Department of Microbiology
Alagappa University
Karaikudi

Inter-departmental Courses offered

(For those admitted in academic year 2022 – 2023 onwards)

Name of Offering Department: Microbiology

Non-Major Electives Course (NME) (For II Semester) - To be chosen by other PG degree students:

Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks I	Max Marks E	Total
Molecular Biology	3	2	30	25	75	100
Agriculture and Environmental Microbiology	3	2	30	25	75	100

Non-Major Electives Course (NME) (For III Semester) - To be chosen by other PG degree students:

Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks I	Max Marks E	Total
Medical Microbiology	3	2	30	25	75	100
Food and industrial Microbiology	3	2	30	25	75	100

Non-major Inter-departmental Course 1: Molecular Biology

Semester: II

Name of Offering Department: Microbiology

Code : 530507 **Maximum Marks: 100**

Hours / Week: 3 **Internal Marks : 25**

Credit : 2 **External Marks : 75**

Outcome

- Receive elaborate knowledge on nucleic acids
- Better understanding of gene expressions
- Get thorough knowledge on tumour viruses and oncogenes

Semester - II			
NME -I: 530507	**Molecular Biology**	**Credits:2**	**Hours: 3**
Objectives	➢ To extend the knowledge on the structure and functions of genetic materials ➢ To focus on genome organization, transcription and translation process in prokaryotes. ➢ To understand the principles of oncogenes		
Unit –I	**Discovery of DNA**. Molecular basis of DNA as genetic material. **Structure of DNA** – A, B and Z form. **Forms of DNA** – DNA heteroduplex, circular, superhelical DNA, twisted circle. **Properties of DNA** - denaturation, renaturation, melting curve, hyperchromicity. **Structure of RNA. Types of RNA** - tRNA, mRNA and rRNA.		
Unit-II	**Replication of DNA** - semi-conservative model, Meselson - Stahl experiment. **Enzymology of DNA replication** - DNA polymerase I, II and III; topoisomerase I and II; helicase; primase and gyrase. **Molecular mechanism of DNA replication**. Replication fork, origin and Okazaki fragments. **Types of replication** - circular and theta.		
Unit III	**Transcription process in Prokaryotes:** Initiation - promotors, upstream and downstream sequences, transcription factors; **Elongation** - RNA polymerase, subunits; **Termination** - Rho-dependent and Rho-independent; nus A protein and antitermination. **RNA processing** (post-transcriptional modifications), inhibitors of transcription. **Reverse transcription.**		
Unit IV	**Genetic code:** Elucidation of triplet code, code characteristics and codon dictionary. Reading frames, sense and nonsense code. **Degeneracy -** wobble hypothesis, the universality of genetic code. **Process of translation in prokaryotes:** Initiation and Termination. Role of rRNA in protein synthesis. **Post-translational modifications** - post-translational transport. Signal hypothesis.		
Unit V	**Tumor viruses and oncogenes:** Transformed cells, detection of integral viral DNA, the structure of integral viral DNA. Protein kinase and transformation by retroviruses. Cellular counterpart of src. Carcinogens. Activation of oncogenes. **Oncogenic proteins** - protein kinases, growth factors, ras protein. Transformation protein in DNA viruses.		

Reference and Textbooks:-

Benjamin Lewin. (2007). *Genes XI*. New York: Oxford University Press.

Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. (2008). *Molecular Biology of the Cell* (5th ed). Garland Science.

David Freifelder. D. (2008). *Microbial Genetics* (18th ed). NewDelhi: Narosa Publishing House.Freifelder, D. (2000). *Molecular Biology* (2nd ed). NewDelhi: Narosa Publishing house.

Jeyanthi, G.P. (2009). *Molecular Biology*. Chennai: MJP Publishers.

Stanley R. Maloy, John E.C. and Freifelder, D. (2008). *Microbial Genetics*. New Delhi: NarosaPublishing House.

Stryer, L. (2019). *Biochemistry* (9th ed). New York: W.H. Freeman and Company.

Veer Russel, P. (2009). *iGenetics: A Molecular Approach*. India: Pearson Education.

Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A. M. (2013). *MolecularBiology of the Gene* (17th ed). Tokyo: The Benjamin Cummings Publishing Company Inc.

Outcomes	➢ Receive elaborate knowledge on nucleic acids ➢ Better understanding of gene expressions ➢ Get thorough knowledge on tumour viruses and oncogenes

Non-major Inter-departmental Course 2: Agriculture and Environmental Microbiology

Semester: II

Name of Offering Department: Microbiology

Code : 530002 **Maximum Marks: 100**

Hours / Week : 3 **Internal Marks : 25**

Credit : 2 **External Marks : 75**

Outcome

- Acquire knowledge on soil microbiology
- Understand the biogeochemical cycles prevail in the environment.
- Able to know about principles and techniques in waste treatment

Semester – II			
NME -I: 530508	**Agriculture and Environmental Microbiology**	**Credits: 2**	**Hours: 3**
Objectives	➢ To create awareness on soil Microbiology ➢ To give knowledge on plant-pathogen interaction and its control ➢ To inculcate on environmental microbiology		
Unit -I	**Diversity and distribution of microorganisms in soil;** Soil Microflora- Bacteria, Fungi and Actinomycetes. Classification, physical, chemical properties and structure of soil. **Microbial interactions** - mutualism, synergism, commensalism, amensalism, parasitism, predation and competition. **Microbial interactions with plants**– phyllosphere, mycorrhizae, rhizosphere and symbiotic association in root nodules. **Biofertilizer** – VAM, *Rhizobium*, *Frankia*, *Azospirillum*, *Azotobacter*, Cyanobacteria, Phospho bacteria and *Azolla*.		
Unit-II	**Bacterial diseases of agricultural crops** - pathogens, symptoms, control measures with reference to paddy, cotton, maize, tomato, citrus, mango and potato. **Plant protection** – phenolics – phytoalexins and related compounds. Bioinsecticides – viral, bacterial and fungal- a brief note.		
Unit III	**Bio-geo chemical cycles in soil** – Carbon cycle, Nitrogen cycle – Nitrogen fixation, nitrification, denitrification, sulphur, iron and phosphorus cycles. **Aerobiology** – a brief introduction - droplet nuclei – aerosols - air-borne transmission of microbes and diseases and assessment of air quality.		
Unit IV	**Aquatic microbiology** - factors affecting microbial growth – temperature – pressure – light – salinity - turbidity – pH -inorganic and organic constituents. **Aquatic habitats** - freshwater - lakes, ponds and streams; **marine habitats** - estuaries, deep sea, hydrothermal vents, saltpans, coral reefs and mangroves and their microbial communities; **zonation** – food chain and food web.		

Unit V	**Types of wastes** - solid and liquid wastes. **Treatment of solid wastes** - Thermal Treatment: Incineration, Gasification, Pyrolysis and Open Burning- **Dumps and Landfills**: Sanitary landfills, Controlled dumps, Bioreactor Landfills-**Biological Waste Treatment**: Composting, Vermicomposting and termi composting. **Treatment of liquid wastes** –primary, secondary, tertiary treatment; anaerobic (methanogenesis), aerobic, trickling, activated sludge, oxidation pond. Production of biogas from waste.

Reference and Textbooks:-

Alexander M. (1997). *Introduction to soil microbiology*, New York: John Wiley & Sons, Inc. EcEldowney S., Hardman, D.J. and Waite, S. (1993). *Pollution Ecology and Biotreatment*. Longman Scientific Technical.

Grant, W.D. and Long, P.L. (1981). *Environmental Microbiology*. Blalckie Glasgow and London. Madigan, M.T., Martinka, M., Parker, J. and Brock, T.D. (2000). Twelfth Edition, *Biology Microorganisms*, New Jerry: Prentice Hall.

Mark Wheelis, (2010). *Principles of Modern Microbiology*, New Delhi: Jones & Bartlett India Pvt. Ltd.

Mehrotra, R.S. (1983). *Plant Pathology*, New Delhi: Tata McGraw Hill Publishing Company Ltd. Pandy, B.P. (1997). *Plant Pathology (Pathogen & Plant Disease)*, New Delhi: S.Chand& Company Ltd.

Ray Chadhuri, S.P. (1977). *A Manual of Virus Diseases of Tropical Plants*, New Delhi: MacMillan Company of India Ltd.

Rengaswami, G. and Rajagopalan, S. (1973). *Bacterial Plant Pathology*. Coimbatore: Tamil Nadu Agriculture University.

SubbaRao, N.S. (1995). *Soil Microorganisms and Plant Growth* (3rd ed). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

Outcomes	➢ Acquire knowledge on soil microbiology ➢ Understand the biogeochemical cycles prevail in the environment. ➢ Able to know about principles and techniques in waste treatment.

Major-related Inter-departmental Course 1: Medical Microbiology

Semester: III

Name of Offering Department: Microbiology

Code : 530507 **Maximum Marks: 100**

Hours / Week: 3 **Internal Marks : 25**

Credit : 2 **External Marks : 75**

Outcome

- understand the normal flora of human body
- know about the clinical technology
- understand the human pathogen

Semester – III			
NME-II: 530509	**Medical Microbiology**	**Credits: 2**	**Hours: 3**
Objectives	➢ To inculcate on the role of normal flora and pathogenic microbes ➢ To understand the pathogenesis of various diseases ➢ To understand the various clinical, microbiological techniques		
Unit -I	**Laboratory management: Normal flora of human systems** – skin, respiratory tract, gastrointestinal tract and genitourinary tract. Nosocomial infections. Collection, transport of clinical samples and laboratory waste disposal system. Microbiological examination of urine, blood, feces, cerebrospinal fluid, throat swabs, sputum, pus and wound exudates.		
Unit-II	**Bacterial Diseases:** Morphology, classification, cultural characteristics, pathogenicity, laboratory diagnosis and prevention of infections caused by the following organisms: **Gram positive cocci**– *Staphylococci*, *Streptococci.* **Gram negative cocci**– *Gonococci.* **Gram positive non-spore-forming bacilli**: aerobic – *Corynebacteria* and anaerobic		
Unit III	**Fungal Disease:** General characteristics, pathogenesis and laboratory diagnosis and control measures of: **Yeast**–*Cryptococcus neoformans.* **Yeast-like fungus** – *Candida spp*. **Filamentousfungi** – *Aspergillus* and *Penicillium.* Dimorphic fungi, yeast morphology, general characteristics and reproduction. – *Blastomyces dermatitis.*		
Unit IV	**Viral Disease:** Infectious diseases- Definition of emerging & re-emerging diseases. Factors contributing to emergence. Examples (Chickungunya, Zika virus, H1N1 and Ebola). National programs in the prevention of infectious diseases.		
Unit V	**Parasitic Diseases:** General characteristics of Intracellular parasites– *Cryptosporidium* and *Plasmodium.* Intralumen parasites – *Entameoba histolytica* and *Ascaris lumbricoides.* Parasitic zoonosis– *Toxoplasma* and *Taenia*		

Reference and Textbooks:

Anathanarayan R and Jeyaram Panikers C.K. (2013). *Text Book of Microbiology* (9th ed). NewDelhi: Jain book depot.

Arora D.R., Brij Bala Arora.(2015). *Textbook of Microbiology*. Chennai: CBS.

Awetz Melnick and Adelberg's. (2010). *Medical Microbiology, 21st Century.*

Appleton & Lange. Bhattacharjee R.N.(2015). *Introduction to Microbiology* (1st ed).

New Delhi: Kalyani Publishers.Connie R Mahon. (2010). *Textbook of Diagnostic Microbiology* (3rd ed). Pearson.

David Greenwood, Richard Slack, John Peutherer. (2012). *Medical Microbiology.* ChurchillLivingstone.

Jesse Russell, Ronald Cohn. (2012). *Medical Microbiology.* Book on

Demand Ltd.Myra

Patrick R. Murray. (2015). *Medical Microbiology.* Elsevier

Patrick Murray & Ken Rosenthal & Michael Pfalle. (2015). *Medical Microbiology* (8th ed). NewYork: Academic Press.

Wilkinson. (2011). *Medical Microbiology.* Scion Publishing Ltd

Outcomes	➢ understand the normal flora of human body ➢ know about the clinical technology ➢ understand the human pathogen

Major-related Inter-departmental Course 2: Food and Industrial Microbiology
Semester: III

Name of Offering Department: Microbiology

Code : 530508 **Maximum Marks: 100**
Hours / Week: 3 **Internal Marks : 25**
Credit : 2 **External Marks : 75**

Outcome

- Get knowledge on importance of microbes fermentation of food
- Students will get knowledge on strain improvement
- Enable them to work in fermentation industry
- Students will get idea on upstream and downstream fermentation process

Semester – III			
NME -II: 530510	Food and Industrial Microbiology	**Credits:2**	**Hours: 3**
Objectives	➢ To learn the diversity of microbes in the fermentation of food ➢ To get knowledge of food-borne diseases ➢ To learn about fermentation types ➢ To understand the extraction and purification of fermented products		
Unit -I	**History and development of Food microbiology:** Role and Significance of Microorganisms in Foods, Outline of food spoilage and preservation, Food safety and microbiological Quality Assurance. Production of fermented dairy products**:** Cheese, yogurt, buttermilk, sourcream, Fermented vegetables; Sauerkraut.		
Unit-II	**Food spoilage, preservation and foodborne diseases:** organism involved in spoilage of fruits and vegetables, cereal and cereal products, meat and meat products. Foodborne diseases- Bacterial foodborne diseases- (Staphylococcal intoxication, Botulism, Salmonellosis, Shigellosis, EPEC Diarrhoea,; Food-borne fungi- Mycotoxins- Aflatoxicosis.		
Unit III	**An introduction to fermentation process**:- Screening of industrial microbes – Detection and assay of fermentation products. Classification of fermentation types. Inoculum development, media formulation, optimization methods, media sterilization, statistical design for media formulation, and optimization.		
Unit IV	**Fermentation of microbial products:**– Single Cell Protein (SCP). Anaerobic fermentation (beer and wine). Aerobic fermentation (vinegar and citric acid. Antibiotic fermentation (penicillin and streptomycin). Vitamins (B12, riboflavin), Hormone (gibberellic acid, IAA). Enzyme (amylase, protease). Biogas production.		
Unit V	**Downstream processing:-** Cell disruption – physical and chemical methods. Precipitation. Filtration- batch and continuous filters. Centrifugation - types, liquid-liquid extraction, chromatography, membrane process, drying, crystallization.		

Reference and Textbooks:-

Adams, M.R. and Moss, M.O. (2008). Food Microbiology. UK: RSC Publishing, Cambridge. Aneja, K.N. (2018). Modern Food Microbiology, Medtec Publisher.

Casida, L.E.J.R. (2019). *Industrial Microbiology* (2nd ed). New Delhi: New Age International (P)Ltd., Publishers.

Crueger, W. (2017). *Biotechnology: A Test Book of Industrial Microbiology* (3rd ed), MEDTECHPublishers.

Demain, A.L. and Davis, J.E.2004, Industrial Microbiology and Biotechnology, (2/e), ASM Press Washington, DC.

Dick M, (2017). Food Microbiology An Introduction (2nd ed). Bengaluru: Medtech.

El-Mansi, E. M. T., Bryce, C. F. A., Arnold L. Demain and Allman, A.R. (2012). *FermentationMicrobiology and Biotechnology*, CRC Press.

Frazier, W.C., and Westhoff, D.C. (1988). Food Microbiology (Reprint 1995). New Delhi: Tata McGraw Hill Publishing Ltd.

Stanbury, P.F, Whitaker, A. and Hall, S.J. (2016). *Principles of Fermentation Technology* (3rd ed).
New Delhi: Aditya Book (P) Ltd.

Prescott, L.M., Harley, J.P. and Helin, D.A. (2015). *Microbiology* (5th ed). New Delhi: McGraw
Hill.

Outcomes	➢ Get knowledge on importance of microbes fermentation of food ➢ Students will get knowledge on strain improvement ➢ Enable them to work in fermentation industry ➢ Students will get idea on upstream and downstream fermentation process