Kingdom of Saudi Arabia
The National Commission for Academic Accreditation & Assessment

T6. Course Specifications (CS)

Course title: Electronics

Course code: 23064473-4

Course Specifications

Institution: **Umm AL – Qura University**	Date : **18/1/1439**
College/Department : **College of Applied Science – Department of Physics**	

A. Course Identification and General Information

1. Course title and code: **Electronics 23064473-4**
2. Credit hours: **4 hrs.**
3. Program(s) in which the course is offered. **BSc Physics.**
(If general elective available in many programs indicate this rather than list programs)
4. Name of faculty member responsible for the course
One of the staff member
5. Level/year at which this course is offered : **4th Year / Level 8**
6. Pre-requisites for this course (if any) : **Solid state physics (1) 23064371-4**
7. Co-requisites for this course (if any) : ---
8. Location if not on main campus: **Al-Jamoum**
9. Mode of Instruction (mark all that apply)

a. traditional classroom	✓	What percentage?	**100%**
b. blended (traditional and online)		What percentage?	
c. e-learning		What percentage?	
d. correspondence		What percentage?	
f. other		What percentage?	

Comments:

B Objectives

1. Summary of the main learning outcomes for students enrolled in the course.

Outcomes of this course are to introduce the basic physical principles and fundamentals of semiconductors and their usage and applications in electronic components like diodes and transistors.

This course introduces basic principles of linear and digital electronic circuits that are used in the everyday experience, like

- Semiconductor Diodes
- Circuit rectifiers.
- Special types of diodes
- Bipolar junction transistors
- Small signal amplifiers and biasing
- Field effect transistors
- Signal operational amplifiers,
- Digital circuits like logic gates
- Applications to memory chips and timers used in most of electronic devices

At the end of this course the student should be able to

1. Understand and analyze relatively simple electronic layouts and circuits

Design special purpose circuits that meet his requirements in his scientific life

2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)

1. Explain strategy of the course in the beginning of the semester
2. Outlines of the physical laws, principles and the associated proofs.
3. Highlighting the day life applications whenever exist.
4. Encourage the students to see more details in the international web sites and reference books in the library.
5. Discussing some selected problems in each chapter.
6. Cooperate with different institution to find how they deal with the subject
7. Renew the course references frequently

Frequently check for the latest discovery in science

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:

- Conduction mechanisms in semiconductors: Energy Bands of metals, semiconductors and insulators, Intrinsic semiconductors, Extrinsic (impurity) semiconductors (n-type semiconductors, p-type semiconductors), majority and minority carriers, generation and recombination rates.
- Junction diode physical electronics: The pn junction: Physical model, Current flow, carrier concentration at edge of space charge layer, Current voltage characteristics at direct and reverse bias - Temperature dependence of idealized diode equation- pn dynamic behavior, junction structures, contacts and metal-semiconductor junctions, Examples of diode circuit analysis.
- Bipolar junction transistors (BJT): BJT as control valves, Operation of BJT, Circuit models of low speed active region operation, Examples of transistor circuit analysis.

- Field effet transistors BJT: Electrical properties of semiconductor surfaces, Volt-Amper characteristics of MOSFET, Dynamics for MOSFET and circuit applications, Junction field effect transistors, Static drain characteristics, Comparison of MOSFET and JFET transistors.
- Operational amplifiers: Introduction, connecting the amplifier to the circuits, Ideal and real amplifiers, Linear amplification and negative feedback, Special application of amplification, Addition and subtraction of signal, Memory and timing applications using positive feedback (Multivibrators), Integration and differentiation.
- Digital electronics: Digital logic (binary numbers-logic levels,. Logic gates-truth. Tables logic. Families-Practical circuits, Main gates (AND-OR-NOT-NAND-NOT-AND-OR-NOT-NAND-NOR), Combinations of gates, Logic laws, XOR and XNOR gates, Adding of binary numbers, Memory elements (Multivibrators-Flip flops).

1 Topics to be Covered

Topics	No of Weeks	Contact hours
❖ Semiconductors and PN Junction Atoms and covalent bonds Conduction in Semiconducting Crystal PN Junction and biasing	2	6
❖ Diode and its applications Diodes Calendar Half- and full-wave rectifiers and filters.	2	6
❖ Special types of diode Diode "zener" Diode "zener" Applications Variable capacitance diode Optical diodes Other types of diode	2	6
❖ BIPOLAR JUNCTION TRANSISTORS BJT as control valves Operation of BJT Circuit models of low speed active region operation An example of transistor circuit analysis ; Transistor operation at extremes of collector voltage	2	6
❖ Bias transistor bipolar DC operating point Base Biasing Emitter Biasing Voltage divider Biasing Collector bias by feedback	2	6
❖ FIELD-EFFECT TRANSISTORS Electrical properties of semiconductors for surfaces Volt-Ampere characteristics of MOSFET A brief view of dynamics for MOSFET and circuit applications Junction Field-Effect Transistors static drain characteristics; Comparison of MOSFET and FET transistors	1	3

❖ Operational amplifiers Introduction Connecting the Amplifier to the circuit Ideal and real Amplifiers Linear Amplification and negative feedback Special applications of amplifications Addition and subtraction of signals Memory and timing applications; using positive feedback (Multivibrators) Integration and Differentiation	**1**	**3**
❖ DIGITAL ELECTRONICS Digital logic (Binary numbers, Logic levels, Logic gates; Truth tables; Logic families-practical circuits) Main gates (AND, OR, NOT, NAND, NOR) Combination of gates Logic laws XOR and XNOR gates Adding of binary numbers Memory elements (Multivibrators, Flip-Flops)	**2**	**6**
❖ **Exe2rcises and Solved problems**	**1**	**3**
	15 weeks	**45hrs**

Practical part:

1. Laboratory Safty Guidelines
2. P-N Junction Diode Characteristic
3. Half and Full-wave rectifiers
4. Filters circuits
5. Zener diode
6. Light emitted diodes
7. Characteristic of bipolar junction transistors
8. Transistor Load line
9. Transistor Biasing
10. Small signal amplifiers
11. JEFT transistor
12. Logic circuits

2. Course components (total contact hours and credits per semester):						
	Lecture	Tutorial	Laboratory or Studio	Practical	Other:	Total
Contact Hours	**52**	**48**		**14**	**32**	**136**
Credit	**3**		**1**	2		

3. Additional private study/learning hours expected for students per week.	4

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.
First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table).
Second, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes.
Third, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Define the physical quantities, physical phenomena, and basic principles.	1- Demonstrating the basic principles through lectures. 2. Discussing phenomena with illustrating pictures and diagrams. 3. Lecturing method: Board, Power point. 4. Discussions 5. Brain storming 6. Start each chapter by general idea and the benefit of it.	Solve some example during the lecture. Discussions during the lectures Exams: a) Quizzes (E-learning) b) Short exams (mid- term exams) c) Long exams (final) d) Oral exams .
1.2	Describe the physical laws and quantities using mathematics		
1.3	Determine the physical quantities at the Lab.	1. Doing team research or team project. 2.Doing team work to perform some experiments 3. Perform the experiments correctly. 4. Demonstrate the results correctly. 5. Write the reports about the experiment. 6. Discussion with the student about the results	Writing scientific Reports. Lab assignments Exam.

2.0	**Cognitive Skills**		
2.1	Apply the laws of physics to calculate some quantities.	1. Preparing main outlines for teaching. 2. Following some proofs. 3. Define duties for each chapter 4. Encourage the student to look for the information in different references. 5. Ask the student to attend lectures for practice solving problem.	1. Exams (Midterm, final, quizzes) 2. Asking about physical laws previously taught 3. Writing reports on selected parts of the course. 4. Discussions of how to simplify or analyze some phenomena.
2.2	Solve problems in physics by using suitable mathematics.		
2.3	Analyse and interpret quantitative results.		
2.4	Apply physical principle on day life phenomena.		
2.5	Derive the physical laws and formulas.		
3.0	**Interpersonal Skills & Responsibility**		
3.1	Show responsibility for self-learning to be aware with recent developments in physics	• Search through the internet and the library. • Small group discussion. • Enhance self-learning skills. • Develop their interest in Science through : (lab work, visits to scientific and research institutes).	• Evaluate the efforts of each student in preparing the report. • Evaluate the scientific reports. • Evaluate the team work in lab and small groups. • Evaluation of students presentations.
3.2	Work effectively in groups and exercise leadership when appropriate.		
4.0	**Communication, Information Technology, Numerical**		
4.1	Communicate effectively in oral and written form.	• Incorporating the use and utilization of computer, software, network and multimedia through courses • preparing a report on some topics related to the course depending on web sites	• Evaluating the scientific reports. • Evaluating activities and homework
4.2	Collect and classify the material for the course.		
4.3	Use basic physics terminology in English.		
4.4	Acquire the skills to use the internet communicates tools.		
5.0	**Psychomotor**		
5.1	Use experimental tools safely and correctly.	Follow up the students in lab and during carryout all experimental work.	• Practical exam. • Giving additional marks for the results with high and good accuracy
5.2	Determine the physical quantity correctly at the Lab.		

5. Map course LOs with the program LOs. (Place course LO #s in the left column and program LO #s across the top.)																
Course LOs #	**Program Learning Outcomes (Use Program LO Code #s provided in the Program Specifications)**															
	1.1	**1.2**	**1.3**	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**3.1**	**3.2**	**4.1**	**4.2**	**4.3**	**4.4**	**5.1**	**5.2**
1.1	✓															
1.2		✓														
1.3			✓													
2.1				✓												
2.2					✓											
2.3						✓										
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4.1											✓					
4.2												✓				
4.3													✓			
4.4														✓		
5.1															✓	
5.2																✓

6. Schedule of Assessment Tasks for Students During the Semester			
	Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Exercises & Home works (lectures)	All weeks	5%
2	Exercises & Home works (lab)	All weeks	5%
3	Participation in lectures activities	All weeks	5%
4	Participation in lab activities	All weeks	5%
5	Midterm Exam (theoretical)	8th week	20%
6	Lab. Reports (Practical)	11th week	5%
7	Final Exam (Practical)	14th week	15%
8	Final Exam (theoretical)	16th week	40%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)
8 office hours per week

E Learning Resources

1. List Required Textbooks

Electronic Devices, 9th Edition Thomas L.Floyd
Electronic Devices and Circuits by Jacob Millman and Christos C. Halkias

2. List Essential References Materials (Journals, Reports, etc.)

3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

4. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

- http://www.physicsclassroom.com
- http://www.electronicstheory.com/
- http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.
Wikipedia

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)
   - Lecture room for 30 students
   - Library
   - Laboratory for electronics there is a special course for laboratory related to electronics)

2. Computing resources (AV, data show, Smart Board, software, etc.) • Computer room • Scientific calculator.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) Each Class room and laboratories require a TV screen at least 65 inch-and smart, and double layer white board.

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching • Questionnaires • Open discussion in the class room at the end of the lectures
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Revision of student answer paper by another staff member. • Analysis the grades of students.
3 Processes for Improvement of Teaching • Preparing the course as PPT. • Using scientific movies. • Periodical revision of course content.
4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) • After the agreement of Department and Faculty administrations
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • Periodical revision by Quality Assurance Units in the Department and institution