

MODULE DESCRIPTOR FORM

نموذج وصف المادة الدراسية

Module Information					
معلومات المادة الدراسية					
Module Title	PHYSICS AND SEMICONDUCTOR		Module Delivery		
Module Type	CORE		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	ATU11105				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		UGI			Semester of Delivery
Administering Department			College	NETC	
Module Leader	Thenaa Hassan Yousaf		e-mail	thanaa.yousif.chm@atu.edu.iq	
Module Leader's Acad. Title		Assistant Lecturer	Module Leader's Qualification		M.Sc.
Module Tutor	Name (if available)		e-mail	E-mail	
Peer Reviewer Name		Nasir Hussein Selman	e-mail	Coj.nas@atu.edu.iq	
Scientific Committee Approval Date		01/10/2024	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 Aims أهداف المادة الدراسية	1. To understand atom models. 2. To Know the Semiconductor materials and their types. 3. To Know the P-N junction and biasing 4. To understand the V/I Characteristics of the diode. 5. To study the Equivalent circuit of the diode and analysis its circuit. 6. To study the diode types and their applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Learn about the structure of the atom. 2. Discuss the energy bands in an atom. 3. Discuss the types of semiconductor materials and how to manufacture them. 4. study generation and recombination of the carrier. 5. How to form the depletion layer. 6. Recognize the forward and reverse biased of the P-N junction. 7. Learn about Diode Equation. 8. Discussion of the Equivalent circuit of the diode. 9. Discuss the series and parallel diode configuration. 10. Study rectifier circuits, clipper and clamper circuits, and voltage doublers. 11. Study zener diode and application,
Indicative Contents المحتويات الإرشادية	- Model of the atom., Bohr's model, atom energy levels, Collisions of Electrons with Atoms, The Photon Nature of Light, energy bands, valance and conduction bands, Insulators, Semiconductors and Metals. [8 hrs] - Semiconductor types: Intrinsic and Extrinsic Semiconductors, n-type and P-type, majority and minority carriers. Drift and diffusion currents, electron-hole pair, carrier and life time, generation and recombination of carrier. [12 hrs] - P-N junction, forward and reverses biased P-N junction, Diode Equation, Forward and reverse V/I Characteristics of diode, diode resistance. [11 hrs] - Equivalent circuit of diode: Piecewise Equivalent Circuit, Simplified Equivalent Circuit, Ideal Equivalent Circuit, Load line analysis, Examples. Series and parallel diode configuration examples. Half wave rectifier, full wave rectifier, clipper and clamper circuits, voltage doublers. [18 hrs] - Types of diodes, zener diode, light emitting diode, [11 hrs]
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by showing the students how the construction members exposed to external loads. This can be done by films or videos or by the ready structural software.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (hr/sem) (SSWL) الحمل الدراسي المنتظم للطالب خلال الفصل	93	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	93/15 = 6.2
Unstructured SWL (hr/sem) (USSWL) الحمل الدراسي غير المنتظم للطالب خلال الفصل	82	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	82/15 = 5.5
Total SWL (hr/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

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	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week	Syllabus
Week 1&2	Atoms, electrons and shells, energy levels, valence electron, Ionization, Molecules and Solids - Combination of atoms - Bonding force in solids, material classifications (conductors, insulators, and semiconductors).
Week 3&4	Semiconductor materials: Ge, Si, and GaAs, Covalent bonding, electron and hole current, intrinsic and extrinsic semiconductors. p-type and n-type materials.
Week 5&6	PN-junction and barrier potential. semiconductor diode, characteristics of diode, Silicon diode versus germanium diode, ideal diode versus practical, current-voltage relationship, temperature effect.
Week 7-9	Diode resistance level, Diode equivalent circuits, Diode in DC circuits series and parallel diode configurations, load line analysis, transition and diffusion capacitance, reverse recovery time, diode switching circuit; OR and AND gates.
Week 10-12	Diode in AC circuits; diode rectifiers circuit; Half wave rectifier operation, transformer coupler, full wave rectifiers operation; Bridge and center-tap full wave, capacitor filter.
Week	Diode clipping circuit, diode clamping circuits. other types of diodes; light emitting diode

13&14	and Zener diode.
Week 15	Zener diode operation and its applications
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to Lab instruments
Week 2	Lab 2: Forward and reverse V/I Characteristics of diode.
Week 3	Lab 3: half wave rectifier.
Week 4	Lab 4: Full wave rectifier with center tap transformer.
Week 5	Lab 5: Full wave (bridge) rectifier.
Week 6	Lab 6: clipper and clamper circuits
Week 7	Lab 7: voltage doubler and voltage triple
Week 8	Lab 8: Zener diode characteristics in forward biasing and reverse biasing.
Week 9	Lab 9: Using a zener diode to stabilize the voltage with a constant and variable resistive load.
Week 10	Lab 10: light emitting diode.
Week 11	Lab 11: characteristics of photo diode.
Week 12	Lab 12: characteristics of varactor diode.
Week 13	Lab 13: characteristics of Schottky diode.
Week 14	Lab 14: characteristics of Lazer diode.
Week 15	Final exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. Electronic Devices And Circuit Theory by R. Boylestad.	Yes
Recommended Texts	1. Electronic devices electronic flow version by Thomas L. Floyd	Yes
Websites		

APPENDIX:

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	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
NB 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.				