GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE AND P.G. COURSES (A)
VISAKHAPATNAM
Department Of Microbiology
Programme Structure for B.Sc. Honours (Microbiology) MAJOR
W.e.f AY 2023-24

I Semester COURSE STRUCTURE

Sl. No	Sem	Course	Name of the Course	Hours /Week	Credits	Marks		
						Internal	External	Total
1	I	English	English	4	3	40	60	100
2	I	Languages	Telugu/Hindi/Sanskrit	4	3	40	60	100
3	I	Skill Enhancement Courses (SEC)	1. Analytical Skills 2. Communication Skills	2+2	2+2		50+50	100
4	I	Multidisciplinary Course	1. Indian History	2	2		50	50
5	I	**Major (Course-1)**	Introduction to Classical biology	5	4	40	60	100
6	I	**Major (Course -2)**	Introduction to Applied biology	5	4	40	60	100
			Total	**24**	**20**	**160**	**390**	**550**

GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE AND PG COURSES (A)
DEPARTMENT OF MICROBIOLOGY
Programme: B.Sc. Honours (MICROBIOLOGY): MAJOR
SEMESTER – I SYLLABUS w. e. f 2023-24 AY

Course: 1 - INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5 **Credits: 4**

Course objectives:

- The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

(CO1) Unit 1: Introduction to systematics, taxonomy and ecology: 8hrs

1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
1.4. Pollution and climate change.

(CO2) Unit 2: Essentials of Botany: 10hrs

2.1. The classification of plant kingdom
2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
2.4 Mushroom cultivation, floriculture and landscaping.

(CO3) Unit 3: Essentials of Zoology: 8hrs

3.1. The classification of Kingdom Animalia and Chordata.
3.2. Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
3.3. Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
3.4. Economic Zoology – Sericulture, Apiculture, Aquaculture

(CO4) Unit 4: Cell biology, Genetics and Evolution: 12hrs

4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
4.3. Central Dogma of Molecular Biology.
4.4. Origin of life

(CO5) Unit 5: Essentials of chemistry: 10hrs

5.1. Definition and scope of chemistry, applications of chemistry in daily life.
5.2. Branches of chemistry
5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.
5.4. Green chemistry

Course Outcomes	
CO1	Learn the principles of classification and preservation of biodiversity.
CO2	Understand the plant anatomical, physiological and reproductive processes.
CO3	Knowledge on animal classification, physiology, embryonic development and their economic importance
CO4	Outline the cell components, cell processes like cell division, heredity and molecular processes
CO5	Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.
3. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers. 4. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India
5. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers
6. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
7. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell
11. Visit to Zoology Lab and observe different types of preservation of specimens
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit
14. List out different hormonal, genetic and physiological disorders from the society

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SEMESTER – I SYLLABUS w. e. f 2023-24 AY

Course: 2: INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5 **Credits: 4**

Course objectives:

- The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

(CO1) Unit 1: Essentials of Microbiology and Immunology:

1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus. 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

(CO2) Unit 2: Essentials of Biochemistry:

2.1. Biomolecules I – Carbohydrates, Lipids.
2.2. Biomolecules II – Amino acids & Proteins.
2.3. Biomolecules III – Nucleic acids -DNA and RNA.
2.4. Basics of Metabolism – Anabolism and catabolism.

(CO3) Unit 3: Essentials of Biotechnology:

3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.
3.4. Transgenic plants – Stress tolerant plants (biotic stress – Bt cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

(CO4) Unit 4: Analytical Tools and techniques in biology – Applications

4.1. Applications in forensics – PCR and DNA fingerprinting
4.2. Immunological techniques – Immunoblotting and ELISA.
4.3. Monoclonal antibodies – Applications in diagnosis and therapy.
4.4. Eugenics and Gene therapy

(CO5) Unit 5: Biostatistics and Bioinformatics:

5.1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.
5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment
5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench.

Learning Outcomes:

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5 th Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.

4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.

6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.

7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata. 8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers. 10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene.
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

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II Semester COURSE STRUCTURE

Sl. No	Sem	Course	Name of the Course	Hours /Week	Credits	Marks		
						Internal	External	Total
1	II	English	English	4	3	40	60	100
2	II	Languages	Telugu/Hindi/Sanskrit	4	3	40	60	100
3	II	Skill Enhancement Courses (SEC)	SEC -III: Plant Nursery SEC- IV: Business Writing	2+2	2+2		50+50	100
4	II	**Major (Course-3)**	Introduction to Microbiology	3	3	40	60	100
		Major course 3 LAB	Introduction to Microbiology	2	1	25	25	50
5	II	**Major (Course -4)**	Bacteriology and Virology	3	3	40	60	100
		Major course 4 LAB	Bacteriology and Virology	2	1	25	25	50
			TOTAL	**22**	**18**	**210**	**390**	**600**
MINOR (offered to the students who opt other than Major MICROBIOLOGY)								
1	II	**Minor (Course -1)**	Introduction to Microbiology	3	3	40	60	100
	II	**Minor LAB (Course -1)**	Introduction to Microbiology	2	1	40	60	100
			TOTAL	**5**	**4**	**80**	**120**	**200**

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SEMESTER – II SYLLABUS w. e. f 2023-24 AY

COURSE 3: - INTRODUCTION TO MICROBIOLOGY

Total No. hours: 45 **Credits – 3**

Course objectives

- To learn the important contributions of scientists to the field of Microbiology and also to Understand the importance of the golden era of Microbiology.
- To become familiar with the system of classification, scope of microbiology, concept of Origin of life and diversity of microbes.
- To study the general characteristics of various Prokaryotic and Eukaryotic microorganisms
- To learn the concept of isolating and culturing microorganisms in laboratory

(CO 1) Unit - 1: History of Microbiology **No. of Hours: 10**

1. Discovery of Microscope and microbial world by Anton von Leeuwenhoek;Aseptic techniques with reference to Charak Samhita, Sushruta Samhita and Ignaz Philipp Semmelweis
2. Golden era of Microbiology- Refutation of abiogenesis; Germ theory of Disease;Discovery of vaccination; Discovery of penicillin
3. Major contributions of Scientists: Edward Jenner, Louis Pasteur, Robert Koch,Joseph Lister, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

(CO 2) Unit - 2: Place of Microorganisms in the living world **No. of Hours: 10**

1. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese
2. Definition and scope of Microbiology; Applications of Microbiology; Diverse groups of Microorganisms
3. Origin of microbial life on earth- Timeline, Miller's Experiment, endosymbiosis(cyanobacteria), distinguishing features of eukaryotic and prokaryotic cell

(CO 3) **Unit - 3: Prokaryotic microorganisms and Viruses** **No. of Hours: 10**

1. General characteristics of Bacteria (Morphology, metabolic diversity and reproduction)
2. General characteristics of Archaea differentiating them from Bacteria
3. General characteristics of viruses (Nature, composition, size, host specificity,diversity in structure)

(CO 4) **Unit - 4: Eukaryotic microorganisms** **No. of Hours: 10**

1. Fungi - Habitat, nutrition, vegetative structure and modes of reproduction
2. Algae- Habitat, thallus organization, photosynthetic pigments, storage granules, reproduction.
3. Protozoa–Habitat, cell structure, nutrition, locomotion, excretion, reproduction,encystment.

(CO 5) **Unit - 5: Growing Microbes in Lab: Five I's** **No. of Hours: 05**

1. Inoculation-Aseptic methods of introducing inoculum to growth media; Composition of basic growth media, solid and liquid
2. Incubation and Isolation- Ambient temperature for growth of microorganisms; Concept of Pure culture, mixed culture and contaminated culture
3. Inspection and Identification - Observation of colour, size and shape of colonies; Wet mount and simple staining of bacteria and fungi.

Course Outcomes:

CO 1: Understand the historical significance of microbiology and the contributions of key scientists.

CO 2: Recognize the classification of microorganisms and their place in the living world and to comprehend the scope and applications of microbiology.

CO 3: Distinction between eukaryotic and prokaryotic cells and describe the characteristics of bacteria, archaea, viruses.

CO 4: Describe the characteristics of fungi, algae, and protozoa

CO 5: Develop practical skills in aseptic techniques, growth media preparation, isolation methods, and the identification of bacteria and fungi.

Reference books for theory:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5thEdition, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5thEdition, WCB McGraw Hill, New York.
3. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
4. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology,5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

SEMESTER – II PRACTICAL SYLLABUS
COURSE 3: - INTRODUCTION TO MICROBIOLOGY

Credits: 1 **Total No. hours: 30**

1. Good Laboratory Practices and Biosafety
2. Compound Light microscope -Parts and its handling
3. Microscopic observation of bacteria, Algae and Fungi and protozoa
4. Observation of electron micrographs of viruses (Lambda, T4, TMV, HIV, SARSCoV-2, Polio)
5. Laboratory equipment -Working principles of Autoclave, Hot air oven, Laminarairflow chamber

Reference books for Lab:

1. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand,New Delhi. Edition), Himalaya Publishing House, Mumbai.
2. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
3. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
4. Gopal Reddy et al., Laboratory Experiments in Microbiology

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SEMESTER – II SYLLABUS w. e. f 2023-24 AY

COURSE 3: - INTRODUCTION TO MICROBIOLOGY
MID I MODEL PAPER

Date: **Max. Marks: 20M**
Time:1 & ½ hour

		PART-A **Answer ALL the following questions**	**3 x 2 = 6M**	
1	a)	Write about Ignaz Philipp Semmelweis.	**2 M**	**CO 1**
	b)	What is Penicillin?	**2 M**	**CO 1**
	c)	What are Cyanobacteria.	**2 M**	**CO 2**
		PART-B **Answer the following questions**	**2 x 7 = 14M**	
2	a)	Explain the contributions of Antony Von Leeuwenhoek	**7M**	**CO 1**
		OR		
	b)	Describe the contributions of Robert Koch.	**7 M**	**CO 1**
3	a)	Explain about Whittaker's five Kingdom concept.	**7 M**	**CO 2**
		OR		
	b)	Explain about Miller's experiment regarding Origin of life on Earth.	**7M**	**CO 2**

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SEMESTER – II MODEL PAPER w. e. f 2023-24 AY
COURSE 3: - INTRODUCTION TO MICROBIOLOGY

Time: 2 &1/2 hours **Total Marks: 60**

		PART – A **Answer ALL of the following questions**	**(5 x 2=10 Marks)**	
1		What is Germ theory of Disease?	CO 1	2 M
2		Write about Haeckel's three kingdom concept.	CO 2	2 M
3		Differentiate between Archaea and Bacteria.	CO 3	2 M
4		Write about photosynthetic pigments in Algae.	CO 4	2 M
5		Explain method of wet mount technique.	CO 5	2 M
		PART – B **Answer the following questions**	**(5 x 10=50 Marks)**	
6	a.	Describe the contributions of Louis Pasteur.	CO 1	10 M
		OR		
	b	Write an essay on discovery of Vaccination.	CO 1	10M
7	a	Describe the scope and Applications of Microbiology.	CO 2	10M
		OR		
	b.	Explain the distinguishing features of Eukaryotic and Prokaryotic cells.	CO 2	10M
8	a.	Explain the general characteristics of Bacteria.	CO 3	10M
		OR		
	b.	Write an essay on the general characteristics of Viruses.	CO 3	10M
9	a.	Describe the habitat, nutrition, structure and reproduction in Fungi.	CO 4	10M
		OR		
	b.	Write in brief the general characteristics of Protozoa.	CO 4	10M
10	a.	Explain the concept of isolating Microorganisms by Pure culture techniques.	CO 5	10M
		OR		
	b.	Explain the principle and procedure of Simple staining.	CO 5	10M

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SEMESTER – II SYLLABUS w. e. f 2023-24 AY

COURSE 4: - BACTERIOLOGY AND VIROLOGY

Total hours: 45 **Credit: 3**

COURSE OBJECTIVES:

- To acquaint the students with the principles of taxonomy, classification and structure of bacteria.
- To study the characteristics of different groups of bacteria.
- To gain knowledge on classification, properties, replication and diseases caused by Viruses.

(CO1) Unit -1: Bacterial Taxonomy and Ultrastructure No. of Hours: 9

1. Introduction to prokaryotic diversity and taxonomy. Types of classification- Numerical and Phylogenetic
2. Introduction to Bergey's manual of Systematic Bacteriology
3. Non-Culturable and Metagenomics
4. Ultrastructure of a Bacterial Cell-Invariable components -cell wall, Structure and/Functions of cell membrane, cytoplasm, nucleoid; Variable components- plasmid, inclusion bodies, flagella (structure and arrangement), pili, capsule, endospore.

(CO 2) Unit - 2: Type studies of Bacteria and Archae No. of Hours:9

1. Salient features of:

a) Photosynthetic bacteria - Purple bacteria, Green bacteria and *Anabaena*
b) Gliding bacteria - Myxobacteria and Cytophaga group
c) Filamentous -Actinomycetes
d) Spore forming bacteria - Bacillus and Clostridia
e) Miscellaneous - Mycoplasma, Rickettsia, Chlamydia

2. Salient features of Fermentative bacteria-Sulphur bacteria, Nitrogen fixing bacteria
3. Salient features of Extremophiles- Methanogens and halo bacteria.

(CO 3) Unit - 3: General Properties and Classification of Viruses No. of Hours:9

1. Discovery of viruses, Nature and definition of viruses, general properties
2. Hierarchy of ICTV nomenclature
3. Outline of Baltimore system of classification.
4. Cultivation of Viruses, Virus Purification and Assay.

(CO 4) Unit - 4: Replication of Viruses No. of Hours:9

1. General features of Viral Replication
2. Replication of T4, lambda, TMV,
3. Replication of Polio, Influenza, Adeno Viruses and HIV

(CO 5) Unit - 5: Pathogenic and other Viruses **No. of Hours:**9

1. Defective Viruses- viroid's, virusoids, satellite viruses and Prions.
2. Emergence of Viral Pathogens, Introduction to Oncogenic viruses, Concept of Oncogenes and Protooncogenes
3. Role of viruses in Ecosystems

COURSE OUTCOMES:

CO 1: Understand the concept of prokaryotic diversity and taxonomy.
CO 2: Identify and describe the salient features of various bacterial groups
CO 3: Comprehend the discovery, nature, and definition of viruses.
CO 4: Describe the replication processes of specific viruses
CO 5: Comprehend the concept of oncogenic viruses, and role of viruses in the ecosystem.

References:

1. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB McGraw Hill, New York, (2002).
2. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. PearsonEducation, Singapore, (2004).
3. Black J.G. Microbiology-Principles and Explorations. John Wiley &Sons Inc. NewYork, (2002).
4. Tom Besty, D.C Jim Koegh. Microbiology Demystified McGraw-Hill.
5. Christopher Burrell Colin Howard Frederick Murphy. Fenner and White'sMedical Virology 5th Edition. Academic Press

II SEMESTER, PRACTICALS

COURSE 4: - BACTERIOLOGY AND VIROLOGY

CREDITS: 1 **Total No. hours:** 30

1. Study of bacteria by colony observation and staining-simple, Gram staining
2. Observation of motility and capsule
3. Isolation of bacteria using Winogradsky column and observation
4. Study of viruses (Bacteriophage, TMV and HIV) using micrographs
5. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique.
6. Studying isolation and propagation of animal viruses by chick embryo technique
7. Study of cytopathic effects of viruses using photographs.

REFERENCES:

1. Cappuccino & Sherman, (1996), Microbiology: A laboratory manual, Benjamin cummings Science publishing, 5th edition.
2. Gopal Reddy, M.N. Reddy, D.V.R. Sai Gopal and K.V. Maliyah, 2006, Laboratory Experiments in Microbiology, Himalaya Publishing House.
3. Reddy S.M. & Reddy S.R., (2017), Microbiology -Practical Manual, Books Selection Centre, Hyderabad
4. P. Gunasekaran, (2018), Laboratory Manual in Microbiology, New Age International Private Limited Publishers, New Delhi.
5. R.C. Dubey and D.K. Maheswari, (2014), Practical Microbiology, S. Chand& Company Limited, New Delhi.

Co-Curricular Activities:

- Invite guest speakers, to provide insights into the latest advancements andemerging trends in bacteriology and virology.
- Conduct laboratory workshops that allow students to gain hands-on experience inbacterial culture techniques
- Case Study Competitions: Organize case study competitions where students canwork in teams to analyze and solve hypothetical cases related to bacteriology and virology
- Arrange field trips to microbiology research facilities, such as government labs,industrial settings, or healthcare institutions

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SEMESTER – II MODEL PAPER w. e. f 2023-24 AY
COURSE 4: - BACTERIOLOGY AND VIROLOGY

Time : 2- & 1/2-hours **Total Max. Marks: 60**

		PART – A **Answer ALL of the following questions**	**(5 x 2=10 M)**	
1		Explain the functions of cell membrane.	CO 1	2 M
2		Describe Chlamydia.	CO 2	2 M
3		Define Virus with an example.	CO 3	2 M
4		Write about TMV.	CO 4	2 M
5		Describe about Oncogenes.	CO 5	2 M
		PART – B **Answer the following questions**	**(5x10=50 M)**	
6	a.	Describe the Bergey's manual of Systematic Bacteriology.	CO 1	10 M
		OR		
	a.	Explain the structure and function of Flagella.	CO 1	10 M
7	a	Write the salient features of Photosynthetic bacteria.	CO 2	10 M
		OR		
	a.	Describe the Characteristics of Mycoplasma.	CO 2	10 M
8	a.	Write an essay on general properties of Viruses.	CO 3	10 M
		OR		
	a.	Explain the different methods of Virus cultivation.	CO 3	10 M
9	a.	Describe the process of Viral replication.	CO 4	10 M
		OR		
	a.	Write an essay on replication of HIV.	CO 4	10 M
10	a.	Define Oncogenic Viruses and add a note on it.	CO 5	10 M
		OR		
	a.	Describe the Role of Viruses in ecosystem.	CO 5	10 M

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SEMESTER – II
BLUE PRINT FOR SEMESTER END EXAMINATION (w. e. f 2023-24 AY)

Time : 2 ½ hours **Total Max. Marks: 60**

SECTION – A (5 X 2 = 10 M)

Answer ALL the following questions

Q. No. 1 to Q. NO. 5 - FIVE short Answer Questions covering minimum one question from each unit of the syllabus.

SECTION – B (5 X 10 = 50 M)

Answer the Following Questions

Q.NO. 6 a and b – Two essay questions from Unit – I of the syllabus with an Internal choice.
Q.NO. 7 a and b – Two essay questions from Unit – II of the syllabus with an Internal choice.
Q.NO. 8 a and b – Two essay questions from Unit – III of the syllabus with an Internal choice.
Q.NO. 9 a and b – Two essay questions from Unit – IV of the syllabus with an Internal choice.
Q.NO. 10 a and b – Two essay questions from Unit – V of the syllabus with an Internal choice.