

Course Title	<b>Microbiology and Virology</b>			
Course Code	<b>MED-302</b>			
Course Type	Required			
Level	Undergraduate			
Year / Semester	Year 3/ Semester 5 (Fall)			
Teacher's Name	<b>Course Lead:</b> Prof Peter Karayiannis <b>Contributors:</b> Dr George Siakallis			
ECTS	6	Lectures / week	3	Laboratories / week 1.5
Course Purpose and Objectives	<p>This course aims to help students understand infectious diseases through the study of the general microbiology concepts of structure, growth and metabolism of microorganisms and viruses and their interrelationship with humans. The course also aims to train students in standard microbiology techniques utilized on a daily basis in laboratories. The main objectives of the course are to:</p> <ul style="list-style-type: none"> <li>• Make students aware of the appropriate terminology in the fields of studying microorganisms and viruses.</li> <li>• Differentiate between bacterial, viral, parasitic and fungal infections and to describe the mechanisms by which such microorganisms can cause disease.</li> <li>• Become familiar with infectious diseases and the pathogens that cause them.</li> <li>• Introduce the processes of infection of opportunistic and pathogenic microorganisms and the body's defence systems.</li> <li>• Present the basic principles for the prevention and control of infections by microorganisms.</li> <li>• Enable students to understand the mode of action of antibacterial, antiviral, antifungal and anti-parasitic drugs/compounds, and their use.</li> <li>• Become familiar with the use of vaccines, their production and limitations.</li> <li>• Enable students to make informed decisions on health and hygiene regarding infectious diseases.</li> <li>• Provide the opportunity to practise in microbiology laboratory techniques and to draw and report appropriate conclusions from the analysis of experimental data.</li> </ul>			
Learning Outcomes	The following list provides the learning objectives that will be covered in the lectures, and tutorials of each week:			

### Week 1

#### **Lobs covered during lectures:**

1. Describe the purpose of microbe existence on earth.
2. Outline the role of normal flora and describe the relationship between microbes and humans.
3. Describe bacterial characteristics, structure and classification.
4. Describe the mechanisms of bacterial invasion of hosts and virulence factors.
5. Define various portals of entry and the routes of transmission of the infection.
6. Describe the metabolic processes of bacteria.
7. Outline the bacterial processes involved in replication and growth.
8. Describe the main mechanisms of immune response against infections.
9. Describe the basic aspects of vaccination.

### Week 2

#### **Lobs covered during lectures:**

10. Describe the mechanisms of action and resistance of antimicrobials.
11. Describe the major methods of susceptibility testing and recognise the resistance phenotypes most frequently found in a clinical microbiology laboratory.
12. Define MIC and MBC.
13. Describe the characteristics, virulence factors and clinical syndromes caused by *Staphylococci*.

#### **Lob covered during lab practical:**

14. Outline main steps & principles of specimen collection & transport and describe laboratory processing for the most important samples.
15. Describe main laboratory diagnostic techniques.
16. Describe sterilization, disinfection & antiseptics.

### Week 3

#### **Lobs covered during lectures:**

17. Define the characteristics, virulence factors and clinical syndromes caused by *Streptococci* and *Enterococci*.
18. Define the characteristics, virulence factors and clinical syndromes caused by *E. coli*, *Salmonella/Shigella* and other *Enterobacteriaceae*.

19. Define the characteristics, virulence factors and clinical syndromes caused by *Pseudomonas aeruginosa* and *Acinetobacter baumannii*.

**Lob covered during lab practical:**

20. Outline the main steps and technical procedures for the isolation and identification of the causative agents in staphylococcal and streptococcal infections.
21. Explain the main laboratory techniques used to differentiate the species between them.

**Week 4**

**Lobs covered during lectures:**

22. Describe the main characteristics of HCAI & the role of MDR microorganisms.
23. Describe the main characteristics & resistance mechanisms of MDR microorganisms.
24. Describe the main aspects of infection control & prevention of nosocomial infections.
25. Describe the characteristics, pathogenesis & clinical manifestations of *T. pallidum*, including assessment of syphilis serology for diagnosis and follow up of patients.
26. Describe epidemiology, clinical course and diagnosis of *Leptospira* and *Borrelia* infections.
27. Describe the characteristics, pathogenesis and clinical syndromes caused by the *Neisseriae*
28. Describe the characteristics, pathogenesis and clinical syndromes caused by *Haemophilus influenzae*/ *H. ducrei*/ *Gardnerella*/ *Bordetella*/ *Moraxella*/ *Legionella*.
29. Describe the characteristics, pathogenesis and clinical syndromes caused by *Mycoplasmas* and *Chlamydiae*.
30. Describe the characteristics, pathogenesis and clinical syndromes caused by *Bacteroides*/ *Fusobacterium* and other non-spore forming anaerobes.

**Week 5**

**Lobs covered during lectures:**

31. Discuss the characteristics, pathogenesis and clinical syndromes caused by *C. tetani*, *C. botulinum* & *C. perfringens* and describe mechanism of action of their associated toxins.
32. Describe the characteristics, biology, virulence, pathogenicity, epidemiology of *Clostridium difficile* and outline the main principles of Infection Control.

33. Describe the characteristics, pathogenesis and clinical syndromes caused by *Vibrio*, *Aeromonas*, *Campylobacter*, and *Helicobacter*.
34. Describe clinical syndromes, epidemiology and diagnosis of infections caused by fastidious & other pleomorphic Gram positive & Gram negative
35. Describe characteristics and clinical syndromes caused *Actinomyces*
36. Define characteristics and clinical relevance of *Nocardia*.

**Lob covered during lab practical:**

37. Describe main resistance phenotypes in Gram (-) & Gram (+) isolates encountered in daily clinical practice and provide basic information on resistance mechanisms behind each resistance phenotype.
38. Briefly describe therapeutics of MDR microorganisms based on PK/PD data.

**Week 6**

**Lobs covered during lectures:**

39. Describe viral structure, virion components, nucleic acid replication and different types of viral life cycles.
40. Explain the concept of viral tropism (infectivity).
41. Describe portals of entry into the body and define pathogenicity.
42. Explain acute, chronic and latent viral infection.
43. Explain the criteria for the classification of viruses and introduction of DNA virus families
44. Describe the symptoms and diseases caused by DNA viruses such as Herpes, Hepatitis B and Papilloma viruses.
45. Differentiate between the different hepatitis viruses and serological profiles.

**Week 7**

**Lobs covered during lectures:**

46. Describe the characteristics, pathogenesis and clinical syndromes caused by *Rickettsia*, *Orientia*, *Coxiella*, *Ehrlichia* and *Anaplasma*.
47. Describe the characteristics, pathogenesis and clinical syndromes caused by *Y. pestis*, *Bartonella* spp, *Pasteurella* spp & *Francisella*.
48. Describe the characteristics, pathogenesis and clinical syndromes caused by *Brucella*, *B. anthracis*, *E.rhusiopathiae*, *Streptobacillus* & *S. minus*.

49. Describe the characteristics, pathogenesis and clinical syndromes caused by *Listeria*, *Corynebacteria* and other *Bacillus* spp.

### **Formative Midterm Exam.**

#### **Week 8**

##### **Lobs covered during lectures and tutorials:**

50. Explain the criteria for the classification of RNA viruses and introduction of RNA virus families.
51. Describe the symptoms and diseases caused by RNA viruses such as HIV, Rabies, flavi- and filoviruses.
52. Describe viral infection in childhood and recognise differences in rashes (exanthemata) produced.
53. Describe viral genetics and manipulation of their genomes for various purposes.

#### **Week 9**

##### **Lobs covered during lectures:**

54. Explain seasonality of flu viruses and the concept of genetic drift or shift.
55. Describe signs and symptoms of respiratory infections by myxo- and paramyxoviruses, rhino- and coronaviruses.
56. Describe the role of the immune system in the clearance or not of viral infections.
57. Describe different mechanisms of immune evasion by viruses.
58. Discuss different types of vaccines for both bacteria and viruses. Immunisation schedule.
59. Discuss in detail the diagnostics of *M. tuberculosis*.
60. Describe the characteristics, pathogenesis and clinical syndromes caused by *M. leprae* and non-tuberculous *Mycobacteria*.
61. Discuss mechanisms of action of antivirals and reasons for antiviral drug resistance.
62. Discuss use of antivirals depending on viral infection.
63. Describe the characteristics, pathogenesis and clinical syndromes caused by *M. tuberculosis* and antibacterial treatment.

#### **Week 10**

##### **Lobs covered during lectures:**

64. Define mycology and the importance of fungi in nature.

65. Describe the relationship of fungi to other organisms and their role in disease.
66. Describe fungal classification and taxonomic features.
67. Define fungal structure, antigenicity, pathogenicity and immune response.
68. Describe the morphological characteristics of yeasts, their reproduction and their medical importance.
69. Describe the morphological characteristics of moulds, their reproduction and their medical importance.
70. Define macroscopic and microscopic features of yeasts and moulds.
71. Perform differential diagnosis between yeasts and moulds and between the main species.
72. Perform anti-fungal susceptibility testing.

### **Week 11**

#### ***Lobs covered during lectures:***

73. Define phylogenetic classification of fungi and recognise representative genera causing fungal infections.
74. Define dimorphic fungi and dermatophytes and their role in fungal infections.
75. Describe the most important superficial and systemic mycoses and their laboratory diagnosis.
76. Describe the mode of action of antifungals, route of administration and spectrum of activity.
77. Describe clinically significant mycotoxins and mycotoxicoses.

### **Week 12**

#### ***Lobs covered during lectures:***

78. Describe the basic biology and life cycles of human parasites, human parasitic infections, including their epidemiology, clinical features, laboratory diagnosis, treatment and prevention.
79. Describe the ways by which parasites affect their hosts.
80. Examine the clinical and pathological manifestations of the most important and prevalent parasitic infections.
81. Describe the factors which determine the geographical distribution of parasites and influence the host-parasite relationship.
82. Critically analyse the results of laboratory investigations.
83. Be able to make a differential diagnosis of some of the most important and prevalent parasitic infections.
84. Examine methods of treatment of various parasitic infections.
85. Identify all the important parasites affecting humans.

	<p>86. Become familiar with parasitological terminology.</p> <p>87. Train in the use of equipment and become familiar with laboratory methods for the diagnosis of parasitic diseases.</p> <p>88. Recognize the basic morphologic criteria and differentiate between the most common parasites.</p>		
Prerequisites	None	Required	None.
Course Content	<p><b>Bacteriology:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Medical Microbiology.</li> <li>• Human Microbiome and the Relationship between host and microbes.</li> <li>• Microorganisms' classification, cell structure.</li> <li>• Mechanisms of Bacterial Pathogenesis and Routes of transmission.</li> <li>• Metabolic processes.</li> <li>• Replication and growth.</li> <li>• Immune Response to infections and vaccines.</li> <li>• Antibacterial agents: Classification, Activity Spectrum and Mechanisms of action.</li> <li>• Conventional laboratory techniques for AST (Antimicrobial Susceptibility Testing) in a routine clinical microbiology laboratory. MIC&amp;MBC explanation. Resistance phenotypes most frequently found in clinical practice.</li> <li>• <i>Staphylococci</i>.</li> <li>• <i>Streptococci/ Enterococci</i>.</li> <li>• <i>Enterobacteriaceae</i> –Part I: <i>E. coli</i>.</li> <li>• <i>Enterobacteriaceae</i> –Part II: <i>Klebsiella, Proteus, Enterobacter, Salmonella, Shigella</i> and others.</li> <li>• Non-fermenting Gram Negative Bacilli: <i>Pseudomonas, Acinetobacter</i>.</li> <li>• HCAI (Health Care Associated Infections). MDR (Multi-Drug-Resistance) microorganisms and their role in infections.</li> <li>• Infection control. Standard Precautions measures.</li> <li>• Miscellaneous Gram Negative and pleomorphic bacteria: <i>Haemophilus, Gardnerella, Bordetella, Moraxella, Legionella</i>.</li> <li>• <i>Neisseria meningitidis</i> and meningococcaemia.</li> <li>• <i>Neisseria gonorrhoeae</i> and gonorrhoea.</li> <li>• Miscellaneous Gram positive &amp; Gram negative and other fastidious and pleomorphic bacteria Part I: Aerobic Gram-Positive bacilli &amp; Branching Filamentous bacilli. <i>Spirochetes</i>.</li> <li>• Miscellaneous Gram positive &amp; Gram negative and other fastidious and pleomorphic bacteria Part II: <i>Vibrio, Aeromonas, Campylobacter, Helicobacter, Clostridium</i>.</li> </ul>		

- Other pleomorphic bacteria: *Mycoplasmas* and *Chlamydiae*.
- Non spore-forming anaerobes: *Bacteroides*, *Fusobacterium* and others.
- *Clostridia Part I. Clostridium botulinum, Clostridium tetani, Clostridium perfringens*
- *Clostridium difficile*: Characteristics, Biology, Virulence, Pathogenicity, and Epidemiology and Infection control.
- Spirochetes Part I: *Treponema pallidum* and syphilis, endemic treponematoses.
- Spirochetes Part II: *Borrelia & Leptospira*.
- Rickettsiales (*Rickettsiae, Orientia, Coxiella, Ehrlichia, Anaplasma*).
- Bacterial Zoonoses I (*Yersinia pestis, Bartonellosis, Pasteurella, Francisella*).
- Bacterial Zoonoses II (*Brucella, Bacillus anthracis, Erysipelothrix rhusiopathiae, Streptobacillus & Spirillum minus*).
- *Listeria, Corynebacteria, Bacillus* spp.
- *Mycobacterium tuberculosis* and related acid-fast bacteria.

**Virology:**

- Viral structure.
- Tropism and pathogenicity.
- Classification and DNA viruses.
- DNA viruses: Herpes/ Hepatitis B / Papilloma.
- Classification of RNA viruses.
- RNA viruses: HIV/Rabies/Flaviviruses/ Filoviruses.
- Childhood infections.
- Respiratory infections.
- Immune responses.
- Vaccines.
- Antivirals and resistance.
- Viruses of medical importance (tutorial).

**Mycology:**

- Introduction to Mycology and Fungi.
- Fungal classification, structure and pathogenicity.
- Yeasts.
- Moulds.
- Fungal infection.



	<ul style="list-style-type: none"> <li>• Dimorphic fungi and Dermatophytes.</li> <li>• Anti-fungals.</li> <li>• Systematic Mycoses.</li> <li>• Superficial Mycoses.</li> </ul> <p><b><i>Parasitology:</i></b></p> <ul style="list-style-type: none"> <li>• Introduction to parasitology.</li> <li>• Protozoa.</li> <li>• Blood and tissue flagellates.</li> <li>• Sporozoa.</li> <li>• Platyhelminthes: Trematodes, Cestodes.</li> <li>• Platyhelminthes: Nematodes.</li> </ul> <p><b><u>Lab practicals and Demonstrations:</u></b></p> <ul style="list-style-type: none"> <li>• General principles of laboratory diagnosis. Sterilisation, disinfection &amp; antisepsis</li> <li>• Specimen collection, transport and laboratory processing in laboratory practice.</li> <li>• Laboratory diagnosis of Staphylococcal and Streptococcal infections: Microscopy, Culture, Biochemical characteristics and Identification. MIC and AST of Staphylococci and Streptococci.</li> <li>• Antibiotic susceptibility testing. Major resistance phenotypes encountered in clinical practice.</li> </ul>														
Teaching Methodology	Lectures, Tutorials, Laboratory Practical Sessions.														
Bibliography	<p><b>Required Textbooks/Reading:</b></p> <table border="1" data-bbox="491 1514 1487 1832"> <thead> <tr> <th>Authors</th> <th>Title</th> <th>Publisher</th> <th>Year</th> <th>ISBN</th> </tr> </thead> <tbody> <tr> <td>Patrick R. Murray &amp; Ken S. Rosenthal &amp; Michael A. Pfaller</td> <td>Medical Microbiology (8<sup>th</sup> Edition)</td> <td>Elsevier</td> <td>2015</td> <td>9780323299565</td> </tr> </tbody> </table> <p><b>Recommended Textbooks/Reading:</b></p> <table border="1" data-bbox="491 1899 1487 1962"> <thead> <tr> <th>Title</th> <th>Publisher</th> <th>Year</th> <th>ISBN</th> </tr> </thead> <tbody> </tbody> </table>	Authors	Title	Publisher	Year	ISBN	Patrick R. Murray & Ken S. Rosenthal & Michael A. Pfaller	Medical Microbiology (8 <sup>th</sup> Edition)	Elsevier	2015	9780323299565	Title	Publisher	Year	ISBN
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	Step 1 Lecture Notes 2016 in Immunology & Microbiology.	Kaplan	2016	9781506200477
Assessment	On-line Formative Midterm Exam and Summative Final Exam. The Summative Final Exam will contribute towards 100% of the course grade. Assessment is by Single Best Answer MCQs (SBAs) and there may also be some Short Answer Questions (SAQs).			
Language	English			