MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Power Plant Engineering**			**Module Delivery**	
Module Type	**Core**			☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	UOMU0206064				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	UGIII		**Semester of Delivery**	Five	
Administering Department	**Fuel and Energy Techniques Engineering Department**		**College**	**Engineering Technical College_Al-Mustaqbal**	
Module Leader	**Hussein K. Halwas**		**e-mail**	Hussein.kadhim@uomus.edu.iq	
Module Leader's Acad. Title	**Lecture**		**Module Leader's Qualification**	**Ph.DrMechanical Engineering**	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date			**Version Number**		

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 Aims أهداف المادة الدراسية	1. The ability to discuss the study of power cycles; steam phase change processes. 2. The ability to analyze the theory and applications of all types of steam and gas cycles; steam/liquid equilibrium in both. 3. The ability to explain the basic components of steam and gas plant cycles, including the turbine, condenser, boiler, pump, etc. 4. The ability to explain the design of power plants and electrical generating stations. 5. The ability to explain the thermodynamic analysis of processes.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The program expects the student to be able to: 1. Provide basic knowledge of the construction and operation of various types of thermal power plants, such as steam and gas turbines. 2. Apply basic thermodynamic principles and fluid flow to various power generation methods. 3. Analyze the thermodynamic cycles of steam power plants, and understand the construction, operation, and importance of their various systems. 4. Analyze the thermodynamic cycles of gas turbine power plants and jet propulsion systems.
Indicative Contents المحتويات الإرشادية	**Module 1: 2.5 hr** Heat transfer – Units. Types of heat transfer- thermal conductivity Thermodynamics cycles, simple cycle, reheating cycles, regenerative cycles, open feed water heater, closed feed water heater. Combined cycle-dual cycle (steam-mercury). **Module 2: 2.5 hr** Types of steam generators. Economizer- boiler-superheater- reheaters coils.-air preheaters. Fuel and combustion-stoichmetric combustion-excess air. Boiler performance-boiler efficiency- equivalent evaporation. **Module 3: 2.0 hr** Application of steam nozzles. analysis of steam nozzles-steam expansion- maximum speed-critical pressure ratio-ratio of area to mass flow rate-friction effect-supersaturated steam. steam ejectors. **Module 4: 2.5 hr** Types-principle theory-non-dimensional numbers groupspump compounding. Centrifugal pump-velocity triangular. Guide vans- priming-pump blades- pump casing. Characteristic of suction and delivery pipes. Hydraulic efficiency. Cavitation. **Module 5: 2.0 hr** Types of steam turbines. Impulse turbine. Impulse –reaction turbine. Reaction degree.compounding of steam turbines.-multi stages turbines. Steam turbine performance. blade efficiency.

	Module 6: 2.5 hr Feed water circuit. Feed water treatment plant. Pipe systems. Valves-ball valves-gate valves-safety valves-vacuum valves-control valves. measurements instruments-aim of measurements-temperature measurements- pressure measurements- flow measurements- gas chromatograph- velocity measurements- level indicator-electrical measurements **Module 7: 2.5 hr** Advantages and disadvantages. Reheating cycles-regenerative cycle with heat exchanger- intercooling cycle. Combined steam and gas power plant. **Module 8: 2.5 hr** Gas Turbine Power Plants factors affecting cost of generation: Load curves, load duration curves, Connected load, maximum load, Peak load, base load and peak load power plants, load factor, Plant capacity factor, Plant use factor, Demand factor, diversity factor, Cost of power plant, Tariffs **Module 9: 2.5 hr** Economic Aspects in Power Generation

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Strategies Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises are 1. Teamwork 2. Visualization 3. Inquiry-Based Teaching 4. Student-led Classroom 5. Implementing Technology in the Classroom 6. Auditory strategies 7. Reading & Writing

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	65
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**1. Introduction and Basic Concepts** 1-1 Thermodynamics and Energy 1-2 Importance of Dimensions and Units 1-3 Systems and Control Volumes 1-4 Properties of a System 1-5 Density and Specific Gravity 1-6 State and Equilibrium 1-7 Processes and Cycles 1-8 Temperature and the Zeroth Law of Thermodynamics 1-9 Pressure 1-10 The Manometer
Week 2	**2. Energy Conversion and General Energy Analysis** 2-1 Introduction 2-2 Forms of Energy 2-3 Energy Transfer by Heat 2-4 Energy Transfer by Work 2-5 Mechanical Forms of Work 2-6 The First Law of Thermodynamics 2-7 Energy Conversion Efficiencies 2-8 Energy and Environment
Week 3	**3. Properties of Pure Substances** 3-1 Pure Substance

	3-2 Phases of a Pure Substance 3-3 Phase-Change Processes of Pure Substances 3-4 Property Diagrams for Phase-Change Processes The T-v Diagram The P-v Diagram 3-5 Property Tables 3-6 The Ideal-Gas Equation of State 3-7 Compressibility Factor—A Measure of Deviation from Ideal-Gas Behavior 3-8 Other Equations of State
Week 4	**4. Vapor and Combined Power Cycles** 4.1 The Carnot Vapor Cycle 4-2 Rankine Cycle: The Ideal Cycle for Vapor Power Cycles 4-3 Deviation of Actual Vapor Power Cycles from Idealized Ones 4-4 How Can We Increase the Efficiency of the Rankine Cycle? 4-5 The Ideal Reheat Rankine Cycle 4-6 The Ideal Regenerative Rankine Cycle 4-7 Second-Law Analysis of Vapor Power Cycles 4-8 Cogeneration
Week 5	**5. Gas Power Cycles** 5-1 Basic Considerations in the Analysis of Power Cycles 5-2 The Carnot Cycle and Its Value in Engineering 5-3 Air-Standard Assumptions 5-4 An Overview of Reciprocating Engines 5-5 Otto Cycle: The Ideal Cycle for Spark-Ignition Engines 5-6 Diesel Cycle: The Ideal Cycle for Compression-Ignition Engines 5-7 Stirling and Ericsson Cycles 5-8 Brayton Cycle: The Ideal Cycle for Gas-Turbine Engines 5-9 The Brayton Cycle with Regeneration 5-10 The Brayton Cycle with Intercooling, Reheating, and Regeneration
Week 6	**6. Combined Gas–Vapor Power Cycles** 6.1 Steam generators 6.2 Cheng cycle 6.3 Unfired boiler 6.4 Dual pressure boiler 6.5 Supplementary firing
Week 7	**7. Hydroelectric Power Plant** 7.1 Definition 7.2 Benefits of hydraulic power plants 7.3 Applications 7.4 Types of hydropower plants 7.5 Parts of a hydroelectric power plant 7.6 Calculating the amount of available power
Week 8	**8. Solar Power Plant** 8.1 Definition 8.2 Benefits of Solar power plants 8.3 Applications 8.4 Types of Solar plants

	8.5 Parts of a Solar power plant 8.6 Calculating the amount of available power
Week 9	**9. Nuclear power plant** 9.1 Definition 9.2 Benefits of Nuclear Power Plants 9.3 Applications 9.4 Types of Nuclear Power Plants 9.5 Parts of a Nuclear Power Plant 9.6 Calculating the amount of available power
Week 10	**10. Steam Turbine Design** 10.1 Introduction 10.2 Steam Nozzles 10.3 Nozzle Efficiency 10.4 The Reheat Factor
Week 11	**11. Steam Condensers Design** 11.1 Introduction 11.2 Types of Condensers 11.3 Select the Condensers consideration 11.4 Calculate the Condensers.
Week 12	**12. Steam Generator Design** 12.1 Introduction 12.2 Types of boilers 12.3 Select the boiler 12.4 Calculate the boiler
Week 13	**13. Pumps and fans Design** 13.1 Introduction 13.2 Types of Pumps 13.3 Select the Number of Pumps 13.4 Calculate the discharge head for the boiler feed pump.
Week 14	**14. Cooling Tower Design** 14.1 Introduction 14.2 Types of Cooling Tower 14.3 Select the Cooling Tower 14.4 Calculate the Cooling Tower .
Week 15	**15. Design and of a Steam Power Plant** 15.1 Problem Description 15.2 Analysis and Assumptions 15.3 State Equations 15.4 Cost Analysis 15.5 Using ESS programs
Week 16	**Final exam**

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1,2	Experiment No.1. Diesel light Oil Gun Burner
Week 3.4	Experiment No.2. Pump efficiency and measurement devices
Week 5,6	Experiment No.2. Operation points system
Week 7,8	Experiment No.4. Steam Boiler System
Week 9,10	Experiment No.4. Types of Turbines
Week 11,12	Experiment No.4. Types of Nozzles
Week 13,14	Experiment No.4. Types of Condensers
Week15	Experiment No.4. Types of pumps

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	A. Çengel and M. A. Boles, Thermodynamics: An Engineering Approach, 5th ed, McGraw-Hill, 2006. (Last update: Dec. 29, 2005)	
Recommended Texts	Power plant engineering/by Black & Veatch; Lawrence F. Drbal, managing editor, Patricia Boston, associate editor, Kayla L. Westra, associate editor. p. cm. Includes bibliographical references and index. ISBN: 0-412-06401-4	
Websites	https://en.wikipedia.org/wiki/Power_plant_engineering	

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.