SEMESTER IV

Paper 13: Medical Microbiology (GMMB -401)
Course Objectives

At the end of this course the students will be able to "1) The course is designed to enhance student knowledge on morphology, pathogenesis, symptoms, laboratory diagnosis, and preventive measures of different gram-positive bacteria. 2) The students will get an insight on normal microflora of human body and infections caused by them. 3) On completion of this course, students' knowledge on morphology, pathogenesis, symptoms, laboratory diagnosis, preventive measures and chemotherapy with regards to gram negative bacteria will be increased."

Course Content:

Unit – I

Historical developments, Classification and characteristics of medically important microorganisms Diagnosis of infectious diseases, types of specimens, specimen collection, transport, processing of material for laboratory investigations. Specific and non specific laboratory tests, morphological identification, culture isolation, detection of antigen by immunological assays; serological tests, antibody stains, immunoblotting.

Molecular diagnosis:- DNA – DNA or DNA- RNA hybridization, 16s RNA, target amplification systems (PCR, RT PCR, TMA, NASBA).Probe amplification systems – Ligase chain reaction(LCR) signal amplification techniques.

Unit -II

Study of etiology, cultural characteristics, antigen structure, biochemical properties, diagnostic laboratory tests of pathogenic bacteria. Epidemiology and prophylaxis of α and β hemolytic Streptococci, Corynebacteriumdiphtheria. Mycobacterium tuberculosis and Neisseria meningities Sexually transmitted desieases: Treponema, Neisseria gonorrhea; LGV agent (Chlamydia); H. ducreyi, Calymmotobacterium grannulomatis

Water borne infections : E. coli, Salmonella, Vibrio Wound infections : Clostridium tetani, Staphylococci, Pseudomonas.

Unit – III

Study of etiology, pathogenesis, epidemiology and prevention of Malaria, Amocbiasis,

Leshmaniasis, Echinococcus grannulosus, Ascariasis, Ancylostomiasis Filariasis. Sudy of etiology , pathogenesis, epidemiology and prevention dermatomycoses. Superficial mycoses (Pityriasis) , Cutaneous mycoses (Microsporum, Trichophyton and Epidermophyton), Subcutaneous mycoses (Sporothrix, Mycetoma), Endemic mycoses (Coccidiomycosis, Histoplasmosis), Oppertunistic mycoses (Candidiasis, Cryptococcosis, Aspergillosis,) and their control.

Unit – IV

Study of etiology , cultivation, antigen structure, pathogenesis, diagnostic laboratory

tests, epidemiology, prevention and treatment of Air borne and zoonotic viral infections;

Influenza virus, rhinovirus, rubella, adenovirus, mumps, measles, varicella zoster virus

rabies, Japaneese encephalitis. Water, contact and sexually transmitted viral diseases; HAV, HBV, HCV, Enterovirus, Rotavirus, HSV, HIVAntimicrobial agents; screening and assay of antimicrobial compounds.

Mode of action of antimicrobials ;cell wall, nucleic acid, purine, pyromidine, protein,

respiration, Enzyme inhibitors, cell membrane disruptors, antimetabolites, analogues,

drug resistance and side effects.

Recommended Books

1. Arnold, 1998 Medical Microbiology, Volume 4
2. Bernard, Davia, Dulbecco Microbiology (4th edition)
3. Blackwell, 1993.Modern Parasitology : A Text Book of Parasitology (2nd Ed.) Cox FEG,
4. Brooks, G.F., J.S. Butel and S.A. Morse, Mc Graw – Hill Medical Microbiology
5. Christie AB,Edinburgh, Churchill – Livingstone Infectious diseases : Epidemilogy and clinical practice
1. (4th ed.)
6. Chung KJ, Bennett JE, Lea & Febiger, 1992 Medical Mycology
7. Kwon – Topley & Wilson'sMicrobiology and Microbial infections (9th Ed.) Ajello L, Hay
8. Churchill Livingstone, Davies et al 2nd edition.Microbiology
9. Churchill Livingstone, 1996 Practical Medical Microbiology (14th ed.)
10. Cruickshank Medical Microbiology Vol. I and II
11. DH et al (ed.) American Society for Microbiology, 1993 Diagnostic Molecular Microbiology,

12. Evans EGV et al (ed.) Medical Mycology, Oxford : Oxford University Press.
13. Jawetz, Melnick & Adebery Reviews of Medical Microbiology
14. Jayaram Paniker Text book of Medical parasitology (4th edition)
15. Jhon Bernard Clinical diagnosis and management – Laboratory methods
16. Joklik, Wille, Amos & Wilfert Zinser Microbiology
17. Longman, 2000 Test Book of Microbiology
18. Macowiak PA N. Engl J. Med. 1982 The normal microbial flora 307: 83
19. Mandell, Douglas and Bennett's2000 Principles and Practice of infectious diseases 5th edition
20. Mosby Bailey and Scott's Diagnostic microbiology
21. Murray PR et al (Ed.) American Society for Microbiology1999 Manual of clinical Microbiology
22. Panjarathinam R Orient Longman. Text book of Medical Parasitology. Principles and Applications,
23. Reppon JW, Philadelphia: WB Saunders, 1988 Medical Mycology,
24. Richmann, DD et al Churchill Livingstone, 1997 Clinical virology,
25. Skinner, FA and Carr, JG (ed.) 1974 The Normal Microbial Flora of Man, Academic Press,
26. Yu VL, Merrigan TC Jr. Barriere William & Wilkins, 1999 Antimicrobial therapy and vaccines
27. Franklin, T.J. and G.A. Snow 2008 Biochemistry and Molecular Biology of Antimicrobial Drug Action. Springer International Edition England

Paper 14: Bacteriology (GMMB -402)

Course Objectives

On the completion of this course the students will be able to describe following subject matters: 1. Natural resources: Renewable and non-renewable resources: Forest resources; Water resources; Mineral resources; Food resources; Energy resource 2. Air pollution; Water pollution; Noise pollution; Waste Water treatment; Thermal Pollution; Marine pollution; Soil pollution; Global warming; Acid Rain; Ozone layer depletion 3. After completion of this course students will learn about the application of microbiology and bacteriology in the environment and living system. the students in bacteriology are studying which organisms live in the human colon and are necessary for proper digestion. The study of bacteria, especially in relation to medicine and agriculture.

Course Content:

Unit I

Bacterial Classification- Basis of Bacterial classification; conventional; molecular and recent approaches to polyphasic bacterial taxonomy; evolutionary chronometers; rRNA oligonucleotide sequencing; signature sequences; and protein sequences. Differences between eubacteria and archaebacteria.

Unit II

Organization of Bacterial Cell- Structure and function of Cell Wall; Cell Membrane; Cytoplasm; Flagella; Endoflagella; Fimbriae; Glycocalyx; Capsule; Endospore; Growth and Nutrition- Cultivation of aerobic; anaerobic and accessing non-cultureable bacteria. Maintenance and preservation of bacterial cultures; Components of media and different types of culture media. Bacterial nutrition: Transport of nutrients; Salient features of bacterial growth curve.

Unit III

Important archaeal groups- According to Brock's 2009 and Bergey's Manual of Systematic Bacteriology.Archaebacteria: General characteristics; phylogenetic overview; genera belonging to Nanoarchaeota (Nanoarchaeum); Crenarchaeota (Sulfolobus; Thermoproteus) and Euryarchaeota [Methanogens (Methanobacterium; Methanocaldococcus); thermophiles (Thermococcus; Pyrococcus; Thermoplasma); and Halophiles (Halobacterium; Halococcus)]

Unit IV

Eubacteria- Non Proteobacteria and Proteobacteria: Morphology; metabolism; ecological significance and economic importance of following groups- Gram Negative- Non proteobacteria(Aquifex, Thermotoga, Deinococcus, Thermus, Chlorobium, Chloroflexus, Chlamydiae, Spirochaete), Alpha proteobacteria (Rickettsia, Coxiella, Caulobacter, Rhizobium, Hyphomicrobium, Agrobacterium), Beta proteobacteria (Neisseria, Burkholderia, Thiobacillus), Gamma proteobacteria (Enterobacteriaceaefamily, Purple sulphur bacteria, Pseudomonas, Vibrio, Beggiatoa, Methylococcus, Haemophilus), Delta proteobacteria (Bdellovibrio, Myxococcus), Epsilon proteobacteria (Helicobacter, Campylobacter). Gram Positive- Low G+C or Firmicutes (Mycoplasmas,Clostridium, Heliobacterium, Lactobacillus, Lactococcus, Staphylococcus, Streptococcus,

Leuconostoc, Bacillus), High G+C or Actinobacteria (Arthrobacter, Bifidobacterium, Corynebacterium, Frankia, Mycobacterium, Nocardia, Streptomyces, Thermomonospora, Propionibacterium Cyanobacteria).

Suggested readings:

1. Salle A.J., Fundamental Principles of Bacteriology.
2. Pelczar M.J., Chan E.C.S. &Kreig N.R., Microbiology: Concepts and Application, Tata McGraw Hill.
3. Stainier RY, Ingraham JL, Wheelis ML & Painter PR General Microbiology. Publisher: MacMillan.
4. Madigan M.T., Martinko J.M. and Parker J., Brock Biology of Microorganisms: Prentice-Hall, Inc USA.
5. Atlas R.M., Principles of Microbiology, Wm C. Brown Publishers.
6. Vandenmark P.V. and Batzing B.L., The Microbes – An Introduction to their Nature and Importance

ELECTIVE PAPER (ANY ONE)

Paper 15: Medical Virology & Parasitology (GMMB -403)

Course Objective

At the end of this course the students will be able to describe: The Microbiology, Virology, and Parasitology related understanding to students an opportunity to undertake concentrated study in the molecular and cellular biology of viral and bacterial pathogenesis and parasitology."

Course Content

Unit 1: Review of key Virology concepts and principle of viral classification, Review of key Virology concepts,Evolutionary origin of viruses, Classification and structure of viruses, Review of general features of viral transmission and reproduction, General principle of viral transmission and Viral reproduction,Pathogenesis and Control of Viral Diseases

Unit 2: RNA Viruses: Single-stranded RNA viruses: HIV and other lentiviruses, Single-stranded RNA viruses: Poliovirus, Rhinovirus, Norovirus and Hepatitis A virus, Single-stranded RNA viruses: Filoviruses, Orthomyxoviruses Paramyxoviruses and Rabies virus.

Unit 3: Double-stranded RNA viruses: Rotavirus Unit DNA Viruses Hepadnaviruses and other reverse-transcribing DNA viruses Herpesviridae: HSV1, HSV2, Herpes simian B virus and Varicella zoster virus, Human Papilloma Virus ,Viral infective syndromes: Respiratory tract and central Nervous System viral infections, Viral infective syndromes: hepatic and digestive tract viral infections, Viral infective syndromes: Occular, skin and mucus layer viral infections.

Unit 4: Parasitology-Introduction, Parasitic association,host parasitic interaction, Effect of parasitism in the host,Sources of parasitic infections. Classification, Introduction of protozoa, Protozoa-Amoeba Flagellates-Intestinal, Hemoflagellates, Sporozoa and Microspora, Trematodes- Schistosoma haematobium, S.mansoni, S.japonicum , Cestodes-Intestinal Tapeworms and extra intestinal tape worm,Nematodes-Intestinal , Blood and tissues.

Books recommended

1. Principle and Applications John B. Carter and Venetia A. Saunders.
2. Medical Microbiology 26th edition, 2013, a LANGE medical book
3. Human parasitology-Burton J Bogtish.
4. Bowman, DD. 2009. Georgi's Parasitology for Veterinarians 9th ed. WB Saunders Press -Garcia, LS. 2007.
5. Diagnostic Medical Parasitology 5th ed. ASM Press -Foreyt, WJ. 2001.
6. Veterinary Parasitology Reference Manual, 5th ed. Blackwell Press

Paper 15: Microbes in sustainable Agriculture & development (GMMB -403)

Course Objectives

On the completion of this course, the students will understand. Plant–microbe interaction is a complex, dynamic and continuous process that is as old as plant colonization on Earth. Students to able to understanding the history of ancients, millions of years' association of plants with microbes has formed an assemblage of host and non-host species."

Course Content

Unit-1Soil Environment- Microorganisms, soil structure, soil profile, Physico-chemical conditions, Microbial composition, sampling techniques, role of Microorganisms in organic matter decomposition (cellulose, Hemicellulose, Lignins). Bio-geo chemical cycles – Carbon cycle, Nitrogen cycle – Nitrogen fixation, nitrification, de-nitrification, sulpher, iron and phosphorus cycles. Rhizosphere – Rhizoshere Microorganisms, Siderophores. PGPM-Plant growth promoting microorganisms. plant-microbe beneficial interactions. Mechanisms of plant growth promotion.

UNIT-2 Major plant disease symptoms caused by fungi, bacteria and viruses. Plant diseases – Principles, symptoms and control measures of the following diseases: Fungal – Tikka, red rot of sugarcane, Fusarium wilts (red gram and cotton), Sclerotium rolfsii and Macrophomina phaseolina (collar rot disease, charcoal rot). Bacterial – Blight of rice, citrus canker, Xanthomonas (black rot). Viral and mycoplasmal – Bud necrosis of groundnut, citrus mosaic, little leaf of brinjal, tomato leaf curl. Principles of plant disease control. Protection - Diseases of field, vegetable, orchard and plantation crops of India and their control; causes and classification of plant diseases; principles of plant disease control biological control of diseases.

UNIT-3 Biofertilizers – Introduction, biofertilizers using nitrogen fixing microbes – phosphate solubilization-Rhizobium, Azatobacter, Azospirillum, Azolla; Anabaena Symbiosis, blue green algae and Ecto- and Endomychorizae. Cultivation, mass production and inoculation of Rhizobium, Azotobacter, Azospirillum, Azolla and cyanobacteria, Carrier-based inoculants, methods of application, quality control, agronomic importance. Application methods for different biofertilizers.

UNIT-4 Biopesticides – Bacillus thuringiensis, B. sphaericus, B. popilliae, Psuedomonas syringae. Biocontrol-Microbial control of plant pathogens- Trichoderma. Useful genes from microorganisms for agriculture (herbicide resistant, Bt, viral). Biological Control – Use of Baculovirus, NPV virus, protozoa & fungi in biological control.

UNIT-5 Molecular plant microbe-interactions: Cell signalling, Quorum sensing, and Biofilm formation. Invasion of plant tissue:- resistance mechanisms against attack by plant pathogens. Molecular detection of pathogens. Integrated pest management-concepts and components; host plant resistance-biological control of insect pests; Recycling of agricultural wastes - Microbiology and biochemistry of biogas, bioethanol and other value added products. Mushroom cultivation and Vermicomposting.

Recommended Text Books:

1. Dirk J, Elas V, Trevors JT, Wellington, EMH (1997) Modern Soil Microbiology, Marcel Dekker INC, New York.
2. Agricultural Microbiology by G.Rangaswamy and Bagyaraj, Prentice Hall India.
3. Bio-fertilizers in Agriculture and Forestry, 1995, by N.S. Subba Rao.
4. Microbes For Sustainable Agriculture by K.V.B.R. Tilak, K.K. Pal, Rinku Dey
5. Soil Microbiology and Plant Growth, 1995, by N.S. Subba Rao.
6. Plant Growth and Health Promoting Bacteria by Dinesh K. Maheshwari
7. Plant-microbe interactions, Volume 1 by Gary Stacey and Noel T. Keen
8. Biological control of crop diseases Volume 89 of Books in soils, plants, and the environment by S. S. Gnanamanickam
9. Plant-microbe interactions and biological control Volume 63 of Books in soils, plants, and the environment by Greg J. Boland, L. David Kuykendall

Paper 15: Socioeconomic aspects and IPR (GMMB -403)

Course Objective:

At the end of this course the students will be able to describe: 1. What is Indian patent law, WTO and how it is related with IPR. 2. Ethical and depository considerations in biotechnology, and What bioethics are and why those are needed in research,"

Course Content

UNIT – 1:

Steps to preserve biodiversity. In situ and Ex Situ conservation - Gene banks, In-situ and Ex situ conservation. Ex situ conservation efforts at international level, Ex-situ conservation by G-15 countries, Europe, India. Conservation efforts by private sectors, management of germplasm collection. Species conservations.

UNIT – 2:

Biosafety and Societal Concern: Public debate and concern on Genetically modified microorganisms, plants and animals, scientific analyses of the concern, Biosafety regulation and guidelines on developing and using the Genetically modified organisms, radiation safety.

UNIT – 3:

Intellectual property, Intellectual property rights (IPR) (Patents, trade secret, copy right, trade marks), Choice of intellectual property protection (IPP). IPR and plant genetic resources (PGR).

UNIT – 4:

Patenting of Biological Materials: International conventions. International cooperation obligations with patent applications, implications of patenting, current issues: Can live form be patented-? with special reference to Factor VIII, Erythropoitin, tissue plasminogen, activator, hybridoma technology etc. Patenting of higher plants and animals: Transgenic organisms and isolated genes. Patenting of genes and DNA sequences, plant breeder's rights and farmer's right.

Paper 15: Microbiology & Human Health (GMMB -403)

Course Objective

On the completion of this course, the students will understand, Micro-organisms matter because they affect every aspect of our lives – they are in us, on us and around us & their versatility, microbes can be put to work in many ways: Students making life-saving drugs, the manufacture of biofuels, cleaning up pollution, and producing/processing food and drink."

Course Content

Unit- 1 **Important developments in medical microbiology: Normal flora of human body, opportunistic infections; Host-parasite interactions. Nosocomical infections and their control. General concepts for clinical specimen collection and biosafety levels.**

Unit- 2 Epidemiology: Concept of epidemic, endemic and pandemic, acute, chronic, morbidity, mortality, prevalence, incidence, Reservoirs, Carriers. Stages of Disease Progression. Modes of transmission; vector, vehicle transmission, portal of entry. Mechanisms of microbial resistance to host cellular and humoral defenses. Molecular basis of microbial pathogenecity. Molecular Koch's postulates, Pathogenicity Islands, bacterial toxins. Active and Passive Immunization: different types of vaccine live attenuated, killed, subunit, recombinant DNA vaccine. Antimicrobial Agents: Multi-drug Resistance, Generation of antibiotics, Mechanism of Action of: Streptomycin, Griseofulvin.

Unit- 3 Infections of Skin: Etiology, Pathogenesis, Laboratory diagnosis, prophylaxis and treatment of Bacterial: Staphylococcus; Streptococcus, Pseudomonas; Viral: Chicken Pox, Measles, Fungal: Cutaneous and Subcutaneous Mycoses Protozoal: Leishmania. Infections of Gastrointestinal System: Etiology, Pathogenesis, Laboratory diagnosis, prophylaxis and treatment of Bacterial: Salmonella, Shigella, E. coli, Viral: Hepatitis, Protozoal: Entamoeba,

Unit- 4 Infections of Nervous System: Etiology, Pathogenesis, Laboratory diagnosis, prophylaxis and treatment of Meningitis, Bacterial: Tetanus, Botulinum, Leprosy. Viral: Rabies, Protozoal: African Sleeping sickness, Systemic Infections: Etiology, Pathogenesis, Laboratory diagnosis, prophylaxis and treatment of Bacterial: Brucellosis, RMSF, Protozoal: Malaria

Unit- 5 Infections of Respiratory System: Etiology, Pathogenesis, Laboratory diagnosis, prophylaxis and treatment of Bacterial: Corynebacterium, Klebsiella, Bordetella, Mycobacterium, Mycoplasma, Pneumonia (bacterial, chlamydial, mycoplasmal), Viral: Common Cold, Influenza, Fungal: Coccdiodomycosis, Pneumocystis pneumonia. Infections of Urinogenital System: Pathogenesis, Laboratory diagnosis, prophylaxis and treatment of AIDS, Gonorrhoea, Chlamydia infections

Suggested Readings:

1. David Wilks, Mark Farrington and David Rubenstein 2010. Infectious Diseases Manual: Blackwell Science
2. George F. Brooks, Karen C.Carroll, Janet S.Butel, Stephen A. Morse. 2007. Jawetz, Melnick & Adelberg's Medical microbiology. 24th Ed. McGraw-Hill Professional.
3. Nester E. W., Anderson D. G. and Nester M. T. 2006. Microbiology: A Human Perspective, McGraw Hill.
4. Harvey, R.A., Champe, P.C. and Fisher, B.D. 2007. Lippincott's Illustrated Reviews : Microbiology. Lippincott Williams and Wilkins, New Delhi/New York
5. Greenwood D. 2007. Medical Microbiology 4th Ed., I.K. International.
6. Murray P.R., Pfaller M.A., Tenover F.C., and Yolken R.H. 2007. Clinical Microbiology, ASM Press.
7. Bauman, R.W. 2009. Microbiology: with diseases by body system; Benjamin Cummings
8. Sherris, John C , Medical Microbiology: an Introduction to infectious diseases., Ed, Elsevier Publication II nd edition.

SEMINAR (GMMB -404)

PROJECT/DISSERTATION (GMMB -405)

EDUCATIONAL TOUR/FIELD WORK