Course Description of Practical Medical Physics
First Year Class, Second Semester

Practical Medical Physics provides hands-on application of the physical principles presented in the theoretical course. Students perform measurements, calculations, demonstrations and device-based activities related to thermodynamics, pressure, heat, medical monitoring devices, bioelectric signals, radiation, medical imaging, diffusion and rheology, with emphasis on accurate observation and safe laboratory practice.	
1. Educational Institution	Al-Zahrawi University - Ministry of Higher Education and Scientific Research
2. University Department / Center	Clinical Laboratory Sciences
3. Course Name / Code	Practical Medical Physics
4. Programs in which it is included	Bachelor Program
5. Available Forms of Attendance	Practical laboratory attendance
6. Semester / Year	Second Semester / First Year
7. Total Number of Study Hours	30 Hours (2 practical hours/week × 15 weeks)
8. Course Component	Practical
9. Date of preparing this description	2026

Course Objectives: This practical course aims to enable students to:

• Apply fundamental physical principles through laboratory measurements and demonstrations.
• Use basic instruments correctly and record physical quantities using appropriate units.
• Demonstrate the operating principles of selected medical monitoring and diagnostic devices.
• Perform simple calculations related to pressure, temperature, gases, heat, work, power, diffusion and rheology.
• Observe and interpret basic ECG and EEG signals and understand their physical basis.
• Recognize practical principles and safety considerations of X-ray, radiotherapy, MRI and CT technologies.

Learning Outcomes, Teaching and Learning Methods, and Evaluation

Practical Skills

• Perform basic physical measurements and calculations accurately.
• Identify components and functions of common medical devices and instruments.
• Relate experimental observations to medical and biological applications.
• Follow laboratory and radiation-safety instructions.

Teaching and Learning Methods

• Laboratory demonstrations, hands-on experiments, device demonstrations, guided calculations, practical worksheets, small-group activities and interpretation of results.

Evaluation Methods

• Practical examinations, laboratory reports, quizzes, worksheets, calculations, oral questions, device identification and participation.

11. Course Structure

Weeks	Hours	Required Learning Outcomes	Practical Topic / Activity	Learning Methods	Evaluation Method
1	2 HOURS	Practical knowledge and application	General Concepts and Thermodynamics Measurement standards and units; identification of laboratory instruments;	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment

			demonstration of thermodynamic systems and conservation of energy.		
2	**2 HOURS**	Practical knowledge and application	Pressure, Temperature and Gas Laws Measurement of pressure and temperature; conversion between Celsius, Fahrenheit and Kelvin; practical calculations using ideal/general gas laws.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
3	**2 HOURS**	Practical knowledge and application	Heat, Energy, Work and Power Simple calorimetry/heat calculations; mechanical work and power; practical verification/calculations related to Boyle's and Charles's laws.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
4	**2 HOURS**	Practical knowledge and application	Blood Glucose Monitoring Devices Demonstration of glucometer components and measurement principle; correct use, calibration/quality considerations and interpretation of readings.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
5	**2 HOURS**	Practical knowledge and application	Parenteral Infusion Devices and Cardiac Output Measurement Demonstration of infusion pump operation and flow-rate calculations; demonstration of principles used for cardiac output measurement.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
6	**2 HOURS**	Practical knowledge and application	Implantable Cardiac Pacemakers Identification of pacemaker components; demonstration/model of pulse generation, rate and basic electrical concepts.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
7	**2 HOURS**	Practical knowledge and application	Electrocardiogram (ECG) Demonstration of ECG machine, electrode placement, leads and recording; recognition of basic ECG waveform components.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
8	**2 HOURS**	Practical knowledge and application	Electroencephalography (EEG) Demonstration of EEG electrodes, signal acquisition and recording; recognition of basic brain-wave patterns.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
9	**2 HOURS**	Practical knowledge and application	Thermal Radiation and Heat Transfer Demonstrations/calculations of conduction, convection and radiation; practical examples related to black-body radiation and thermal laws.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
10	**2 HOURS**	Practical knowledge and application	X-Ray and X-Ray Spectra Demonstration/model of X-ray tube and image formation; factors affecting	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment

			X-ray production, absorption and attenuation.		
11	**2 HOURS**	Practical knowledge and application	UV, IR and Biological Effects of Radiation Demonstration of UV/IR sources where available; discussion of exposure effects, protective measures and radiation-safety practice.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
12	**2 HOURS**	Practical knowledge and application	Radiotherapy and Radioactive Iodine Demonstration/models of radiotherapy equipment and radioactive iodine applications; basic dose and safety concepts.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
13	**2 HOURS**	Practical knowledge and application	Magnetic Resonance Imaging (MRI) Demonstration using images/models/videos of MRI components, magnetic field and image formation; MRI safety screening principles.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
14	**2 HOURS**	Practical knowledge and application	Computed Tomography (CT Scan) Demonstration using CT images/models; basic concepts of X-ray attenuation, scanning and image reconstruction.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment
15	**2 HOURS**	Practical knowledge and application	Diffusion and Rheology Practical demonstration of diffusion; measurement/comparison of viscosity and flow behavior of selected liquids; medical/biological applications.	Demonstration, hands-on activity, guided calculations, discussion and practical worksheet	Practical quiz, worksheet/report, oral questions and practical assessment

Name of the Instructor: Dr. Mariam Raheem

12. Infrastructure

Required Readings / References	1. Physics for Biology and Medical Students, 2nd ed. 2. Schreiner, Steven. Medical Instruments and Devices: Principles and Practices. CRC Press, 2015.
Practical Requirements	Medical physics laboratory instruments; thermometers and pressure-measurement tools; glucometer; infusion-device demonstrations; ECG/EEG teaching equipment or simulations; medical imaging examples/models; viscosity and diffusion demonstration materials; appropriate PPE and safety resources.
Teaching Resources	Laboratory manuals, worksheets, PowerPoint presentations, device manuals, audiovisual demonstrations and simulation resources.
Prerequisites	Concurrent or prior study of theoretical Medical Physics according to the academic plan
Minimum Number of Students	Not specified
Maximum Number of Students	According to laboratory capacity and approved admission capacity