SCHEME OF EXAMINATION
AND
COURSE OF STUDY AS PER NATIONAL EDUCATION POLICY (NEP 2022)

IN

INDUSTRIAL MICROBIOLOGY

B.Sc. I, II, III & IV YEAR
(w.e.f. Session 2022-23 onward)

DEPARTMENT OF BOTANY & MICROBIOLOGY
GURUKULA KANGRI (DEEMED TO BE UNIVERSITY),
HARIDWAR – 249404
AUGUST, 2022

COURSE STRUCTURE

NOTE: Questions of theory paper are to be set under two sections i.e., A and B. In section A, the student has to answer any five out of ten **short answer questions** (150 words) uniformly distributed from the entire syllabus. In Section B, the student has to answer any four questions out of eight **long answer questions/descriptive questions** uniformly distributed from the entire syllabus are to be set for section B. Section A and B will be of 30, and 40 marks respectively. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper

Year/ Programme	Semester	Paper Code	Paper title	Credits	Theory /Practical	Total Number of Classes (in hours)
1st/ Certificate in Microbial Techniques	I	BIM-C 101	DSC-1: Fundamentals of Microbiology	4	Theory	60
		BIM-C 151	DSC-1: Lab Course CC-01	2	Practical	60
		BIM-V 101	VAC-1	2	-	-
			AECC-1: Environmental Science and Sustainable Development	4	-	-
			Co-Curricular-1: NSS/NCC/Cultural (Music/Arts/Painting/Dance) **(Qualifying)**	-	-	-
	II	BIM-C 201	DSC-2: Microbial Technology	4	Theory	60
		BIM-C 251	DSC-2: Lab Course CC-02	2	Practical	60
		BIM-V 201	VAC-2	2	-	-
			AECC-2: Environmental Science and Sustainable Development	4	-	-
			Co-Curricular-2: NSS/NCC/Cultural (Music/Arts/Painting/Dance) **(Qualifying)**	-	-	-
2nd/ Diploma in Fermentation Technology	III	BIM-C 301	DSC-3: Microbial Physiology and Metabolism	4	Theory	60
		BIM-C 351	DSC-3: Lab Course CC-03	2	Practical	60
		BIM-S 301	SEC-1: Food Fermentation Techniques	4	Theory	60
		BIM-V 301	VAC-3	2	-	-
	IV	BIM-C 401	DSC-4: Industrial Microbiology	4	Theory	60
		BIM-C 451	DSC-4: Lab Course CC-04	2	Practical	60

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		BIM-S 401	SEC-2: Biofertilizers	4	Theory	60
		BIM-V 401	VAC-4	2	-	-

Year/ Programme	Semester	Paper Code	Paper title	Credits	Theory /Practical	Total Number of Classes (in hours)
3rd/ Degree in Bachelor of Science in Industrial Microbiology	V	BIM-E 501	DSE-5: Environmental Microbiology	4	Theory	60
		BIM-E 551	DSE-5: Lab Course - 05	2	Practical	60
		BIM-S 501	SEC-3: Pharmaceutical Microbiology	4	Theory	60
		BIM-V 501	VAC-5	2	-	-
	VI	BIM-E 601	DSE-6: Immunology	4	Theory	60
		BIM-E 651	DSE-6: Lab Course - 06	2	Practical	60
		BIM-S 601	SEC-4: Molecular Genetics	4	Theory	60
		BIM-V 601	VAC-6	2	-	-
4th/ Degree in Bachelor of Science in Industrial Microbiology (Honours)	VII	BIM-E 701	DSE-7: Recombinant DNA Technology	4	Theory	60
		BIM-E 751	DSE-7: Lab Course CC-07	2	Practical	60
		BIM-E 702	DSE-8: Food Borne Diseases and Food Preservation	4	Theory	60
		BIM-E 752	DSE-8: Lab Course CC-08	2	Practical	60
		BIM-E 703	DSE-9: Medical Microbiology	4	Theory	60
		BIM-E 753	DSE-9: Lab Course CC-09	2	Practical	60
		BIM-T 754	Industrial Training/Survey and Field Work/Research Project/Dissertation	6	-	-
			VoC-1: Communication Skills and Personality Development	2	-	-
	VIII	BIM-E 801	DSE-10: Basic Tools and Techniques in Microbiology	4	Theory	60

		BIM-E 851	DSE-10: Lab Course CC-10	2	Practical	60
		BIM-E 802	DSE-11: Agricultural Microbiology	4	Theory	60
		BIM-E 852	DSE-11: Lab Course CC-11	2	Practical	60
		BIM-E 803	DSE-12: Microbiological Analysis of Air and Water	4	Theory	60
		BIM-E 853	DSE-12: Lab Course CC-12	2	Practical	60
		BIM-T 854	Industrial Training/Research Project/Dissertation	6		
		BIM-E 855	VoC-2: Vedic Microbiology	2	Theory	30

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B.Sc. I Year **Semester – I**

BIM -C101
DSC-1 FUNDAMENTALS OF MICROBIOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To understand the Vedic culture in which there is information related to microorganisms and microbial diseases and their control
- To acquire knowledge of different techniques to stain microorganisms and how they can visualize the microorganisms under different types of microscopes.
- To acquire an overall knowledge on the morphology and functions of the structures associated with the prokaryotes and eukaryotes.
- To become familiar with general characteristics of prokaryotic and eukaryotic microbes and also acquire knowledge of cellular organization, life cycle and economic importance.

Learning outcomes:

At the end of course student will be able

- To know the different milestones in the history of microbiology, importance of Vedic microbiology and scope of microbiology
- To understand and know the application of techniques used in the field of Microbiology.
- Identify key constituents of prokaryotic cells and their function.
- To classify the prokaryotic cell by conventional as well as modern methods.
- To stain bacteria with simple, differential and special stains.

UNIT–I

Vedic Microbiology: Agnihotra- A Vedic technology for environment purification, Origin of earth with reference to Veda, different terms used for microbes, distribution of microorganisms, microbes and diseases, different methods for control of microorganisms as described in Vedas., Health and healthy life; prevalence of utensil and food grains; Kshudra Rog in humans- PanduRoga (jaundice), Galaganda/Gandmala (mumps) and Masurika (smallpox)

(04 Lectures)

UNIT-II

Historical account of microbiology, spontaneous generation vs biogenesis, golden age of microbiology, contributions made by Anton von Leeuwenhoek, Louis Pasteur, Elie Metchnikoff, Robert Koch and Edward Jenner, Joseph Lister, Alexander Fleming; germ theory of disease.

(12 lecture)

UNIT III

General features of various groups of microorganisms: bacteria, cyanobacteria, archaea, mycoplasma, viruses (Morphology and Multiplication of T4 Bacteriophage), protozoa and fungi, Bacterial cells (size and arrangement), ultrastructure of bacterial cells.

(16 Lectures)

UNIT-IV

Growth and its mathematical expression, Culturable and non-culturable microorganisms (metagenomics): broad outline classification of different microorganisms, bacterial nomenclature, modern trends in bacterial taxonomy, Whittaker's five kingdom classification, three domain system of classification, Eight kingdom classification.

(12 Lectures)

UNIT-V

Staining Vs Dye,special stain, various methods of staining (Gram stain, differential stain, endospore, capsule, flagella and negative stain).Physical methods of microbial control: Heat, Low temperature, High pressure, Filtration, Desiccation, Osmotic pressure, Radiation,Chemical methods of microbial control,Antiseptic, Disinfectants: types and mode of action.

(16 Lectures)

DSC 1 SEMESTER I / BIM-C151 (LAB COURSE CC-01)

1. Principles and applications of microbiology laboratory instruments (Autoclave, Laminar Air Flow, Incubator, Hot Air Oven, and Light Microscope).
2. Perform Gram staining of bacteria.
3. Perform Endospore staining of bacteria.
4. Perform Capsule staining by negative staining technique of bacteria.
5. Perform Flagella staining of bacteria.
6. Perform Negative staining of bacteria.
7. Isolation of microorganisms from soil by pour plate method.
8. Isolation of microorganisms from air.
9. Effect of osmotic pressure.
10. Effect of radiation.
11. Cultivation of bacteriophages.
12. To prepare the Nutrient Agar Medium.
13. To prepare the Potato Dextrose Agar Medium.

Suggested Reading

1. Navneet, N. Handa, P. Kumar, S. Kumar, & S Gautam. 2011. Yagya Therapy. Swami Shraddhanand Educational and Welfare Society, Haridwar
2. Dubey, R.C. 2021. *Vedic microbiology- A Scientific Approach* (English Version), Motilal Banarasidas International, Delhi– 110007.
3. Dubey, R.C. 2020. *Vedic microbiology- Ek Vaijnanik Drishti*(Hindi Version), Aastha Prakashan, Delhi-110053
4. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
5. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81:219-2559-2
6. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.
7. Cappachino. Microbiology- A laboratory Manual, Pearson Education India ISBN: 978-9332535190
8. Powar and Daginawala. General Microbiology Vol1 and Vol2, Himalaya Publishing House,**ISBN-13:** 978-9350240892

B.Sc. I Year

BIM -V101 **Semester – I**

Credits: 2 **VAC-1**

B.Sc. I Year **Semester – II**

BIM -C201
DSC-2 MICROBIAL TECHNOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- To learn and understand the cultivation technique of aerobic and anaerobic bacteria
- To know the isolation and preservation techniques of bacteria.
- To get the knowledge of agriculture techniques for improving crop production.
- To understand how biopesticides will be prepared from bacteria and fungi

Learning outcomes:

At the end of course student will be able

- To cultivate aerobic and anaerobic bacteria in the laboratory.
- To preserve industrially important bacteria in the laboratory.
- To develop biopesticide from bacteria and fungi.

UNIT – I

Cultivation of bacteria: aerobic and anaerobic; Culture media: types and preparation; various techniques used for isolation of microorganisms from soil, water and air; pure cultures techniques; cultural characteristics; Preservation techniques.

(10 Lectures)

UNIT – II

History of evolutionary trend of fermentor from ancient to modern period/era; shake flask, bioreactor, construction material:Design of fermentors; aeration and agitation, control of pH, temperature, foaming agents, biosensor.

(12 Lectures)

UNIT -III

Fermentation media and its preparation: sterilization of apparatus and production media;Inoculum preparation; downstream processing;Types of fermentation: batch, fed batch, continuous, dual or multiple, surface and submerged fermentation.

(15 Lectures)

UNIT -IV

Agricultural microbiology: Plant growth promoting rhizobacteria (PGPR); N_2- fixers and phosphate solubilizers; production of bioinoculants; cyanobacteria, bacteria and fungi.

(11 Lectures)

UNIT -V

Biopesticides: concept of biopesticides;advantages of biopesticides; microorganisms used for preparation of biopesticides; Mass production of microbial pesticides in general: bacterial and fungal pesticides.

(12 Lectures)

Suggested Reading

1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034 ISBN 81-219-2620-3
2. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81-219-2559-2
3. Casida, L.E.J.R. Industrial Microbiology, New Age International Publisher.
4. A.H.Patel, Industrial Microbiology, Laxmi Publication, **ISBN-10:** 9385750267
5. Prescott and Dunns.Industrial Microbiology, CBS Publishers and Distributers, ISBN-10: 8123910010
6. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.

DSC 2 SEMESTER II / BIM-C151 (LAB COURSE CC-02)

1. Isolation of bacteria from soil by serial dilution method.
2. Isolation of Phosphate solubilising bacteria.
3. Isolation of aquatic fungi by bait technique.
4. Effect of pH on growth of microorganisms.
5. Effect of temperature on growth of microorganisms.
6. Determination of oxygen requirement of given bacteria.
7. Demonstration of fermentation by yeast.
8. Isolation of cyanobacteria from paddy fields.
9. Isolation of root nodulating bacteria from leguminous plants.
10. Isolation of bacteria inhibiting phytopathogenic fungi
11. Cultivation of anaerobic bacteria

B.Sc. I Year **Semester – II**

BIM –V201

VAC-2

Credits: 2

Semester – III
BIM -C301
DSC-3 MICROBIAL PHYSIOLOGY AND METABOLISM

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- To understand different phases of bacterial growth and its kinetics.
- To understand how microbes do catabolism to get energy to build structure.
- To understand different metabolic pathways and enzymes involved by which energy will be generated
- To acquire knowledge of classifying enzymes and how they function.
- To understand how the nitrogen is fixed by symbiotic and non-symbiotic nitrogen fixation and genes involved in nitrogen fixation

Learning outcomes:

At the end of course student will be able to

- Calculate generation time and number of generations.
- Explain principles and mechanism of aerobic and anaerobic respiration in microorganisms.
- Explain the concept nitrogen metabolism, assimilation of nitrates, ammonia assimilation and fixation of nitrogen
- Explain the bacterial photosynthesis and also the differentiation between oxygenic and anoxygenic photosynthesis bacteria
- Classify enzymes and demonstrate the mechanism of enzymes and their functions.

UNIT-I

Bacterial Growth Curve; Synchronous growth; microbial growth kinetics in batch cultures; growth measurement: by cell mass, cell count and cell turbidity;factor affecting the growth of microorganism.

(12 Lectures)

UNIT II

Enzymes: characteristics, nomenclature, classification and application of enzymes;Factors influencing enzymatic activity;Mechanism of enzyme action;Allosteric enzymes.

(10 Lectures)

UNIT-III

General concepts of respiration and fermentation: aerobic and anaerobic respiration, fermentation; alcoholic fermentation, lactic acid fermentation

(10 Lectures)

UNIT-IV

Microbial metabolism: General strategy of metabolism, anabolism, catabolism, ATP, Phosphorylation, Oxidative phosphorylation and substrate level phosphorylation, primary metabolic pathway, secondary metabolic pathway, metabolism of carbohydrates (glycolysis, TCA cycle)

(14 Lectures)

UNIT-V

Nitrogen fixation in symbiotic and free-living microorganisms, root nodule formation, leghaemoglobin, nitrogenase enzyme;Photosynthetic bacteria and their classification.

(14 Lectures)

Suggested Reading

1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81:219-2559-2
3. Roger Y. Stanier, John L. Ingraham. General Micobiology, Palgrave Macmillan, **ISBN-13**: 978-0333763643
4. Powar and Daginawala. General Microbiology Vol1 and Vol2, Himalaya Publishing House,**ISBN-13**: 978-9350240892
5. M.T.Madigan, J.M.Mahinko Jack Parkar Brock. Biology of Microorganisms, Pearson Education ISBN 978-9332586864

DSC 3 SEMESTER II / BIM-C351 (LAB COURSE CC-03)

1. Determination of growth curve of bacteria.
2. Bacterial population count by turbidimetry method
3. Amylase production test.
4. Cellulase production test.
5. Demonstration of carbohydrate metabolism.
6. Demonstration of enzyme activity in given microorganism.
7. Detection of number of bacteria in milk by standard plate count technique.
8. Determination of quality of milk sample by MBRT (methylene blue reductase test).
9. Laboratory preparation of sauerkraut.
10. Different tools in microbiology lab (Autoclave, Laminar Air Flow, Incubator, Hot Air Oven, and Light Microrscope).
11. Effect of ultraviolet radiation on bacterial growth.
12. Effect of dyes on bacterial growth.
13. Separation of leaf pigments through paper chromatography on bacterial growth.

B.Sc. II Year **Semester – III**

BIM -S301
SEC-1 FOOD FRERMENTATION TECHNIQUES

MM : 100
Time : 3 hrs
L Credit
4 4
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To know the different types of fermented foods available in markets.
- To know about the vegetable and grain based fermented products.

Learning outcomes:

At the end of course student will be able to

- Prepare the fermented foods from milk, grain and vegetables.
- Prevent and control the bacterial infection through various techniques.

UNIT-I

Fermented Foods: Definition, types, advantages and health benefits of fermented foods. **(10 Lectures)**

UNIT- II

Milk Based Fermented Foods: Dahi/Yogurt, Buttermilk (Chhach), Shrikhand and Cheese: Preparation of inoculum and production process. **(16 Lectures)**

UNIT-III

Grain Based Fermented Foods: Soy sauce, Tempe, Bread, Jalebi, Miso, Tofu, Idli and Dosa: Microorganisms used and production process. **(16 Lectures)**

UNIT–IV

Vegetable Based Fermented Foods: Pickels, Saeurkraut: Microorganisms and production process. **(08 Lectures)**

UNIT–V

Probiotic Foods: History, definition, types, microorganisms and health benefits in supply of vitamins, Immunomodulation, control of pathogenic bacteria *in vivo* **(10 Lectures)**

Suggested Reading

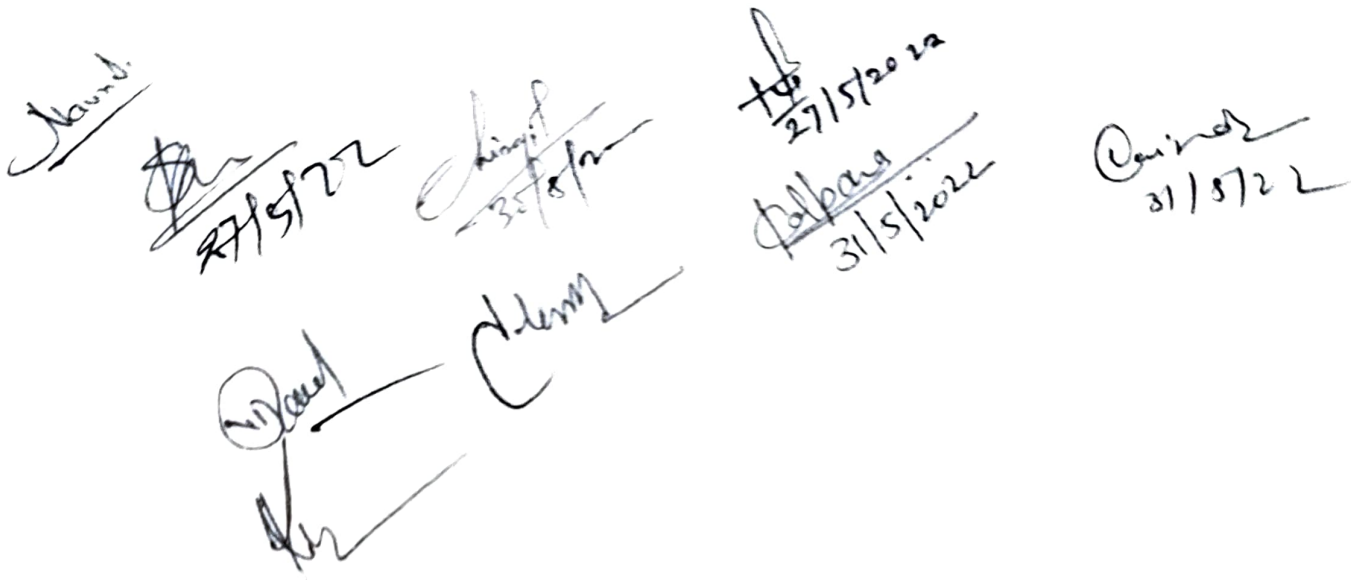
1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81:219-2559-2
3. Doyle et al., Food Microbiology: Fundamentals and Frontier, American Society of Microbiology
4. William C Frazier, Food Microbiology, MacGraw Hills Education.
5. Adam and Moss, Food Microbiology, Royal Society of Chemistry
6. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.

B.Sc. II Year **Semester – III**

BIM –V301

VAC-3

Credits: 2



B.Sc. II Year **Semester – IV**

BIM -C401
DSC-4 INDUSTRIAL MICROBIOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- To understand the scope and applications of industrial microbiology.
- To understand fermentation technologies used for the production of industrially important products.
- To understand how different fermentation products are produced, purified and recovered.

Learning outcomes:

At the end of course student will be able to

- Screen and isolate industrially important microorganisms.
- Make use of fermenters to produce alcoholic beverages and other fermentation products.
- Explain the different methods of disinfection used in industry and also how to maintain quality of product.

UNIT - I

Metabolite: Primary and secondary, principal of exploitation of microorganisms and their products, screening of microorganisms, primary and secondary screening, strain development strategies, downstream processing: filtration, centrifugation, coagulation and flocculation **(14 Lectures)**

UNIT – II

Alcoholic products: production and recovery of industrial alcohol, beer, wine, whiskey, rum, and brandy; commercial production of vinegar; Yeast and Baker's yeast **(10 Lectures)**

UNIT – III

Antibiotics: Fermentation and recovery process of penicillin, streptomycin and tetracycline. **(10 Lectures)**

UNIT - IV

Enzymes and Amino acids: Microbial production and applications of amylases, lipase and protease; Amino acids: production of L-glutamic acid and L-lysine. **(14 Lectures)**

UNIT - V

Vitamin B-12; Vitamin B2 (riboflavin), Vitamin C;Organic acids: Lactic acid and citric acid (fermentation and recovery). **(08 Lectures)**

Suggested Reading

1. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.
2. Casida, L.E.J.R. Industrial Microbiology, New Age International Publisher,
3. A.H.Patel, Industrial Microbiology, Laxmi Publication, ISBN-10: 9385750267
4. Prescott and Dunns.Industrial Microbiology, CBS Publishers and Distributers, ISBN-10: 8123910010

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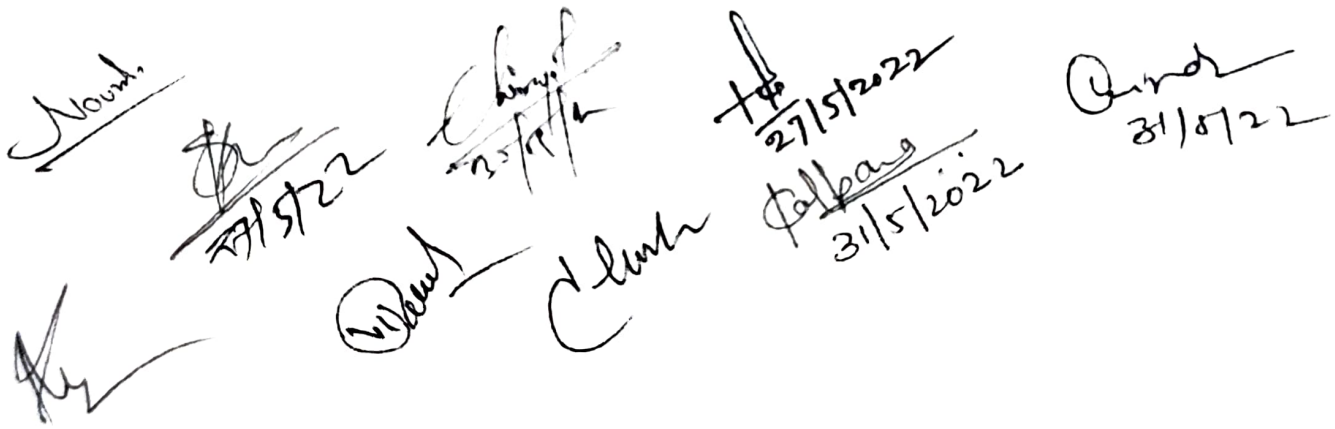
1. Isolation of antibiotic producing microorganisms from soil.
2. Laboratory production of alcohol from Grape Juice/Sugarcane Juice.
3. Demonstration of vinegar production in the laboratory.
4. Bioassay of vitamin B_{12}.
5. Fat hydrolysis (lipase activity) by a given bacterial culture.
6. Demonstration of fermentation by yeast.
7. Isolation of *Azotobacter* from garden soil.
8. Isolation of VAM (Vesicular Arbuscular Mycorrhiza) spores from soil.
9. Isolation of phosphate solubilising microorganisms from soil.
10. Antibiotic sensitivity of UTI causing bacteria.
11. Slide agglutination reaction of unknown bacterial culture.
12. Demonstration of antigen-antibody reaction.

Suggested Reading

1. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81:219-2559-2



B.Sc. II Year **Semester – IV**

BIM -S401
SEC-2 BIOFERTILIZERS

MM : 100 Sessional : 30
Time : 3 hrs ESE : 70
L Credit Pass Marks : 40
4 4
Total Hours: 60

Learning objectives:

- To understand the beneficial plant-microbes interaction and their role as biofertilizer.
- To understand symbiotic and non-symbiotic nitrogen fixation.

Learning outcomes:

At the end of course students will be able to

- Explain the role of microorganisms in nitrogen fixation, phosphate solubilisation and other beneficial roles.
- Cultivate cyanobacteria in laboratory by different methods

UNIT–I

Biofertilizers; General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic Nitrogen fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and mass cultivation; Field applications; Carrier materials. **(16 Lectures)**

UNIT-II

Non - symbiotic nitrogen fixers; Free living *Azospirillum*, *Azotobacter*- isolation, characteristics, mass inoculum, production and field application. **(08 Lectures)**

UNIT–III

Phosphate Solubilizers; Phosphate solubilizing microbes - isolation, characterization, mass inoculum production, field applications. **(08 Lectures)**

UNIT–IV

Mycorrhizal Biofertilizers: Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Inoculum production and Mass production of VAM; field applications of Ectomycorrhizae and VAM.

(16 Lectures)

UNIT –V

Cyanobacteria: *Nostoc/ Anabena*; cultivation methods (tray and pit methods); applications in field. *Azolla*: isolation, characterization, mass multiplication, role in rice cultivation, crop response, field application

(12 Lectures)

Suggested Reading

1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. N.S. SubbaRao, Soil Microbiology, Science Publishers.
3. M.K.Rai, Handbook of Microbial Fertilizers, International Book Distributing Co.
4. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.
5. Rangaswami,G. Agriculture Microbiology, Prentice Hall India Learning Ltd

B.Sc. II Year **Semester – IV**

BIM –V401

VAC-4

Credits: 2

B.Sc. III Year **Semester – V**

BIM -E501
DSE-5 ENVIRONMENTAL MICROBIOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To understand how micro organisms adapt to different environments and their interaction with different habitats and also the spread of microorganisms from the environment.
- To know different techniques of detection of water, air and soil microorganisms.
- To acquire knowledge of treating sewage and industrial water through different means.

Learning outcomes:

At the end of course student will be able to

- Isolate and identify pathogenic microorganism from air, soil and water habitat
- Characterize the waste water and also explain the method that can be utilized in wastewater treatment.

UNIT - I

Microorganisms in different habitats: brief account of heterogeneous group of microorganisms, different habitats such as soil, water, air; factors affecting microbial population in nature.

(10 Lectures)

UNIT - II

Water microbiology: type of water (atmospheric, surface and stored), parameters of aquatic environment (temperature, light, pressure, pH, turbidity and organic constituents); Microflora of aquatic environmental (freshwater and marine microbiology;deep sea-vent, volcano and soda lake.

(15 Lectures)

UNIT - III

Microbiology of domestic and waste water: sewage/waste water (physical, chemical and microbiological analysis), BOD and COD;Waste water treatment (primary, secondary and tertiary treatment).

(10 Lectures)

UNIT – IV

Solid waste management: solid waste processing (landfills, composting and anaerobic sludge digestion), Effect of solid waste on public health;Microbial pathogens in municipal solid waste;Regulation for disposal of biohazardous materials.

(12 Lectures)

UNIT - V

Bioremediation and Biodegradation: concept of bioremediation, types of bioremediation, Microbial degradation of Xenobiotics;Bioindicators of pollution.

(13 Lectures)

Suggested Reading

1. N.S. SubbaRao, Soil Microbiology, Science Publisher, ISBN: 9781578080700
2. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X
3. P.D. Sharma, Microbiology, Rastogi Publication ISBN:978-8171339358
4. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3

DSE 5 SEMESTER V / BIM-E551 (LAB COURSE CC-05)

1. Demonstration of the bacterial flora of the skin.
2. Estimation of urine bacteria by pour-plate method.
3. Isolation of microorganisms from gastrointestinal tract.
4. Isolation of microorganisms from upper respiratory tract.
5. Determination of quality of milk by MBRT (methylene blue reductase test).
6. Demonstration of microbial production of curd.
7. Microbial production of Asav/wine.
8. Determination of biological oxygen demand (BOD) of water.
9. Determination of chemical oxygen demand (COD) of water.
10. Water analysis for total bacterial population by standard plate count.
11. Sterility testing of injectables.
12. Microbial limit tests.
13. Bacterial examination of water by multiple-tube fermentation test or multiple tube tests.

B.Sc. III Year **Semester – V**

BIM -S501
SEC-3 PHARMACEUTICAL MICROBIOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- Students will learn about the basics of pharmaceutical microbiology and important microorganisms playing a role in pharmaceutics.
- To understand different products of microbial origin playing a key role in pharmaceutical applications.
- To understand the role of secondary metabolites in the pharmaceutical industry.
- To understand good practices and regulation involved in utilizing microbial product for pharmaceutical applications

Learning outcomes:

At the end of course students will be able to

- Describe how antibiotic work and resistance develop in microorganisms.
- Suggest good practices and regulation involved in utilizing microbial products for pharmaceutical applications.
- Design microbiology laboratory and explain the safety measures used in microbiology laboratory.
- Determine antibiotic sensitivity, MIC, MBC and other quality parameters of microbiology laboratory.

UNIT - I

Pharmaceutical premises: selection of area for a pharmaceutical premise, different components of a premise, Govt. norms for a premise. **(08 Lectures)**

UNIT - II

Good manufacturing practices (GMP) and its organization, good laboratory practice (GLP), cGMP; Operation of quality control (QC) and quality assurance (QA) units. **(12 Lectures)**

UNIT - III

Sterile area and its maintenance, environmental monitoring, types of environmental monitoring, methods of sterilization in pharma, disinfectants and antiseptics, evaluation of disinfectants. **(16 Lectures)**

UNIT - IV

Routine tests: antibiotic assay, microbial limit test (MLT), pyrogen tests (in rabbit, *in vitro*, endotoxin tests), preservative efficacy test.**(10 Lectures)**

UNIT - V

Safety in microbial laboratory: Biosafety cabinets ; Occurrence of laboratory infections: tuberculosis and serum Hepatitis in lab workers; Routes of infection in laboratory (infection through mouth, skin, respiratory tract)

(14 Lectures)

Suggested Reading

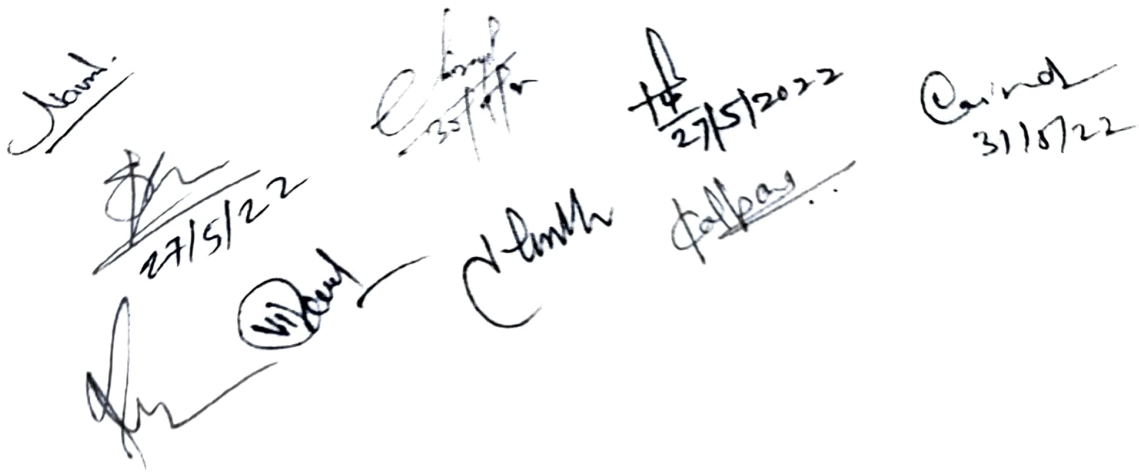
1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. SS Purohit and AK Saluja. Pharmaceutical Microbiology, Agrobios (India), ISBN-13-9788177541939
3. CKJ Paniker. Test Book of Microbiology, Orient Longman

B.Sc. III Year **Semester – V**

BIM –V501

VAC-5

Credits: 2



B.Sc. III Year **Semester – VI**

BIM -E601
DSE-6 IMMUNOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- Students will learn about the components of the immune system as well as their functions and response..
- To develop understanding of innate and adaptive immunity
- To understand different serological reaction for the diagnosis of diseases.
- To integrate immunology with medical sciences and enrich the knowledge for autoimmune disorders, hypersensitivity reactions.

Learning outcomes:

At the end of course student will be able to

- Explain the different components of immune system and how they provide defense against infections.
- Describe how our immune system protects against foreign pathogens.
- Diagnose the viral and bacterial infection through different serological tests.
- Gain knowledge of different diseased conditions generated due abnormalities in immune system.
- Explain antigen antibody reactions.

UNIT - I

Introduction; Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Paul Ehrlich, Elie Metchnikoff; Functions of immune cells - Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen.

(14 Lectures)

UNIT - II

Antigens and antibodies; Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants; Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies.

(12 Lectures)

UNIT - III

Major Histocompatibility Complex;Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways); Complement System-Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation.

(14 Lectures)

UNIT - IV

Generation of Immune Response;Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells.

(12 Lectures)

UNIT - V

Immunological Techniques; Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, Western blotting, Immunofluoresence, Flow cytometry.

(08 Lectures)

Suggested Reading

1. Janis Kubey, Immunology, W.H.Freeman
2. Peter J Delves, S.J. Martins, D.R. Burtons, Roitts Essential Immunology, Wiley Blackwell
3. C.V.Rao , An Introduction to Immunology, Alpha Science International Ltd , ISBN 978-1842650356

27/5/2022

DSE 6 SEMESTER VI / BIM-E651 (LAB COURSE CC-06)

1. Blood group determination by slide agglutination method.
2. Demonstration of bacterial plasmid isolation.
3. Demonstration of Genetic recombination in bacteria.
4. UV induced auxotropic mutant production, isolation replica plate technique.
5. Determination of nitrate production in nitrite broth soil cultures.
6. Isolation of *Fusarium*sp. from soil.
7. Isolation of *Macrophominaphaseolina* from soil.
8. Isolation of Rhizobia from root nodule.
9. Isolation of *Azotobacter*.
10. Isolation of antibiotic resistant bacteria by gradient plate technique.
11. Estimation of DNA by diphenylamine method.
12. Predict the microorganism on the basis of reaction on TSI slant
13. Perform citrate utilisation test.
14. Determination of titre by slide agglutination method.

B.Sc. III Year **Semester – VI**

BIM –S601
SEC-4 MOLECULAR GENETICS

MM : 100
Time : 3 hrs
L Credit
4 4
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To know the Genetic constituents of bacteria with special emphasis on inheritance and mutations
- To know the mechanism of genetic transfers in microbes
- To know the different techniques used to study the microbial genetics and utilizing the microbial phenomenon in different biotechnological applications.

Learning outcomes:

At the end of course student will be able to

- Explain why DNA is the genetic material of bacteria.
- Explain the application of genetic engineering techniques in basic and applied experimental biology.
- Use Plasmids as cloning vector and its applications.

UNIT - I

Genetic Material: DNA structure, Salient features of double helix, Types of DNA, denaturation and renaturation, topoisomerases in general; Organization of DNA in Prokaryotes and Eukaryotes, RNA Types and Structure; Replication of DNA:-Mechanism of DNA replication: Enzymes and proteins involved in DNA replication- DNA polymerases, DNA ligase, primase. **(15 Lectures)**

UNIT - II

Transcription: Definition, promoter - concept and strength of promoter. Transcriptional Machinery and Mechanism of transcription.Translation-Genetic code, Translational machinery, charging of tRNA, aminoacyltRNAsynthetases. Mechanisms of initiation, elongation and termination of polypeptides. **(15 Lectures)**

UNIT - III

Regulation of gene Expression Principles of transcriptional regulation, Operon-operator theory with examples from *lac* and *trp*operons; Mutations-: Definition and types of Mutations; Physical and chemical mutagens; Uses of mutations. **(15 Lectures)**

UNIT - IV

Mechanisms of Genetic Exchange: Transformation - Discovery, mechanism of natural competence Conjugation – Discovery and mechanisms, Hfr and F' strains; Transduction- Generalized transduction, specialized transduction. **(06 Lectures)**

UNIT – V

Plasmids and Transposable Elements: Property and functions of plasmids, Types of plasmids. Prokaryotic transposable elements – Insertion Sequences, composite and non-composite transposons, Replicative and Non replicative transposition, Importance of transposons and transposition. **(09 Lectures)**

Suggested Reading

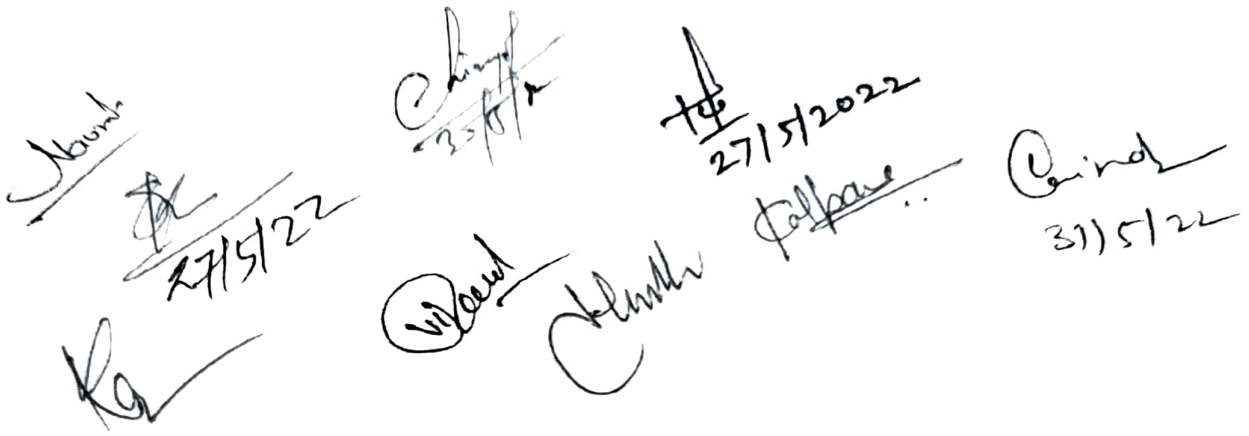
1. David Friefelder, Microbial Genetics, Narosa Publishing House.
2. Gardner, Principle of Genetics, Wiley
3. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.
4. Lehninger, Nelson and Cox. Principles of Biochemistry, WH Freeman; 7th ed, ISBN:978-1319108243

B.Sc. III Year **Semester – VI**

BIM –V601

VAC-6

Credits: 2



B.Sc. IV Year **Semester – VII**

BIM –E701
DSE-7 RECOMBINANT DNA TECHNOLOGY

MM : 100
Time : 3 hrs
L Credit
44
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To make students understand about the structure and function of biologically important molecules.
- To know the historical background of DNA structure and its role as genetic material.
- Become familiar with different tools and techniques used in genetic engineering and recombinant DNA technology.
- To understand the applications of DNA modifying enzymes, cloning strategies, vector types, and screening of recombinants
- Students will know how gene expresses and regulates in prokaryotic cells.

Learning outcomes:

At the end of course students will be able to

- Explain why DNA is the genetic material of bacteria.
- Explain the application of genetic engineering techniques in basic and applied experimental biology.
- Amplify the DNA using PCR for the diagnosis and DNA fingerprinting.
- Describe how protein synthesis occur in procaryotic cell and enzyme involved in it.

UNIT- I

Introduction to Genetic Engineering: Milestones in genetic engineering and biotechnology;Molecular Cloning- Tools and Strategies-Cloning Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyltransferase, kinases and phosphatases, and DNA ligases Cloning Vectors: Definition and Properties Plasmid vectors: pBR, Cosmids, Expression vectors.

(16 Lectures)

UNIT- II

Methods in Molecular Cloning: Transformation of DNA: chemical method, electroporation, Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viralmediated delivery, *Agrobacterium* - mediated delivery DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern – blotting techniques, DNA Western blotting. **(14 Lectures)**

UNIT- III

DNA Amplification and DNA sequencing PCR: Basics of PCR, Real-Time PCR, Sanger's method of DNA Sequencing: traditional and automated sequencing.

(09 Lectures)

UNIT- IV

Construction and Screening of Genomic and cDNA libraries: Genomic and cDNA libraries: Preparation and uses, Screening of libraries: Colony hybridization and colony PCR.

(09 Lectures)

UNIT - V

Applications of Recombinant DNA Technology: Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, antisense molecules. Bt transgenic - cotton, brinjal, Gene therapy, recombinant vaccines, protein engineering and site directed mutagenesis.

(12 Lectures)

Suggested Reading

1. Bruce Alberts. Molecular Biology of the Cells, W.W. Norton and Company, ISBN: 9780815344643
2. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.
3. Harvey, Lodish. Molecular Cell Biology, W.H.Freeman
4. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81:219-2559-2

DSE 7 SEMESTER VII / BIM-E751 (LAB COURSE CC-07)

The practicals based on BIM E701 will be performed.

A. To perform Bacterial DNA isolation and Southern analysis.

1. Bacterial DNA isolation and restriction digestion.
2. Agarose gel electrophoresis, staining and southern transfer.
3. Probe preparation and southern hybridization.
4. Washing and Blot development.

B. To perform plasmid isolation and restriction mapping.

5. Plasmid isolation and restriction digestion.
6. Agarose gel electrophoresis.

C. To perform acquiring antibiotic resistance through bacterial transformation.

7. Preparation of competent cells.
8. Transformation of competent *E. coli* with pBR322.

B.Sc. IV Year **Semester – VII**

BIM –E702
DSE- 8 FOOD BORNE DISEASES AND FOOD PRESERVATION

MM : 100
Time : 3 hrs
L Credit
4 4
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To understand the prevalence of bacteria in food commodities.
- To understand the occurrence of food-borne diseases.
- To know the different tests for the detection of food-borne infection.

Learning outcomes:

At the end of course student will be able to

- Explain the role of microorganisms in food commodities.
- Explain the factor responsible for the growth of bacteria.
- Perform different microbiological tests to determine the quality of food.

UNIT – I

Food spoilage: Microbes in food, factors affecting microbial growth in foods: Extrinsic and intrinsic, microbial spoilage of foods, microbial spoilage of food – milk and milk products, fruits and vegetables, meat products, canned foods.

(15 Lectures)

UNIT – II

Food preservation methods: Aseptic handling, temperature treatment, dehydration, lyophilization, osmotic pressure, radiations canning, chemical preservatives (salt and sugars, organic acids, propylene oxide, wood smoke and antibiotics), mechanism of chemical preservatives.

(09 Lectures)

UNIT - III

Food-borne diseases (Bacteria and Virus): Food poisoning (food intoxication and food infections);Bacterial food poisoning (*Clostridium, Bacillus cereus* and *Staphylococcus);* Viral infections:Rotavirus, Hepatitis A & C

(12 Lectures)

UNIT – IV

Food-borne diseases (Fungus and protozoans): Fungal food poisoning (*Aspergillus* and *Penicillium*), health hazards of mycotoxins; Protozonal infections; *Entamoeba histolytica, Tenia solium, Fasciola hepatica* **(12 Lectures)**

UNIT - V

Methods for microbiological examination of food and quality control: Indicator organisms for assuring the suitability of food products, methods of microbiological examination, direct culture technique, enumeration methods (plate count and MPN), alternative methods (dye reduction tests), electrical methods, quality criteria, sampling schemes.

(12 Lectures)

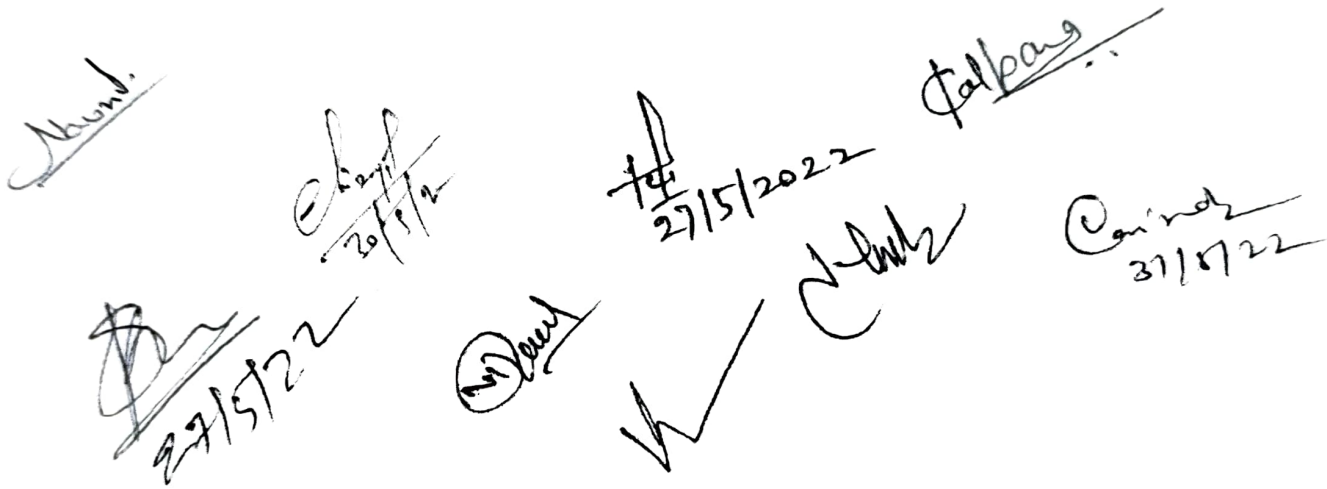
Suggested Reading

1. Doyle et al., Food Microbiology: Fundamentals and Frontier, American Society of Microbiology
2. William C Frazier, Food Microbiology, MacGraw Hills Education.
3. Adam and Moss, Food Microbiology, Royal Society of Chemistry
4. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
5. Mackie and McCartney. Practical Medical Microbiology. Elsevier
6. CKJ Paniker. Test Book of Microbiology, Orient Longman

DSE 8 SEMESTER VII / BIM-E752 (LAB COURSE CC-08)

The practicals based on BIM E702 will be performed.

1. Quantitative estimation of milk by standard plate count method.
2. Enzymatic test of milk by MBRT.
3. Quality testing of milk by resazurin test.
4. Determination of phosphatase activity of milk.
5. Microbiological analysis of food products.
6. Analysis of mycotoxin in fungal contaminated food materials.
7. Presumptive test of coliforms in butter.
8. Detection of bacteria in spoiled tinned food.
9. Demonstration of microbial production of curd.



B.Sc. IV Year **Semester – VII**

BIM –E703
DSE-9 MEDICAL MICROBIOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- Students will understand the disease caused by the bacteria, fungi, virus and protozoa.
- To know the diagnosis and treatment of bacteria, fungi and viral pathogens.

Learning outcomes:

At the end of course students will be able to

- Understand the development and contribution of different scientist in the field of medical microbiology.
- Describe etiology, pathogenicity, epidemiology and laboratory diagnosis of disease caused by microorganism.
- To isolate and detect the pathogens from the clinical samples.
- Suggest different antimicrobial agent for the treatment of bacterial infections.

UNIT–I

Normal microflora of the human body: importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, and respiratory tract; Immunology- concept of innate and adaptive immunity, T-cell and B-cell, Antigen- Antibody reactions(Precipitation, Agglutination, and ELISA). **(14 Lectures)**

UNIT -II

Bacterial diseases: symptoms, mode of transmission, prophylaxis, treatment and control of: Respiratory Diseases: *Streptococcus pyogenes*, *Mycobacterium tuberculosis;* Gastrointestinal Diseases: *Escherichia coli*, *Salmonella typhi*, *Vibrio cholerae*, others: *Staphylococcus aureus* **(12 Lectures)**

UNIT –III

Viral diseases: Symptoms, mode of transmission, prophylaxis and control of Polio, Herpes, Hepatitis-B, Rabies, Dengue and AIDS **(12 Lectures)**

UNIT–IV

Fungal diseases: Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention of cutaneous mycoses: Tineapedis (Athlete's foot); Systemic mycoses: Histoplasmosis; opportunistic mycoses: candidiasis. **(12 Lectures)**

UNIT–V

Prevention of Microbial Diseases: General preventive measures, Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents Vaccines:Importance, types of vaccines, vaccination schedule in Indian context. **(10 Lectures)**

Suggested Reading

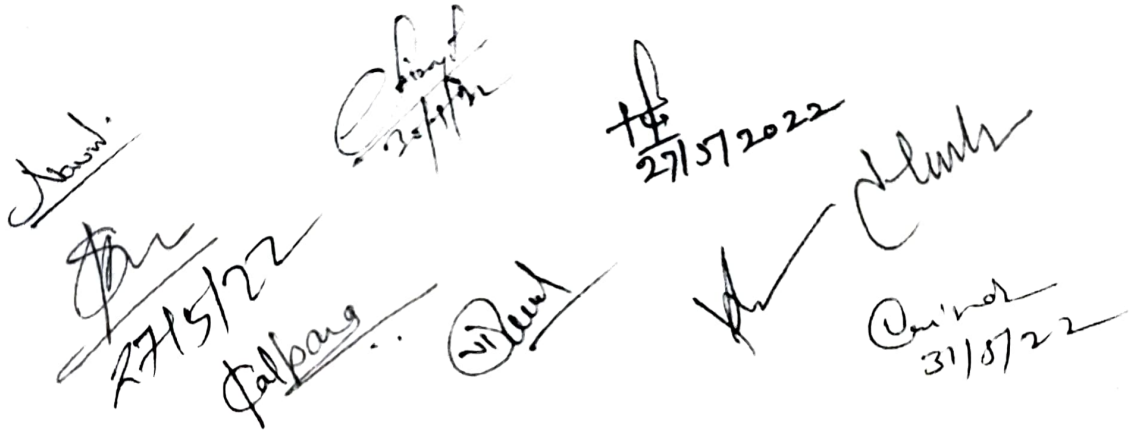
1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. Mackie and McCartney. Practical Medical Microbiology, Elsevier
3. CKJ Paniker. Test Book of Microbiology, Orient Longman
4. D.R.Arora. Medical Mycology, CBS Publisher and Distributors

31

DSE 9 SEMESTER VII / BIM-E753 (LAB COURSE CC-09)

The practicals based on BIM E703 will be performed.

1. Determination of susceptibility to dental caries by snyder test.
2. Isolation of microflora from human skin.
3. Isolation of microflora from human throat.
4. Differentiation of Streptococci by bacitracin test.
5. Inulin fermentation.
6. Urine culture and it's microbiological analysis.
7. Isolation of enteric pathogens from stools using direct plating method.
8. Determination of antibiotic sensitivity of UTI pathogens.
9. Differentiation of Streptococci by bile esculin test.
10.



B.Sc. IV Year **Semester – VII**

BIM –T754

Credits: 6

Students will have to undergo Industrial Training/ Survey and Field Work/Research project/Dissertation .

B.Sc. IV Year **Semester – VIII**

BIM –E801
DSE-10 BASIC TOOLS AND TECHNIQUES

MM : 100
Time : 3 hrs
L Credit
4 4
Total Hours: 60

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To get the knowledge of sophisticated and common instruments used in the microbiology laboratory
- To know aseptic techniques to keep the instrument and media sterile.

Learning outcomes:

At the end of course students will be able to

- Maintain the sterility of glassware, utensils and medium by different physical and chemical procedure.
- Operate the different sophisticated instruments available in the laboratory.

UNIT–I

Industrial microbiology- Definition and scope, history of industrial microbiology, industrial microbiology in present scenario, development of industrial microbiology in India. **(06 Lectures)**

UNIT-II

Basic knowledge of different instruments and their applications in microbiology such as microscope (Compound, SEM & TEM), micrometry, spectrophotometer, hot air oven, autoclave, laminar air flow and BOD incubator.

(10 Lectures)

UNIT–III

Isolation of industrially important microorganisms, Primary screening (crowded plate technique, auxanography technique, enrichment culture technique, differential culture technique), Importance of screening.

(14 Lectures)

UNIT–IV

Aseptic technique: contamination, sterilization (heating, steam sterilization, tyndallization, dry heat, chemicals, radiation sterilization, filter sterilization), sterilization of air. **(14 Lectures)**

UNIT–V

Chromatography techniques: paper chromatography, thin layer chromatography, adsorption column chromatography, gas liquid chromatography, gel permeation, ion exchange and affinity chromatography, gel electrophoresis.

(16 Lectures)

Suggested Reading

1. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. Prescott's Microbiology, 10th Edition, McGraw Hill Publication
3. Dubey, R.C. and Maheshwari, D.K. *Practical Microbiology*. 2nd ed., S. Chand & Co. P Ltd, New Delhi, p. 413. ISBN: 81:219-2559-2
4. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.

27/5/2022

DSE 10 SEMESTER VIII / BIM-E851 (LAB COURSE CC-10)

The practicals based on BIM E801 will be performed.

1. To perform column chromatography for separation of different components.
2. To perform gel electrophoresis.
3. To perform demonstration of paper chromatography.
4. To perform demonstration of thin layer chromatography.
5. Perform primary screening for antibiotic producers using crowded plate technique.
6. To perform industrially important organisms using auxanographic technique.
7. To perform different aseptic techniques.
8. Demonstration of enrichment culture technique for isolation of industrial important microbes.
9. To perform indicator dye technique for the isolation of microorganisms producing acids or amines.

B.Sc. IV Year **Semester – VIII**

BIM –E802
DSE-11: AGRICULTURAL MICROBIOLOGY

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- Students will learn about positive or negative interaction of microorganisms with soil.
- To impart in-depth information on soil and agriculture.
- To know the importance of biofertilizers and biopesticides.
- To make the students to know about various techniques involved in biofertilizers and biopesticides production.

Learning outcomes:

At the end of course students will be able to

- Describe the positive and negative aspects of microbes in soil fertility.
- Explain or suggest different biocontrol methods to control pests.
- Develop biofertilizer or biopesticide in lab conditions .
- Isolate *Rhizobium* from the root nodule of leguminous plants.

UNIT - I

Soil Microbiology: Soil as microbial habitat, soil profile and properties, soil formation, diversity and distribution of microorganisms in soil; mineralization of organic & inorganic matter in soil-mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica, potassium.

(16 Lectures)

UNIT - II

Microbial Control of Soil Borne Plant Pathogens(Biopesticides): Biological control; biocontrol mechanisms; microbial preparations used as biocontrol agents against plant pathogens, insects, weeds, commercial biofungicides

(14 Lectures)

UNIT - III

Biofertilizers & PGPRs: Plant growth promoting bacteria, biofertilizers – symbiotic (*Bradyrhizobium, Rhizobium, Frankia*), Non Symbiotic (*Azospirillum, Azotobacter*, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs and its application.

(16 Lectures)

UNIT - IV

Secondary Agriculture Biotechnology: Biomanure, biogas, biofuels– advantages and processing parameters.

(08 Lectures)

UNIT - V

GM crops: Advantages, social and environmental aspects; methods of preparation; Bt crops, golden rice.

(06 Lectures)

Suggested Reading

1. DubeyR.C.*A Textbook of Biotechnology*, 5th ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3
2. Singh and Purohot, Microbial Ecology, AGROBIOS
3. Atlas. Microbial Ecology, Pearson Education ISBN13: 9788129707710

DSE 11 SEMESTER VIII / BIM-E852 (LAB COURSE CC-11)

The practicals based on BIM E802 will be performed.

1. To perform isolation of fungal pathogens (*Fusarium* sp., *Macrophomina phaseolina*, *Phytophthora* sp. from soil.
2. Demonstration of production of amino acid by soil fungi.
3. Detection of siderophore produced by given organism.
4. Production of ammonia from organic compounds i.e., ammonification.
5. Isolation of *Azotobacter* from garden soil.
6. Isolation of *Azospirillium* from soil/roots.
7. Demonstration of bacterial commensalism.
8. Demonstration of bacterial synergism.
9. Demonstration of bacterial antagonism.
10.

B.Sc. IV Year

Semester – VIII

BIM –E803
DSE-12 MICROBIOLOGICAL ANALYSIS OF AIR AND WATER

MM : 100
Time : 3 hrs
L Credit
4 4

Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objectives:

- To understand how microorganisms adapt to different environments and their interaction with different habitats and also the spread of microorganisms from the environment.
- To know different techniques of detection of microorganisms from air,soil, and aquatic environment.
- To acquire knowledge of treating polluted water.

Learning outcomes:

At the end of course student will be able to

- Perform and demonstrate different methods used to determine the quality of water and air.
- Purify the household water through physical, chemical and biological methods.

UNIT - I

Aeromicrobiology: Bioaerosols, Air borne microorganisms (bacteria, viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens. **(16 Lectures)**

UNIT - II

Air Sample Collection and Analysis: Bioaerosol sampling, air samplers, methods of analysis, CFU, culture media for bacteria and fungi, Identification characteristics. **(14 Lectures)**

UNIT - III

Control Measures: Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration. **(08 Lectures)**

UNIT - IV

Microbiological Analysis of Water: Sample Collection, Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive/MPN tests, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests. **(16 Lectures)**

UNIT - V

Control Measures: Precipitation, chemical disinfection, filtration, high temperature, UV light. **(06 Lectures)**

+Suggested Reading

1. N.S. SubbhaRao. Soil Microbiology, Science Publisher, ISBN: 9781578080700
2. Dubey, R.C. *Advanced Biotechnology*. S. Chand & Co. P Ltd, New Delhi, p. 1161; ISBN: 81:219-4290-X.
3. P.D. Sharma, Microbiology, Rastogi Publication ISBN:978-8171339358.
4. Dubey R.C. and Maheshwari, D.K. *A Textbook of Microbiology*. 3rd ed., S. Chand & Co, Ram Nagar, New Delhi, p. 1034. ISBN 81-219-2620-3

DSE 12 SEMESTER VIII / BIM-E853 (LAB COURSE CC-12)

The practicals based on BIM E803 will be performed.

1. To perform isolation of air borne microorganisms (bacteria & fungi) by settle plate method.
2. To perform sampling of air (bioaerosol sampling) using air sampler and enumeration of air microflora.
3. Bioburden testing of different water samples.
4. Demonstration of potability of water using presumptive/MPN test.
5. Demonstration of potability of water using confirmed and completed test
6. Demonstration of potability of water using membrane filter technique

B.Sc. IV Year **Semester – VIII**

BIM –T854

Credits: 6

Students will have to undergo Industrial Training/Research project/Dissertation.

B.Sc. IV Year **Semester – VIII**

BIM –E855
VOC-2: Vedic Microbiology

MM : 100
Time : 3 hrs

L	Credit
2	2

Sessional : 30
ESE : 70
Pass Marks : 40

Learning objectives:

- To understand the Vedic culture in which there is description of different technique related to microorganism

Learning outcomes: At the end of course student will be able

- To know the different milestone in the history of microbiology, importance of Vedic microbiology and scope of microbiology

UNIT – I

Vedic Microbiology: Introduction to Vedas- Types and great saying of Vedas; Aryans- definition, indigenous or invaders; Rishi Kanva- the Father of Vedic Microbiology; Cosmogony; Vedic concept of origin of life; Vedic period **(08 Lectures)**

UNIT – II

Vedic classification of Krimis- classification by Charak; shape and colour of germs (Krimis); occurrence of germs (Krimis)in the environment- on animals, body surface of human, water whey, milk, food grains; knowledge of invisible germs through logic and Devine Eyes; classification of germs (Krimis)- major groups of Krimis- Drishta, Adrishta; Various names of the krimis in Vedas and in Charaka Samhita; colours of Krimis as in Vedic texts; different terms used for microbes- Amīva, Durnāmā, Sunāmā, Yādudhān, Piśāca, etc **(10 Lectures)**

UNIT – III

Vedic Technology: Occurrence of diseases- Yakshma on different parts of body, Kushth, etc.; eradication of Krimis by using medicinal herbs- Apāmārga (*Achyranthus aspera*), Ajashringi (*Pergularia daemia*), Vach (*Acorus calamus*) and Prishniparni (*Uraria picta*); eradication of Yakshma by Guggual (*Commiphora wightii*) and by Vach (*Acorusc alamus*) **(06 Lectures)**

UNIT – IV

Disease Eradication: Eradication of leprosy by Kushtha (*Costus speciosus*) and by Pṛśniparṇi (*Uraria picta*); Agnihotra (Hawan, Homa)- material used in daily Yajña, effect of Agnihotra on environment, plants and human health. **(06 Lectures)**