College of Computer, Science & Information Technology - Junagadh

AFFILIATED TO BHAKTA KAVI NARSINH MEHTA UNIVERSITY

✦ Syllabus (NEP-2020) ✦

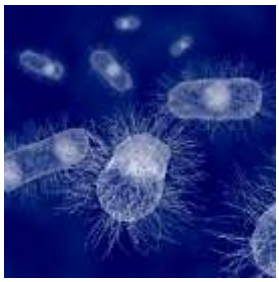
Bachelor of Science (Honours)

[MICROBIOLOGY]

[Semester – V]

Academic Year : 2025 – 26

(Effective from June – 2025)



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Credit Structure

Semester – 5								
Sr. No.	Course Group (Major/Minor/ SEC)	Course Paper Title	Credit	Ext. Marks (Theory)	Int. Marks (Theory)	Ext. Marks (Pract.)	Int. Marks (Pract.)	Total Marks
1	Major-11	Clinical Diagnostic Microbiology	4	50	50	--	--	100
2	Major-12	Microbial Practice in the Ancient Indian System	4	50	50	--	--	100
3	Major-13	Combine Practical	4	--	--	50	50	100
4	Minor-4	Microbes in Sustainable Agriculture	4	50	50	--	--	100
5	Minor-5	Environmental Microbiology	4	50	50	--	--	50
6	SEC	Nursery and Gardening	2	25	25	--	--	50
Total Credits			22	Total Marks				500

Syllabus of B.Sc.(Honors) Semester – V

Major-11 : Clinical Diagnostic Microbiology

Course Objectives:

- The main objective of this course is to explain the various clinical diagnosis reactions as hematological, serological etc.
- This course also focuses on the various microorganisms related to infections.

Course Learning Outcomes: After completion of the course:

- Students improved their understanding of hematological and serological diagnosis.
- Have developed an understanding of different types of advanced diagnosis techniques.
- Students have acquired a piece of detailed knowledge about the microorganisms associated with various infectious diseases.

Course Contents

Unit No.	Syllabi	Teaching Hours
1	**Hematology** • Hematopoiesis • Discovery of human blood group system, ABO and Rh system • Hemostasis • Introduction to blood banking • Cross matching • Principle, significance and procedure of blood transfusion • Separation and storage of blood components.	15
2	**Serology** • In vitro antigen: antibody reaction, Precipitin test (in fluid and gel), Agglutination test (Hemagglutination, Bacterial • Agglutination, Passive Agglutination and agglutination • inhibition), Complement fixation test • Special Serological test; Fluorescent antibody technique Nuefeld Quellung reaction, Detection of heterophile antibody, Virus neutralizing antibody. • Evaluation of Virulence; Antifibrinolysin, Antistreptolysin • Overview of Intracutaneous diagnostic test	15
3	**Conventional and Advanced Diagnostic Techniques** • Conventional techniques; Methods of specimen collection, Identification of microbes from specimen; Microscopy, Rapid methods of identification, Molecular methods. • Advanced techniques; Immunoelectrophoresis, Immunofluoroscence, Radioimmunoassay, ELISA, Western Blot, Detection of pathogen by PCR, Immunohistochemistry, Immunotherapy.	15

4	**Processing** • Epidemiology of infectious disease: Markers, concepts and tools. • Microbial agents of disease: Bacteria – Pathogenicity, diagnosis, treatment and prevention; Gram negative Bacteria – *Treponema, Salmonella, Shigella, Neisseria, Vibrio* • Gram positive Bacteria – *Clostridium, Mycobacterium, Streptococci, Corynebacterium* • Fungi - Pathogenicity, diagnosis, treatment and prevention; Superficial mycoses –*Piedra and Malassezia furfur*, Cutaneous mycoses – *Tinea pedis*, Subcutaneous mycoses –*Sporoctrichum schencii*, Systemic mycoses- *Cryptococcus neoformans and Histoplasma capsulatum*, Opportunistic fungi– *Candida albicans, Aspergillus fumigatus, and Cladosporium*.	**15**

Suggested Reading:

1. Microbiology – Pelczar – McGraw Hill
2. Immunology – 5th edition – J.Kuby, R. A. Goldsby , .J.Kindt , B.A. Osborne – W.H. Freeman and Company , New York
3. Principles of Microbiology- 2nd edition – R.M.Atlas – Wm.C.Brown Publishers
4. Microbiology – 5th edition – Prescott , Harley , Klein – McGraw-Hill Publishers
5. Instant Notes in Microbiology – P.M. Lyolyard , A. Whelan, M.W. Fanger
6. Medical Bacteriology including Medical Mycology and AIDS – N C Dey, T K Dey and D Sinha – New Central Book Agency Calcutta
7. Textbook of Microbiology – A Panikar

Major-12 : Microbial Practice in the Ancient Indian System

Course Objectives:

- To explore and understand the scientific basis of ancient Indian biological knowledge
- To understand the value of ancient medicinal practices of Charaka, Sushruta and Ayurveda
- To study ancient Indian agricultural and environmental microbiology.
- To examine traditional Indian microbiological practices in healthcare and medicine

Course Learning Outcomes: After completion of the course:

- Students will gain insights into Ayurveda, Siddha, and unani and their relevance to modern microbiology.
- The course will evaluate ayurvedic formulations, fermentation techniques, and surgical innovations in light of contemporary biomedical sciences.
- This course will allow students to explore sustainable farming methods, organic fertilizers, bio-pesticides, and seed preservation techniques used in historical Indian agriculture.
- The study will give knowledge of traditional fermentation, probiotic food preparation, and ancient water purification methods for their microbiological basis.
- This subject will integrate traditional Indian biological knowledge with modern research for sustainable solutions in healthcare, agriculture, and environmental microbiology.

Course Contents

Unit No.	Syllabi	Teaching Hours
1	**Ancient Indian Medicine** • The concept of Ayurveda, its introduction, and the microbiology practice behind it. • Investigating the historical understanding and use of substances with antimicrobial properties in traditional Indian medicine systems (Ayurveda, Siddha, Unani) from a modern microbiological perspective. • Traditional drug formulations: Asava, Arishta, Churna, Bhasma, Kadha	**15**

2	**Traditional Indian Fermentation Microbiology** • Ancient fermentation techniques: Preparation of curd, idli, kanji, dhokla, pickles, and alcoholic beverages • Microbial applications in food preservation and water purification. • Ancient knowledge on Probiotics and gut health in Ayurveda	**15**
3	**Ancient Agriculture and Environmental Microbiology** • Traditional organic farming techniques: Panchagavya, Jeevamrut, and biofertilizers in sustainable agriculture • Plant-based pest control methods, developing microbial biopesticides, and plant disease management practices using natural predators, herbal pesticides, and Agnihotra in ancient India • Sustainable ancient Indian practices for organic and chemical-free livestock farming.	**15**
4	**Traditional Environmental Microbiology** • Soil fertility improvement using green manure, vermiculture, animal dung, crop residues • Indigenous method of rainwater harvesting: stepwells, nadi system, kanats • Use of charcoal, sand filters, moringa seeds, and copper vessels for natural water purification.	**15**

Suggested Reading:

1. Ayurveda: The Science of Self-Healing – Dr. Vasant Lad
2. The Charaka Samhita – Translated by P.V. Sharma
3. Siddha Medicine: Fundamentals and Practice – Dr. K. Sivaraman
4. Vrikshayurveda: The Science of Plant Life – Surapala (Translated by Nalini Sadhale)
5. Indian Farming: Traditional Techniques and Practices" by R. K. P. Prakash Ayurvedic Medicinal plants by Vasant Lad

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Major-13 : Combined Practical

Course Objectives:

- To study and improve the hands-on practical skills in clinical and diagnostic microbiology and some ancient Indian practices.

Course Learning Outcomes: After completion of the course:

- Students gain knowledge on microorganisms associated with various infectious diseases.
- The diagnosis and treatment strategies followed for the infectious diseases.
- Explain basic concept of ancient Indian practices.
- Students learned the ancient Indian fermentation process and techniques

Course Contents

Practical No.	Syllabi	Teaching Hours
1	Antibiotic susceptibility of the pathogens isolated from the clinical specimen	**120**
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 Drabkin's method	
4	Bleeding time by filter paper technique and clotting time by capillary method	
5	Blood sugar estimation by GOD / POD method	
6	Determination of Serum Bilirubin	
7	Determination of Serum Cholesterol	
8	Physical, chemical and microscopic analysis of urine	

9	Screening of Thalassemia by NESTROFT	
10	Total count of platelets	
11	Fermentation of bioproduct using crude and synthetic media	
12	Isolation of probiotic microbes	
13	Prepare curd in a laboratory and study its parameters	
14	Preparation of panchgavya and its microbial activities	
15	Preparation of Jeevamrut and its microbial activities	
16	Improvement of soil fertility using microbes	
17	Preparation and development of biopesticides	
18	Water purification using the moringa seed/biocharcoal	
19	Preparation and application of biofertilizer	

Suggested Reading:

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 & Techniques, Ane Books, Delhi.

Minor-4 : Microbes in Sustainable Agriculture (Theory)

Course Objectives:

- To explore the sustainable practices in the field of agricultural microbiology and biotechnology
- Study the possible bioenergy sources and their current status in agricultural biotechnology.

Course Learning Outcomes: After completion of the course:

- Has acquired a fairly good understanding of microbes in the soil.
- Has developed a fairly good understanding of the use of microbes in sustainable agriculture, namely role in nitrogen fixing, organic matter degradation, use as bio fertilizers, as bio pesticides, and production of biofuels.
- Has developed skills for growing microorganisms in the laboratory to produce different enzymes by different microorganisms.

Course Contents

Unit No.	Syllabi	Teaching Hours
1	**Soil Microbiology** • Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil. • Microbial Activity in Soil and Green House Gases- Carbon dioxide, methane, hydrogen, nitrous oxide, nitric oxide – production and control.	**12**
2	**Microbial Biocontrol** • Mineralization of Organic & Inorganic Matter in Soil: Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica, potassium • Microbial Control of Soil Borne Plant Pathogens: Biocontrol mechanisms and ways, • Microorganisms used as biocontrol agents against • Microbial plant pathogens, Insects, Weeds.	**12**
3	**Microbial Biofertilizer** • Biofertilization, Phytostimulation, Bioinsecticides: 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	**11**

4	**Agriculture Biotechnology** • Agriculture Biotechnology: Biotech feed, Silage, Biomanure, biogas, biofuels– advantages and processing parameters. • GM crops: Advantages, social and environmental aspects, Bt crops, golden rice, transgenic animals.	**10**

Suggested Reading:

1. Eldor A.Paul. Soil Microbiology. Ecology and Biochemistry. VI Edition: AcademicPress, (2007).
2. Eugene L. Madsen. Environmental Microbiology: From Genomes to BiogeochemistryI Edition, Wiley-Blackwell Publishing. (2008).
3. Agrios, G. N. Plant pathology. Harcourt Asia Pvt. Ltd. (2000).
4. Buchanan.B.B., Gruissem, W. and Jones, R. L Biochemistry and Molecular Biology of Plants. I. K. International Pvt. Ltd. (2000)
5. Mehrotra R S and Ashok Agrawal. Plant Pathology. Tata Mc Graw Hill ,6th reprint (2006)
6. K. S. Bilgrami, H. C. Dube. A textbook of modern pathology. 6th Edition, Vani Educational Books a division of Vikas, (1984).
7. K. R. Aneja. Experiments in Microbiology, Plant Pathology and Biotechnology. New Age Publications. 2017

Minor-4 : Microbes in Sustainable Agriculture (Practical)

Practical No.	Syllabi	Teaching Hours
1	Isolation and purification of cyanobacteria, actinomycetes, fungi	**30**
2	Methods of isolation and identification of fungi by traditional methods Study of soil fungi	
3	Staining and observation of plant pathogenic fungi.	
4	Isolation of amylase producing microorganisms from soil	
5	Isolation of protease producing microorganisms from soil	
6	Isolation and Rhizobium and Azotobacter Nitrogen bacteria from soil.	
7	Laboratory scale production of biofertilizers.	
8	Isolation and characterization of plant growth promoting bacteria.	
9	Splash liberation of fungal spores from diseased tissue.	

Suggested Reading:

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 & Techniques, Ane Books, Delhi.
5. International student edition: Microbiology- A laboratory Manual 4th edition. By James G. Chappuccino & Natalie Sherman.

Minor-5 : Environmental Microbiology (Theory)

Course Objectives:

- The objective of the course is to enhance the understanding of environmental microbiology and to know the microbial habitats and their role in the ecology and biogeochemical cycle.
- Study the possible waste management and microbial treatment to improve the environmental understanding.

Course Learning Outcomes: After completion of the course:

- Students have acquired a fairly good understanding of microbes in the various habitats.
- Understand how microbes interact among themselves and with higher plants and animals with the help of various examples.
- Gain in-depth knowledge of the biological aspects of water pollution, its bacteriological analysis and management.

Course Contents

Unit No.	Syllabi	Teaching Hours
1	**Microorganisms and their Habitats** • Structure and function of ecosystems-Terrestrial Environment: Soil profile and soil microflora • Aquatic Environment: Microflora of fresh water and marine habitats Atmosphere: Aeromicroflora and dispersal of microbes • Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body. • Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic &osmotic pressures, salinity, & low nutrient levels.	**12**
2	**Microbial Interactions** • Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation • Microbe-Plant interaction: Symbiotic and non-symbiotic interactions • Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria.	**11**
3	**Biogeochemical Cycles** • Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin • Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitratereduction • Phosphorus cycle: Phosphate immobilization and solubilisation. • Sulphur cycle: Microbes involved in sulphur cycle.	**10**
4	**Waste management and degradation** • Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill). • Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment. • Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants.	**12**

Suggested Reading:

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
4. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
5. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
7. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. Subba Rao NS. (1999). Soil Microbiology. 4th edition. Oxford & IBH Publishing Co., New Delhi.
9. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

Minor-5 : Environmental Microbiology (Practical)

Practical No.	Syllabi	Teaching Hours
1	Isolation of microbes (bacteria & fungi) from soil.	**30**
2	Isolation of microbes from rhizosphere and phyllosphere.	
3	Assessment of microbiological quality of water.	
4	Determination of BOD of waste water sample.	
5	Study of amylase production by soil bacteria at extreme conditions	
6	Study the phosphorus solubilization by soil bacteria	
7	Study the air microflora	

Suggested Reading:

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 & Techniques, Ane Books, Delhi.
5. International student edition: Microbiology- A laboratory Manual 4th edition. by James G. Chappuccino & Natalie Sherman.

Paper Style:

EXTERNAL ASSESSMENT BY UNIVERSITY			
Que. No.	**Particulars**	**Unit**	**Marks**
Que. 1	(1) ……	**Unit 1**	05
	(2) ……		05
	OR		
	(1) ……		05
	(2) ……		05
Que. 2	(1) ……	**Unit 2**	05
	(2) ……		05
	OR		
	(1) ……		05
	(2) ……		05
Que. 3	(1) ……	**Unit 3**	05
	(2) ……		05
	OR		
	(1) ……		05
	(2) ……		05
Que. 4	(1) ……	**Unit 4**	05
	(2) ……		05
	OR		
	(1) ……		05
	(2) ……		05
Que. 5	(1) ……	**Unit 1 & 2**	05
	(2) ……		05
	OR		
	(1) ……	**Unit 3 & 4**	05
	(2) ……		05
		Total	**50**

SEC-5 : NURSERY & GARDENING (THEORY)

Course Objectives:

- Understand nursery management, including objectives, planning, seed storage, and transplanting.
- Develop skills in vegetable cultivation, storage, and marketing of crops like cabbage, brinjal, and tomatoes.
- Learn gardening basics, including types, objectives, and landscape and home garden design.
- Practice gardening operations, such as soil preparation, manuring, watering, pest control, and harvesting.
- Apply plant propagation techniques like air-layering, cutting, hardening, and use of greenhouses and mist chambers.

Course Learning Outcomes: After completion of the course, the students will be able to:

- **Career Opportunities:** Roles in landscaping, garden maintenance, nursery management, or as a horticulturist.
- **Entrepreneurship:** Start your own plant nursery, landscaping business, or organic gardening venture.
- **Skill Development:** Gain expertise in plant care, soil management, pest control, and sustainable gardening.
- **Personal Use:** Enhance home gardening, kitchen gardens, or terrace farming.
- **Further Education:** Foundation for advanced studies in horticulture, botany, or agricultural sciences.

Pedagogy: Lectures/Use of Multimedia/Assignments/Hands-on experiments/Demonstrations/Field visit.

Course Contents

Unit No.	Syllabi	Teaching Hours
1	**NURSERY** **1.1** Definition, objectives, scope and *plant propagation techniques*. **1.2** Planning and seasonal activities - Planting - direct seeding and transplant. **1.3** Seed storage: Seed banks, factors affecting seed viability. **1.4** Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.	**15**
2	**GARDENING** **2.1** Definition, objectives and scope - different types of gardening - *home gardening*. **2.2** Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. **2.3** Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. **2.4** Hardening of plants - green house - mist chamber, shed root, shade house and glass house.	**15**

Suggested Reading:

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National _Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

Paper Style

Ques. No.	Particular	From Which Unit	Marks
1(A)	Describe in detail (Any One)	1	**06**
1(B)	Write a Short Note (Any One)		**04**
2(A)	Describe in detail (Any One)	2	**06**
2(B)	Write a Short Note (Any One)		**04**
3	Do as Directed (Any Five from Seven)	**From 1 & 2**	**05**
		Total	**25**

Science Laboratory rules

1. Wash your hands with disinfectant, soap when you arrive in the lab and again before you leave.
2. Absolutely no food, drinks, chewing gum, or smoking is allowed in the laboratory. Do not put anything in your mouth such as pencils, pens, labels, or fingers. Do not store food in areas where microorganisms are stored.
3. Do not enter the lab without lab coat and Put off lab coat in the lab and do not wear it to other non-lab areas.
4. Wear lab slippers (sandals are not allowed) in the lab. Always put your slippers in shoe rack.
5. Keep your workspace free of all unnecessary materials.
6. Before each lab and at the completion of each lab you must wipe your lab bench thoroughly with disinfectant.
7. Label everything clearly and properly.
8. Replace caps on reagents, solution bottles, and bacterial cultures.
9. If you are accidently exposed to the UV light, immediately go to the sunlight.
10. Do not open Petri dishes in the lab unless absolutely necessary. Do not speak while handling Petri plates as it will increase the chances of contamination as well as infection.
11. Inoculating loops and needles should be flame sterilized in a Bunsen burner before you lay them down.
12. Turn off Bunsen burners when not in use.
13. Long hair must be tied up when Bunsen burners are in use.
14. Long nails and painted nails are not allowed.
15. When you flame sterilize with alcohol, be sure that you do not have any papers and cottons under you.
16. Use appropriate care for all cultures and do not take cultures out of the laboratory.
17. Wear disposable gloves when working with potentially infectious microbes or samples (e.g. sewage). If you are working with a sample that may contain a pathogen, then be extremely careful to use good bacteriological technique.
18. Never pipette hazardous chemicals by mouth. [Mouth pipetting is strictly prohibited].
19. Consider everything a biohazard. Do not pour anything down the sink. Autoclave liquids and broth cultures to sterilize them before discarding.
20. Dispose broken glass in the given container.
21. Report all injuries or accidents immediately to the instructor, do not clean them yourself, no matter how small they seem.
22. You must keep notes of all your experiments in a Lab notebook.
23. Place all the requirements at their correct place.
24. Do not operate the instruments without any proper guidance given by the instructor.
25. Noise is strictly prohibited in lab.