Course Description Form

1. Course Name:
Microprocessor
2. Course Code:
WBM-51-06
3. Semester / Year:
Semester
4. Description Preparation Date:
28/10/2026
5. Available Attendance Forms:
Presence in the classroom
6. Number of Credit Hours (Total) / Number of Units (Total)
30h Theory – 45h Lab / 3 units
7. Course administrator's name (mention all, if more than one name)
Name: Ali Abdulhussein Mohammed Email: ali.masaoodi@uowa.edu.iq
8. Course Objectives
Understanding Microprocessor Architecture: Students should acquire a comprehensive knowledge of the 8086 microprocessor architecture, including the bus interface, memory organization, and instruction set. **Programming Skills:** Develop students' proficiency in assembly language programming, with a focus on writing and executing programs specific to the 8086 microprocessor. **Interfacing Techniques:** Enable students to understand how to connect the 8086 microprocessor to other components and electronic devices, and acquire the skills necessary to design and implement interface circuits. **Problem Solving:** Equip students with the ability to analyze theoretical and practical problems related to the 8086 microprocessor, and to develop appropriate solutions using design and programming skills. **Application in Biomedical Engineering:** Understand the applications of microprocessors in the design and implementation of medical devices and systems, and employ them to meet diagnostic and therapeutic needs.

9. Teaching and Learning Strategies

1. Teaching Methods

- **Lectures and Demonstrations:**
  Use lectures to cover theoretical aspects, and live demonstrations to highlight practical applications.
- **Interactive Sessions:**
  Engage students in interactive sessions that allow them to explore microprocessor components and functions through virtual simulations.

2. Educational Activities

- **Hands-on Laboratory Work:**
  Organize lab sessions where students work in groups to build and test simple devices using microprocessors and electronics.
- **Applied Projects:**
  Implement mini-projects that require designing a part of a dev using the 8086 microprocessor, focusing on developing studen practical and innovative skills.
- **Simulation Programs:**
  Use tools and simulation software for microprocessor function and circuit design, enhancing understanding without relying solely on physical components.

3. Continuous Improvement

- **Review Results Analysis:**
  Collect student feedback systematically to improve course content and delivery, aligning with technological advancement and changing learning needs.
- **Content Updates:**
  Rely on insights from student evaluations and teaching strategi to continuously update concepts and course material.
- **Integration with Modern Developments:**
  Regularly review curricula to stay aligned with advancements i microprocessor technologies and their applications in biomedical devices.

10. Course Structure

Week	Hours	Unit or subject name and required learning outcomes	Learning method	Evaluation method
3-1	2 h theory / 3 h lab	Introduction to microprocessor, microcomputer.	Lectures and experiments.	Daily exams + classwork

5-4	2 h theory / 3 h lab	Microprocessor organization	Lectures and experiments.	Daily exams + classwork
6-8	2 h theory / 3 h lab	Computer language and assembly language	Lectures and experiments.	Daily exams + classwork
11-9	2 h theory / 3 h lab	Stacks and subroutines, microprocessors set and computer languages,	Lectures and experiments.	Daily exams + classwork
13-12	2 h theory / 3 h lab	Logic devices for interfacing, memory mapped I/O, the 8085 (8086) and its input/output mapping	Lectures and experiments.	Daily exams + classwork
15-13	2 h theory / 3 h lab	Interrupt routines, peripheral devices, PPI, practical interface.	Lectures and experiments.	Daily exams + classwork

11. Course Evaluation

1. **Daily quizzes** with practical and theoretical questions.
2. **Participation grades** awarded for answering challenging competitive questions among students.
3. **Periodic exams** covering the course material, in addition to a **midterm exam** and a **final exam**.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro Processor Architecture, Programming, and Interfacing", 6th Edition, Prentice-Hall Inc., 2003.
Main references (sources)	Walter A. Triebe, "The 8086 Microprocessor: Architecture, Software, and Interfacing Techniques", Prentice-Hall Inc., 1998.
Recommended books and references (scientific journals, reports…)	Browsing scientific websites to stay updated on the latest developments in the subject. www.sciencedirect.com

University of Warith Al-Anbiyaa / College of Engineering / Biomedical Engineering Department

Course Description Form

1. Course Name:
Diagnostic Instrumentation
2. Course Code:
WBM-51-03
3. Semester / Year:
1st Semester / 2023 2024
4. Description Preparation Date:
19/3/2024
5. Available Attendance Forms:
Weekly (Theoretical & Practical)
6. Number of Credit Hours (Total) / Number of Units (Total)
45 Hrs. Theoretical & 30 Hrs. Practical / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Hayder A. Yousif Email: hayder.ab@uowa.edu.iq
8. Course Objectives

Course Objectives	The main aim of this study is studying some diagnostic devices that are related to the human body (such as the sonar device, the medical endoscope device, and the vital activity monitoring device) and study the principle working with its effect on the human body. In this course the student will study the Diagnostic Instrumentation (Medical Ultrasound, Endoscopy, and Patient Alarm Systems) The student will be able to know the following: 1- The properties of ultrasound waves. The decibel notation for ultrasound intensity and pressure. The ultrasound properties of velocity, attenuation, and absorption. The ultrasound reflection, refraction and

	scattering, and principle working of ultrasound device. 2- Basic component of Endoscopy, Principle working of Endoscopy, and Types of Endoscopies.

9. Teaching and Learning Strategies

Strategy	The student will be able to understand the principle of operation of the Diagnostic Instrumentation and its dealings with the human body, and to graduate engineers specialized in the field of biomedical engineering, which relates to human life with the medical device and work in the medical engineering environment.

10. Course Structure

Week	Hours	Unit or subject name and Required Learning Outcomes	Learning method	Evaluation method
1	3	2	Theoretical & Practical	Daily test and oral questions
2	3	2	Theoretical & Practical	Daily test and oral questions
3	3	2	Theoretical & Practical	Daily test and oral questions
5&4	3	2	Theoretical & Practical	Daily test and oral questions
6	3	2	Theoretical & Practical	Daily test and oral questions
7	3	2	Theoretical & Practical	Daily test and oral questions
8	3	2	Theoretical & Practical	Daily test and oral questions
10&9	3	2	Theoretical & Practical	Daily test and oral questions
11	3	2	Theoretical & Practical	Daily test and oral questions
12 13&	3	2	Theoretical & Practical	Daily test and oral questions
& 14 15	3	2	Theoretical & Practical	Daily test and oral questions

11. Course Evaluation	
1- Weekly exams 2- Monthly exams 3- Participations inside the class 4-present the seminars 5- Writing reports	
12. Learning and Teaching Resources	
Required textbooks (curricular books any)	Handbook of Biomedical Instrumentation Second Edition - R S KHANDPUR
Main references (sources)	Handbook Of Biomedical Instrumentation 3rd Edition 933920543X · 9789339205430 By R S Khandpur
Recommended books and references (scientific journals, reports…)	Standard handbook of biomedical engineering & design - M Kutz
Electronic References, Websites	https://books.google.iq/books/about/Handbook of_Biomedical_Instrumentation.html?idesc=y

Course Description Form

1. Course Name:

Infrared and Thermal Imaging

2. Course Code:

WBM-51-02

3. Semester / Year:

First Semester / Five Year

4. Description Preparation Date:

12/24/2025

5. Available Attendance Forms:

Bologna system attendance form

6. Number of Credit Hours (Total) / Number of Units (Total)

30 Hours / 2 Units

7. Course administrator's name (mention all, if more than one name)

Name: Karrar Aqeel Hussein
Email: karrar.aqeel@uowa.edu.iq

8. Course Objectives

Course Objectives	Infrared thermal imaging aims to identify the technology of generating quantitative radiometric digital images of object scenes recorded at infrared thermal wavelengths. Besides qualitative visualization as well, it allows measuring the surface temperatures of objects.

9. Teaching and Learning Strategies

Strategy	□ Giving detailed theoretical lectures. □ Request periodic reports on the basic topics of the subject.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1,2	4	1	Introduction: Infrared and Thermal Imaging, History of IR, General Definition Of	Lecture	NA

			Thermography, Principle Used In Thermography, Thermal Imaging Cameras, History Of Electromagnetic Waves. Electromagnetic Waves and the Electromagnetic Spectrum, Nature of electromagnetic Waves, Radio Waves, Micro Waves, Infrared Waves, Visible Light, Ultra violet, X-rays, Gamma Rays.		
3,4,5	6	1	Basics of Geometrical Optics for Infrared Radiation, Behavior of Waves, Reflection, Refraction, Interference, Diffraction, Laws of Reflection and Refraction, Reflection of Light from Optical Surface, Smooth Surface Reflection, Rough Surface Reflection, Reflection Index, Snell's Law, Refraction in Prism. Basic Radiometry, Radiant Power, Excitance, Irradiance, Spectral Densities of Radiometric Quantities, Radiant intensity, Radiance and Lambertian Emitter, Radiation Transfer between surfaces.	Lecture	HW
5,6,7	6	1	Blackbody Radiation, Blackbody Radiation Definition, Planck Distribution Function for Blackbody Radiation, Different Representations of Planck's Law, Stefan–Boltzmann Law, Band Emission. Emissivity definition, Classification of Objects According to Emissivity, Emissivity and Kirchhoff 's Law, Parameters Affecting the Value of Emissivity. Instruments Overview, Introduction and Classification of Instruments, Instrument Manufacturers, Discussion of Instruments, Infrared thermocouples and probes, Portable hand-held instruments, Infrared cameras (thermal imagers).	Lecture	Quizzes

8	2	1	Diagnostic Thermal Image-Processing Capabilities, Quantitative Thermal Measurements of Targets, Detailed Processing and Image Diagnostics, Image Recording, Storage and Recovery, Image Comparison, Thermal Image Fusion, Report and Database Preparation.	Lecture	HW
9	2	1	Camera Systems, Standards, and Calibration, The Imaging System, Temperature Reference, Mounting the Imager, Camera Initialization, Patient Position and Image Capture, Location for Thermal Imaging, Ambient Temperature Control, Pre-Imaging Equilibration, Positions for Imaging, Field of View.	Lecture	Quizzes
10	2	1	Usage of IR-based technologies in medical applications: Screening of breast cancer, Screening of diabetic neuropathy and vascular disorders.	Lecture	HW
11	2	1	Usage of IR-based technologies in medical applications: Usage in Raynaud's phenomenon, Usage for body temperature monitoring.	Lecture	Quizzes
12	2	1	Usage of IR-based technologies in medical applications: Usage for diagnosis of skin diseases, Usage for diagnosis of rheumatic diseases.	Lecture	HW
13	2	1	Usage of IR-based Technologies in Medical Applications Usage for Diagnosis of Ocular Diseases, Usage for Diagnosis of Pain.	Lecture	HW
14	2	1	Why use Thermal Imaging Cameras, Infrared Thermometers		

15	2	1	- Thermal Imaging Cameras, Finding Problems Faster and with Extreme Accuracy, Use Thousands of Infrared Thermometers at the Same Time. Camera Types, Thermal Detector Types, The lens.	Lecture Lecture	HW Quizzes

11. Course Evaluation

1- Daily exams scientific questions.

2- Establishing grades for environmental duties and the reports assigned to them.

3- Semester exams for the curriculum, in addition to the mid-year exam and final exam

12. Learning and Teaching Resources

1. Practical applications of infrared thermal sensing and imaging equipment / by Herbert Kaplan. — 3rd ed. 2. Infrared Thermal Imaging Fundamentals, Research and Applications/ Michael n and Klaus-Peter Mollmann	

Course Description Form

1. Course Name:	
Control systems I	
2. Course Code:	
WBM-52-04	
3. Semester / Year:	
First Semester- 2025 / 2026	
4. Description Preparation Date:	
1 – 12 – 2025	
5. Available Attendance Forms:	
Class Attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
75 \ 3	
7. Course administrator's name (mention all, if more than one name)	
Name: **Qayssar Ayad Ahmed** Email: **qayssar.ayad@uowa.edu.iq**	
8. Course Objectives	
Course Objectives	• Building the student scientifically and qualifying him to understand the applications of digital control in some scientific and engineering fields, especially electrical and mechanical applications. • Building and preparing the student psychologically to play his role as a reliable engineer in this field. • Urging the student to be creative and think about specialization projects and keep pace with the development taking place in this field in terms of the basis of digital control in engineering work systems. • Identify the types of digital control and some of their practical applications.
9. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in developing the main features of this module to encourage student's participation in the exercises, while at the same time refining and expanding their critical thinking skill. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the

	students. Building and preparing the student psychologically to play his role as an engineer.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1-2	6	Learning Outcome:1 and 2	Introduction to Control System. Classification of control systems.	Lectures DATA SHOW	Quizzes and classroom activities
3-4	6	Learning Outcomes: 1 and 2	Transfer function representation Negative feedback, mathematical models, examples	Lectures DATA SHOW	Quizzes and classroom activities
5-6	6	Learning Outcomes: 1 and 2	Block diagram elements and representation, examples	Lectures DATA SHOW	Quizzes and classroom activities
7-8	6	Learning Outcomes: 1 and 2	Reduction rules an examples	Lectures DATA SHOW	Quizzes and classroom activities
9-10	6	Learning Outcomes: 1 and 2	Types of inputs and stability of the systems with examples	Lectures DATA SHOW	Quizzes and classroom activities
11-12	6	Learning Outcomes: 1 and 2	First and second order systems with examples.	Lectures DATA SHOW	Quizzes and classroom activities
13-14	6	Learning Outcomes: 1 and 2	Elements and representation of signal flow graph, introduction to state space domain	Lectures DATA SHOW	Quizzes and classroom activities

11. Course Evaluation

Quizzes (4%), Assignment (3%), lab. (10%), attendance (3%), Mid exam (30%), FINAL exam (50%)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1- Modern Control Engineering, (5th Edition) By: Katsuhiko Ogata. Mechanical Engineering, University of Minnesota.

	2- Control Systems Engineering, (6th Edition) By: Norman S. Nise. Electrical and Computer Engineering Department at California State Polytechnic University.
Main references (sources)	Modern Control Engineering, (5th Edition)
Recommended books and references (scientific journals, reports…)	1- Internet files. 2- All solid scientific journals and sites that are related to the broad concept of engineering control
Electronic References, Websites	Tracking Scientific websites to view recent developments in the prescribed subject For fifth year students.

Course Description Form

1. Course Name:
Hospital systems and design
2. Course Code:
WBM-51-07
3. Semester / Year:
Semester
4. Description Preparation Date:
2025−12−11
5. Available Attendance Forms:
presence in the classroom
6. Number of Credit Hours (Total) / Number of Units (Total)
30 Hours / 2 Units
7. Course administrator's name (mention all, if more than one name)
Name: Natiq A. Omran Email: nataq.az@uowa.edu.iq
8. Course Objectives

Course Objectives	To increase student knowledge in the field of designing hospitals and recent trends associated with developing hospitals concerning general and specialized buildings, gardens, waiting areas, traffic routes, ventilation system, safety, etc… To enable him from dealing with different future modifications about adding additional departments or medical devices.
9. Teaching and Learning Strategies	
Strategy	1- Making the student able to demonstrate real knowledge of hospital systems and design concepts during the academic level and their applications. 2- Learn the fundamental hospital departments and their size, medical devices included, ventilation requirements, sterilization procedures, etc. 3- Learn and understand modern solution methods in modification cases.

10- **Module Aims, Learning Outcomes and Indicative Contents**	
Module Aims	1. To develop student knowledge in hospital design principles and modern trends in healthcare facilities. 2. To understand general and specialized hospital buildings, including circulation, ventilation, safety systems, and public areas. 3. To prepare students to plan for future modifications involving new departments or medical equipment. 4. To strengthen the student's ability to apply hospital design concepts in real architectural and biomedical contexts.
Module Learning Outcomes	1. Demonstrate a comprehensive understanding of hospital systems and design principles. 2. Identify the main hospital departments, their functions, required spaces, and associated medical equipment. 3. Explain ventilation, sterilization, and environmental safety requirements in hospital design. 4. Analyze healthcare facility distribution models, including centralization, decentralization, and network hospitals. 5. Evaluate care pathways and spatial organization within hospital departments such as maternity, outpatient, and inpatient areas. 6. Apply evidence-based design concepts to create healing and patient-centered environments. 7. Describe zoning, traffic flow, way finding systems, and the role of public spaces in hospital design. 8. Assess the planning needs of treatment areas including diagnostic imaging, operating theaters, ICUs, and emergency departments. 9. Examine global case studies of general, children's, and university hospitals to identify best design practices. 10. Propose solutions and modifications to hospital layouts for future needs or new technologies. 11. Integrate modern design strategies to enhance patient safety, workflow efficiency, and environmental comfort. 12. Apply theoretical hospital design knowledge to real-world architectural or biomedical scenarios.
Indicative Contents	1- Circuit Theory of Healthcare Architecture: definitions, spatial relationships, and functional planning. 2- Hospital design approaches: centralization vs. decentralization, networked healthcare systems. 3- Evidence-Based Design for healing environments. 4- Public spaces: circulation systems, entrances, wayfinding, waiting areas, gardens, and patient-centered zones. 5- Treatment areas: outpatient clinics, inpatient wards, operating theaters, imaging units, ICU, emergency department, and laboratories

11−Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1 +2+3	4	Introduction	Defining the hospital, the Perspective of the Patient, Healthcare as a Public Service, T Business Case for Hospitals, Changing Healthcare Needs.	Lectures presented PDF format	Daily exams + homework assignments + monthly exams
4+5+6	4	DESIGNING HOSPITALS:	Distribution of Healthcare Facilities: Centralization, Decentralization and the Network Hospital, The Design of Hospitals: Care Pathways, Processes and Spaces: The Example of the Maternity Department, Evidence-Based Design for Healing Environments, The Building Type and its Emergence.	Lectures presented in PDF format	Daily exams homework assignments monthly exams
6+7	4	Limits and continuity	Limits: Introduction, limits found numerically and Algebraically, examples. Continuity: Introduction, Examples Evaluating limits at a point: introduction, Examples. Infinite limits: Introduction , Examples.	Lectures presented in PDF format	Daily exams homework assignments monthly exams
8+9	4	PUBLIC SPACES	Zoning and Traffic System, Arrival and Entrance, Public Spaces in and Around the Hospital: Streets, Squares, Patios, Waiting Areas, Healing Gardens, Way finding: Signage and Orientation Systems	Lectures presented in PDF format	Daily exams homework assignments monthly exams
10 +11	4	TREATMENT AREAS	Planning: an Integral Approach, Outpatient Department, Inpatient Wards, Diagnostic Imaging, Operating Theater and Recovery Area, Intensive Care Unit, Emergency Department, Laboratory Department.	Lectures presented in PDF format	Daily exams homework assignments monthly

12	4	GENERAL HOSPITALS Part 1	Circle Bath, Butaro District Hospital Butaro, Rwanda MASS Design Group, Private Hospital, Lille, France Jean-Philippe Pargade Architectes, Extension Kolding Hospital Kolding, Denmark Schmidt Hammer Lassen Architects, AZ Groeninge Kortrijk, Belgium Baumschlager Eberle Architekten Zaans Medisch Centrum.	Lectures presented in PDF format	Daily exams homework assignments monthly
13	4	GENERAL HOSPITALS Part 2	Hôpital Riviera-Chablais, Medisch Spectrum Twente Enschede, Rey Juan Carlos Hospital, Meander Medisch Centrum, Cleveland Clinic Abu Dhabi.	Lectures presented in PDF format	Daily exams homework assignments monthly
14	4	CHILDREN'S HOSPITALS	Nemours Children's Hospital, Randall Children's Hospital, Juliana Children's Hospital, Mother-Child and Surgical Center, Children's Hospital, Royal Children's Hospital.	Lectures presented in PDF format	Daily exams homework assignments monthly
15	4	UNIVERSITY HOSPITALS	Center for Surgical Medicine, University Hospital, Düsseldorf , St. Olav's Hospital, Akershus University Hospital, Reconstruction of the Johann Wolfgang Goethe University Hospital, Erasmus MC Hospital and Education Center	Lectures presented in PDF format	Daily exams homework assignments monthly

12- Course Evaluation

- Daily exams with practical and scientific questions.
- Participation scores for difficult competition questions among students
- Establishing grades for environmental duties and the reports assigned to them
- Semester exams for the curriculum, in addition to the mid-year exam and final exam

13- Learning and Teaching Resources

Required textbooks (curricular books, if any)	Hospital_Design_Guide_How_to_get_started
Main references (sources)	• College library to obtain additional sources for academic curricula • Check scientific websites to see rec developments in the subject
Recommended books and references (scientific journals, reports…)	All reputable scientific journals that are related the broad concept of designing hospitals and th results

Course Description Form

1. Course Name:
Image Processing
2. Course Code:
WBM-51-05
3. Semester / Year:
Semester 1 / 2025-2026
4. Description Preparation Date:
20250- 9-20
5. Available Attendance Forms:
presence in the classroom
6. Number of Credit Hours (Total) / Number of Units (Total)
60 Hours / 3 Units
7. Course administrator's name (mention all, if more than one name)
Name: Faris Kareem SHAMMARI Email: faris.kar@uowa.edu.iq

8. Course Objectives	
Course Objectives	-Introduce the fundamental concepts of digital image formation and representation. -Study basic image processing techniques such as image denoising, enhancement, and restoration. -Learn image segmentation methods, feature extraction techniques, and structural analysis of images. -Cover classical computer vision techniques including motion tracking, detection, and recognition. -Introduce modern deep learning–based approaches for image and video analysis. -Apply practical techniques to common tasks such as: Image classification • Object detection and tracking • Semantic segmentation • Face recognition -Perform programming exercises and case studies to bridge theoretical concepts with practical implementation. -Equip students with the knowledge and skills required to design and develop advanced image processing and computer vision systems.
9. Teaching and Learning Strategies	
Strategy	1. **Theoretical lectures** to explain the fundamental concepts and mathematical models of image processing and computer vision. 2. **Demonstrations** to illustrate image processing workflows using real-world examples. 3. **Project-Based Learning**, where students develop a practical project in image processing or build a computer vision model.

	4. **Laboratory sessions** using MATLAB and various image datasets for hands-on practical implementation. 5. **Collaborative learning** through group discussions and analysis of real-world image and video problems. 6. **Case studies** to explore real applications such as face recognition, object detection, and medical image enhancement.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Learning Outcomes 2 and 6	Introduction	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
2+3	4	Learning Outcomes 2 and 6	Human visual system. Sources of Digital Images, Simultaneous contrast. Optical illusions. Image acquisition.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
4	4	Learning Outcomes 2 and 6	Image formation model. Image sampling and quantization.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
5	4	Learning Outcomes 2 and 6	Representing digital images. Spatial and intensity resolution.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
6	4	Learning Outcomes 2 and 6	Image file format. Basic relationships between pixels. Distance measures.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
7	4	Learning Outcomes 2 and 6	Distance measures. Point operations. Arithmetic operations Set and logical operations.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
8	4	Learning Outcomes 2 and 6	**First mid teams**	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams.
9+10	4	Learning Outcomes 2 and 6	Set and logical operations. Spatial domain. Processes on spatial domain.	Theoretical lectures. Discussion lectures/tutorials.	Written exams. Quizzes. Scientific report writing. Homework.

				Practical laboratory experiments.	
11	4	Learning Outcomes 2 and 6	Basic intensity transformation functions.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
12	4	Learning Outcomes 2 and 6	Piecewise-linear transformation functions. Histograms. Histogram processing. Histogram equalization.	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
13	4	Learning Outcomes 2 and 6	What is a spatial filter? The mechanics of linear spatial filtering. Correlation and convolution. Smoothing spatial filters (linear and nonlinear). Sharpening spatial filters characteristics Foundation of sharpening filters. Laplacian filter	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.
14	4	Learning Outcomes 2 and 6	**Second mid teams**	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. .
15	4	Learning Outcomes 2 and 6	Image Segmentation, Application of image segmentation, Point Detection, Line Detection, Edge detection, Sobel Edge detection, Prewitt Edge detection	Theoretical lectures. Discussion lectures/tutorials. Practical laboratory experiments.	Written exams. Quizzes. Scientific report writing. Homework.

11. Course Evaluation

Monthly Exams: 2 × 15 = 30 marks
Homework Assignments: 5 marks
Quizzes: 5 marks
Laboratory Work: 10 marks

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Digital Image Processing -Gonzales R.C., Woods R.E. 4th ed., 2018.
Main references (sources)	- Digital Image Processing using SCILAB, Rohit M. Thanki • Ashish Kothari, 2019.

	- Digital Image Processing Using MATLAB, Gonzalez R.C., Woods R and Eddins S., 3rd ed., 2020.
Recommended books and references (scientific journals, reports...)	All reputable scientific journals that are related to the broad concept mathematical theories and their results