**Sohar University**
**Faculty of Engineering**
**Mechanical and Mechatronic Engineering**
**Courses Description**

| | Course Code & Name | Description |
|---|---|---|
| **Level 1: Semester 1** | **MATH1000:** Mathematical Foundations | This course covers basic mathematics that will be necessary in any degree or career that involves quantitative skills. The course covers many aspects of analysing functional relationships. Graph sketching is useful in picking trends and modelling economic or physical systems. The course will cover limits and continuity of functions. Carrying on from this, the calculus of derivatives and integrals will be introduced. Any system, which varies with time, requires knowledge of derivatives. Also, the theory of integration is important for differential equations. |
| | **COMP1500:** Introduction to Programming | This course will enable you to solve engineering problems, develop computer algorithms, acquire working knowledge of C++ programming and experience some "hands-on" computer lab activities. |
| | **ENGG1013:** Engineering Drawing and Computer Drafting | This course will introduce the standards, conventions, techniques and tools of technical graphics so that the students will be able to convey graphically the ideas and information necessary for the construction or analysis of machines, structures and systems. In addition Computer Aided Drafting is also covered and practiced using AutoCAD. |
| | **CHEM1020:** General Chemistry | General Chemistry deals with the Properties of gases, solids, & solutions, phase changes, Thermochemistry, Equilibria with applications to acid – base chemistry & to solubility of salts, Electrochemistry and kinetics. This course will introduce the students the fundamental concepts about various states of matter. It will enhance their knowledge on mass and energy conversion .In general terms the course is aimed to make the student understand the basic principles of chemistry. |
| | **UNIR1000:** Communicatio n Skills | This course is designed to provide students with those skills required to communicate effectively and efficiently at their future work place and increase their career prospects. Being directed towards the work environment, the course intends not just to familiarize students with the functional language they will need to employ in their future jobs, but also to build up their confidence in communicating in English and increase their fluency. Also the course will enlarge students' knowledge of the business world. |

| | Course Code & Name | Description |
|---|---|---|
| Level 1: Semester 2 | **ENGG1023:** Engineering Materials | This introductory course involves the development of the following concepts: Types of Materials-Metals, ceramics, and polymeric materials. Bonding between atoms-The characteristics of atoms, atomic structure, bonding and inter-atomic forces. Describe quantitatively and qualitatively the structure of SC, FCC, BCC and HCP crystals. The microstructure and Properties– the way in which large groups of atoms are arranged in a solid on the microscopic scale – governs many of the properties of a material; Processing-Structure-Properties-Performance. Determine the mechanical properties of a material from its stress-strain diagram. Determine steady state and transient diffusion profiles. Determine the equilibrium phase structures in binary alloys. Describe techniques to prevent corrosion in metal. |
| | **ENGG1010:** Applied Mechanics | Mechanics refers to the branch of science that studies the way in which forces affect bodies either at rest or in motion. Engineers are concerned with the way that mechanics can be applied so that they can determine how objects will react to forces that are applied to them. This allows the engineer to ensure that an object under a given load will serve its intended purpose. Thus the title of this course, Applied Mechanics. Engineering students learn how to analyze and predict the behaviour of physical systems in this course. This course comprises two major sections - Statics and Dynamics. Statics is the study of objects in a state of force equilibrium and dynamics is the study of objects in motion. While this course leads to skills that an engineer can directly apply to basic analysis and design, applied mechanics also forms the basis for more advanced courses taken by students during their studies. These range from structural analysis, advanced dynamics, fluid and particle mechanics through to engineering acoustics. |
| | **ELEC1100:** Principles of Electrical Circuits | The course provides the necessary skills in the analysis and design of electrical and electronic circuit and components which are fundamental to the study of electrical systems, electronics, computer systems and communications systems. The course covers the fundamental parameters of electrical system such as voltage, current, power, energy, resistance, capacitance, and inductance. DC circuit analysis theorems such as Ohms law, Kirchhoff's laws, node analysis, Mesh analysis, Thevenin's theorem, Norton's theorem are covered. The concept of AC circuit including sinusoidal waveform interpretation and the basic RLC circuit analysis also covered. |
| | **MATH1100:** Calculus & Linear Algebra | The course provides an exposition of appropriate results in the study of basic differential equations, basic linear algebra, and vector calculus with emphasis on methods and techniques that have proved relevant in a wide variety of applications. Students should gain knowledge of various mathematical tools and be able to apply these tools to problems from various sources. |
| | **UNIR1001:** Oman & Islamic Culture | The course provides introduction to Islamic Culture, its importance, resources and characteristics, Islamic culture and contemporary events, Omanis role in spreading Islam and building Islamic civilisation. |

| | Course Code & Name | Description |
|---|---|---|
| Level 2: Semester 1 | **MECH2308** Strength of Materials | Relationships between stress and strain in deformable solids are studied. Analysis is applied to axially-loaded members, circular shafts, beams and columns. Combined stresses, statically indeterminate Systems and properties of structural materials are included. Stress and strain analysis, principal stresses/strains, Mohr's Circle and combined loading. Thin/thick wall cylinder analysis, torsion, power transmitting, beam bending, transfer shear and buckling in beam are also covered. |
| | **MECH2118** Manufacturing Processes | Course Description: This course is meant to provide manufacturing processes understanding; comparison between materials properties, processing & the function of a component; design & manufacture of complex products. It covers wide range of manufacturing processes. The course starts with a review on material properties and presents in details the processes of casting (sand, die, precision casting, etc.), forming (forging, rolling, drawing, and extrusion), sheet metal work, |
| | **ELEC2113** Instrumentation and Measurements | Course Description: Measurement and Instrumentation introduces undergraduate engineering students to the measurement principles and the range of sensors and instruments that are used for measuring physical variables. The course also covers data acquisition and signal processing, sampling theory and linkage to acquisition/processing software, providing students with a more modern approach to the subject matter, in line with actual data acquisition and instrumentation techniques now used in industry. |
| | **MATH2100:** Calculus & Statistics | This course deals with statistics and probability for engineers. The following topics are covered: data representation, mean, median, range, mode and standard deviation. Probability topics include experiments, outcomes, events, permutations and combinations, Random variables, probability distributions, median and standard deviation as well as the normal, binomial, and hyper-geometric distributions. The second part involves series, arithmetic series and geometric series and their applications. The third part covers the application of Laplace Transforms to solve differential equations and systems of differential equations with constant coefficients. In particular, the following are to be introduced in this part: Laplace transform definition, Inverse Laplace Transform, linearity, shifting, Transforms of derivatives and integrals, differential equations, Unit step function, second shifting theorem, Dirac's Delta function, Differentiation and integration of transforms, Convolution and integral equations. In the final part of the course, the three main types of linear partial differential equations (PDEs) are introduced in the context of applications to vibrations of a stretched string, steady and unsteady diffusion. Fourier's method of separation variables and superposition is presented in this context, including an introduction to Fourier Series. |
| | **UNIR2001A B** Entrepreneurship A and B | |

| | Course Code & Name | Description |
|---|---|---|
| Level 2: Semester 2 | **MECH2413** Fluids Mechanics | The course covers the following topics: Introduction and basic fluid properties. Fluids statics, pressure measurements Fluid Kinematics, application of conservation laws, continuity, momentum & energy balances. Bernoulli equation, flow measurement. Viscous flow in Pipe, pumps. External flow. Dimensional Analysis |
| | **METR2000** Fundamentals of Mechatronics | Course Description: This course deals with the field of mechatronics. It aims to equip the second level students of both Mechanical and Mechatronics Engineering and Electrical and Computer streams with detailed engineering knowledge in the related disciplines of the field. The course discusses the main components of Mechatronics systems and provides essential tools required to implement such systems in industrial and real life applications. The course focuses on Actuators (including Electrical, Hydraulics, and Pneumatics types), Sensors, ADC/DAC, Signal processing, Robotics, CNC machines, Block diagrams of Mechatronics systems, Computer vision systems and related image processing. |
| | **MECH2108** Mechanical Drawing & Design Fundamentals | This course will emphasize on developing students ability to analyze a structure and to provide a realistic applications encountered in professional practice. the students taking this course will be introducing to elementary structural analysis techniques, analysis of statically determinate beams, trusses, frames, Structural Loading, Structural instability, influence lines, deflections by moment |

| | | |
|---|---|---|
| | | areal method and conjugate beams and computer software for structural analysis. The students will also be introduced to the principles of structural design |
| | **UNIR2000** Organisational Communications | The purpose of the course is to equip students with the necessary skills/tools that are required in communicating within an organization. It focuses on understanding the various types of communication that organizations use and ways in which to make and create effective communication. |
| | **UNIR1002:** Arabic Language Skills | It involves simple definition about Arabic language branches and skills (speaking, reading, writing) in addition to the fundamental rules that help mastering these skills. |

| | **Course Code & Name** | **Description** |
|---|---|---|
| **Level 3: Semester 1** | **MECH3800** Non Destructive Testing & Metrology | Non Destructive testing methods have a significant importance in production and service operations as far as the quality assurance of the products are concerned. This course provides the knowledge for the usage of non-invasive techniques to determine the integrity of a material, component or structure. Six important and commonly used NDT methods such as eddy current, magnetic particle, Penetrant, X-ray radiography, ultrasonic flaw detection and Thermography are discussed. The lessons also give emphasis on the comparison and selection of different NDT techniques and choice of using a method in relation to materials, defect type, position and weld geometry.<br>The second part, metrology covers the theoretical and practical aspects of dimensional metrology including the principle and construction details of various metrological instruments used for linear measurements, angular measurements , surface texture etc and the study of comparators, gauges etc. |
| | **METR3200** Control System Engineering | Course Description: Introduction to control system design; system modelling principles for electrical & mechanical systems; the Laplace transform; block diagram modelling; open & closed loop control; role of feedback; transient & steady state performance; root locus; frequency response analysis; compensator design, practical issues in the implementation of control systems. |
| | **MECH3408** Heat Transfer | Course Description: The course covers the following topics: Fundamental concepts of heat transfer; conduction, convection, and radiation. One and two dimensional heat transfer modes. Heat-exchanger types, principles and design. Boilers and furnaces types and principles. |
| | **ENGG3700:** Numerical Analysis | This introductory course in numerical analysis provides the Knowledge and methods required to solve numerically, practical mathematical problems frequently encountered in engineering applications. This course include Mathematical modelling & error analysis, programming with MATLAB, root finding, solving of linear algebraic equations, curve fitting, performing numerical integration and differentiation and solving ordinary differential equations. |

| | Course Code & Name | Description |
|---|---|---|
| Level 3: Semester 2 | **METR3013** Programmable Logic Controllers and Automation | Course Description: This course will introduce you to the fascinating world of industrial automation and programmable logic controllers (PLCs). The course teaches the principles of Programmable Logic Controllers (PLCs), and how they are used to control industrial processes. Allen-Bradley Micro Logix PLC will be used to learn the basics of programming and creating automated industrial processes. Topics covered include PLC hardware, number systems and codes, fundamentals of logic, PLC programming, wiring and ladder diagrams, programming timers, and programming counters. Concepts of logic control with electronic programmable controllers Step-action diagrams for graphic sequence control illustration PLC programming for basic logic functions PLC programming for timer, counter, and keep relay functions Logic lines and ladder diagram presentation Step-counter concept of programming of PLC based sequential controls Ladder diagram generation. Testing of PLC program with will also be covered for both dry run and hot run tests. Hands-on integration of PLC to Stepper motors, Traffic lights and Fluid power control systems are examples of applications considered in the course. |
| | **MECH3313** Advanced Machine Design and Finite Elements | Course Description: The course deals with the prediction of failure of machine components and structures, by computer modeling of stresses using the finite element method and by assessment of criteria to predict fracture. The lectures on the finite element method will focus on issues in modeling and on the interpretation of results, rather than emphasizing the underlying mathematical theory. The lectures on fracture mechanics will consider issues on theoretical strength of solids, concepts of stress concentration, and application of fracture mechanics to structural failures and fatigue. |
| | **MECH3508** Thermodynamics | Course Description: This course will emphasize the energy and entropy considerations as applied to energy production processes. Students will develop the skills needed to analyze steady state flow processes, reversible and adiabatic processes. Specific examples which are included in the course include: steam power plants, gas power plants, refrigeration cycles, pumps and compressors. |
| | **UNIR3000** Research Methodology | The purpose of the course is to equip students with the necessary writing and language skills required to undertake an independent research project. It focuses on developing academic writing skills and understanding the various steps in the research process. This will include an introduction to the research process, reviewing and analysing sources, incorporating sources, and applying correct academic format. |

| | Course Code & Name | Description |
|---|---|---|
| Level 4: Semester 1 | **ENGG4801A** Thesis Project (2 units) | The thesis Project course is aim to develop the student's research and problem solving skills. The course involves the specification, development and evaluation of an individual research project on a specific topic or problem within the broad fields of engineering streams. The student is expected to systematically plan and manage the project, and to clearly present the work and its contribution in context of the current literature and prior art. |
| | **MECH4213** Robot Dynamics and Vibrations | Course Description: This course consists of two parts. Part 1 provides an in-depth coverage of the central topics in robotics, namely geometry, kinematics, differential kinematics, dynamics of robot manipulators. Part 2 of the course deals with the fundamentals mechanical vibrations: free, force, damped and undamped, vibration isolation and multi degree of freedoms vibration systems. Practical Sessions: analyses of robot dynamics and vibration problems using MATLAB. |
| | **MECH4913** Design Project A | Course Description: This course is a capstone design course. It is the continuation of Mechanical design courses in level 2 and level 3. The course focuses on detail design of a mechanical, Mechatronic or thermal system. The students will apply their knowledge to design a mechanical or mechatronic system by working on a term project. They will work in teams, prepare written and technical presentations, and determine the economical, environmental, and ethical aspects of a proposed design. |
| | **METR4913** Computer Vision and Image Processing | This course will introduce students to vision sensors, computer vision systems and digital image processing. It also introduces the areas of artificial intelligence that relate to fundamental issues and techniques of computer vision and image processing. Emphasis will be on physical, mathematical, image-processing, pattern recognition, and feature extraction aspects of vision.<br>The course will have a proper Lab activities to enable students understand the breadth and depth of the lecturing materials |

| | Course Code & Name | Description |
|---|---|---|
| **Level 4: Semester 2** | **ENGG4801B:** Thesis Project (2 units) | The thesis Project course is aim to develop the student's research and problem solving skills. The course involves the specification, development and evaluation of an individual research project on a specific topic or problem within the broad fields of engineering streams. The student is expected to systematically plan and manage the project, and to clearly present the work and its contribution in context of the current literature and prior art. |
| | **MECH4012** Advanced Manufacturing Technology | Course Description: The manufacturing industry requires skilled professional engineers that are well equipped with knowledge on advanced engineering techniques to enable them plan, execute and supervise engineering tasks especially in areas that involve advanced technologies and equipment. The aim of this course is to help in the preparation of students for future roles in meeting these requirements. The "Advanced Manufacturing Technology" course is meant to provide the students (in the fourth year of Mechanical and Mechatronic Engineering stream) with an understanding of specific advanced and emerging manufacturing technologies and skills relating to the implementation of these technologies in modern industry. It is expected that students passing this course will have sufficient knowledge to direct the design and implementation of specific technologies and/or processes addressed during the course in the context of a particular organization. This course focuses on advanced and emerging manufacturing technologies which can be deployed to increase the product quality, manufacturing efficiency, and productivity of modern manufacturing industry. The course provides further advancement to the knowledge already delivered to students while studying (MECH2118 Manufacturing Processes) course. Hence it discusses more advanced manufacturing technologies and provides deeper understanding of the manufacturing field. |
| | **MECH4914** Design Project B | Course Description: This course is the continuation of Capstone Design course MECH4913A. The course focuses on detail design of a mechanical, Mechatronic or thermal system. The students will apply their knowledge to design a mechanical or mechatronic system by working on a term project. They will work in teams, prepare written and technical presentations, and determine the economical, environmental, and ethical aspects of a proposed design. |
| | **MECH4513** Refrigeration & Heat Engines | Course Description: This course is a study of thermodynamics as applied to Heat engines (Prime movers), refrigeration & air conditioning. The first part of the course covers the construction, operation, cycle & performance analysis and effect of operating conditions of Internal combustion engines, steam & gas turbines (prime movers).<br>Refrigeration and air-conditioning deal with various air refrigeration cycles, vapour compression refrigeration systems, vapour absorption refrigeration systems, cascade refrigeration systems, Refrigerants, components of refrigeration system, various air-conditioning processes and systems. |