Form: Course Syllabus		
	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	05

1	**Course Title**	Electronics
2	**Course Number**	0908320
3	**Credit Hours (Theory, Practical)**	3
	Contact Hours (Theory, Practical)	3 hours theoretical
4	**Prerequisites/ Corequisites**	Electrical Circuits I (0903211)
5	**Program Title**	B.Sc. in Mechatronics Engineering
6	**Program Code**	0908
7	**School/ Center**	The University of Jordan
8	**Department**	Mechatronics Engineering Department
9	**Course Level**	3rd year
10	**Year of Study and Semester (s)**	2023/2024 2nd Semester
11	**Other Department(s) Involved in Teaching the Course**	None
12	**Main Learning Language**	English
13	**Learning Types**	☒ Face to face learning ☐ Blended ☐Fully online
14	**Online Platforms(s)**	☒Moodle ☒Microsoft Teams
15	**Issuing Date**	24/2/2024
16	**Revision Date**	21/3/2024

17 Course Coordinator:

Name: Prof. Riad Taha Al-Kasasbeh Contact hours: As per schedule
Office number: Mechatronics Dept., 3rd Floor Phone number: 065355000 ext. 23031
Email: R.Al-kasasbeh@ju.edu.jo

18 Other instructors:

None

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This course provides a thorough examination of solid-state theory, semiconductors, and PN junctions, emphasizing their roles in fundamental diode circuits. Students will also gain proficiency in designing and analyzing basic power supplies, half-wave and full-wave rectifier circuits, Clipper and Clamper circuits, and Filters (Smoothing Circuit), as well as Regulators. The curriculum extensively covers Bipolar Junction Transistors (BJTs), encompassing various types and biasing techniques such as Self-biasing, Emitter-stabilized, Divider Voltage Biasing, Collector feedback biasing, Darlington transistors, and DC Analysis Multistage transistor circuits. Special emphasis is placed on designing BJT circuits to attain optimal resistor values for collector, emitter, and base configurations. Students will delve into MOS Field Effect Transistors (MOSFETs), including N-type and P-type MOSFETs, biasing methods, and their Current-Voltage characteristics. Additionally, the course introduces and discusses CMOS technology. Furthermore, students will analyze small-signal equivalent circuits of BJTs using Hybrid Analysis to define voltage and current gains, as well as AC Analysis Multistage transistor circuits, to enhance their understanding of these components and their behavior in electronic circuits.
Finally, the course explores modern applications of semiconductor devices, highlighting their cutting-edge uses in various industries and mechatronics applications.

Course Description:

20. Program Intended Learning Outcomes:

The Program Intended Learning Outcomes (PILOs) for this course might include:

1. **Solid-State Theory Understanding:** Students will demonstrate a comprehensive understanding of solid-state theory, including the behavior of semiconductors and PN junctions in fundamental diode circuits.
2. **Design and Analysis Skills:** Students will gain proficiency in designing and analyzing Diode Circuit DC Analysis, basic power supplies, half-wave and full-wave rectifier circuits, Clipper and Clamper circuits, Filters (Smoothing Circuit), and Regulators.
3. **BJT Knowledge:** Students will acquire in-depth knowledge of Bipolar Junction Transistors (BJTs), including various types and biasing techniques such as Self-biasing, Emitter-stabilized, Divider Voltage Biasing, Collector feedback biasing, Darlington transistors, and DC Analysis Multistage transistor circuits.
4. **BJT Circuit Design:** Students will be able to design BJT circuits to achieve optimal resistor values for collector, emitter, and base configurations, emphasizing practical applications.
5. **"FET and MOSFET Understanding :** This course will explore Field Effect Transistors (FETs) and Metal Oxide Semiconductor Field Effect Transistors (MOSFETs), covering N-type and P-type MOSFETs, biasing methods, and their Current-Voltage characteristics. The focus will be on practical design considerations."**Circuit**
6. **Analysis Skills:** Students will analyze small-signal equivalent circuits of BJTs using Hybrid Analysis to define voltage and current gains, as well as AC Analysis Multistage transistor circuits, enhancing their understanding of these components and their behavior in electronic circuits.
7. **"Overview of Darlington BJT Pair Biasing and Cascade BJT Amplifier**: Learn how to set the operating point for stable transistor operation in a Darlington pair and understand the cascade amplifier's configuration, advantages, and signal amplification principles. Additionally, explore the transistor's role as a switching circuit in digital applications."

8. **Modern Applications:** Students will explore modern applications of semiconductor devices, highlighting their cutting-edge uses in various industries and mechatronics applications, and understand their practical implications.

These PILOs outline the specific knowledge, skills, and understanding that students are expected to achieve upon completing the course.

SO: 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Course ILOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analyzing	evaluating	Creating
1	✓	✓				
2	✓	✓	✓	✓		
3	✓	✓	✓			
4	✓	✓	✓			
5	✓	✓	✓	✓		
6	✓	✓	✓		✓	
7	✓	✓	✓			
8	✓	✓	✓	✓	✓	

22. Matrix linking the Course Intended Learning Outcomes (CILOs) to the Program Intended Learning Outcomes (PILOs

Program ILOs / SOs / Course ILOs	ILO (1) SO: 1	ILO (2) SO: 2	ILO (3) SO: 3	ILO (4) SO: 4	ILO (5) SO: 5	ILO (6) SO: 6	ILO (7) SO: 7
1							
2	✓						
3							
4							
5							
6	✓						
7							
8							

23. Topic Outline and Schedule:

Week	Lecture	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Sources
1	1	Introduction/Outline	1	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	2	Solid-State Theory Of Semi conductors,	1	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	3	Positive and Negative Types of semi conductors ,PN junctions	1	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
2	4	Diode Applications	1	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	5	Half-wave Rectifier	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	6	Full-wave Rectifier, Center Tapped Rectifier	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
3	7	Filters RC (Smoothing Circuit)	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle

	8	Series and parallel positive and negative clipper	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	9	Clipper Dual (com Clamper Circuitbination)Diode clipper,	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
4	10	Regulators(Zener Diode)	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	11	"Reviewing and solving examples of diode applications in DC and AC circuits	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	12	Overview of Bipolar Junction Transistor:(BJT) Definition as a semiconductor device Structure of BJT Types of BJT (PNP, NPN), construction and symbols	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
5	13	BJT characteristics and parameters	2	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	14	Self biasing of BJT Common Emitter Biasing	1, 3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	15	Emitter-stabilized biasing of BJT Collector feedback biasing of BJT	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
6	16	"Divider Voltage Biasing for BJT, including Exact calculation methods."	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	17	"Divider Voltage Biasing for BJT, including Approximately calculation methods."	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	18	Design BJT circuits to achieve optimal resistor values for collector, emitter, and base configurations, emphasizing practical applications.	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
7	19	DC Analysis Multistage transistor circuits	3	E-Learning	E-Learning	Synchronous	Written quiz Project	Book+Moodle
	20	Overview of Hybrid Parameter Analysis of AC Circuits	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	21	Hybrid Parameter Analysis of AC Self biasing -and , Emitter-Stabilized Biasing BJT Circuits	3, 4	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
8	22	Hybrid Parameter Analysis of AC Divider Voltage Biasing of BJT Circuits	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	23	"Hybrid Parameter Analysis of AC Multistage Biasing BJT Circuits"	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle

	24	Overview of Darlington BJT Pair Biasing transistor operation and DC Analysis	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
9	25	Darlington BJT Pair Biasing transistor operation and AC Analysis	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	26	Overview of Cascade BJT Amplifier BJT Pair Biasing transistor operation and DC Analysis	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	27	Cascade BJT Pair Biasing transistor operation and AC Analysis	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
10	28	This lecture covers the role of Bipolar Junction Transistors (BJTs) in mechatronics circuits, including optimal performance criteria (voltage gain, current gain, input impedance, load resistance, and biasing conditions), with detailed explanations and design calculations.	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	29	"Practical examples and design exercises will be provided to illustrate the concepts discussed, including an in-depth explanation of key parameters (Rb, Rc, Re, Beta, VCC) and their calculations for designing BJT circuits, as well as an exploration of biasing conditions."	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	30	Switching Characteristics: Examination of BJT as a switch in mechatronic systems, covering switching modes, speed factors, and control strategies.	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
11	31	Advanced Topics in BJT Applications : Exploration of advanced BJT configurations, current applications, thermal considerations, and future trends in mechatronic systems.	3	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	32	Introduction to Field-Effect Transistors (FETs))	3, 4	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	33	Introduction to Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFETs)	3, 4	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
12	34	(MOSFET) Self Biasing Method and their Current-Voltage Characteristics, with a Focus on Practical Design Considerations.	3, 4	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	35	(MOSFET) divider voltage Biasing Method and their Current-Voltage Characteristics, with a Focus	2, 5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle

		on Practical Design Considerations.						
	36	(MOSFETs) Divider Voltage and Self-Biasing Methods, along with their Current-Voltage Characteristics, are explored with a focus on practical design considerations..	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
13	37	Common-Source configuration	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	38	Commn Drain configuration	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	39	Common Gate configuration	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
14	40	AC analysis,Voltage divider	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	41	Design Problem	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	42	Construction of Photodiodes, Phototransistors, and Photoresistors, Semiconductor materials used, Structure and doping profile .	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
15	43	Operation Principles Photovoltaic mode vs. photoconductive mode (for photodiodes and phototransistors) ,Resistance change mechanism (for photoresistors)	5	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	44	Characteristic Curves of Photodiodes, Phototransistors: Current-voltage (I-V) characteristics, Light vs. current (L-I) characteristics, Resistance vs. light intensity characteristics	5, 6	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle
	45	Examples and practice problems for circuit design	7	Classroom	Classroom	Synchronous	Written quiz Project	Book+Moodle

24. Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	ILO/s Linked to the Evaluation activity	Period (Week)	Platform
In-class participation	20	TBA		TBA	Verbal evaluation

Midterm Exam	30	Midterm material	TBA	On campus
Final Exam	50	Post Midterm material	TBA	On campus
Total	100%			

25. Course Requirements (e.g: students should have a computer, internet connection, webcam, account on a specific software/platform…etc):

Each student should have a Textbook, Computer, Internet access & Scientific calculator.

26. Course Policies:

A- Attendance policies: Attendance will be taken every class and University policy will be enforced.
B- Absences from exams and submitting assignments on time: Absence not allowed and no Late submission.
C- Health and safety procedures: As per University policy
D- Honesty policy regarding cheating, plagiarism, misbehavior: Not tolerated as per University p olicy
E- Grading policy: As mentioned in Evaluation Methods above.
F- Available university services that support achievement in the course: Platforms, Instructor support, Administrative support.

27. References:

A- Required book(s), assigned reading and audio-visuals:

- Text book: **"Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky** - Another popular textbook that covers the fundamentals of electronic devices and circuits..

B- Recommended books, materials, and media: Reference books:

1. **"Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith** - A comprehensive textbook covering the basics of electronic circuits, including semiconductor devices and their applications.
2. **"Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N.O. Sadiku** - This textbook provides a solid foundation in electric circuits, including analysis and design principles.
3. **"Practical Electronics for Inventors" by Paul Scherz and Simon Monk** - A practical guide for beginners and hobbyists interested in electronics, covering basic concepts and practical circuits.
4. **"The Art of Electronics" by Paul Horowitz and Winfield Hill** - Considered a classic in the field, this book covers a wide range of topics in electronics with an emphasis on practical circuit design.
5. **Online Resources:** Websites like All About Circuits (https://www.allaboutcircuits.com/) and Electronics Hub (https://www.electronicshub.org/) offer tutorials, articles, and circuit examples for learning electronics.

28. Additional information:

Name of the Instructor or the Course Coordinator: **Prof. Riad Taha Al-Kasasbeh**	Signature: ……...……	Date: 21/3/2024
Name of the Head of Quality Assurance Committee/ Department	Signature:	Date:
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Name of the Head of Department	Signature:	Date:

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Name of the Head of Quality Assurance Committee/ School or Center	Signature:	Date:
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Name of the Dean or the Director	Signature:	Date:
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