هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title	**Electronics**
Course Code:	**PHY 1324**
Program:	**Bachelor of Science in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	4
Last Revision Date:	***26/09/2024***

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 5/ Year 3)					
4. Course General Description:					
This course introduces the characteristics and applications of semiconductor devices and circuits. Emphasis is placed on analysis, selection, biasing, and applications. Upon completion, students should be able to construct, analyze, verify, and troubleshoot analog circuits using appropriate techniques and test equipment. This course covers the concepts, equations and construction of analogue and electronics circuits and it includes amplification, filtering, oscillation, voltage regulation, and other analog circuits. It deals also with semiconductor devices used in industrial applications such as the basic theory, application, and operating characteristics of semiconductor devices.					
5. Pre-requirements for this course (if any):					
Electricity & Magnetism , PHY 1221					
6. Co-requisites for this course (if any):					
7. Course Main Objective(s):					

- **Understand the basic principles of circuit theorems.**
- **Develop and enhance the students' knowledge and understanding of the concepts of electronics.**
- **Appreciate semiconductor technologies and their use in basic circuits.**
- **Get a lot of practical experience in building all kinds of electronic circuits.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)**	**0**
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Define key electrical concepts-current, voltage, and resistance.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**State the basic scientific principles of electrical and electronic devices.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Describe the characteristics, operation and application of a broad range of electronic components, devices and equipment.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Outline formulates for solving electronic problems and analyzing electronic circuits.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	**Explain and summarize the basic knowledge gained from studying electronics course.**	**S1, S2**	▪ Lectures. ▪ Class discussions. Tutorials.	▪ Exams. ▪ Discussions. Participation.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	**S2, S3**	▪ Problem classes and group tutorial. Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. Homework.
2.3	**Communicate in a clear and concise manner orally, on paper and using IT for acquiring and analyzing information.**	**S4, S5**	• Lectures. • Class discussions. • Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Exams. ▪ Participation and activities of students in the course community and blackboard. ▪ Homework.
3.0	**Values, autonomy, and responsibility**			
3.1	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Participation. ▪ Homework. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**AC Fundamentals:** The Sine wave –Average and RMS values–The J operator – Polar and rectangular forms of complex numbers – Phasor diagram – Complex impedance and admittance- Concept of voltage and current sources – KVL and KCL- Application to AC circuits R, C, L, RL, RC, RLC - Resonance: Series resonance and parallel resonance RLC circuits.	8
2.	**Introduction to Semiconductor:** Atomic structure, semiconductors, conductor, Insulators, conduction in semiconductor, Pure semiconductor, recombination of electrons and holes Intrinsic and extrinsic semiconductors, N and P- type semiconductors, Mobility, Drift Velocity, Energy band gap. The potential barrier, Work function, Different type of electron emission, Applications of continuity equation for the study of junction behavior – Avalanche and zener breakdown.	8
3.	**PN Junction:** Depletion region – Junction capacitance – Diode equation (no derivation) – Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of: Junction diode, Zener diode, Tunnel diode and Varactor diode. Filter considerations.	8

4.	**Rectifiers:** Half wave and full wave and bridge rectifiers - power, efficiency and ripple factor for half wave and full wave rectifiers, Regulation – Harmonic components in rectified output.	6
5.	**Silicon Controlled Rectifier (SCR):** Structure and working of SCR. Two transistor representation, Characteristics of SCR. Application of SCR for power control.	4
6.	**Bipolar Junction Transistor (BJT):** PNP and NPN transistors–current components in BJT – BJT static characteristics (Input and Output) – Early effect-CB, CC, CE configurations (cut off, active, and saturation regions) CE configuration as two port network – Alpha and Beta of a transistor, Biasing and load line analysis – Fixed bias and self-bias arrangement. Transistor action, Transistor as an amplifier, Operating point, Load line, expressions for current gain, voltage gain, input impedance, output impedance and power gain. Power amplifier - power BJT - Thermal resistance - Maximum power- Class A, Class B, Class AB and Class C amplifiers -Basic operational amplifier- Differential amplifier.	8
7.	**Operational Amplifier fundamentals:** Characteristics – OpAmp parameters - inverting amplifier-non-inverting amplifier - unity follower - summing amplifier-difference amplifier. Differentiator, integrator, comparator using OP-Amps.	6
8.	**Field Effect Transistor (FET):** Field-Effect Transistors (FET): Construction and classification, Principle of operation, Characteristic curves, Characteristic parameters of the FET, Effect of temperature on FET, Common source amplifier, Common drain amplifier, Classification of MOSFET & UJT. Application of FET as voltage variable resistor and MOSFET as a switch – Advantages of FET over transistor.	6
9.	**Optoelectronic Devices:** Structure and operation of PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display.	4
10.	**Digital Electronics:** Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables – Positive and negative logic – Logic families and their characteristics – RTL, DTL, ECL, TTL and CMOS- Universal building blocks NAND and NOR gates.	4
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (class quizzes, homework, solving problems, etc.....)**	**weekly**	**10 %**
2.	**Midterm Exam 1**	**6thweek**	**25 %**
4.	**Midterm Exam 2**	**12thweek**	**25 %**
5.	**Final Exam**	**16thweek**	**40 %**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	- Floyd T. L., ***Electronic Devices, Prentice Hall***,9th Edition (2011).
Supportive References	- Horowitz P. and Hill W., ***The Art of Electronics, Cambridge University Press,*** 2nd Edition (1989). - Boylestad R.L. and Nashelsky L., ***Electronic Devices and Circuit Theory,*** Pearson Education (2005).
Electronic Materials	- **https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	- **Classrooms.** - **Labs.**
Technology equipment (projector, smart board, software)	- **Classroom equipped with a whiteboard and a projector.**
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	- **Students** - **Second examiner**	- **Indirect (The students complete the evaluation forms at the end of term.** - **Final exam is evaluated by the second examiner)**
Effectiveness of Students assessment	- **Instructors**	- **Direct (exams, HW, project, …)**
Quality of learning resources	- **Faculty** - **Students**	- **Indirect (surveys)**
The extent to which CLOs have been achieved	- **Instructors** - **Program Leaders**	- **Direct (excel sheet)**
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Quality Unit-Physics Department
REFERENCE NO.	Department council No. 06
DATE	26/09/2024