COURSE SYNOPSIS
BACHELORS OF SCIENCE (HONS) INDUSTRIAL PHYSICS
UNIVERSITI TEKNOLOGI MARA

Calculus 1

This course is an introductory course in calculus. Students will learn the basic concepts of calculus, which includes functions, limits and continuity. Students will then study one of the most powerful tools in mathematics, namely, the derivative of a function. Applications of the derivative are also discussed.

Physics 1.

Physics for scientists and engineers 1 has been compiled for students taking physics at the first year university level for students majoring in the technical fields. This subject comprises of two parts: Physics for scientists and engineers 1 and Physics for scientists and engineers 2. It assumes a concurrent exposure in calculus-based mathematics. The students will be expected to understand physical concepts and to be able to analytically derive solutions to realistic problems.

Physics for scientists and engineers 1 covers topic in mechanics, matter, vibrations, waves and thermodynamics

General Chemistry.

This is an introductory chemistry course towards providing a firm foundation in chemical concepts and principles. This course covers chemical equations and calculations, the mole concept, acids and bases, the periodic table, oxidation-reduction reactions, electronic structure of atoms, chemical bonds and gases

Algorithm Fundamentals.

This course is an introduction to problem solving using computers. It emphasises various aspects of problem solving, mainly consisting of the problem domain, phases of problem solving and basic techniques in designing a solution. The approach to problem solving is via the object-oriented paradigm. Students will be familiarised with using objects in developing programs. At this stage, the emphasis will be on computer problem solving rather than syntactical aspects of the chosen programming language

Calculus 2.

This course discusses the concept that forms the basis of integral calculus: the definite integral. Students will also be exposed to basic concepts and fundamental results associated with infinite series which is very useful in advanced courses in mathematics, physics and engineering

Physics 2.

Physics for scientists and engineers 2 is a continuation of Physics for scientists and engineers 1. It covers topics in electricity, magnetism, light, optics and modern physics
Circuit Theory 1

The course covers the basic network theory. It deals with direct current (D.C.), basic theorem and electrical quantities relationship in circuit network, both in direct and alternating current. Magnetic circuit and balanced 3-phase system are also introduced.

Differential Equations.

This subject consists of two topics in differential equations, namely Ordinary Differential Equations and Linear Differential Equations. Students will learn about the existence and uniqueness of solutions to differential equations. They will also study the various methods of solving differential equations of several types. Some applications of differential equations are also discussed.

Electricity and Magnetism 1

The subject covers the material on fields with topics on the electromagnetic model, vector analysis, static electric fields, and solution of electromagnetic problems, steady electric currents, static magnetic fields, time-varying fields and Maxwell's Equations.

Modern Physics 1

This subject is an overview of modern physics. It is a new way of modeling physical reality transformed the way scientists study fundamental particles, nuclei, atoms and molecules. Looking at Einstein relativity (relation between space and time) and also quantum mechanics.

Solid State Physics

This course covers topics on the basic crystal structure and x-ray diffraction of waves by crystals and physical properties of crystalline solids as well as a fundamental understanding of atomic structure and thermal, dielectric, magnetic, semiconducting, optical and superconducting properties of solids.

Electronics and Instrumentation Lab

This laboratory course provides students with practical hands-on experience following the theories and concepts taught in class. Experiments will be conducted in areas of digital and analog electronics, microprocessor, pneumatic, hydraulic, interfacing and computer language.

Electronics Fundamentals and Devices

This course introduces solid state and some basic electronic devices made from it followed by the operating concepts of the electronic devices, their characteristics and applications in simple electronic circuits.

Thermal Physics

This course will interactively engage students cognitively and scientifically in areas of thermal physics. Students will define concepts, state and explain laws and theories and make predictions as to the possible outcome of an event. They will be able to verbally and in writing, discuss the results and relationships with peers and facilitators. The designated lecture session is used to discuss laws theories and concepts leading to its relation to an understanding of the workings of a thermodynamics system. Lecture sessions employ a mixture of lectures and active learning (self and peer discussions). The outcomes shall be assessed through a variety of tools which include
the traditional paper examination via quizzes and tests and also informal interviews during classroom engagement like tutorials and student’s participation.

**Industrial Physics Lab I**

Industrial Physics Lab 1 is a lab based course designed to give the opportunity to operate and characterize essential semiconductor tools/process such as lithography, furnace, wet bench, spin coater and measurement equipment in a cleanroom. The experience and knowledge gained will be useful in the subsequent fabrication of basic semiconductor devices class

**Mechanical Measurement and Testing Techniques**

This course is designed to introduce the students to a range of mechanical measurement techniques that are widely used in laboratories and industries. Emphasize will be placed on mechanical properties of solid state materials especially metals. It assumes that students will have had exposure to concepts and principles of undergraduate physics. One half of the course covers destructive mechanical measurement and testing while the other half covers non-destructive mechanical measurement and testing

**Electromagnetic Measurement and Testing Techniques**

This subject is designed to introduce the research students to a broad range of characterization techniques that have become currently available for different materials. Emphasize be placed on characterization of electrical, magnetic, and optical of solid materials. It assumes that students will have had exposure to concepts and principles of undergraduate physics such as electricity, electromagnetic, magnetic and optic. Students will able to distinguish different techniques that can be used for different materials in measurement, testing, and characterization. The outcomes shall be accessed through a variety of tools which include paper examination, tests, quizzes, and assignment.

**Electronics**

This course is to provide a clear understanding on the operation of cascade transistors and operational amplifier in linear electronics systems and introduces digital principles necessary for understanding basic digital systems.

**Semiconductor Process Technology**

Semiconductor Process Technology is course designed to give students knowledge, concept understanding of various semiconductor processing involved in the fabrication of integrated circuits. After learning each individual process students will be able to integrate the processes and designing the process flow of the fabrication of device. Students will also be exposed to the relationship between various semiconductor based industries

**Digital System 1**

This course introduces the basic building blocks of practical digital systems. It includes techniques necessary for the design of simple digital circuits and the analysis of sequential circuits.
Industrial Physics Lab 2

The course is designed to give students the experience in designing the mask, fabricate a transistor and characterize the transistor independently. Every student will be given one wafer each to fabricate their own device based on their proposal, mask design and process flow. At the end of this project, the fabricated device will be tested and characterized. A viva will be held to observe the project works device finally fabricated and characterized.

Final year project 1

This is the first part of the Final Year Project Course. Students will be introduced to conceptual issues regarding organizing, designing and conducting research in general and specifically in Physics Disciplines that are related to industrial usage and activities. Throughout the course, students will be guided into producing a viable research proposal on topics suggested by the faculty members.

Industrial Training

Students are required to undergo two-months training in various physics related industries. At the end of the training period, students are required to submit a written report and deliver an oral presentation. Written report and oral presentation will be assessed.

Special Topics in Microelectronics

The course will study a selected advanced topic and techniques of current interest in microelectronics. Teaching and learning will focus on concepts not included in the existing course syllabus and includes recent development and progress in the subjected area.

Final Year Project 2

This is the final of the final Year Project Course. Students will carry out research and experimentation based on the Research Proposal produced in the PHY602 course. Throughout the course students, students will spend most of their time in the university’s laboratory or other outside laboratories recognized by the university to carry out experiment under the supervision of the faculty supervisor. They will be guided into producing a written report on the results of the experiment.

Optoelectronics

The aim of this course is to provide final year students with the introduction to optoelectronics. The study of optoelectronics covers the interaction of light (wavelength range from about 0.2 μm to 20 μm) with matter and the devices which depend on these interactions. Fiber optics communication provides an excellent example of a system that incorporate a wide range of devices based on semiconductors and based on behavior of light in crystals. The course intends to provide an emphasis on the fundamental principles underlying the operation of the devices and systems. The study on optoelectronics depends greatly on the subject of waves and optics, and solid state physics and the students are expected to have some fundamental background knowledge of these fields.
However, the topics on the fundamental of light wave and solid-state physics will be covered in this course to provide brief reviews and giving emphasis on certain content. Description and elementary analysis of sub-systems such as transmitters (light source), transmission (optical amplifiers/repeaters) and receivers (photo-detector) is essential in the comprehending the structure and functionality of the optical communication system.
Basic principles and ray theory in planar and fiber optic waveguides as passive and active optical component are discussed. Other topics include laser, light emitting diode (LED) and its spectral
properties, efficiency; stimulated emission, light-electron confinement, losses, gain and lasing threshold conditions.

**Quality Control and Assurance**

This module covers both control and quality assurance. Topics covered will be quality cost, quality circles, statistical tools for quality control, company wide planning for quality and introduction to quality manual.