UG MICROBIOLOGY

UCMBA20 - FUNDAMENTALS OF MICROBIOLOGY

Year 2020	**Course Code**	**Title Of The Course**	**Course Type**	**Course Category**	**H/W**	**Credits**	**Marks**
SEM: I	UCMBA20	Fundamentals of Microbiology	Theory	Core	6	5	100

Course Objective: To provide basic knowledge on the structure of bacteria, fungi, algae, protozoa, virus along with the principles of microscopy and the control of microbial growth by physical and chemical methods.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the history, recent developments and scope of Microbiology.

CO2: Demonstrate microscopy with deep knowledge on the sample preparation and staining techniques.

CO3: Discuss important aspects of microbial evolution and diversity by employing classical techniques of microbial identification.

CO4: Explain the ultra-structure, arrangement and function of a bacterial cell.

CO5: Perform the sterilization and disinfection techniques

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	H	M	H	M	L	H
CO2	H	H	H	L	H	M
CO3	H	M	H	H	H	L
CO4	H	L	H	H	H	L
CO5	H	L	H	L	L	M

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	H	M	H	M	L	H
CO2	H	H	H	L	L	M
CO3	H	M	H	H	L	L
CO4	H	L	H	H	L	L
CO5	H	L	H	L	L	M

H – HIGH (3)

M – MODERATE (2)

L – LOW (1)

COURSE SYLLABUS

UNIT I: History and Scope of Microbiology. (15 hours)

1.1 Definition and Scope of Microbiology. (K1,K2)

1.2 History and recent developments- Spontaneous generation Vs Biogenesis. (K1,K2)

1.3 Contribution of Louis Pasteur, Robert Koch, Antony Van Leewenhoek. (K1,K2)

1.4 Sergei N. Winogradsky, Joseph Lister, Wilkn Beijerink. (K1,K2)

1.5 Alexander flemming, Selman A. Waksman, Emil Christian Hansen, Hans Christian Gram. (K1,K2)

1.6 Impact of Microbiology and the future. (K1,K2)

UNIT II: Microscopy and Staining methods. (15 hours)

2.1 Microscopy and principle of working - Simple, compound, Dark Field, Phase contrast. (K1,K2, K3)

2.2 Fluorescent and Electron Microscope - its types (SEM and TEM). (K1,K2, K3)

2.3 Staining methods: Dyes and its uses – Simple staining. (K1,K2, K3)

2.4 Differential staining - Gram staining and Acid fast staining (Zeihl Neelson method). (K1,K2, K3)

2.5 Special staining techniques - Spore staining, Capsule staining (negative staining). (K1,K2, K3)

2.6 Flagella staining and Alberts staining for metachromatic granules. (K1,K2, K3)

UNIT III: Microbial evolution and diversity. (15 hours)

3.1 Microbial evolution & diversity - Endosymbiotic theory. (K1,K2)

3.2 Binomial Nomenclature of Microbes. (K1,K2, K3)

3.3 Classification Five Kingdom concept (Whittaker Classification) - Eight Kingdom concept (Cavalier smith). (K1,K2)

3.4 Prokaryotes and eukaryotes – their differences. (K1,K2)

3.5 Classical techniques of Microbial identification- Morphological, Physiological and biochemical properties. (K1,K2, K3,K4)

3.6 General introduction to Fungi, Algae, Virus and protozoa. (K1,K2)

UNIT IV: Morphology and Anatomy of Bacteria. (15 hours)

4.1 Morphological shape, structure and arrangement of bacteria- Anatomy of Bacteria. (K1,K2)

4.2 Ultrastructure and functions of cell wall (Gram positive and Gram negative cell wall). (K1,K2)

4.3 Cytoplasmic membranes. (K1,K2)

4.4 Flagella- structure and arrangement, Pili / fimbriae. (K1,K2)

4.5 Capsule - Slime layer, cytoplasmic inclusions and granules. (K1,K2)

4.6 Spore - process of sporulation. (K1,K2)

UNIT V: Methods of Sterilization and Disinfection. (15 hours)

5.1 Overview on Sterilization– Principles and Methods of Sterilization. (K1,K2, K3)

5.2 Dry heat sterilization - Incineration and Hot air Oven- principle and uses. (K1,K2, K3)

5.3 Moist heat sterilization – Pasteurization, Tyndallization and Autoclave- principle and uses. (K1,K2, K3)

5.4 Filtration, Radiation- ionizing and non-ionizing and Sterilization control. (K1,K2, K3)

5.5 Disinfection - Chemical disinfectants and its uses – fumigation. (K1,K2, K3)

5.6 Phenol coefficient test. (K1,K2, K3, K4)

TEXT BOOKS:

1. Pelczar Jr .M.J., Chan E.C.S and Kreig, N.R (2006). Microbiology. 6th Edition, Mc Graw Hill Inc., Newyork.
2. Lansing M. Prescott, John P. Harley, Donald Klein. (2011) .Microbiology. 8th Edition, McGraw Hill Inc., New York.

REFERENCE BOOKS:

1. Dubey R.C and Maheswari D.K (2012). A Text of Microbiology. Revised edition, S.Chand & Company Ltd., New Delhi.
2. Geeta Sumbali and Mehrotra R.S (2009). Principles of Microbiology. 1st edition, Tata McGraw Hill P. Ltd., New Delhi.
3. Robert F. Boyd (2000). General Microbiology. 2nd Edition, Times Mirror / Moshy College publishing, Virginia.

OER:

E-books

1. www.gutenberg.org
2. www.free-ebooks.net
3. www.e-booksdirectory.com

Video lessons

1. www.learnerstv.com
2. www.webcast.berkeley.edu
3. www.cosmolearning.org

UCMBB20 -MICROBIAL PHYSIOLOGY AND METABOLISM

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: II	UCMBB20	Microbial Physiology and Metabolism	Theory	Core	6	5	100

Course Objective: The course is designed to familiarize students with basic concepts of microbial growth and metabolism along with an in-depth knowledge on the morphology and reproduction of fungi and algae.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Discuss on various physical and chemical growth requirements of bacteria.

CO2: Practically apply the knowledge in preparation of culture media for bacterial growth and identification.

CO3: Equip with various techniques employed to measure microbial growth and evaluate different classes of antibiotics and their mode of actions.

CO4: Explain the structural similarities and differences among various groups of fungi and algae along with its physiological properties.

CO5: Outline microbial transport systems and mechanisms of energy conservation in metabolism.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	H	M	L	M	M
CO3	H	M	L	L	L	L
CO4	H	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	M	L	L	L
CO2	H	H	M	L	L	L
CO3	H	M	M	L	L	L
CO4	H	L	M	L	L	L
CO5	H	L	M	L	L	L

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Nutrition requirement and types of Microorganisms. (15 hours)

1.1 Nutritional requirement of Microorganisms- Macro and Micro elements (K1,K2)

1.2 Nutritional types of Microorganisms – phototrophs and chemotrophs. (K1,K2)

1.3 Nutritional types of Microorganisms lithotrophs and organotrophs. (K1,K2)

1.4 Nutritional types of Microorganisms autotrophs and heterotrophs. (K1,K2)

1.5 Uptake of nutrients into the cell -Transport of nutrients by active method. (K1,K2)

1.6 Uptake of nutrients into the cell -Transport of nutrients by passive method. (K1,K2)

UNIT II: Culture media, types and culture techniques. (15 hours)

2.1 Culture Media and its types. (K1,K2,K3)

2.2 Preparation of culture media. (K1,K2,K3)

2.3 Pure culture techniques - Streak, spread, pour plate techniques. (K1,K2,K3)

2.4 Factors affecting growth of bacteria- pH, temperature, oxygen. (K1,K2,K3)

2.5 Capnophilic organisms. (K1,K2,K3)

2.6 Preservation of cultures- aerobic and anaerobic culture techniques- Lyophilization. (K1,K2,K3)

UNIT III: Microbial growth and Antimicrobial chemotherapy. (15 hours)

3.1 Microbial growth (Population doubling time / generation time) – Growth curve of Bacteria. (K1,K2,K3)

3.2 Measurement of microbial growth (cell number, cell mass). (K1,K2,K3)

3.3 Batch and continuous culture- Synchronous growth. (K1,K2,K3)

3.4 Control of microbial growth by antimicrobial drugs & Antibiotics- An introduction. (K1,K2)

3.5 Drugs inhibiting cell wall, cell membrane, protein and nucleic acid synthesis. (K1,K2)

3.6 Antimicrobial drug resistance. (K1,K2)

UNIT IV: Morphology, reproduction and cultivation of fungi and algae. (15 hours)

4.1 Fungi- Morphology, reproduction and cultivation of yeast (*Saccharomyces*). (K1,K2,K3)

4.2 Morphology, reproduction and cultivation of Molds (*Aspergillus, Penicillium, Rhizopus* and *Mucor*). (K1,K2,K3)

4.3 Algae- Morphology and reproduction of *Chlamydomona and Volvox.* (K1,K2)

4.4 Algae- Morphology and reproduction of *Chlorella*, *Ulothrix* and *Diatoms.* (K1,K2)

4.5 Classification and Salient feature of Cyanobacteria. (K1,K2)

4.6 Cultivation of Cyanobacteria. (K1,K2, K3)

UNIT V: Microbial metabolism. (15 hours)

5.1 Enzymes – classification- coenzymes (functions of TPP, NAD, NADP, FMN, FAD and Coenzyme A). (K1,K2)

5.2 Basic concepts of Microbial Metabolism – enzymes involved. (K1,K2)

5.3 Mechanism of ATP Synthesis- Krebs cycle. (K1,K2)

5.4 Glycolysis. (K1,K2)

5.5 Electron transport chain – oxidative phosphorylation. (K1,K2)

5.6 Photophosphorylation- types (Cyclic and Non-cyclic). (K1,K2)

TEXT BOOKS:

1. Lansing M. Prescott, Harley J. P and Klein D.A (2005). Microbiology. 6th edition, International edition, McGraw Hill. New York.
2. Pelczar T.R, Chan M.J and Kreig N.R (2006). Microbiology.6th edition, Tata McGraw-Hill INC., New York.

REFERENCE BOOKS:

1. Dubey R.C and Maheswari D.K (2012). A Text of Microbiology. Revised edition, S. Chand andCompany Ltd., New Delhi.
2. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology, 4th edition, A John Wiley sons, Inc. publication. New Delhi.
3. David white (2011).The physiology and biochemistry of prokaryotes. 4th edition, Oxford university press, UK
4. Sale A.J (1992). Fundamental principles of Bacteriology, 7th edition, McGraw Hill Publishing Co. Ltd., New York.

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2. www.webcast.berkeley.edu
3. www.cosmolearning.org

UCMBC20 – CORE PRACTICAL I: BASIC TECHNIQUES IN MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: II	UCMBC20	Basic techniques in Microbiology	Practical	Core	3	4	100

Course Objective: The candidate will gain hands-on training and acquire adequate skill required to identify microorganism through staining techniques, sterilize and prepare culture media, inoculate observe and distinguish the growth patterns of microorganisms in different media.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Perform cleaning, sterilization of glasswares and prepare culture media.

CO2: Examine the different morphological forms of microbes.

CO3: Analyze and employ different staining methods for the identification of bacteria.

CO4: Competently cultivate bacteria in different types of media and identify their sensitivity and resistance.

CO5: Use Classical techniques for the identification of bacteria based on their biochemical properties.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	M	H	M	M
CO3	M	M	L	H	L	L
CO4	M	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	H	L	M
CO3	H	H	H	H	L	M
CO4	H	H	H	H	L	M
CO5	H	H	H	H	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

1. Sterilization: Principle & Methods –Dry heat, Moist heat, Filtration, fumigation and radiation.
2. Microscopy – Bright field Microscope.
3. Smear Preparation and simple staining technique.
4. Differential staining - Gram Staining and Acid fast staining.
5. Negative staining for capsule.
6. Motility Demonstration in Hay infusion broth.
7. Culture media preparation - Basal media, Enriched media, Differential media and selective media.
8. Pure culture techniques – Serial dilution, pour plate, spread plate & streak plate techniques.
9. Demonstration of Bio-chemical Characteristics - Indole, Methyl red, Voges Proskauer, Citrate, TSI test, Urease test and Sugar fermentation test.
10. Antibiotic sensitivity test – Kirby Bauer Disc Diffusion method.
11. Morphology of Fungi - LPCB wet mount preparation.
12. Examination of pond water sample – algae and protozoa.

REFERENCE BOOKS:

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007). Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology. 13th edition, Mosby Publishers, United states.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6th edition, Published by Pearson Education, United States.
4. Monica Cheesbrough. (2005) District Laboratory Practice in Tropical Countries –Part I and II. 2nd edition, Cambridge University Press, New Delhi.

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VIRTUAL LABS/ INTERACTIVE SIMULATIONS:

1. www.vlab.co.in
2. www.aview.in/aview
3. www.pbs.org
4. www.micro.magnet.fsu.edu/primer/java/scienceopticsu

UCMBD20 - BASIC IMMUNOLOGY AND MICROBIAL GENETICS- I

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: III	UCMBD20	Basic Immunology and Microbial Genetics -I	Theory	Core	6	5	100

Course Objective: The syllabus is designed to provide basic knowledge on immunity and organs of immune system, types of antigens and antibody interactions and the role of DNA as a basic unit of gene expression.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the history of immunology and immunohaematology.

CO2: Discuss the overall organization of the immune system and differentiate the humoral and cell mediated immune mechanisms.

CO3: Explain about types of antigen, antibody and apply the principles and techniques involved in antibody production.

CO4: Describe the structure of DNA & RNA with their physical & chemical properties.

CO5: Familiarize with the process involved in the replication of DNA.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	L	M	L	M	M
CO3	H	M	L	M	M	M
CO4	H	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	L	M	L	L	H
CO3	H	H	M	L	L	L
CO4	H	L	M	L	L	M
CO5	H	L	H	L	L	L

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I : History of immunology and Immunohaematology. (15 hours)

1.1 History of Immunology- contributions of Elie metchnikoff. (K1,K2)

1.2 Contributions of Louis Pasteur and Edward Jenner. (K1,K2)

1.3 Immunohaematology- blood grouping, Rh typing. (K1,K2)

1.4 Rh incompatability- Haemolytic disease of the newborn. (K1,K2)

1.5 Normal Microbial flora of the human body and its function. (K1,K2)

1.6 Gnotobiotic animals, their interaction and uses. (K1,K2)

UNIT II : Structure and function of immune system. (15 hours)

2.1 Structure and functions of cells of the immune system- B cells, T cells. (K1,K2)

2.2 Functions of NK cells, phagocytic cells, Mast cells. (K1,K2)

2.3 Primary Lymphoid organs (Thymus and Bone marrow). (K1,K2)

2.4 Secondary Lymphoid organs (Lymph node and Spleen), MALT, GALT, BALT. (K1,K2)

2.5 Immunity – Types of Immunity – Humoral and Cell mediated immunity. (K1,K2)

2.6 Innate and Acquired immunity. (K1,K2)

UNIT III : Antigen and Antibodies, types and function. (15 hours)

3.1 Antigens- properties, types of antigen- haptens, adjuvants. (K1,K2)

3.2 Immunoglobulins- General Structure. (K1,K2)

3.3 Types of immunoglobulins, properties and its functions. (K1,K2)

3.4 Theories of antibody formation. (K1,K2)

3.5 Monoclonal and polyclonal antibodies. (K1,K2)

3.6 Production of Monoclonal antibodies and their applications. (K1,K2,K3)

UNIT IV : Introduction to genetics and nucleic acids, its types and function. (15 hours)

4.1 Genetics – Historical Introduction – Discovery of DNA Structure, Nucleic acids – DNA & RNA as Genetic Material. (K1,K2)

4.2 Nucleosomes, Repetitive DNA, highly repetitive DNA, Satellite and mini satellite DNA - forms of DNA. (K1,K2)

4.3 Types of RNA- mRNA, tRNA ,rRNA. (K1,K2)

4.4 Post transcriptional and translational modification. (K1,K2)

4.5 Genetic code. (K1,K2)

4.6 Central Dogma of Molecular biology. (K1,K2)

UNIT– V: Functioning of bacterial genetic material. (15 hours)

5.1 Organization & functioning of bacterial genetic material. (K1,K2)

5.2 Gene and Gene concept. (K1,K2)

5.3 Plasmids – characteristics, Structure, types and functions. (K1,K2)

5.4 Mechanism of DNA Replication- enzymes involved. (K1,K2)

5.5 Semi conservative method of replication- experimental proof. (K1,K2)

5.6 Types of replication- rolling circle and theta model of replication. (K1,K2)

TEXT BOOKS:

1. Kuby J Richard A. Goldsby, Thomas J. Kindt (2006). Immunology. 6th edition, W.H. Freeman and company, New York.
2. Richard M.Hyde (2011).Immunology. 3rd edition, Williams & Wilkins, Philadelphia.
3. Robert H Tamarin (2002). Principles of Genetics. 7th edition, Tata McGraw Hill P. Ltd., New Delhi.

REFERENCE BOOKS:

1. Bashir S.F (2011). Text Book of Immunology. 1st edition, PHI Learning Private limited, New Delhi.
2. Ananthanarayan R & Paniker C.K.J (2013). Text Book of Microbiology, 9th edition, Universities Press, Hyderabad
3. Tizard K (1995). Immunology. An Introduction. 1st edition, Saunders college publishing, Philadelphia.
4. Benjamin A. Pierce (2002). Genetics: A Conceptual Approach. W.H.Freeman and Company, United States.
5. Gardner Simion Snustad (2005). Principles of Genetics. 8th edition, John Wiley and Sons Inc, New York.
6. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. 3rd edition, John Wiley and Sons, Inc. publication, New Delhi.

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1. http://www.learnerstv.com/
2. http://webcast.berkeley.edu/
3. http://cosmolearning.org/
4. http://www.world-lecture-project.org/
5. http://cec.nic.in/
6. http://epgp.inflibnet.ac.in/
7. http://www.co-learn.in/

UCMBE20 – APPLIED IMMUNOLOGY AND MICROBIAL GENETICS- II

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	UCMBE20	Applied Immunology and Microbial Genetics -II	Theory	Core	5	5	100

Course Objective: The syllabus is designed to familiarize students on the antigen antibody reactions invivo and exvivo and an in depth understanding on the central dogma of molecular biology.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline and apply the basic principle and mechanism of antigen and antibody reactions.

CO2: Discuss on the significance of autoimmune diseases, hypersensitivity reactions and interpret on different types of vaccine and vaccination schedule.

CO3: Explain the gene transfer mechanisms between the prokaryotes and eukaryotes.

CO4: Identify mutations and DNA repair mechanisms.

CO5: Comprehend the process of protein synthesis and the methods of gene expression.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	L	M	M	M	L
CO3	H	M	L	M	M	L
CO4	H	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	L
CO2	H	M	H	L	L	L
CO3	H	H	H	L	L	L
CO4	H	H	H	L	L	L
CO5	H	M	H	L	L	L

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I : Antigen –Antibody reactions. (15 hours)

1.1 Antigen and Antibody interaction invitro – Zone phenomenon- Lattice hypothesis. (K1,K2,K3)
1.2 Agglutination reactions- Direct, indirect, Haemagglutination inhibition test, Coombs test. (K1,K2,K3)
1.3 Precipitation reactions- Ring test, slide test, tube test, Precipitation reaction in gel- immunoelectrophoresis, CIE, Single diffusion in one dimension, double diffusion in one dimension, single diffusion in two dimension and double diffusion in two dimension, Counter Immunoelectrophoresis. (K1,K2,K3)
1.4 ELISA- direct and indirect. (K1,K2,K3)
1.5 RIA and flow cytometry. (K1,K2,K3)
1.6 Western blotting. (K1,K2,K3)

UNIT II : Complements cascade and Antigen- antibody reactions invivo. (15 hours)

2.1 Complements, components and pathways (classical and alternate pathways). (K1,K2)
2.2 Hypersensitivity reactions and its types ((Types I to V). (K1,K2)
2.3 Transplantation immunology. (K1,K2)
2.4 Autoimmune diseases (Rheumatoid Arthritis, Systemic Lupus Erythematosus, Myasthinia gravis, Thrombocytopaenia and Hashimoto thyroiditis). (K1,K2)
2.5 Vaccine- Definition, types and functions. (K1,K2)
2.6 Immunization Schedule. (K1,K2,K3)

UNIT III: Gene transfer mechanisms. (15 hours)

3.1 Gene transfer mechanism – Griffith experiment. (K1,K2)
3.2 Transformation – Definition, competent cell, transfection. (K1,K2, K3)
3.3 Mechanism of transformation and transformation frequency. (K1,K2,K3)
3.4 Transduction – Definition, generalized, abortive and specialized transduction. (K1,K2,K3)
3.5 Conjugation – Definition, U Tube experiment (K1,K2,K3)
3.6 Hfr, F^+, F^-,F' conjugation. (K1,K2,K3)

UNIT IV: Mutation and DNA repair mechanisms. (15 hours)

4.1 Mutation and its types – transition, transversion. (K1,K2)
4.2 Spontaneous (Frame shift mutation, mis sense mutation and non sense mutation). (K1,K2)
4.3 Induced mutation. (K1,K2,K3)
4.4 Detection and isolation of auxotrophic mutants - Replica plating and Ames test. (K1,K2,K3)
4.5 DNA repair mechanisms- photoreactivation, (K1,K2)
4.6 Excision repair and SOS repair. (K1,K2)

UNIT V: Gene expression system. (15 hours)

5.1 Protein synthesis (initiation, elongation, termination) in Prokaryotes. (K1,K2)
5.2 Protein synthesis (initiation, elongation, termination) in Eukaryotes. (K1,K2)
5.3 Operon- Definition, structure and function. (K1,K2)
5.4 Overview on the Gene expression system. (K1,K2)
5.5 Concept of Lactose operon. (K1,K2)
5.6 Tryptophan operon – Attenuation control. (K1,K2)

TEXT BOOKS:

1. Kuby J Richard A. Goldsby, Thomas J. Kindt (2006). Immunology. 6th edition, W.H. Freeman and company, New York.
2. Richard M.Hyde (2011).Immunology. 3rd edition, Williams & Wilkins, *Philadelphia.*
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4. http://www.world-lecture-project.org/
5. http://cec.nic.in/
6. http://epgp.inflibnet.ac.in/
7. http://www.co-learn.in/

UCMBF20 – CORE PRACTICAL II: BASIC AND APPLIED IMMUNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	UCMBF20	Basic and Applied Immunology	Practical	Core	3	4	100

Course Objective: To impart hands on training on various agglutination and precipitation reaction and to provide an insight in identifying the cells of immune system.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Identify the ABO blood groups and its Rh types.

CO2: Enumerate and observe various granulocytic and agranulocytic cells of immune system.

CO3: Perform serological diagnosis for the detection of typhoid, syphilis, rheumatoid factor and anti streptolysin 'o'.

CO4: Demonstrate the direct and indirect pregnancy testing procedure.

CO5: Quantitate the antigens and antibodies by performing immunodiffusion techniques.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	L	M	L	L	H
CO3	H	M	L	M	M	H
CO4	H	L	M	H	M	H
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	H	L	L	L
CO2	H	L	H	M	M	L
CO3	H	H	H	M	M	L
CO4	H	M	H	L	L	L
CO5	H	H	H	L	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

1. Blood Grouping & Rh typing.
2. Differential counting.
3. Enumeration of WBC using Haemocytometer.
4. Enumeration of RBC using Haemocytometer.
5. Isolation of Buffy coat by wintrobes tube.
6. Widal test (Qualitative slide test and Quantitative tube test).
7. Rapid Plasma Reagin test.
8. Pregnancy test –Direct dip stick method and Indirect slide test.
9. Latex Agglutination- Anti Streptolysin 'o' test.
10. Latex Agglutination-Rheumatoid factor.
11. Treponema Pallidum Haemagglutination test (TPHA).
12. Precipitation reaction in Gel -Ouchterlony Double Diffusion.
13. Precipitation reaction in Gel - Radial Immuno Diffusion.

REFERENCE BOOKS:

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13th edition, Mosby Publishers, United States.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education, United States.
4. Monica Cheesbrough (2005). District Laboratory Practice in Tropical Countries - Part I and II. 2nd edition, Cambridge University Press, New Delhi.

OER:

VIRTUAL LABS/ INTERACTIVE SIMULATIONS:

1. www.vlab.co.in
2. www.aview.in/aview
3. www.pbs.org
4. www.micro.magnet.fsu.edu/primer/java/scienceopticsu

UCMBH20 - FOOD, DAIRY AND INDUSTRIAL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V	UCMBH20	Food, Dairy and Industrial microbiology	Theory	Core	5	5	100

Course Objective: To provide basic knowledge on food preservation, causes of spoilage, control and preventive measures from harmful microorganisms. The course is also designed for the learners to acquire idea about fermentation technology and commercially important microbial products.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Understand the role of microorganisms in food and the factors influencing their growth

CO2: Apply the principles and procedures involved in preservation of food.

CO3: Identifying the spoilage causing microorganisms in various foods and analysing the significance of food borne and milk borne diseases in association with public health.

CO4: Formulate knowledge on the fermentation process with adequate information on the fermentors and identifying industrially important microorganisms.

CO5: Discuss on the industrial production and purification of sauerkraut, cheese, yoghurt, organic solvents, beverages, vitamins and growth factors

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	L	M	L	L	H
CO3	H	M	L	M	M	H
CO4	H	M	M	H	M	H
CO5	H	M	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	M	H	L	L	H
CO3	H	H	M	L	L	H
CO4	H	M	M	L	L	H
CO5	H	H	H	L	M	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Microorganism important in food microbiology and food preservation methods. (15 hours)

1.1 Food as Substrate for Microorganisms.(K1,K2)

1.2 Microorganisms important in food microbiology; Molds, yeasts and bacteria – General characteristics- Classification and importance. (K1,K2)

1.3 Principles of food preservation – Asepsis – Removal of microorganisms – anaerobic conditions. (K1,K2, K3)

1.4 Food preservation using high temperature – Canning. (K1,K2, K3)

1.5 Food preservation using low temperature. (K1,K2, K3)

1.6 Food preservation by Drying – Food additives. (K1,K2, K3)

UNIT II: Contamination and spoilage of foods. (15 hours)

2.1 Contamination, spoilage and preservation of cereal and cereal products. (K1,K2, K3)

2.2 Contamination, spoilage and preservation of vegetables and fruits. (K1,K2, K3)

2.3 Contamination, spoilage and preservation of meat and meat products. (K1,K2, K3)

2.4 Contamination, spoilage and preservation of milk and milk products. (K1,K2, K3)

2.5 Contamination, spoilage and preservation of Poultry, fish and other sea foods.(K1,K2,K3)

2.6 Spoilage of canned foods. (K1,K2,K3)

UNIT III: Food and milk borne diseases. (15 hours)

3.1 Food borne illness – General introduction to etiological agents, treatment, prevention and control measures (K1,K2,K3)

3.2 Food intoxication and Food infection. (K1,K2,K3)

3.3 Bacterial food borne diseases. (K1,K2,K3)

3.4 Non – bacterial food borne diseases (viral and parasitic). (K1,K2,K3)

3.5 Mycotoxicosis and Mycotoxins. (K1,K2,K3)

3.6 Milk borne diseases. (K1,K2,K3)

UNIT IV: Bioreactors and fermentation. (15 hours)

4.1 Bioreactors – Principle, types. (K1,K2,K3)

4.2 Design and functional Characteristics of bioreactors. (K1,K2,K3)

4.3 Mode of operation and control. (K1,K2,K3)

4.4 Primary and secondary metabolites. (K1,K2)

4.5 Fermentation – Types of fermentation – Batch and continuous fermentation. (K1,K2,K3)

4.6 Dual (or) multiple, surface and submerged fermentation. (K1,K2,K3)

UNIT V: Fermented products and industrial production of organic solvents, beverages, vitamins and growth factors. (15 hours)

5.1 Fermentation- fermented vegetables – sauerkraut. (K1,K2,K3)

5.2 Fermented dairy products – cheese, yoghurt. (K1,K2,K3)

5.3 Production of organic solvents: ethanol, acetone. (K1,K2,K3)

5.4 Beverages: wine, beer. (K1,K2,K3)

5.5 Organic acid: citric acid, acetic acid. (K1,K2,K3)

5.6 Production of Vitamins and growth factors: Vitamin B2 (Riboflavin), Vitamin B12, Vitamin C. (K1,K2,K3)

TEXT BOOKS:

1. Frazier W.C. and West Hoff D.C (2008). Food Microbiology. 4th edition, Mc Graw Hill, New York.
2. Vijaya Ramesh K (2007). Food Microbiology. 1st edition, MJP Publishers, Chennai.
3. Patel A.H (2001). Industrial Microbiology. 3rd edition, Mac Millan India ltd, Chennai.

REFERENCE BOOKS:

1. Adam M.R. and Moss M.O (2004). Food Microbiology. 2nd edition, New international pvt. Ltd., publishers.UK.
2. Casida J.E (1986). Industrial Microbiology, 1st edition. Wiley Eastern publishers.UK
3. Stanbury P.F., Whitaker A and Hall S.J (1995). Principles of Fermentation technology. 1st edition, Pergamon, UK.
4. Banwart G. J (2004). Basic Food Microbiology. 2nd edition, CBS Publishers and Distributors, New Delhi.
5. James M. Jay (2003). Modern Food Microbiology. 4th edition, CBS Publishers, New Delhi.

OER:

DIGITAL LIBRARIES:

1. http://www.loc.gov/
2. http://library.clark.edu/
3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/

UCMBI20 - MOLECULAR BIOLOGY AND rDNA TECHNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V	UCMBI20	Molecular biology and rDNA technology	Theory	Core	4	5	100

Course Objective: Familiarize the students understanding on the concepts of recombinant DNA technology and strategies involved in gene manipulations.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Compare the use of various cloning vectors in gene cloning techniques and the application of genetic engineering and strain improvement using mutational rDNA technology.

CO2: Apply the strategies of gene cloning techniques and identify rDNA clones.

CO3: Compile the techniques of nucleic acid hybridization and DNA amplification.

CO4: Explain the procedure involved and applications of enzyme and algal biotechnology.

CO5: Discuss on the methods involved in the Production, of pharmaceutical products and the importance of Gene therapy.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	M	M	L
CO4	H	H	H	H	M	M
CO5	H	H	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	M
CO4	H	H	H	M	L	H
CO5	H	H	H	L	M	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Vectors - cloning and expression. (15 hours)

1.1 Historical perspectives – Plasmids – Vectors. (K1,K2,K3)

1.2 Psc101, P^{BR322} , Ti plasmid. (K1,K2,K3)

1.3 Bacteriophage vectors- λ (lamda) and M 13 phage. (K1,K2,K3)

1.4 cosmid (pJB8), YAC (pYAC3). (K1,K2,K3)

1.5 Introduction to principles and applications of genetic recombinant technology. (K1,K2,K3)

1.6 Strain improvement in the production of biotechnologically useful products (mutational rDNA technology). (K1,K2,K3)

UNIT II: Strategies of gene cloning techniques. (15 hours)

2.1 Restriction endonucleases- nomenclature, its types. (K1,K2,K3)

2.2 Enzyme Ligase and its function. (K1,K2,K3)

2.3 DNA manipulative enzymes- DNA Polymerases and its types. (K1,K2,K3)

2.4 DNA modifying enzymes- Alkaline phosphatase, polynucletide kinase, Terminal deoxynucleotidyl transferase. (K1,K2,K3)

2.5 Gene cloning techniques – Isolation and identification of rDNA clones. (K1,K2,K3)

2.6 Genomic and cDNA libraries. (K1,K2,K3)

UNIT III: Nucleic acid hybridization and DNA amplification. (15 hours)

3.1 Overview on Nucleic acid hybridization. (K1,K2)

3.2 Solution and Filter hybridization – Dot blot. (K1,K2,K3)

3.3 Insitu hybridization -colony and plaque hybridization. (K1,K2,K3)

3.4 Southern, northern, western methods of hybridization. (K1,K2,K3)

3.5 DNA amplification technique – Polymerase Chain Reaction. (K1,K2,K3)

3.6 Restriction Fragment Length Polymorphism. (K1,K2,K3)

UNIT IV: Enzyme and algal biotechnology. (15 hours)

4.1 Enzyme biotechnology – source selection. (K1,K2,K3)

4.2 Extraction and purification of enzymes. (K1,K2,K3)

4.3 Enzyme immobilization techniques (physical binding, cross linking, entrapment) - their application – products produced. (K1,K2,K3)

4.4 Microbial algal technology – Cultivation methods of *Spirulina.* (K1,K2,K3)

4.5 Exploitation of microalgae for food and feed. (K1,K2,K3)

4.6 Fuel (Methane, hydrogen) and Drug production from microalgae.(K1,K2,K3)

UNIT V: Biotechnological application in the production of pharmaceuticals.(15 hours)

5.1 Production of Humulin. (K1,K2)

5.2 Production of Interferon. (K1,K2)

5.3 Tissue plasminogen Activator. (K1,K2)

5.4 Recombinant vaccine (HBs Ag). (K1,K2)

5.5 Production of antibiotics- Penicillin, Streptomycin and Tetracycline. (K1,K2)

5.6 Gene therapy- Definition, Gene therapy methods. (K1,K2)

TEXT BOOKS:

1. Brown T. A (2016). Gene cloning and DNA analysis- An introduction. 7th edition, Black wiley, United States.
2. Old R.S and Primrose S.B (2001). Principles of Gene Manipulation: An introduction to Genetic Engineering. 6th edition, Blackwell Scientific publication, London.

REFERENCE BOOKS:

1. Jogdnand S.N (2005). Gene biotechnology. 2nd edition, Himalaya Publishing House, Mumbai.
2. Satyanarayana U (2005). Biotechnology. 1st edition, Books and Allied (P) Ltd., Kolkata.
3. Dubey R.C (2005). A Text of Biotechnology. Multicolour Illustrative edition, S.Chand and Company Ltd., New Delhi.
4. Bernad R Glick and Pasternak, J.J (2003). Molecular Biotechnology - Principles and Applications of Recombinant DNA.3rd edition, ASM Press, Washington, D.C.
5. Hugo W.B and Russell A.D (2002). Pharmaceutical Microbiology. 4th edition, Blackwell scientific publications / oxford, London.

OER:

VIDEOS/VIDEO LESSONS / E-CONTENT FOR LEARNING

1. http://www.learnerstv.com/
2. http://webcast.berkeley.edu/
3. http://cosmolearning.org/
4. http://www.world-lecture-project.org/
5. http://cec.nic.in/
6. http://epgp.inflibnet.ac.in/
7. http://www.co-learn.in/

UEMBB20 - ELECTIVE I B: ENTREPRENEURIAL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V	UEMBB20	Elective I B: Entrepreneurial Microbiology	Theory	Core Elective	4	4	100

Course Objective: To facilitate the students understanding on the concepts of entrepreneurship such as Planning, decision making, leadership, organizations and authority.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Explain the historical development of industrial microbiology and outline on the importance of entrepreneur development and risk assessment.

CO2: Analyze the microbial cells as fermented products.

CO3: Demonstrate the procedures involved in mushroom cultivation and its storage method.

CO4: Utilize various microorganisms as biofertilizers.

CO5: Design and use patent in the development of entrepreneurship.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	H	L	L	H
CO3	H	M	M	M	M	M
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	H	H	H	M	H
CO3	H	M	H	M	L	M
CO4	H	H	H	M	L	H
CO5	H	H	H	L	L	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Entrepreneur Development. (12 hours)

1.1 Entrepreneur development and activity. (K1,K2,K3,K4)

1.2 Institutes involved in Entrepreneurial development. (K1,K2,K3,K4)

1.3 Government contributions to Entrepreneurs. (K1,K2,K3,K4)

1.4 Risk assessment in Entrepreneurship. (K1,K2,K3,K4)

1.5 Industrial Microbiology- Definition and History. (K1,K2)

1.6 Scope of Industrial Microbiology. (K1,K2,K3)

UNIT II: Microbial cells as fermented products. (12 hours)

2.1 Microbial cells as fermentation products – Brewers and Baker's yeast. (K1,K2,K3)

2.2 Food and feed yeasts. (K1,K2,K3)

2.3 Bacterial insecticides. (K1,K2,K3)

2.4 Legume inoculants - Algae. (K1,K2,K3)

2.5 Enzymes as fermentation products- bacterial and fungal amylases. (K1,K2,K3)

2.6 Enzymes as fermentation products - proteolytic enzymes. (K1,K2,K3)

UNIT III: Mushroom cultivation. (12 hours)

3.1 History of Mushroom cultivation in India. (K1,K2)

3.2 Common edible mushrooms cultivated in India. (K1,K2)

3.3 Preparation of compost and composting. (K1,K2,K3)

3.4 Spawn and spawning. (K1,K2,K3)

3.5 Methods used in Cultivation of *Agaricus bisporous* and *Agaricus campestris.*(K1,K2,K3)

3.6 Methods used in Cultivation *Volvoriella volvaciae*. (K1,K2,K3)

UNIT IV: Biofertilizers. (12 hours)

4.1 Chemical fertilizers versus biofertilizers. (K1,K2)

4.2 Biofertilizer- Historical background. (K1,K2)

4.3 Organic farming. (K1,K2,K3)

4.4 Methods involved in the production of Bacterial biofertilizers. (K1,K2,K3)

4.5 Methods involved in the production of algal biofertilizers. (K1,K2,K3)

4.6 The importance of *Rhizobium* sp., *Azospirillum* sp., *Azotobacter* sp.,as biofertilizers. (K1,K2)

UNIT V: Patenting and Fermentation economics. (12 hours)

5.1 Patent and secret process. (K1,K2)

5.2 History of patenting. (K1,K2)

5.3 Composition, subject matter for patenting. (K1,K2)

5.4 Characteristics of a patent, inventor, infringement, cost of patent. (K1,K2)

5.5 Patents in India and other countries. (K1,K2)

5.6 Fermentation economics. (K1,K2)

TEXT BOOKS:

1. Arora (2009).Entrepreneurial Development .1st edition, Himalaya Publishing House, New Delhi.
2. Arora R and Sood S.K (2010). Entrepreneurship Development. 1st edition, Kalyani Publishers, New Delhi.
3. Batra G.S and Dangal R.C (2000). Entrepreneurship and Small Scale Industries. 1st edition, Deep & Deep Publications, New Delhi

REFERENCE BOOKS:

1. Casida J.R (2005). Industrial Microbiology. 2nd edition, New Age International (P) Ltd., New Delhi.
2. SubbaRao NS (1997). Biofertilizer in Agriculture and Forestry, 3rd edition, Oxford &IBU Publications. New Delhi
3. Aneja K.R (2010). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, 6th edition, New age International Publication.
4. Anand Saxena (2005). Entrepreneurship Motivation, Performance, Reward. 1st edition, Deep & Deep Publication, New Delhi.
5. Anil Kumar S, Poornima S.C, Mini K and Jayashree K (2006).Entrepreneurship Development. 1st edition, New age international Publishers,New Delhi.
6. Batra G.S (2002). Development of entrepreneurship.1st edition, Deep & Deep Publication, New Delhi.

OER:

E- CONTENT FOR LEARNING:

1. http://www.learnerstv.com/
2. http://webcast.berkeley.edu/
3. http://cosmolearning.org/
4. http://www.world-lecture-project.org/
5. http://cec.nic.in/
6. http://epgp.inflibnet.ac.in/
7. http://www.co-learn.in/

UCMBK18 - MICROBIAL ECOLOGY AND SOIL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UCMBK20	Microbial Ecology and Soil Microbiology	Theory	Core	5	5	100

Course Objective: To facilitate students understanding on the microorganisms present in their environments and their habitat, microbial interaction, biogeochemical cycling and waste management.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Compare the role of microbial communities in the environment and discuss on the significance of Aero and Water Microbiology

CO2: Assess on the microbiological aspects of management of sewage and design the treatment procedures.

CO3: Outline on the importance of bioremediation and biodegradation of xenobiotic compounds.

CO4: Familiarize with microorganisms of soil and their role in biogeochemical cycle.

CO5: Comprehend the importance of plant- microbe interactions.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	M
CO2	H	H	H	L	L	M
CO3	H	M	M	H	M	M
CO4	H	M	H	H	M	M
CO5	H	M	H	M	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	H	L	M
CO2	H	L	H	M	L	M
CO3	H	M	H	L	L	M
CO4	H	H	H	M	L	L
CO5	H	L	H	L	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: **Aero Microbiology and Water Microbiology. (15 hours)**

1.1 Microbes of air, Droplet, Droplet nuclei, aerosol.Assessment of air quality, solid- liquid impingement method. (K1,K2,K3,K4)

1.2 Brief account of air borne transmission of microbes and diseases. (K1,K2)

1.3 Microbiology of water – Types of water- potability of water (K1,K2)

1.4 Microbial assessment of water quality. (K1,K2,K3,K4)

1.5 Brief account on water borne diseases. (K1,K2)

1.6 Municipal water treatment method process. (K1,K2,K3,K4)

UNIT II: **Sewage treatment. (15 hours)**

2.1 Sewage– Chemical and Microbiological characteristic of sewage. (K1,K2)

2.2 Types of wastes - Characterization of solid and liquid waste (K1,K2)

2.3 Sewage treatment methods– Primary treatment. (K1,K2,K3)

2.4 Sewage treatment - Secondary, anaerobic – methanogenesis, aerobic – trickling filters , activated sludge, oxidation pond. (K1,K2,K3)

2.5 Tertiary treatment- sewage disinfection. (K1,K2,K3)

2.6 Utilization of solid and liquid wastes- saccharification – gasification – composting. (K1,K2,K3)

UNIT III: **Biodeterioration and remediation. (15 hours)**

3.1 Bioaugmentation, recalcitrants/xenobiotic compounds -Bioremediation, biodeterioration-Definition. (K1,K2)

3.2 Deterioration of paper. (K1,K2,K3)

3.3 Deterioration of leathers. (K1,K2,K3)

3.4 Deterioration of wood. (K1,K2,K3)

3.5 Deterioration of textiles /fabrics. (K1,K2,K3)

3.6 Metal corrosion – Biocorrosion. (K1,K2,K3)

UNIT IV: Microbiology of soil. (15 hours)

4.1 Microorganisms in soil – qualitative and quantitative microflora of different soils. (K1,K2,K3)

4.2 Role of microorganisms in soil fertility. Enumeration of microorganisms in soil. (K1,K2,K3)

4.3 Factors affecting soil microflora – moisture, pH, temperature, organic matter, agronomic practices. (K1,K2,K3)

4.4 Bio-Geo chemical cycles – Nitrogen cycle (K1,K2)

4.5 Phosphorus cycle and sulphur cycle. (K1,K2)

4.6 Carbon cycle and iron cycle. (K1,K2)

UNIT V: Plant - Microbe interactions. (15 hours)

5.1 Overview on Plant Microbe interactions. (K1,K2)

5.2 Inter relationships between plants and Microorganisms – Rhizosphere, Rhizoplane, Phyllosphere, Spermosphere – their importance in plant growth. (K1,K2)

5.3 Mycorrhiza – ecto and endo mycorrhiza – AM fungi – distribution and importance. (K1,K2, K3)

5.4 Lichens and their role. (K1,K2)

5.5 Symbiotic Nitrogen fixation - Root nodule bacteria. (K1,K2, K3)

5.6 Non- symbiotic nitrogen fixation (K1,K2,K3)

TEXT BOOKS:

1. Vijaya Ramesh K (2004). Environmental Microbiology. 1st edition, MJP publishers. Chennai
2. Joseph C. Daniel (1999). Environmental aspects of Microbiology. 1st edition, Bright Sun publications, Chennai.
3. Subba Rao N.S (2004). Soil Microbiology. 4th edition, Oxford and BH Publishing Co.Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Murugesan A.G and Rajakumari C (2005). Environmental Science and Biotechnology. 1st edition, MJP Publishers, Chennai.
2. Singh D.P and Dwivedi S.K (2005). Environmental Microbiology and Biotechnology. 1st edition, New Age International (P) Ltd., New Delhi.
3. Mishra RR (2004). Soil Microbiology. 1st edition, CBS Publishers and distributors, New Delhi.
4. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. 4th edition, PHI Learning (P) Ltd., New Delhi.
5. Atlas R.M. and Bartha R (1992). Microbial Ecology, Fundamental and Application, 3rd edition, Bengamin and Cummings. United States.

OER:

E- CONTENT FOR LEARNING:

1. http://www.learnerstv.com/
2. http://webcast.berkeley.edu/
3. http://cosmolearning.org/
4. http://www.world-lecture-project.org/
5. http://cec.nic.in/
6. http://epgp.inflibnet.ac.in/
7. http://www.co-learn.in/

UEMBC20- ELECTIVE II A: MARINE MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBC20	Elective II A: Marine Microbiology	Theory	Core Elective	4	4	100

Course Objective: To facilitate students understanding on the ecological role of microorganisms in marine environment.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline about the different marine environment and compare the microbial communities in the aquatic environment.

CO2: Discuss adaptations strategies of various extremophilic microorganisms, extremozymes and their importance in biotechnology.

CO3: Identify the kinetics of aquatic microbial population and microbial interactions – symbiosis and antagonism.

CO4: Describe about the marine food borne and water borne pathogens.

CO5: Explain the production and biotechnological applications of novel marine microbial products.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	L	M
CO2	H	H	H	L	L	M
CO3	H	M	M	H	H	M
CO4	H	M	H	H	H	M
CO5	H	L	M	M	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	L	L
CO2	H	M	H	M	L	L
CO3	H	M	H	H	L	L
CO4	H	M	H	M	L	L
CO5	H	H	H	H	L	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I : The marine environment. (12 hours)

1.1 Marine environment - sea-benthic & littoral zone. (K1,K2)

1.2 Saltpan. (K1,K2)

1.3 Mangroves. (K1,K2)

1.4 Estuarine microbes. (K1,K2)

1.5 Microbial loop. (K1,K2)

1.6 Marine microbial community - planktons, bacteria, fungi, protozoa. (K1,K2)

UNIT II: Extremophiles and their growth environment. (12 hours)

2.1 Survival at extreme environments – starvation. (K1,K2)

2.2 Adaptive mechanisms in thermophilic, psychrophilic microorganisms. (K1,K2)

2.3 Alkalophilic microorganisms. (K1,K2)

2.4 Barophilic microorganisms and Osmophilic microorganisms. (K1,K2)

2.5 Hyperthermophiles microorganisms. (K1,K2)

2.6 Halophiles - importance in biotechnology. (K1,K2)

UNIT III: Microbe- Microbe interactions. (12 hours)

3.1 Microbe-microbe interactions – Lichens. (K1,K2)

3.2 Antagonistic interactions - amensalism, mycoparasitism. (K1,K2)

3.3 Animal-microbe interaction - Ectosymbiosis of Protozoa, Ruminant symbiosis. (K1,K2)

3.4 Plant-microbe interaction – *Rhizobium.* (K1,K2)

3.5 Plant-microbe interaction – *Mycorrhizae.* (K1,K2)

3.6 *Anabaena* - sponge. (K1,K2)

UNIT IV: Marine pathogens. (12 hours)

4.1 Marine food borne pathogens & Water borne pathogens – An overview. (K1,K2)

4.2 *Aeromonas.* (K1,K2)

4.3 *Vibrio.* (K1,K2)

4.4 *Salmonella.* (K1,K2)

4.5 *Pseudomonas.* (K1,K2)

4.6 *Leptospira.* (K1,K2)

UNIT V: Marine microbial products. (12 hours)

5.1 Production and applications of marine microbial products - pigments – Astaxanthin. (K1,K2)

5.2 Production and applications of marine microbial products - β carotene. (K1,K2)

5.3 Production and applications of marine microbial products – enzymes. (K1,K2)

5.4 Production and applications of marine microbial products – antibiotics. (K1,K2)

5.5 Production and applications of marine microbial products – polysaccharide. (K1,K2)

5.6 Sea food preservation methods. (K1,K2)

TEXT BOOKS:

1. Lansing M. Prescott, John P. Harley, Donald Klein (2011) .Microbiology. 8th edition. McGraw Hill Inc., New York.
2. Bhakuni D.S. and Rawat D.S. (2005). Bioactive marine natural products. 1st edition, Anamaya Publishers, New Delhi.
3. Jamesh W. Nybakker (2001). Marine Biology.1st edition, Benjamin Cumming Publications, United States.

REFERENCE BOOKS:

1. Raina M. Maier, Ian L. Pepper, Charles, P. Gerba (2006). Environmental Microbiology. 1st edition, Academic press, United States.
2. Shimshon Belkin and Rita R. Colwell (2005). Ocean and Health: Pathogens in the marine environment. 1st edition, Springer, United States.
3. Scheper T. (2005). Advances in Biochemical Engineering/Biotechnology-Marine Biotechnology I. 1st edition, Springer, United States.

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3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/

UEMBD20 - ELECTIVE II B: MICROBIAL NANOTECHNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBD20	Elective II B: Microbial Nano Technology	Theory	Core Elective	4	4	100

Course Objective: To facilitate students understanding on microbial nanotechnology and its applications.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline evolution of nanoscience and hurdles in the development of nanotechnology.

CO2: Understand the use spectroscopy for nanotechnology research.

CO3: Discuss the role of microscopy in nanotechnology research.

CO4: Utilize nano materials for drug development and its application in nuclear medicine.

CO5: Apply nanotechnology for air and water treatment and become familiar with nanoscience education in India and abroad.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	H	L	L	M
CO3	H	M	M	H	L	M
CO4	H	M	H	H	M	M
CO5	H	L	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	M	M	M
CO5	H	H	H	M	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: History and evolution of Nano Science. (12 hours)

1.1 Definition – Evolution of Nano science. (K1,K2)

1.2 Need of Nano technology. (K1,K2)

1.3 Hurdles for Nanotechnology development. (K1,K2)

1.4 Factors affecting the manufacturing process of nano materials. (K1,K2)

1.5 Role of physicists, chemists, computer scientists, engineers in nanotechnology. (K1,K2)

1.6 Role of Medical doctors, biologists in nano technology. (K1,K2)

UNIT II: Spectroscopy in nanotechnology research. (12 hours)

2.1 Spectroscopy- An overview. (K1,K2)

2.2 Importance of spectroscopy in nano technology research. (K1,K2)

2.3 Mass spectroscopy. (K1,K2)

2.4 Infra-red spectroscopy. (K1,K2)

2.5 Raman spectroscopy. (K1,K2)

2.6 Ultra violet-visible spectroscopy. (K1,K2)

UNIT III: Microscopy in nanotechnology research. (12 hours)

3.1 Microscopy in nanotechnology research- An over view. (K1,K2)

3.2 Atomic force microscope. (K1,K2)

3.3 Scanning electron microscope. (K1,K2)

3.4 Transmission electron microscope. (K1,K2)

3.5 Magnetic resonance force microscopy. (K1,K2)

3.6 Nano probes for nucleic and hybridization detection. (K1,K2)

UNIT IV: Nanotechnology for drug development and medical applications. (12 hours)

4.1 Nanotechnology for drug development and medical applications. (K1,K2)

4.2 Nanotechnology for drug solubilization and drug delivery. (K1,K2)

4.3 Diagnosis using nanomaterials. (K1,K2)

4.4 Nanotherapy for cancer treatment. (K1,K2)

4.5 Nanotherapy for interior artery embolisms. (K1,K2)

4.6 Radioactive tuberene cages in Nuclear medicine. (K1,K2)

UNIT V: Cleaning the air with nanotechnology. (12 hours)

5.1 Cleaner environment with Nanotech. Cleaning the air with Nanotechnology. (K1,K2)

5.2 Nanotechnology for water treatment. (K1,K2)

5.3 Microbial nanoparticles used in cleaning air. (K1,K2)

5.4 Nanocarbon ball as deodorizer in fermentation process. (K1,K2)

5.5 Possible harm from Nanomaterials. (K1,K2)

5.6 Nanoscience in India – Nanoscience education abroad – ethics and society. (K1,K2)

TEXT BOOKS:

1. Richard Brooker and Earl Boysen (2006). Nanotechnology. 1st edition, Wiley Publishing Inc., India.
2. Bernd H.A.Rehm (2006). Microbial Bionanotechnology: Biological self-assembly systems and Biopolymer Based Nanostructures. 1st edition, Horizon Bio Science.UK.
3. Nicola Cioffi and Mahendra Rai (2012). Nano - Antimicrobials.1st edition, Springer. United States.

REFERENCE BOOKS:

1. Duckruix, A. and R. Giege (1992). Crystallization of Nucleic acids and Proteins. A practical approach, 1st edition, Oxford University Press, England.
2. Vadlapudi Varahalarao and Nayak B.K (2017). Microbial Nanotechnology: Mycofabrication of Nano particles and their Novel Applications.1st edition.IGI global publishers. India.
3. Nicola Cioffi and Mahendra Rai (2012). Nano - Antimicrobials.1st edition, Springer. United States
4. Anton Ficai and Alexandru Grumaezescu.(2017) .Nanostructures for Antimicrobial Therapy. 1st edition, Elsevier. Netherlands.

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1. http://www.loc.gov/
2. http://library.clark.edu/
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UEMBF20 - ELECTIVE III B - ADVANCED MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBF20	Elective III B: Advanced Microbiology	Theory	Core Elective	4	4	100

Course Objective: To provide the learners an overview on the advanced aspects of Microbiology

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Utilize microorganisms in the preparation of cosmetics**.**

CO2: Evaluate the biological potential in samples return from satellites and solar system.

CO3: Discuss the role of antimicrobial fabrics, carpets, tiles, colourants and produce bacteriostatic sanitary napkins and towels.

CO4: Comprehend on paper, rubber and plastic Microbiology

CO5: Analyze the methods for producing its antimicrobial products.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	M	L	L	M
CO3	H	M	L	H	M	H
CO4	H	M	L	H	M	H
CO5	H	H	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	M	L	L
CO3	H	H	H	L	M	H
CO4	H	M	H	L	M	H
CO5	H	H	H	L	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT–I: Cosmetic Microbiology. (12 hours)

1.1 Definition; Preparations of Skin whitening compositions from microbes like Ascomycetes and Black yeast. (K1,K2, K3)
1.2 Preparations of Skin whitening compositions- enzymes. (K1,K2, K3)
1.3 Preparations of Skin whitening compositions- Mineral yeast ferments. (K1,K2,K3)
1.4 Microbial Production of Alpha Arbutin. (K1,K2,K3)
1.5 Microbial production of Hyaluronic acid. (K1,K2,K3)
1.6 Kojic acid and their use in Cosmetics preparations. (K1,K2)

UNIT–II: Space Microbiology. (12 hours)

2.1 Introduction to Space Microbiology. (K1,K2)
2.2 Monitoring of astronauts microbial flora. (K1,K2,K3)
2.3 Alterations in the load of medically important microorganisms. (K1,K2)
2.4 ESA STONE experiment. (K1,K2,K3,K4)
2.5 Evaluating the Biological Potential in Samples Returned from Planetary Satellites. (K1,K2, K3,K4)
2.6 Evaluating the Biological Potential of Small Solar System Bodies. (K1,K2,K3,K4)

UNIT–III: Textile Microbiology. (12 hours)

3.1 Introduction to Textile Microbiology. (K1,K2)
3.2 Antimicrobial fabrics. (K1,K2)
3.3 Antimicrobial garments. (K1,K2)
3.4 Antimicrobial carpets. (K1,K2)
3.5 Antimicrobial colorants. (K1,K2)
3.6 Bacteriostatic sanitary napkins and towels. (K1,K2,K3)

UNIT–IV: Paper and Rubber Microbiology. (12 hours)

4.1 Paper Microbiology- Introduction & Definition. (K1,K2)
4.2 Antimicrobial papers and its production. (K1,K2)
4.3 Antimicrobial currency. (K1,K2)
4.4 Rubber Microbiology – Introduction & Definition. (K1,K2)
4.5 Note on Antimicrobial rubbers. (K1,K2)
4.6 Antimicrobial rubber compositions. (K1,K2)

UNIT–V: Plastic Microbiology. (12 hours)

5.1 Definition- Bacteriostatic plastics. (K1,K2)
5.2 Antimicrobial plastic composition and production. (K1,K2)
5.3 Antiseptic plastics. Fungistatic plastics: Definition and production. (K1,K2)
5.4 Production of plastics materials from microorganisms. (K1,K2,K3)
5.5 Methods for producing anti-microbial plastic product. (K1,K2,K3,K4)
5.6 Plastic article containing a metallic bactericidal agent. Casein plastic**.** (K1,K2,K3)

TEXT BOOKS:

1. Vimaladevi M (2015) Text book of Herbal Cosmetics.1st edition, CBS Publishers and Distributors, New Delhi.
2. Alfonso F Davila (2010). Astromicrobiology.1st edition, John Wiley & Sons, Inc. New Delhi.
3. Srikanth Pilla (2011). Handbook of Bioplastics and Biocomposites Engineering and Applications.1st edition, John Wiley and Sons Inc., New Delhi.
4. Nierstrasz V and Cavaco Paulo A (2010). Advances in Textile Biotechnology. 1st edition, Elsevier, London.

REFERENCE BOOKS:

1. Philip A. Geis (2006) Cosmetic Microbiology: A Practical Approach. 2nd edition, CRC Press, Taylor and Francis Group, New York, London.
2. David M. Klaus (2003). Space Microbiology: Microgravity and Microorganisms. 1st edition, John Wiley & Sons, Inc.New Delhi
3. Ashish Kumar Sen (2007). Coated Textiles: Principles and Applications. 2nd edition, CRC Press, New Delhi
4. Tappi (2007). Monograph on Microbiology of Papermaking systems. Tappi publishers, New York.
5. Roberts A.D (1988). Natural Rubber Science and Technology. 1st edition, Oxford University Press.UK.
6. Chen, George Guo- Qiang (2010). Plastics from Bacteria: Natural Functions and Applications. 1st edition, Springers, United States.

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