



Syllabus Master's Degree Course in Medicine and Surgery ***a.y. 2026 – 2027***

LAB WORKS

Fourth year, first semester (5 academic credits [CFU])

Teachers

Subject	Academic credits (CFU)	Lecturer
Microbiology and clinical microbiology	2	DI MARCO Roberto
Clinical pathology	1	STELLA Stefania
Clinical biochemistry and molecular clinical biology	1	BARRESI Vincenza
Technical and laboratory medical sciences	1	FAGONE Paolo F.

Learning outcomes

Subject	Learning outcomes
Microbiology and clinical microbiology	Knowledge and understanding By the end of the module, students are expected to: • Acquire knowledge of the basis of the host-parasite interaction and its relation to microbial pathogenicity. • Understand the procedures for the collection, transport, and storage of biological specimens. • Acquire basic knowledge of the conventional and molecular diagnostic methods routinely utilized in bacteriology, virology, mycology, and parasitology for the detection, isolation, and identification of microorganisms. Applying knowledge and understanding By the end of the module, students are expected to: • Be able to integrate microbiological knowledge and apply it to the understanding of the pathogenesis of infectious diseases and their underlying pathophysiological mechanisms. • Be able to interpret the results of microbiological tests and apply the acquired knowledge to the laboratory diagnosis and selection of appropriate treatment of infectious diseases. • Apply the acquired knowledge for the prevention and prophylaxis of infectious diseases.

Clinical pathology	Knowledge and understanding By the end of the module, students are expected to: • Acquire knowledge on the indications and interpretation of laboratory methods used in clinical pathology for diagnosis, assessment, and monitoring of hematological, autoimmune, inflammatory, and organ-specific diseases. • Understanding the laboratory features of neoplastic diseases. • Acquire knowledge on laboratory methods used for the cellular and molecular characterization of tumors. Applying knowledge and understanding By the end of the module, students are expected to: • Be able to clinical evaluate and interpret the main laboratory tests for an integrated clinical assessment of diseases. • Be able to correlate laboratory findings with the corresponding clinical and pathophysiological features. • Apply the acquired knowledge to integrate laboratory findings into the diagnostic and therapeutic management of the patient.
Clinical biochemistry and molecular clinical biology	Knowledge and understanding By the end of the module, students are expected to: • Acquire knowledge on laboratory diagnostic methods and biomarkers used in clinical biochemistry. • Understanding the major biologically relevant molecules used as laboratory diagnostic markers. • Understanding the indications for different biochemical tests, their cost–benefit considerations, and the interpretation of laboratory results in different clinical settings. Applying knowledge and understanding By the end of the module, students are expected to: • Be able to evaluate and interpret the main biochemical laboratory tests. • Be able to correlate the laboratory finding with the corresponding biochemical and pathophysiological abnormalities. • Apply the acquired knowledge to integrate the biochemical laboratory findings into the diagnostic and therapeutic management of the patient.
Technical and laboratory medical sciences	Knowledge and understanding By the end of the module, students are expected to: • Acquire knowledge of the fundamental principles of diagnostic performance and the evaluation of laboratory tests. • Understanding the principles and applications of major immunological, cellular, biochemical, and molecular diagnostic techniques, including immunoassays, immunofluorescence assays, flow cytometry, electrophoresis, and PCR. • Acquire knowledge of the principles underlying antibody production and their applications in laboratory diagnostics. • Understanding the fundamental principles of flow cytometry. • Understand the principles of genomic and transcriptomic technologies, including microarrays, and DNA sequencing technologies. Applying knowledge and understanding

	By the end of the module, students are expected to: • Be able to evaluate the diagnostic performance and clinical usefulness of laboratory tests. • Apply the acquired knowledge to recognize appropriate applications, advantages, and limitations of immunological, cellular, biochemical, and molecular diagnostic techniques. • Be able to interpret the use of immunofluorescence assays and autoantibody detection in the laboratory diagnosis of rheumatic disorders. • Be able to interpret the basic principles of flow cytometric analysis and recognize the main diagnostic applications of flow cytometry, including immunophenotyping, analysis of hematological malignancies, evaluation of immune cell populations, and other applications in laboratory medicine.
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Prerequisites

Subject	Prerequisites
Microbiology and clinical microbiology	Attainment of the educational objectives set by prerequisite courses.
Clinical pathology	
Clinical biochemistry and molecular clinical biology	
Technical and laboratory medical sciences	

Course contents

Subject	Course contents
Microbiology and clinical microbiology	• Principles of infection and microbial pathogenicity: pathogenicity and virulence, host factors predisposing to infection, modes of transmission, community-acquired and healthcare-associated infections, microbial ecology, microbiota, and microbiome. • Principles of microbiological diagnosis: direct and indirect diagnostic methods, culture and isolation, antigen detection, serology, molecular diagnostics, identification of microorganisms, and interpretation of laboratory results. • Clinical specimens and interpretation of microbiological results: selection, collection, transport, and storage of appropriate clinical specimens; formulation of the clinical question and laboratory request; interpretation of microbiological results in relation to the suspected etiological agent and clinical presentation. • Antimicrobial susceptibility testing and antimicrobial resistance: principles and interpretation of antimicrobial susceptibility testing, including minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and laboratory detection of antimicrobial resistance. • Central nervous system, respiratory, and cardiovascular infections: major bacterial, viral, fungal, and parasitic infections and laboratory diagnostic methods.

	• Gastrointestinal, hepatobiliary, and urinary tract infections: major infectious diseases and laboratory diagnostic methods, including foodborne infections and viral hepatitis. • Genitourinary, sexually transmitted, and maternal–fetal infections: major infections and laboratory diagnostic methods. • Skin, soft tissue, ocular, and osteoarticular infections: major infections and laboratory diagnostic methods. • Healthcare-associated and opportunistic infections: microbiological surveillance, prevention and control of healthcare-associated infections, infections in immunocompromised patients, and laboratory diagnostic methods.
Clinical pathology	• Principles of clinical pathology and laboratory medicine: role of laboratory diagnostics in disease diagnosis, prognosis, monitoring, and therapeutic decision-making; principles of test selection and interpretation. • Laboratory assessment of hematological disorders: basic laboratory evaluation of anemia, disorders of white blood cells and platelets, and selected hematological malignancies. • Laboratory assessment of hemostasis and coagulation disorders: basic coagulation tests and laboratory evaluation of bleeding and thrombotic disorders. • Laboratory assessment in pregnancy: physiological changes in laboratory parameters during pregnancy, prenatal screening, screening for maternal and fetal conditions, and laboratory assessment of pregnancy-related disorders. • Laboratory assessment of renal function disorders: urinalysis. • Laboratory biomarkers in neoplastic diseases: tumor biomarkers, principles of laboratory assessment of neoplastic diseases, and applications of molecular biomarkers in diagnosis and monitoring.
Clinical biochemistry and molecular clinical biology	• General Principles of clinical biochemistry and molecular biochemistry: biochemical biomarkers, biological variation, reference intervals, and the clinical interpretation of biochemical laboratory results. • Glucose metabolism and diabetes: laboratory assessment of glucose homeostasis; diagnosis and monitoring of diabetes mellitus and its complications; hypoglycaemia. • Lipid metabolism and cardiovascular risk: lipoprotein metabolism; clinical disorders of lipid metabolism, hypertension, laboratory assessment of dyslipidemias; and biochemical markers for cardiovascular risk assessment. • Amino acid and nitrogen metabolism: biochemical pathways of amino acid and nitrogen metabolism, the urea cycle, hyperammonemia, phenylketonuria, homocystinuria and hyperhomocysteinemia, and selected inherited metabolic disorders, screening the newborn for disease. • Purine metabolism and disorders of uric acid: biochemical pathways of purine metabolism, hyperuricemia, gout, and laboratory assessment of disorders of uric acid metabolism • Liver and biliary function: biochemical markers of hepatocellular injury, cholestasis, and liver function/integrity, including aminotransferases, bilirubin, alkaline phosphatase, gamma-glutamyl transferase, and plasma proteins, biochemical pathways of heme synthesis and degradation; laboratory assessment of jaundice and porphyrias;

	• Renal function, electrolytes, and acid–base balance: biochemical assessment of kidney function, electrolytes, and acid–base disorders • Cardiac and tissue injury biomarkers: biochemical markers of myocardial injury, heart failure, and selected forms of tissue damage • Biochemical markers and cancer
Technical and laboratory medical sciences	• Principles of diagnostic performance and laboratory test evaluation: diagnostic sensitivity and specificity, positive and negative predictive values, likelihood ratios, interpretation of diagnostic tests, reference values and reference intervals, data distributions, and analytical detection limits. • Principles of immunological techniques and antigen–antibody interactions: basic principles of antibody-based laboratory methods and their applications in diagnostics. • Production and applications of antibodies: principles of polyclonal and monoclonal antibody production, hybridoma technology, and phage display techniques. • Immunoassays and enzyme-linked immunosorbent assays (ELISA): principles, formats, methodologies, and applications of immunoassays and ELISA in laboratory diagnostics. • Immunofluorescence assays and autoantibody detection: principles of indirect immunofluorescence assays (IFA) and their application to the detection and interpretation of autoantibodies in rheumatic disorders. • Flow cytometry: fundamental principles of flow cytometry, including cell analysis based on light scattering and fluorescence; fluidics, optics, and detection systems; principles and roles of lasers, optical filters, and detectors; multicolor analysis and fluorescence compensation; data acquisition and interpretation; and diagnostic applications of flow cytometry. • Electrophoresis and Western blotting: principles of electrophoretic separation techniques and Western blot analysis, including their methodological basis and diagnostic applications. • Principles of polymerase chain reaction (PCR): fundamental principles, methodology, and applications of PCR in molecular diagnostics. • Microarray technologies: principles and applications of microarrays for the analysis of gene expression and genetic variation. • DNA sequencing and sequencing technologies: principles and applications of sequencing, including the evolution of sequencing technologies from first- to third-generation approaches and their relevance to genomic and transcriptomic analysis.

Assessment methods

Subject	Assessment methods
Microbiology and clinical microbiology	The final assessment of acquired knowledge is conducted by a written examination consisting of 60 multiple-choice questions covering all four modules of the integrated course. Students have one minute per question, for a total examination time of 60 minutes.

Clinical pathology	The 60 questions are distributed among the 4 course modules as follows: 12 questions for each of 3 modules (clinical pathology, clinical biochemistry and molecular clinical biology, technical and laboratory medical sciences), and 24 questions for 1 module (Microbiology and clinical microbiology). Each correct answer is awarded 1 point; incorrect answer and unanswered questions receive zero points. The minimum score to pass the exam is 30 out of 60, with a minimum of correct answers of at least 12 for Microbiology and clinical microbiology, 6 for clinical pathology, 6 for clinical biochemistry and 6 for technical and laboratory medical sciences. The final grade is determined by the total number of points awarded to the correct answers and is expressed on a scale of thirty, up to a maximum of 30/30 cum laude (with honors). The assessments aim to evaluate: i) the level of knowledge on the principles, methods, and applications of laboratory medicine and laboratory diagnostics (knowledge and understanding); ii) the ability to apply the acquired knowledge to select, evaluate, and interpret appropriate laboratory tests and diagnostic methods and to integrate laboratory findings into the patient's diagnostic and therapeutic management (applying knowledge and understanding); iii) the ability to apply the acquired knowledge to critically and independently evaluate the appropriateness of laboratory tests and diagnostic methods, considering advantages and limitations, and to use laboratory findings to support clinical decision-making (making judgements); iv) clarity of expression in describing and discussing laboratory findings and their clinical significance (communication skills); v) the ability to independently assess emerging laboratory technologies and diagnostic methods by critically evaluating their diagnostic performance (learning skills). The assessment of learning can also be conducted remotely if the conditions necessitate it. To ensure equal opportunities and in compliance with current laws, interested students may request a personal interview in order to plan any compensatory and/or dispensatory measures based on educational objectives and specific needs. Students can also contact the CInAP (Centro per l'integrazione Attiva e Partecipata – Servizi per le Disabilità e/o i DSA) referring teacher within their department (https://www.cinap.unict.it/content/referenti).
Clinical biochemistry and molecular clinical biology	
Technical and laboratory medical sciences	

Examples of common questions and/or exercises

Subject	Examples of common questions and/or exercises
Microbiology and clinical microbiology	- A urine culture from a patient with symptoms of a urinary tract infection yields significant growth of Escherichia coli. Which of the statements best describes the role of antimicrobial susceptibility testing? - A patient presents with fever and suspected bacterial meningitis. Which of the following is the most appropriate approach to microbiological diagnosis?
Clinical pathology	In a patient with suspected alcoholic hepatitis, the AST-to-ALT ratio is characteristically greater than 2:1. Which of the following biochemical mechanisms best explains this finding? A) Induction of ALT synthesis by ethanol in hepatocytes.

	B) Decreased clearance of AST by the reticuloendothelial system in chronic alcoholism. C) Pyridoxal-5'-phosphate deficiency preferentially impairing ALT activity and the release of mitochondrial AST. D) Accelerated renal excretion of ALT compared to AST in ethanol toxicity.
Clinical biochemistry and molecular clinical biology	A neonate presents with lethargy, vomiting, and severe hyperammonemia. Laboratory workup reveals elevated blood ammonium, respiratory alkalosis, and a marked increase in urinary orotic acid. Which enzymatic defect in the urea cycle is most consistent with these findings? A) Carbamoyl phosphate synthetase I (CPS-I) deficiency. B) Ornithine transcarbamylase (OTC) deficiency. C) Argininosuccinate synthetase deficiency (Citrullinemia). D) Arginase deficiency
Technical and laboratory medical sciences	- What is the difference between sensitivity and specificity? - How does sandwich ELISA work? - Explain the Illumina DNA sequencing technique

Reference texts

Subject	Textbooks
Microbiology and clinical microbiology	- Murray PR, Rosenthal KS, Pfaller MA. Medical Microbiology. 10th ed. Elsevier; 2025. - Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.
Clinical pathology	Educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.
Clinical biochemistry and molecular clinical biology	- Michael Murphy, Rajeev Srivastava, Kevin Deans. Clinical Biochemistry: An Illustrated Colour Text. 7th edition · Elsevier, 2023. - Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.
Technical and laboratory medical sciences	Educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.

Course format

Subject	Course format
Microbiology and clinical microbiology	Teaching will be primarily delivered through in-person lectures, combining theoretical instruction with practical exercises. If teaching is conducted in blended or remote mode, appropriate adjustments will be made to ensure alignment with the objectives and content outlined in the Syllabus.
Clinical pathology	
Clinical biochemistry and molecular clinical biology	
Technical and laboratory medical sciences	

Attendance

Subject	Attendance
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Microbiology and clinical microbiology	Mandatory attendance.
Clinical pathology	
Clinical biochemistry and molecular clinical biology	
Technical and laboratory medical sciences	

Course schedule

Subject	Course schedule
Microbiology and clinical microbiology	Students may refer to the recommended textbooks and educational material to identify the correspondence between the topics covered in the syllabus and the relevant chapters.
Clinical pathology	
Clinical biochemistry and molecular clinical biology	
Technical and laboratory medical sciences	