MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Biofuel**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	**RE 303**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	**3**		**Semester of Deliver**		**6**
Administering Department	**PM**		**College**	**TEMO**	
Module Leader	**Ammar Hasan Suhail**		**e-mail**	**ammarsuhail@ntu.edu.iq**	
Module Leader's Acad. Title	**Assistant Lecturer**		**Module Leader's Qualification**		**M. sc.**
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	**01/6/2023**		**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	1. Provide an overview of existing energy utilization, production and infrastructure. 2. Cover the consequences of our energy choices on the environment. 3. Introduce the impact of energy on food production and delivery. 4. Examine the growing field of biofuels by introducing the basics of renewable biofuel production.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Define Biofuel and identify their applications. 2. Define the food which is used in preparation of biofuel. 3. Preparation of bio hydrogen. 4. Preparation of biogas. 5. Preparation of biodiesel. 6. Preparation of bioethanol. 7. Preparation of biobutanol.
Indicative Contents المحتويات الإرشادية	After studying this chapter, the student is expected to master the following knowledge and skills: 1. Biofuel production, microorganisms, biochemical pathway, and biological approaches [10 hrs]. 2. Biohydrogen and biomethanation production [20 hrs]. 3. Biodiesel, bioethanol, and biobutanol [15]. 4. Reactor configuration [5 hrs]. 5. Microbial Electrochemical Technologies [5 hrs]. 6. Energy analysis [5 hrs].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The biofuel module employs a range of effective learning and teaching strategies. Students engage in theoretical lectures, practical demonstrations, and hands-on laboratory sessions to grasp the underlying principles and gain practical skills. Case studies and real-world scenarios enhance problem-solving abilities, while group projects foster teamwork and communication skills. Continuous assessment methods, including assignments and practical assessments, ensure students' progress and understanding of the subject matter. The module promotes equipping students with the knowledge and skills necessary for success in the field of biofuel.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	137	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	9
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**200**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	15% (10)	3,6,12 and 14	LO #1,#2,#3,#4, #5,#6and#7
	Assignments	4	10% (10)	2,4,7 and 13	LO #2, #3,#4 and #6
	Projects / Lab.	7	15% (10)	Contentious	All
	Report	0	0		
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1-#4
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Biofuels
Week 2	Biofuels Production from Renewable Energy Sources
Week 3	Microorganisms Involved in Biofuel Production Processes
Week 4	Biochemical Pathways for the Biofuel Production
Week 5	Molecular Biological Approaches for the Improvement of Biofuels Production
Week 6	Biohydrogen Production by the Dark Fermentation Process
Week 7	Biohydrogen Production by Photobiological Processes
Week 8	Biomethanation.
Week 9	Bioethanol
Week 10	Biobutanol
Week 11	Biodiesel
Week 12	Microbial Electrochemical Technologies and Their Applications
Week 13	Effect of Reactor Configurations on Gaseous Biofuel Production
Week 14	Scale-up and Case Studies of Biofuel Production Processes
Week 15	Energy and Economic Analysis of Biofuel Production Processes
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Fermentation experiment.
Week 2	Lab 2: Anaerobic digestion experiment.
Week 3	Lab 3: Stem Distillation experiment.
Week 4	Lab 4: Adsorption experiment.
Week 5	Lab 5: Gasification experiment.
Week 6	Lab 6: Liquefaction experiment.
Week 7	Lab 7: Trans esterification experiment.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Fundamental of biofuel production processes, Debabrata Das and Jhansi L. Varanasi Taylor & Francis Group, LLC	Yes
Recommended Texts	Biofuel Technology Handbook, Dominik Rutz & Rainer Janssen WIP Renewable Energies	yes
Websites	https://www.aiche.org/topics/energy/biofuels-energy	

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.

Module 1

Code	Course/Module Title	ECTS	Semester
RE 303	Biofuel	8	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	63	137
Description			

Biofuels encompass a range of transportation fuels derived from biomass feedstock. These fuels include ethanol, methanol, butanol, biodiesel, hydrogen, and methane, all obtained through different processes. The combustion of biofuels results in reduced greenhouse gas emissions, minimal acid rain components, no oxygen depletion, and decreased environmental pollution.

Manufacturing biofuels involves various methods, including direct thermal, thermochemical, electrochemical, and biological approaches. These methods allow for the conversion of biomass feedstock into usable fuels, contributing to a more sustainable and environmentally friendly energy sector.

By utilizing biofuels, society can mitigate the impact of fossil fuel consumption on climate change and environmental degradation. The development and utilization of biofuels play a vital role in promoting renewable energy sources and reducing reliance on non-renewable fossil fuels.