SEMESTER V
COURSE 5 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

Theory | Credits: 3 | Total teaching hours: 45

I Course Outcomes

By the completion of the course, the learner should be able to:

CO1. Describe the key concepts in immunology and how the immune system discriminates self from non-self.

CO2. Explain how the innate and adaptive immune systems work together to generate an effective immune response against a specific pathogen.

CO3. Explain how the immune system responds to diverse antigens.

CO4. Explain the importance of pathogenic microorganisms in human disease, including infections of the respiratory, gastrointestinal and urinary tracts.

CO5. Correlate disease symptoms with causative agents, and isolate and identify pathogens.

Activity Implementation

The activities listed under each unit provide options for classroom and independent learning. The instructor shall select and schedule appropriate activities, communicate the expected submission and assessment criteria in advance, and provide feedback. Activity time shall be planned within the course delivery and independent study schedule; the theory allocation remains nine hours per unit.

II Syllabus of Theory

Unit 1 Immune System

Teaching hours: 9 | Related course outcomes: CO1 and CO2

1.1 Concept of innate and adaptive immunity.

1.2 Primary and secondary organs of the immune system – thymus, bursa of Fabricius, bone marrow, spleen, lymph nodes and lymphoid tissues.

1.3 Cells of the immune system – identification and functions of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils. Components of innate immunity; complement system (in brief).

Suggested Learning Activities

Activity	Task	Expected submission
Assignment	Compare innate and adaptive immunity. Prepare a chart of immune cells, their identifying features and principal functions.	A comparison table and an annotated immune-cell chart.
Seminar	Explain the roles of primary and secondary lymphoid organs in immune-cell development and immune responses.	A 5–7 minute presentation with labelled diagrams and references.

Activity	Task	Expected submission
Quiz	Identify immune cells and organs from supplied images or descriptions; distinguish innate and adaptive responses.	A 20-mark individual quiz.
Project	Develop a concept map showing how barriers, innate immune cells, complement and lymphocytes contribute to host defence.	A labelled concept map and a 300-word explanation of the connections.
Peer teaching	Teach a small group the functions of B cells, T cells and null cells using role cards and a simple immune-response scenario.	A 5-minute lesson and three check questions.

Evaluation

The instructor shall prepare a dedicated rubric for each selected activity before implementation, adapting the activity-specific criteria in Section IV to the task. Share the rubric and maximum marks with students, assess the submitted evidence and individual contribution, and record feedback and marks.

Unit 2 Immune Response

Teaching hours: 9 | Related course outcomes: CO1, CO2 and CO3

2.1 Characteristics of antigens – foreignness, molecular size, heterogeneity and solubility; haptens.

2.2 Antibodies – basic structure and types.

2.3 Generation of immune responses – primary and secondary responses; humoral immune response (plasma and memory cells); MHC and the generation of cell-mediated immune responses.

2.4 Immune complex formation and elimination – agglutination, precipitation, neutralisation, complement fixation and phagocytosis.

2.5 Hypersensitivity – definition and types (in brief).

Suggested Learning Activities

Activity	Task	Expected submission
Assignment	Draw a labelled antibody and compare immunoglobulin classes. Explain the difference between an antigen and a hapten using examples.	An annotated diagram, comparison table and brief explanation.
Seminar	Explain primary and secondary immune responses and the roles of plasma cells, memory cells and MHC in adaptive immunity.	A 5–7 minute presentation with a response graph or concept map.
Quiz	Interpret antigen–antibody reaction diagrams, compare immune-response graphs and classify brief hypersensitivity scenarios.	A 20-mark individual quiz.

Activity	Task	Expected submission
Project	Prepare a visual atlas of agglutination, precipitation, neutralisation and complement fixation using schematic or supplied images.	An illustrated atlas explaining the principle and observed outcome of each reaction.
Peer teaching	Explain how humoral and cell-mediated immunity differ and cooperate, using a classroom role-play or labelled flowchart.	A 5-minute lesson and three questions to check understanding.

Evaluation

The instructor shall prepare a dedicated rubric for each selected activity before implementation, adapting the activity-specific criteria in Section IV to the task. Share the rubric and maximum marks with students, assess the submitted evidence and individual contribution, and record feedback and marks.

Unit 3 Microbes in Health and Disease

Teaching hours: 9 | Related course outcomes: CO4 and CO5

3.1 Normal flora of the human body.

3.2 Definitions – infection, invasion, pathogen, pathogenicity, virulence, toxigenicity, opportunistic infections and nosocomial infections.

3.3 General account of microbial diseases: causal organism, pathogenesis, epidemiology, diagnosis, prevention and control. Bacterial diseases – tuberculosis, typhoid and botulism; fungal diseases – candidiasis and aspergillosis; viral diseases – COVID-19 and AIDS.

Suggested Learning Activities

Activity	Task	Expected submission
Assignment	Prepare a comparative disease chart covering all seven listed diseases: causative agent, affected system, transmission, major features and prevention.	A referenced disease-comparison chart.
Seminar	Explain the role of normal flora in health and opportunistic disease, or discuss the prevention of nosocomial infections.	A 5–7 minute presentation supported by a concept map and sources.
Quiz	Match causative agents with diseases and distinguish infection-related terms using brief classroom scenarios.	A 20-mark individual quiz.
Project	Analyse instructor-provided fictional case summaries of listed diseases. Compare possible causes and identify evidence needed to support identification.	A case-comparison report with reasoned conclusions and stated limitations.
Peer teaching	Teach the distinction between pathogenicity, virulence and toxigenicity using concept cards and non-procedural examples.	A 5-minute lesson, glossary and three check questions.

Evaluation

The instructor shall prepare a dedicated rubric for each selected activity before implementation, adapting the activity-specific criteria in Section IV to the task. Share the rubric and maximum marks with students, assess the submitted evidence and individual contribution, and record feedback and marks.

Unit 4 Principles of Diagnosis

Teaching hours: 9 | Related course outcomes: CO5

4.1 General principles of diagnostic microbiology – collection and transport of clinical samples; development of diagnostic kits.

4.2 Identification by culturing.

4.3 Identification by biochemical and physiological properties.

4.4 Identification by molecular assays – PCR and DNA probes.

4.5 Identification by serological tests – ELISA, immunofluorescence, agglutination-based tests and complement fixation.

Suggested Learning Activities

Activity	Task	Expected submission
Assignment	Compare culture, biochemical, molecular and serological identification by principle, evidence obtained, applications and limitations.	A referenced comparison table with suitable examples.
Seminar	Explain the principle of ELISA, PCR or immunofluorescence and discuss the role of controls in interpreting diagnostic results.	A 5–7 minute presentation with a labelled schematic.
Quiz	Interpret supplied biochemical profiles, serological images or molecular-test reports, including positive and negative controls.	A 20-mark individual interpretation quiz.
Project	Design a conceptual diagnostic decision chart for a fictional case using supplied sample information and test results; identify uncertainty and confirmatory needs.	A decision chart, evidence table and a short rationale.
Peer teaching	Use clean sample containers and fictional labels to explain sample identification, documentation and transport considerations.	A 5-minute simulation and a peer observation checklist.

Evaluation

The instructor shall prepare a dedicated rubric for each selected activity before implementation, adapting the activity-specific criteria in Section IV to the task. Share the rubric and maximum marks with students, assess the submitted evidence and individual contribution, and record feedback and marks.

Unit 5 Prevention and Treatment

Teaching hours: 9 | Related course outcomes: CO2, CO3, CO4 and CO5

5.1 Vaccines and immunization – active immunization using conventional and recombinant vaccines, and passive immunization.

5.2 Antimicrobial agents – general modes of action of antibacterial agents (penicillin, streptomycin), antifungal agents (amphotericin, griseofulvin) and antiviral agents (amantadine, acyclovir).

5.3 Interferons.

5.4 Antibiotic resistance; tests for antimicrobial susceptibility – disc diffusion.

Suggested Learning Activities

Activity	Task	Expected submission
Assignment	Compare active and passive immunization. Create a target–action chart for the antibacterial, antifungal and antiviral agents listed in the syllabus.	A comparison table and a referenced mode-of-action chart.
Seminar	Discuss recombinant vaccines, interferons or antibiotic resistance, focusing on the underlying concepts and public-health significance.	A 5–7 minute presentation and responses to questions.
Quiz	Distinguish active from passive immunization, match agents to general modes of action and interpret supplied susceptibility scenarios.	A 20-mark individual quiz.
Project	Analyse instructor-provided disc-diffusion images and a supplied interpretive table. Record zone measurements and explain classifications and limitations.	An annotated results sheet and a short interpretation report.
Peer teaching	Explain active and passive immunization through a timeline, or teach interpretation of a supplied susceptibility report.	A 5-minute lesson and three scenario-based check questions.

Evaluation

The instructor shall prepare a dedicated rubric for each selected activity before implementation, adapting the activity-specific criteria in Section IV to the task. Share the rubric and maximum marks with students, assess the submitted evidence and individual contribution, and record feedback and marks.

V SEMESTER

COURSE 5: IMMUNOLOGY AND MEDICAL MICROBIOLOGY (Practical)

Credits -1

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (E. coli, Pseudomonas, Staphylococcus, Bacillus)

   using laboratory strains on the basis of cultural, morphological and biochemical characteristics:

   IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS Isolation of bacterial flora of skin by swab method.
7. Antibacterial sensitivity by Kirby-Bauer method
8. Determination of minimal inhibitory concentration of an antibiotic
9. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
10. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab

method.

III References

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
5. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
6. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
7. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education Practical microbiology M.N.Reddy Practical microbiology-M.N.Reddy
8. Microbiology: a laboratory manual / James G. Cappuccino, Natalie.
9. Plant pathology and Microbiology-K.R.Aneja
10. Mackie & Mccartney Practical Medical Microbiology,

VI. Co-Curricular Activities:

1. Screening of Blood groups
2. Visit to Diagnostic /Laboratory
3. Competition on composition and sterile media preparation
4. Competition on Isolation and Identification of bacteria from a sample