and germination of spore</p>	15	23

Break up of Continuous Internal Evaluation:

1. Assignments	10 Marks
2. Test	10 Marks
3. Seminar	<u>10 Marks</u>
Total Marks	30 Marks



Paper No. MI-302: Introduction to Physiology & Bio-Chemistry:

Credit: 03

Total Marks: 100
Marks: Semester End Examination: 70
Continues Internal Evaluation: 30

UNIT	DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
Unit – I	General properties, structure, types, classification with suitable examples and functions of important bio-molecules: 1. Carbohydrates 2. Proteins. 3. Fats, lipids and steroids 4. Vitamins and growth factors 5. DNA and RNA [nucleic acids] Pigments especially chlorophyll & bacterio-chlorophylls	15	23
Unit – II	Carbohydrate pathways and its regulation: 1. EMP pathway and pyruvic acid as a key compound 2. HMP shunt 3. ED pathway 4. Krebs's cycle 5. Anaploratic reactions Regulation of metabolic pathways	15	23
Unit – III	Microbial reproduction, growth and control 1. Microbial growth a. Reproduction: modes of cell division and new cell formation b. Types of growth : continuous, synchronous, batch and random growth c. Normal growth curve of bacteria d. Factors affecting growth e. Techniques of measuring bacterial growth (principle, methods, advantages and limitations) 2. Control of microorganism <i>in vitro</i> a. Definition of terms: Terminology for microbial control. b. Physical and chemical agents/agencies for control of c. Microorganism in vitro. d. Ideal disinfectant. e. Evaluation methods for antiseptics and disinfections e.g. phenol	15	24

Break up of Continuous Internal Evaluation:

1. Assignments 10 Marks
2. Test 10 Marks
3. Seminar 10 Marks
Total Marks 30 Marks



Paper No. MI-303: Introduction to Environmental Microbiology:

Credit: 03

Total Marks: 100
Marks: Semester End Examination: 70
Continues Internal Evaluation: 30

UNIT	DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
Unit – I	<u>Elements of microbial ecology:</u> 1. Distribution of microorganisms in nature and various natural habitats. 2. Normal and abnormal flora. 3. Microbial communities 4. Extreme environments. 5. Temperature, high solute concentration, osmotic pressure, and pH as an environmental extremes. 6. Other environmental extremes: Axonic environment. Archaeobacteria and other microbial flora of extreme environment	15	23
Unit – II	<u>Microbial interactions [Positive and / or negative interactions with suitable examples]:</u> 1. Clay-humus-microbe interaction. 2. Plant-microbe interactions. 3. Interactions on above ground parts. 4. Interactions on below ground parts. 5. Animal-microbe interactions. 6. Microbe-microbe interactions. 7. Termites and microbes interactions. 8. Fungi-algal interactions.	15	23
Unit – III	<u>Pollution and environmental hazards:</u> 1. Pollution of : Air, land, water and other ecosystems 2. Pollution by: Noise, temperature, radiation, heavy metal and microorganisms 3. Dangers of manmade materials as polluting agents – e.g. Insecticides, pesticides, junk electronic components 4. Biodegradation of hazardous wastes: Hospital, industrial and solid wastes 5. Biodegradation of environment pollutants: Alkyl benzyl sulfonates (ABS), chlorinated hydrocarbons and oil pollutants. 6. Bioremediation: Need and scope, environmental applications and future scope.	15	23

Break up of Continuous Internal Evaluation:

1. Assignments	10 Marks
2. Test	10 Marks
3. Seminar	10 Marks
Total Marks	30 Marks



Paper No. MI-304: Practical's in Microbiology:

Credit: 09

Total Marks: 90 (External Only)

DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
1. Introduction to laboratory instruments Microscope Autoclave Incubator Hot-air oven Balance Refrigerator Inspissator Shaker Colorimeter pH meter Anaerobic jar Spectrophotometer Hellige – Lovibond comparator Semi-autoanalyzer Distillation Plant Centrifuge Electrophoresis kit Water-bath Colony counter Chromatography kit Membrane filtration kit Computer		
2. Cleaning, neutralization and sterilization of glasswares		
3. Preparation of media and its sterilization. (Broth and agar media and preparation of slant and agar plates)		
4. Disposal of bacteriological wastes and cultures.		
5. Preparation of standard solutions.		
a. Percent solutions		
b. Molar and Molal solutions		
c. Normal solutions		
d. Parts per million solutions		
e. Preparation of phosphate buffer (various pH)		
6. To study the effect of following on microbial growth/development.		
a. Effect of pH		
b. Effect of osmotic pressure (salt and sugar)		
c. Effect of temperatures		
d. Effect of chemicals (crystal violet, HgCl ₂ , phenol & sterile distilled water)		
e. Effect of antibiotics (ditch and disk method)		
f. Effect of heavy metals (Oligodynamic action)		
7. Microscopic examination of inanimate objects.		
a. Flour		
b. Dust particles		
c. Fabric threads, cotton, wool, silk and man-made fibers.		
d. Chalk particles		
e. Mineral particles: NaCl and CuSO ₄		
8. Microscopic examination of hay infusion.		
9. Study of motility by: Hanging drop method and agar stab technique		
10. Microscopic measurements (Micrometry)		
11. Study of pigment production by microorganisms including its solubility test		
12. Qualitative analysis of carbohydrate and protein.		
13. Adjustment of pH of culture medium.		
a. Paper - strip		
b. Hellige's Lovibond comparator with pH comparator disk		
c. Digital pH meter		



<p>14. Staining of bacteria and bacterial cell structures</p> <ul style="list-style-type: none">a. Monochrome stainingb. Negative stainingc. Gram's stainingd. Acid-fast staininge. Capsule stainingf. Spore stainingg. Metachromatic granule stainingh. Cell wall stainingi. Fat-body stainingj. Nucleus/nuclear material stainingk. Spirochete's stainingl. Flagella staining <p>15. Cultivation and identification of fungi (based on colony characteristics and microscopic observation)</p> <ul style="list-style-type: none">a. Aspergillusb. Penicilliumc. Rhizopusd. Mucore. Neurosporaf. Yeast-Saccharomyces <p>16. Computer based experiments</p> <p>To create branch and linear polymers of sugars, amino acids and nucleotides by creating appropriate bonds.</p>		
---	--	--

List of Books Recommended:

1. Microbiology (5th Edition) - Pelczer M.J. Chan E.C.S. Krieg N.L.R.
Pub: McGraw Hill Book Company. N.Y.
2. Microbiology (International Edition) Concepts and Applications. - Pelczer M.J. Chan E.C.S. Krieg N.L.R.
Pub: McGraw Hill Book Company. N.N. Secondar N.
3. Microorganisms in Action: Concepts and Applications in Microbial Ecology - Lynch J.M. Hobbie J.B.
Pub: Black well scientific publications, Loncon.
4. General Microbiology (7th Edition). - Hans G. Schlegel
Pub: Cambridge University Press (Loss Price Edition.)
5. Biology of microorganisms (Brocks') (9th Edition) 2002 - Madigan, M.T. Martinko & J. Parker.
Prentice Hall Intan Inc N.Y.
6. Environmental Biology and Toxicology (2nd Edition) - P.D. Sharma.
Pub: Restage Publications, Meerut.
7. Microbiology (2nd Edition) - P.D. Sharma.
Pub: Restage Publications, Meerut.
8. General Microbiology (5th Edition) - Stanier R.J, Ingraham J.L., Wheelio M.L.
Pub: Macmillan Education Ltd., Hampshire. Painer P.R.
9. Microbial Ecology – Fundamental and Applications - Atlas R.M., Bartha R. London.
Pub: Addison – Wesley Publications Co.
10. Basic Microbiology With applications (2nd Edition) - Brock K.M.
Pub: Prentice Hall, New Jersey
11. Basic Microbiology With applications (2nd Edition) - Tortora G.J., Funke B.R., Case C.L.
Pub: The Benjamin / gumming Publishing INC. London
12. Microbiology: Fundamentals and Applications - Atlas R.M.
Pub: Macmillan Publishing Co, New York
13. Introduction Mycology (3rd Edition) - Alexopoulos C.J.
Pub: Willey Eastern Ltd. New Delhi



- | | |
|--|---|
| 14. Outlines of Biochemistry (5 th Edition)
Pub: John Willey A& Sons, N.Y. | - Conn E.B. Stumpf P.K., Bruening G.
Doi. R.H. |
| 15. Elementary Microbiology Vol. I & II – Edited by
Pub: Akta Prakashan, Nadiad, INDIA. | - Modi H-A |
| 16. Microbes in action
Pub: McGra Hill Books Co. pelazer. | - Seeley H.W., Vandemark P.J. |
| 17. Textbook of biochemistry
Pub: Prentice-Hall of india Pvt. Ltd. New Delhi. | - Ranganatha Rao. |
| 18. General Biochemisry
Pub: Wiley Eastern Ltd. New Dilhi. | - Weil J.H. |
| 19. Zinsser Microbiology (15 th Edition)
Pub: Meredith Corpo Ration,N.Y. | - Jiklik W.K., Smith D.T. |
| 20. Biochemistry of Bacterial Growth (2 nd Edition)
Pub: Blackwell Scientific pub. Oxford, London | - Mandelstam J.
- Mcquilloen K.] |
| 21. Review of Physiological chemistry (17 th Edition)
Pub: Kothari Book Depot, Parel, 'Bombay-430 066 | - Harper H.A., Rodwell V.H.
Mayes P.A. |
| 22. Elementary Biochemistry (2 nd Edition)
Pub: Vakils, ferror and Simons Pvt. Ltd. Bombay | - Merta E.T. |
| 23. The Blue Greens
Pub: Edward Arnold, London. | - Fay Peter |
| 24. Microbiology: Concepts and Applications
Pub: John Wiley and Sons, N.Y. | - P.A. Ketchum |
| 25. Basic Microbiology (4 th Edition) | - Volk W.A. Wheeler M.F |
| 26. Microbiology (5 th International Edition)
Pub: Tata McGrow – Hill Publ. Co. Ltd. New Delhi. | - Pelezar M.J., Reid R.D., Chan E.C.S. |
| 27. Microbiology (2 nd Edition)
Pub: WCB McGraw Hill, Bosto | - Lim Dgine |
| 28. A textbook of environmental chemistry and pollution control (3 rd Edition)
Pub: S. Chand and Company Ltd. New Dilhi-110 055. | - S.S. Dara |
| 29. Environmental pollution
Pub: Anmol Publications Pvt. Ltd., New Delhi-110 002. | - Timy Katyal, M. Satak
Efited by Rja Kumar |
| 30. Concepts of ecology
Pub: Saras Publication, Kanyakumari | - A. J. Salle |
| 31. Fundamental principles of bacteriology | - W.D. Grant |
| 32. Tertiary level biology, Environmental Microbiology | - P.E. Long. |
| 33. Microbiology and pethology for nurses. | - Frobisher Goodole |
| 34. Textbook of Microbiology (2 nd Edition) | - R. Ananthanarayan , C.K. Murroy |
| 35. Fundamental of Microbiology | - I.Edward Alcamo |
| 36. Medical Microbiology (2 nd Edition) | - P.R. Murroy, G.S.Kobayashi,
M.A. Pfalled, K.S. Rosenthal |
| 37. General Microbiology Vol. I & II
Pub: Himalaya Publishing House, Mumbai | - C.B. Power, Dr.H.F. Daginawala |
| 38. Food Microbiology | - Frazier |
| 39. Dairy Microbiology
Pub: Akta Prakashan | - Prajapati |
| 40. Mackie and McCartney's Practical Medical Microbiology (15 th Edition) | - Colld J.E. |
| 41. Laboratory experiments in Microbiology (5 th Edition) | - Johnson T.R., Cape C. L. |
| 42. Laboratory Manual in Biochemistry (1981) | - Jayaranan J. |
| 43. An nitrification to practical biochemistry (3 rd Edition)
Pub: McGraw Hill Book Co., U.K. 1987. | - Plummer D.T. |
| 44. Experimental Microbiology Vol . I & II.
Pub: Aditya, Ahmedabad. | - Rakesh J. Patel, Kiran R. Patel |
| 45. Microbiology A. Practical approach | -Bhavesh Patel, Nandini Phanse |



B.Sc. (Microbiology)
SEMESTER – IV

PREAMBLE:

1. There shall be three theory papers each of 100 marks (70 marks based on external examination and 30 marks based on internal examination).
2. Practical examination will be of 150 marks, based on external university examination.
3. There shall be three lectures (1 hour each) per theory paper per week and practicals of three lecture hours per day for three days in a week.
4. It is compulsory to pass in internal as well as external examinations independently.
5. There shall be Two Semesters in Academic Year.(Semester-1&2)
6. Proposed syllabus has been framed as per guidelines suggested by U.G.C.

PRACTICAL EXAMINATIONAL SCHEME:

	<u>Marks</u>
1. Isolation and characterization of bacterial pure cultures	25
2. Applied microbiological problem	25
3. General Exercise	25
4. Spotting	20
5. Identification of fungi (Cultural and microscopic characteristics)	10
6. Computer based experiments	15
7. Journal and slides	10
8. Viva-Voce: I	10
9. Viva-Voce: II	10
Grand total:	150

TWO EXAMINERS:

A		B	
Ex. No.	Marks	Ex. No.	Marks
1	25	2	25
3	25	4	20
6	15	5	10
8	10	7	10
-	-	9	10
Total	75	Total	75

THREE EXAMINERS:

A		B		C	
Ex. No.	Marks	Ex. No.	Marks	Ex. No.	Marks
1	25	2	25	3	25
4	20	5	10	7	10
8	10	6	15	9	10
Total	55	Total	50	Total	45

Note:

1. The viva-voce will be illustrative of theoretical portion of the syllabus.
2. The candidate is required to bring for inspection his/her practical journal duly signed and certified by Head of the Department at the time of practical examination daily.
3. The candidate is required to submit permanent slides prepared during the course of study during practical examination.



B.Sc. (MICROBIOLOGY)
SEMESTER – IV

Paper No. MI-401: Nutrition and Microbial Diversity:

Credit: 03

Total Marks: 100

Marks: Semester End Examination: 70

Continues Internal Evaluation: 30

UNIT	DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
Unit – I	<p><u>Study of acellular, prokaryotic & eukaryotic life:</u></p> <ol style="list-style-type: none"> 1. Study of acellular, prokaryotic life <ol style="list-style-type: none"> a. Cyanobacteria and phototrophic bacteria b. Actinomycetes. c. Eubacteria: aerobic and anaerobic d. Rickettsia and Chlamydia e. Archaeobacteria f. Viroids, prions and viruses 2. Study of Eukaryotic life <ol style="list-style-type: none"> a. Fungi including yeast b. Algae c. Protozoa (Occurrence, characteristics, morphology, reproduction, cultivation and classification) 	15	23
Unit – II	<p><u>Nutrition, cultivation, isolation and preservation of Microbial cultures:</u></p> <ol style="list-style-type: none"> 1. Nutrition: Requirements of nutritional types of microorganisms transfer across cell membrane 2. Cultivation: Types of Media, common ingredients, and steps of preparation. 3. Physical conditions required for the cultivation of bacteria (temperature, gaseous requirements, acidity and alkalinity, hydrostatic pressure, etc.) 4. Isolation and preservation of pure cultures [Various techniques, and their principle, applications, advantages and limitations] 5. Culture collection centers and gene bank including reference centers 	15	23
Unit – III	<p><u>Bacterial nomenclature and taxonomy:</u></p> <ol style="list-style-type: none"> 1. Principles of binomial nomenclature including International code of nomenclature 2. Major characteristic used in taxonomy 3. Approach to classification <ol style="list-style-type: none"> a. Phenetic b. Numerical c. Phylogenetic d. Molecular tools: T_m, G+C content, Ribosomal, RNA analysis and sequential analysis e. Present Picture: Bergey's Manual of Systemic Bacteriology (IInd Ed.) 	15	24

Break up of Continuous Internal Evaluation:

1. Assignments	10 Marks
2. Test	10 Marks
3. Seminar	<u>10 Marks</u>
Total Marks	30 Marks



Paper No. MI-402: Bioenergetics & Microbial Metabolism:

Credit: 03

Total Marks: 100
Marks: Semester End Examination: 70
Continues Internal Evaluation: 30

UNIT	DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
Unit – I	<u>Basic principles of bioenergetics:</u> 1. Principles of bioenergetics 2. Structure of ATP and functions of ATPase. 3. Principle modes of energy production a. [Phosphorylation, Oxidative phosphorylation including substrate level, photophosphorylation.] 4. Transport of nutrients across membrane. a. Membrane structure: Fluid mosaic model and Fick's law b. Siderophores [metal transport] c. Membrane transport receptors	15	23
Unit – II	<u>Enzyme and coenzymes:</u> 1. General properties, nomenclature and classification. a. Nature and mechanisms of enzyme action. b. Factors affecting enzyme activity. c. Inhibition of enzyme action. d. Regulatory (allosteric) enzymes e. Applications of enzymes. (i) Research / Academic (ii) Industrial (iii) Diagnostic / Therapeutic f. Classification of Enzymes 2. Proteolytic enzymes 3. Types and functions of coenzymes and co-factors	15	24
Unit – III	<u>Photosynthesis, assimilation and catabolism:</u> Photosynthesis - pathways C3 and C4. 1. Assimilation of carbon in bacteria and carbon-dioxide fixation. [Calvin Benson cycle] and gluconeogenesis. 2. Assimilation of: nitrogen, phosphorous and sulfur. 3. Catabolism of proteins. 4. Catabolism of fats/lipids	15	23

Break up of Continuous Internal Evaluation:

1. Assignments	10 Marks
2. Test	10 Marks
3. Seminar	10 Marks
Total Marks	30 Marks



Paper No. MI-403: Applied Microbiology:

Credit: 03

Total Marks: 100

Marks: Semester End Examination: 70

Continues Internal Evaluation: 30

UNIT	DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
Unit – I	<u>Aerobiology:</u> 1. Origins, number and kinds of micro-organisms present in air a. Air sampling & methods of enumeration of micro-organisms present in air b. Air-borne pathogenic organisms c. Air sanitation-its importance in hospitals and their industrial micro-biota d. Air borne diseases.	15	23
Unit – II	<u>Microbiology of fresh, domestic and waste water:</u> 1. Types of water. 2. Collection and examination of water. 3. Control of microorganism in fresh water and waste water. 4. Microbiological examination of water (qualitative and quantitative) 5. Water purification – individual and municipal water supplies 6. Chemical and microbiological waste water treatment (COD and BOD) 7. Waste water treatment processes: a. Single dwelling units: Septic tank b. Municipal treatment: Primary, secondary tertiary and quaternary treatment processes 8. Sludge treatment, composting, compost as fertilizer 9. Water-borne diseases: Bacterial, fungal, protozoal and viral	15	23
Unit – III	<u>Microbiology of milk and food</u> 1. Microbiology of milk and dairy products. a. Sources of microorganisms in milk. b. Qualitative and quantitative examination of milk. c. Grading of milk, pasteurization and methods to check its efficiency. d. Undesirable organisms in milk causing spoilage in different ways e. Milk-borne infections. f. Preparation of dairy products: Cheese, Butter, Yoghurt & other fermented milk / products 2. Microbiology of Food a. HACCP analysis of food b. Microbial flora of fresh foods: c. [Meats, Poultry –eggs, Fruits and Vegetables, Shellfish and Fin-fish] d. Intrinsic and extrinsic factors affecting food spoilage e. Food spoilage by: radiation, pressure, freezing , enzymes and organisms	15	24



	f. Microbial control, food preservation techniques including canning process g. Bacteriological examination of food: Microscopic and cultural techniques (i) Fermented foods: Sauerkraut, Pickles and Ensilage (ii) SCP and Mushrooms as food (iii) Food infection and food poisoning (iv) Food borne disease		
--	--	--	--

Break up of Continuous Internal Evaluation:

1. Assignments	10 Marks
2. Test	10 Marks
3. Seminar	<u>10 Marks</u>
Total Marks	30 Marks



Paper No. MI-404: Practical's in Microbiology:

Credit: 09

Total Marks: 90 (External Only)

DETAILED SYLLABUS	TEACHING HOURS	MARKS / WEIGHT
<ol style="list-style-type: none">1. Study of pure cultures.<ol style="list-style-type: none">a. Enterobacter aerogenesb. Escherichia colic. Proteus vulgaris or Proteus mirabilisd. Salmonella groupe. Dysentery groupf. Pseudomonas aeruginosag. Staphylococcus aureush. Bacillus subtilis2. Bacteriological examination [qualitative and quantitative] of: (A) Air (B) Water (C) Food (D) Milk3. Study of metabolic activities of bacteria:<ol style="list-style-type: none">a. Degradation of caseinb. Degradation of gelatin (gelatin agar and nutrient gelatin medium).c. Amino acid deamination test: phenylalanine deamination.d. Amino acid decarboxylation test (using Moeller's medium)e. Lipid hydrolysis testf. Dehydrogenase testg. Oxidase testh. Catalase testi. Starch hydrolysis testj. Coagulase testk. M R Testl. V P testm. Indole production testn. H₂S production testo. Sugar fermentation tests (Glucose, sucrose, lactose, xylose, maltose, mannitol)4. Cultivation and identification of fungi (based on colony characteristics and microscopic observation)<ol style="list-style-type: none">a. <u>Alternaria</u>b. <u>Helminthosporium</u>c. <u>Cunninghemella</u>d. <u>Curvularia</u>e. Yeast – <u>Saccharomyces</u>5. Determination of phenol coefficient for known & unknown disinfectant6. BOD and COD determination of waste-water samples7. Quantitative estimation of sugar / protein and nucleic acid using colorimeter/ spectrophotometer8. Study of human skin flora9. Lethal action of UV rays10. Comparative study of lethal effect of heat on vegetative cell and spore of microorganisms at pasteurization temperature		



11. Study of permanent slides of: a. Algae (Volvox, Spirogyra, Diatoms), b. Blue-green algae (Nostoc, Anabena) c. Protozoa (Amoeba, Paramecium, Euglena).		
12. Computer based experiments: a. Study of complementary strands of DNA and t-RNA. b. Study of peptide chain biosynthesis: transcription and translation		

List of Books Recommended:

1. Microbiology (5th Edition)
Pub: McGraw Hill Book Company. N.Y. - Pelczar M.J.
Chan E.C.S. Krieg N.L.R.
2. Microbiology (International Edition) Concepts and Applications.
Pub: McGraw Hill Book Company. N.Y. - Pelczar M.J.
Chan E.C.S.
Krieg N.L.R.
3. Microorganisms in Action: Concepts and Applications in Microbial Ecology: - Lynch J.M., Hobbie J.B.
Pub: Blackwell Scientific Publications, London
4. General Microbiology (7th Edition)
Pub: Cambridge University Press (Loss Price Edition.) - Hans G. Schlegel
5. Biology of microorganisms (Brooks') (9th Edition) 2002
Prentice Hall International Inc N.Y. - Madigan,
M.T. Martinko & J. Parker.
6. Environmental Biology and Toxicology (2nd Edition)
Pub: Restage Publications, Meerut. - P.D. Sharma.
7. Microbiology (2nd Edition)
Pub: Restage Publications, Meerut. - P.D. Sharma.
8. General Microbiology (5th Edition)
Pub: Macmillan Education Ltd., Hampshire. - Stanier R.J.
Ingraham J.L., Wheelock M.L.
Painer P.R.
9. Microbial Ecology – Fundamental and Applications
Pub: Addison – Wesley Publications Co. - Atlas R.M.
Bartha R. London.
10. Basic Microbiology With applications (2nd Edition)
Pub: Prentice Hall, New Jersey - Brock K.M.
11. Basic Microbiology With applications (2nd Edition)
Pub: The Benjamin / Cummings Publishing INC. London. - Tortora G.J.
Funke B.R., Case C.L.
12. Microbiology: Fundamentals and Applications
Pub: Macmillan Publishing Co, New York - Atlas R.M.
13. Introduction Mycology (3rd Edition)
Pub: Wiley Eastern Ltd. New Delhi - Alexopoulos C.J.
14. Outlines of Biochemistry (5th Edition)
Pub: John Wiley & Sons, N.Y. - Conn E.B.
Stumpf P.K., Bruening G.,
Doi. R.H.
15. Elementary Microbiology Vol. I & II – Edited by
Pub: Akta Prakashan, Nadiad, INDIA. - Modi H-A
16. Microbes in action
Pub: McGraw Hill Books Co. Pelzer. - Seeley H.W.
Vandemark P.J.
17. Textbook of biochemistry
Pub: Prentice-Hall of India Pvt. Ltd. New Delhi. - Ranganatha Rao.
18. General Biochemistry
Pub: Wiley Eastern Ltd. New Delhi. - Weil J.H.
19. Zinsser Microbiology (15th Edition)
Pub: Meredith Corporation, N.Y. - Jiklik W.K.
Smith D.T.
20. Biochemistry of Bacterial Growth (2nd Edition)
Pub: Blackwell Scientific pub. Oxford, London - Mandelstam J.
Mcquilloen K.]
21. Review of Physiological chemistry (17th Edition) - Harper H.A.



- Pub; Kothari Book Depot, Parel, 'Bombay-430 066
22. Elementary Biochemistry (2nd Edition)
Pub; Vakils, ferror and Simons Pvt. Ltd. Bombay
23. The Blue Greens
Pub; Edward Arnold, London.
24. Microbiology: Concepts and Applications
Pub : John Wiley and Sons, N.Y.
25. Basic Microbiology (4th Edition)
26. Microbiology (5th International Edition)
Pub: Tata McGrow – Hill Publ. Co. Ltd. New Delhi.
27. Microbiology (2nd Edition)
Pub: WCB McGraw Hill, Boston
28. A textbook of environmental chemistry and pollution control (3rd Edition)
Pub; S. Chand and Company Ltd. New Dilhi-110 055.
29. Environmental pollution
Pub: Anmol Publications Pvt. Ltd., New Delhi-110 002.
30. Concepts of ecology
Pub: Saras Publication, Kanyakumari
31. Fundamental principles of bacteriology
32. Tertiary level biology, Environmental Microbiology
33. Microbiology and pethology for nurses.
34. Textbook of Microbiology (2nd Edition)
35. Fundamental of Microbiology
36. Medical Microbiology (2nd Edition)
37. General Microbiology Vol. I & II
Pub: Himalaya Publishing House, Mumbai
38. Food Microbiology
39. Dairy Microbiology
Pub: Akta Prakashan
40. Mackie and McCartney's Practical Medical Microbiology (15th Edition)
41. Laboratory experiments in Microbiology (5th Edition)
42. Laboratory Manual in Biochemistry (1981)
43. An nitrification to practical biochemistry (3rd Edition)
Pub: McGraw Hill Book Co., U.K. 1987.
44. Experimental Microbiology Vol. I & II.
Pub: Aditya, Ahmedabad.
45. Microbiology A. Practical approach
- Rodwell V.H., Mayes P.A.
- Merta E.T.
- Fay Peter
- P.A. Ketchum
- Volk W.A., Wheeler M.F.
- Pelezar M.J.
Reid R.D., Chan E.C.S.
- Lim Dgine
- S.S.Dara
- Timy Katyal
- M. Satak
Efited by Rja Kumar
- A. J. Salle
- W.D. Grant
- P.E. Long.
- Frobisher, Goodole
- R. Ananthanarayan
- C.K. Murroy
- I. Edward Alcamo
- P. R. Murroy,
- G.S.Kobayashi,
M.A. Pfalled,
K.S. Rosenthal
- C.B. Power
Dr. H. F. Daginawala
- Frazier
- Prajapati
- Colld J.E.
- Johnson T.R., Cape C. L.
- Jayaranan J.
- Plummer D.T.
- Rakesh J. Patel
- Kiran R. Patel
- Bhavesh Patel
Nandini Phanse