# Course Specification
## (Bachelor)

| | |
|---|---|
| Course Title: | **Applied Physics** |
| Course Code: | **PHY 1104** |
| Program: | **B.Sc. in Computer Science** |
| Department: | **Physics** |
| College: | **Science** |
| Institution: | **Imam Mohammad Ibn Saud Islamic University** |
| Version: | 3 |
| Last Revision Date: | **29/09/2024** |

## Table of Contents

## A. General information about the course:

### 1. Course Identification

| | | | | | |
|---|---|---|---|---|---|
| **1. Credit hours: 3(2 Lectures, 1 Lab, 0 Tutorial)** | | | | | |
| **3(2 Lectures, 1 Lab, 0 Tutorial)** | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☐Department | ☐Track | ☒ Others |
| **B.** | ☒ Required | | ☐Elective | | |
| **3. Level/year at which this course is offered: Level 2/Year 1** | | | | | |
| **4. Course general Description:** | | | | | |
| **This course covers the basics and applications of semiconductor devices and circuits, focusing on analysis, selection, biasing, and real-world uses. Students will learn to build, test, and troubleshoot analog and digital circuits using proper techniques and equipment. The lab sessions provide hands-on experience with electronic circuits, reinforcing key concepts and skills. Each class includes a short lecture introducing the experiment's procedures, concepts, and expectations for the lab report. Attendance and participation are required. Experiments are typically done in groups, but each student must submit an individual report.** | | | | | |
| **5. Pre-requirements for this course** (if any)**:** | | | | | |
| **General Physics, PHY 1103** | | | | | |
| **6. Co-requisites for this course** (if any)**: None** | | | | | |
| **7. Course Main Objective(s):** | | | | | |

- **Understand the basic principles of the circuit theorems.**
- **Develop and enhance the students' knowledge and understanding of the concepts of electronics.**
- **Appreciate the semiconductor technologies and their use in basic circuits.**
- **Get a lot of practical experience in building all kinds of electronic circuits.**
- **Provide a background in analogue and digital electronics.**
- **Give an understanding of the fundamental electronic components of computer hardware.**
- **Instruct students in the competent use of laboratory equipment to collect and record data, apply relevant mathematical models and perform required computations, and present the derived results as an application of a measured observation of the electronic physics.**

## 2. Teaching mode (mark all that apply)

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

## 3. Contact Hours (based on the academic semester)

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

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

| Code | Course Learning Outcomes | Code of PLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| **1.0** | **Knowledge and understanding** | | | |
| 1.1 | **Define key electrical concepts.** | | • Lectures.<br>• Tutorials.<br>• Class discussions. | ▪ Exams.<br>▪ Participation.<br>▪ Discussions. |
| 1.2 | **State the basic scientific principles of electrical and electronic devices.** | | • Lectures.<br>• Tutorials.<br>• Class discussions. | ▪ Exams.<br>▪ Homework.<br>▪ Quizzes. |
| 1.3 | **Describe the characteristics, operation and application of a broad range of electronic components, devices and equipment.** | | • Lectures.<br>• Class discussions.<br>• Tutorials. | ▪ Participation.<br>▪ Exams.<br>▪ Discussions.<br>▪ Homework. |

| Code | Course Learning Outcomes | Code of PLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| 1.4 | **Outline formulates for solving electronic problems and analyzing electronic circuits.** | | • Lectures.<br>• Tutorials.<br>• Class discussions. | ▪ Exams.<br>▪ Participation.<br>▪ Discussions. |
| 1.5 | **State the basic principles of logic circuit.** | | • Lectures.<br>• Tutorials.<br>• Class discussions. | ▪ Exams.<br>▪ Homework.<br>▪ Quizzes. |
| 1.6 | **Use the laboratory equipment to collect and record data and describe the derived results as an application of a measured observation of the electronic physics.** | | • Supervision by lab instructor<br>• Reading the required material in the online lab tutorial according to the experiments plan.<br>• Submitting an individual lab report.<br>• Performing lab. experiments at the scheduled times. | ▪ Discussion.<br>▪ Reports.<br>▪ Lab experiment check.<br>▪ Exams. |
| **2.0** | **Skills** | | | |
| 2.1 | **Explain and summarize the basic knowledge gained from studying electrical and electronic devices.** | | • Lectures.<br>• Class discussions.<br>• Tutorials. | ▪ Exams.<br>▪ Discussions.<br>▪ Participation. |
| 2.2 | **Develop the students ability to solve and analyze problems in physics related the topics covered by the course.** | | • Problem classes and group tutorial. | ▪ Exams.<br>▪ Discussions.<br>▪ Homework. |
| 2.3 | **Explain and use information from the output of experiment to draw conclusions.** | | • Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites). | ▪ Compare with standard results.<br>▪ Feedback and explanations. |
| 2.4 | **Summarize conclusions and write reports.** | | • Experiments setting up, data recording and calculations based on lab manual and lectures (co-requisites). | ▪ Compare with standard results.<br>▪ Feedback and explanations. |

| Code | Course Learning Outcomes | Code of PLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| 2.5 | **Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.** | | • Lectures.<br>• Class discussions.<br>• Tutorials.<br>• Encourage students to use electronic mail and internal network for submitting homework and assignments.<br>• Use digital library. | ▪ Exams.<br>▪ Participation and activities of students in the course community and blackboard.<br>▪ 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.** | | • Small team tasks<br>• Open discussion at classroom.<br>• Office hours. | ▪ Participation.<br>▪ Homework.<br>▪ Mini-project(s). |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1. | **An introduction to electric circuits:** Electrical power and energy – summary of terms, units and their symbols, Electric current and quantity of electricity, Potential difference and resistance, Linear and non-linear devices, Ohm's law, Conductors and insulators, Main effects of electric current – Resistance, and resistivity, Solution of series and parallel combination of resistances in brief, KCL and KVL2, Introduction to capacitors , Capacitance, Capacitors, Capacitors connected in parallel and series, Energy stored in capacitors, Energy stored, Inductance of a coil. | **6** |
| 2. | **A.C. Fundamentals and Single phase A.C. circuits:** Generation of Voltage and Current and their Equations, Definitions, RMS value, Average Value, Complex Algebra, Vector representation of alternating quantities, AC series and parallel circuit, Resonance in series and parallel circuits. | **5** |
| 3. | **Physics of Semiconductors:** Introduction to band theory, metals semiconductors and insulators, charge carriers in semiconductors, conductivity and mobility of charge carriers, concepts of Fermi level, Fermi level in Intrinsic and Extrinsic semiconductors, semiconductor junction diodes. | **5** |
| 4. | **PN-Junction Diode and its Applications:** PN Junction, Forward & Reverse Bias PN Junction, V-I Charac. Of PN Junction, Junction Break down, Zener | **5** |

| | | |
|---|---|---|
| | and Avalanche Break down, Diode Resistance, PN Junction Diode, V-I Characteristic and Diode Parameters, Diode Ratings or Specification, Photo Diode, Zener Diode, Full wave and half wave rectifiers, Bridges Rectifiers. | |
| 5. | **Transistor and its Characteristics:** Introduction of BJT, Transistor's components – emitter, base and collector, Transistor Construction and Biasing, Transistor Circuit Configuration: Common Base, Common Emitter, Common Collector Configuration, DC–Operating point, Bias Stabilization, Stabilization Techniques, Bias Compensation. | **5** |
| 6. | **Logic Circuits:** Introduction, Gates: AND, OR, NAND, NOR, NOT, Gate Applications (Diodes, Transistors). | **4** |
| **List of Topics (Laboratory)** | | |
| 1. | **Experiment 1:** Alternating Current with Coil and Ohmic Resistors | **2** |
| 2. | **Experiment 2:** Determining the Capacitive Reactance of a Capacitor in an AC Circuit. | **3** |
| 3. | **Experiment 3:** Recording the Current – Voltage Characteristics of a Diode. | **3** |
| 4. | **Experiment 4:** Half-Wave Rectifier Circuit. | **3** |
| 5. | **Experiment 5:** Full-wave Rectifier Circuit. | **3** |
| 6. | **Experiment 6:** Capacitor Filter Circuit. | **3** |
| 7. | **Experiment 7:** Zener-Diode Characteristics. | **3** |
| 8. | **Experiment 8:** Voltage Stabilization with Zener Diode. | **3** |
| 9. | **Experiment 9:** Bipolar Transistor Characteristics. | **3** |
| 10. | **Experiment 10:** Field Effect Transistor (FET). | **3** |
| 11. | **Revision.** | **1** |
| **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. | **Laboratory** | **During the term** | **30 %** |
| 3. | **Midterm Exam** | **8th week** | **20 %** |
| 4. | **Final Exam** | **16th week** | **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).<br>- Horowitz P. and Hill W., ***The Art of Electronics, Cambridge University Press,*** 2nd Edition (1989). |
| **Supportive References** | - 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** | - Laboratory Manual supplied by the Department of Physics.<br>- Laboratory Manual is available at the website of the Department of Physics. |

### 2. Required Facilities and equipment

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

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | **Students**<br>**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**<br>**Students** | **indirect (surveys)** |
| The extent to which CLOs have been achieved | **Instructors**<br>**Program Leaders** | **Direct (excel sheet)** |
| Other | | |

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

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