



**RAFFLES
UNIVERSITY**

TEACHING PLAN: Agricultural Microbiology

SCHOOL: (SOAS) School of Agricultural Science		ACADEMIC SESSION: 2024– 2025		FOR STUDENTS’ BATCH: II Sem	
1	Course Code.	-101/AMB-P-101			
2	Course Title	Course name: Agricultural Microbiology			
3	Credits	2 (1+1)			
4	Learning Hours		Contact Hours	48	
			Assessment	24	
			Guided Study	24	
			Total hours	96	
5	Course Objective	1. To understand the basic knowledge of microbiology and examining the microbes that inhabits our planet and their effect on the biosphere. 2. Microbiology has helped to treat and prevent diseases which are caused by viruses, bacteria, protozoa and fungi. In medicine, for example, microbiology led to the discovery and development of: Antibiotics, and. Vaccines. 3. The study of microbes helps us to understand our world and our place within it. It gives us insights into the complexity of nature and society, which in turn provide many different healths, environmental, social, cultural, industrial and economic benefits. 4. Students will gain knowledge about the different cell organelles of microorganisms and their detailed functions. 5. Students will also study the growth and control of microbes as well as different bacteriological techniques involved in microbiology. 6. To study the basics of different fields in Microbiology 7. To study Industrial and Food Microbiology			
6	Course Outcomes	1. Understand the basic microbiology, microbial structure, microbial world and function. 2. Understand the structural similarities and various groups of bacteria/archaea. 3. Know General bacteriology, bacterial genetics, growth and its reproduction and measurement. 4. Understand the role and impact of microorganisms in various domains of agriculture sciences. 5. Learn aseptic techniques and be able to perform routine culture handling tasks safely			

		and effectively.				
7	Outline syllabus:					
7.01	Paper Code	Units	Syllabus	Page Number s ¹	Lectures	
7.02	APP-101/AP P-P-101		Agricultural Microbiology			
		Unit –I				
		a	Introduction of microbiology and Microbial world.			
			Prokaryotic and eukaryotic microbes.			
			Bacteria: cell structure			
			Chemoautotrophy, photo autotrophy,			
		b	Growth of Bacteria			
			Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids.			
		c	Role of microbes in soil fertility			
			Role of microbes in crop production			
			Role of microbes in Carbon, Nitrogen, Phosphorus and Sulphur cycles.			
			Biological nitrogen fixation- symbiotic, associative and asymbiotic.			
			mycorrhiza.			
			Azolla and blue green algae			
			Rhizosphere and phyllosphere.			
		Unit -II	Microbes in human welfare and silage production			
		a	Microbes in biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.			
		b	Microbes in human welfare and silage production			
		c	Microbes in biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.			
		7.03				
		7.04	Unit -III (Practical)	Topic to be taught		
			a	Introduction to microbiology laboratory and its equipments;		
		Microscope- parts, principles of microscopy, resolving power and numerical aperture.				
			b	Methods of sterilization. Nutritional media and their preparations.		
				Methods of isolation and purification of microbial cultures.		
	Enumeration of microbial population in soil- bacteria, fungi, actinomycetes.					

			Isolation of Rhizobium from legume root nodule.		
			Isolation of Azotobacter from soil.		
			Isolation of Azospirillum from roots.		
		c	Isolation of BGA.		
			Staining and microscopic examination of microbes.		
8	Course Evaluation				
8.1	CA: 30%				
8.11	Atten- dance	5%			
8.12	Home work	2 Assignments, 5%			
8.13	Quizzes	-			
8.14	Presentat ion	-			
8.15	Any other	Practical Examination- 15%			
8.2	MTE	30%			
8.3	End-term examination: 50%				
9	Text Books & References				
9.1	Text book	Textbook of microbiology; Dr. CP Baveja, Arya Publication. Short text book of microbiology; Neeraj Sethi, Lotus Publishers. Microbiology; RP Singh. Kalyani Publication. Agriculture Microbiology; NS Subba, Medtech Publication.			
9.2	Journal and E- Book Reference s	1. Tortora GJ, Funke BR and Case CL. Microbiology: An Introduction. Pearson Education 2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. Brock Biology of Microorganisms. Pearson International Edition 3. Wiley JM, Sherwood LM and Woolverton CJ. Prescott’s Microbiology. Mc GrawHill International 4. Atlas RM. Principles of Microbiology. WM.T.Brown Publishers. 5. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. General Microbiology. McMillan 6. Cappucino J and Sherman N. Microbiology: A Laboratory Manual. Pearson Education Limited 7. Salle A.J. Fundamental Principles of Bacteriology. Tata Mc Graw-Hill Education.			

		8. Modi H.A, Elementary Microbiology Vol I, Fundamentals of Microbiology
9.3	Video References	https://www.youtube.com/watch?v=5vH_4_5-WGs https://www.youtube.com/watch?v=liHnCDVzRCA https://www.youtube.com/watch?v=dko_P0uZpW4 https://www.youtube.com/watch?v=Iy0I5PrhVTc https://www.youtube.com/watch?v=SGhIRCSE8U8 https://www.youtube.com/watch?v=9Svtqi10P-k https://www.youtube.com/watch?v=fihc7LQp4G0 https://www.youtube.com/watch?v=00E0kB7r7fE https://www.youtube.com/watch?v=6pqEwpAHsPs https://www.youtube.com/watch?v=ZrogAKO3dhI https://www.youtube.com/watch?v=MOsMQKmSDCY
9.4	For Video lectures	Subscribe the channel. Agri Coaching Chandigarh

Mapping of Outcomes v. Topics

Outcome no. → Syllabus topic↓	1	2	3	4	5
Paper Code. Unit I (a)	✓				
Paper Code. Unit I (b)		✓	✓		
Paper Code. Unit I (c)			✓	✓	
Paper Code. Unit II (a)		✓	✓	✓	
Paper Code. Unit II (b)	✓		✓	✓	✓
Paper Code. Unit II (c)		✓		✓	
Paper Code. Unit III (a) practical					✓
Paper Code. Unit (b)					✓
Paper Code. Unit III (c)					

QUESTION BANK

MULTIPLE CHOICE QUESTIONS

1. What groups listed below have true cell walls?

- algae B. mycoplasmas
- Gram-positive bacteria
- fungi E. Protozoans

2. Identify which statements are correct.

- All bacteria have peptidoglycan in their cell walls.
- All fungi have chitin in their cell walls.

- All algae have cellulose in their cell walls
- All protozoans have protein in their cell walls.

3. Which of the following characteristics do not occur in prokaryotic cells?

- cellular organization
- thylakoid membranes within chloroplasts
- oxygenic photosynthesis
- anaerobic respiration
- . several circular chromosomes

4. The membrane of gas vesicles is composed of:

- triglycerides
- phospholipids
- proteins
- lipopolysaccharide
- hydrocarbons

5. Which of the following are not found in Cyanobacteria?

- thylakoids
- gas vesicles
- chloroplasts
- heterocysts
- endospores

6. Phagocytosis is not a characteristic of which groups?

- protozoans
- algae
- fungi
- Archaea
- Bacteria

7. The bacterial cytoplasmic membrane contains:

- ester-linked phospholipids, but no sterols
- ester-linked phospholipids and sterols
- ether-linked phospholipids, but no sterols
- ether-linked phospholipids, sulfolipids, and glycolipids

8. Who accidentally identified the antimicrobial action of penicillin?

- Robert Koch
- Richard Petri

- Alexander Fleming
- Louis Pasteur
- Lazzaro Spallanzani

9. Ribosomes associated with cells or organelles have a certain size, which is expressed in Svedberg units. Which associations are incorrect?

- cyanobacteria - 80s
- chloroplasts - 70s
- photosynthetic bacteria - 80s
- green algal cytoplasm - 80s
- mitochondria - 70s

10. Which group(s) of microorganisms is (are) thought to be the oldest living organisms?

- eukaryotes
- heterotrophic prokaryotes
- Archaea
- viruses
- autotrophic prokaryotes

11. Based on studies of 16S ribosomal RNA and cell wall composition, which of the following bacteria are classified as Archaea?

A. Halobacterium B. Methanococcus C. Sulfolobus D. Desulfovibrio

12. Which group(s) of fungi do not generally produce sexual reproductive structures and are also sometimes known as imperfect fungi?

A. Ascomycotina B. Oomycetes C. Zygomycotina D. Hyphochytridiomycetes E. Deuteromycotina

SHORT AND LONG QUESTIONS

1. List the similarities and differences between passive diffusion and facilitated diffusion.
2. Explain the structure and symmetry of bacterial cytoplasmic membranes as suggested by the Fluid Mosaic Model. List the biochemicals that are present in or attached to the cytoplasmic membranes of microorganisms.
3. Diagram and name four mechanisms bacteria use to transport materials across the cytoplasmic membrane. Note when energy and additional compounds are necessary for any of these mechanisms to operate.

4. Name three reserve materials synthesized by microorganisms and note which microbial groups use them as their primary storage product.
5. List the principle differences (ie. structure, anchoring, motion) between prokaryotic and eukaryotic flagella.
6. Give two other names for bacterial capsule and list five functions proposed for it.
7. Give four lines of evidence that support the Endosymbiotic Theory of the origin of eukaryotic cells.
8. Carl Woese suggested a phylogenetic classification scheme in 1980 that contained how many domains? Name these domains and explain how the relationships in his universal phylogenetic tree were determined.
9. Explain the differences in the curves resulting from the growth of bacterial and viral populations.
10. Is DNA replication a conservative or semi-conservative process? Explain how this question was answered.
11. Explain how attenuation regulates protein synthesis in prokaryotic cells.
12. You have inserted a single DNA fragment into a cloning vector. Describe two methods you could use to determine which host bacterial cells will eventually contain the clonal insert.
13. What is the outcome of photorespiration in algae? What Calvin cycle enzyme plays a central role in this process? Name three conditions that promote photorespiration in photoautotrophs.
14. Which autotrophic processes are known to produce the organic matter that supports whole ecosystems? Give an equation for each process and underline the electron donor.
15. Demonstrate how the activities of biofilm communities result in the pitting and corrosion of iron and steel pipes.
16. (A) Draw the Diagram a Gram-positive and Gram-negative bacterial cell wall. (B) Demonstrate the differences in the chemical structure of these two types of bacterial cell walls. (C) Where and when does penicillin affect bacterial cells? (D) Explain how autolysins affect the cell walls of Gram-negative bacteria and mycoplasmas.