Module Information

معلومات المادة الدراسية

Module Title	**Thermodynamic and Heat**	**Module Delivery**	
Module Type	**C**	☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	UOMU0301042		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		
Module Level	2	**Semester of Delivery**	3
Administering Department	Type Dept. Code	**College**	Type College Code
Module Leader	Name Hussein Ali Abed	**e-mail**	E-mail hussein.ali.abed@uomus.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	Ph.D.
Module Tutor	Name (if available)	**e-mail**	E-mail
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023	**Version Number**	1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	• Understand the fundamental concepts of thermodynamics, including temperature, heat, and work. • Learn to apply the laws of thermodynamics to systems and processes in medical physics. • Understand the properties of ideal gases and their behavior under various conditions. • Describe the principles of heat transfer and their application in medical physics. • Learn about phase changes and the relationship between pressure, temperature, and volume during these changes. • Understand the principles of thermodynamic cycles and their application in medical physics. • Learn about statistical thermodynamics and its relevance to medical physics. • Apply the principles of thermodynamics to practical problems in medical physics.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	• Demonstrate an understanding of the fundamental concepts of thermodynamics, including temperature, heat, and work. • Apply the laws of thermodynamics to systems and processes in medical physics, including the study of heat engines, refrigeration systems, and heat pumps. • Demonstrate an understanding of the properties of ideal gases and their behavior under various conditions, including the calculation of thermodynamic variables such as pressure, volume, and temperature. • Describe the principles of heat transfer and their application in medical physics, including the study of conduction, convection, and radiation. • Demonstrate an understanding of phase changes and the relationship between pressure, temperature, and volume during these changes, including the study of phase diagrams.

	• Apply the principles of thermodynamic cycles and their application in medical physics, including the study of the Carnot cycle and its limitations. • Demonstrate an understanding of statistical thermodynamics and its relevance to medical physics, including the calculation of thermodynamic variables using statistical methods. • Apply the principles of thermodynamics to practical problems in medical physics, including the design and analysis of medical devices and systems that use thermodynamic principles.

Indicative Contents المحتويات الإرشادية	Introduction to Thermodynamics Thermodynamic Systems and Processes Ideal Gases and Gas Laws Heat Engines and Refrigerators Entropy and the Second Law of Thermodynamics Applications of Thermodynamics in Medical Physics

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1- Active learning: Encourage students to participate in discussions and activities to deepen their understanding of the subject matter. For example, you could organize group discussions, case studies, and problem-solving exercises to stimulate critical thinking and collaboration. 2- Real-world examples: Use examples from the medical physics field to help students contextualize their learning. For example, you could discuss how thermodynamics applies to radiation therapy, MRI machines, and other medical applications. 3- Technology integration: Incorporate technology such as online simulations, virtual labs, and interactive quizzes to make the learning experience more engaging and interactive. This can help students stay motivated and learn at their own pace.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	91	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6

Total SWL (h/sem) الحمل الدراخ الاًنخ للطالب خلال الفصل	١٥٠

Module Evaluation

تقيم المادة الدراسنة

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبو ر النظري

	Material Covered
Week 1	Introduction to Heat and Thermodynamics, State Variables, Thermodynamic Processes
Week 2	First Law of Thermodynamics, Work and Heat Transfer
Week 3	Second Law of Thermodynamics
Week 4	Entropy, Carnot Cycle
Week 5	Thermodynamic Properties of Substances, Ideal Gas Law, Joule-Thomson Effect
Week 6	Phase Transitions, Clausius-Clapeyron Equation, Vapor Compression Refrigeration

Week 7	Energy, work, and heat transfer, energy within system boundary, energy transfer.
Week 8	saturation and quality, compressed liquids, superheated vapor, gases, ideal gas law, other thermodynamics properties.
Week 9	Psychrometry, Air-Conditioning Processes, Heat Exchangers
Week 10	Radiation Heat Transfer, Blackbody Radiation, Stefan-Boltzmann Law
Week 11	Radiative Properties of Materials, Greenhouse Effect, Solar Thermal Energy
Week 12	Analysis of thermodynamics cycles, first and second laws for cycles, power
Week 13	cycles, refrigeration and heat pump cycles
Week 14	Applications of thermodynamics in medical physics
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبو؛ للمختy	
	Material Covered
Week 1	Lab 1 Introduction to Heat and Thermodynamics • Basic concepts and terminology • Temperature scales • Heat transfer mechanisms (conduction, convection, radiation)
Week 2	Lab 2 The First Law of Thermodynamics • Work and heat • Internal energy and enthalpy • Closed and open systems

Week 3	Lab 3 The Second Law of Thermodynamics • Entropy and the Carnot cycle • Thermodynamic processes • Heat engines and practical applications
Week 4	Lab 4: Properties of Gases • Ideal gas law • Real gases and deviations from ideal behavior • Specific heats and heat capacities
Week 5	Lab 5: Heat Transfer • Heat conduction • Heat convection • Heat radiation
Week 6	Lab 6: Applications of Thermodynamics in Medical Physics • Thermodynamics of the human body
Week 7	• Lab 7: Thermal therapies • Thermal imaging

Learning and Teaching Resources

مصادر التعلم والتدرنس

	Text	**Available in the Library?**
Required Texts	"An Introduction to Thermal Physics" by Daniel V. Schroeder "Thermodynamics: An Engineering Approach" by Yunus A. Cengel and Michael A. Boles	Yes
Recommended Texts	"Fundamentals of Statistical and Thermal Physics" by Frederick Reif	Yes
Websites	https://www.cambridge.org/us/academic/subjects/physics/thermal-physics/introduction-thermal-physics?format=HB&isbn=9780521865579 https://www.mheducation.com/highered/product/thermodynamics-engineering-approach-cengel-boles/M9780073398174.html	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	**A -** Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.