



Sohar University
Faculty of Engineering

MECHANICAL & MECHATRONIC ENGINEERING PROGRAM

COURSE DESCRIPTIONS

AY 2016-2017

Level-1

Semester-1

Course Title: General Chemistry
Course Code: CHEM1020
Course Description: 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; CHEM1020 is aimed to make the student understand the basic principles of chemistry.
Course Title: Introduction to programming
Course Code: COMP1500
Course Description: 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.



Course Title: Engineering Drawing
Course Code: ENGG1013
Course Description: In engineering drawings are widely used, they communicate solutions to technical problems. However, these drawings must be produced according to certain standards and conventions so they can be read and accurately interpreted by anyone who learned those standards and conventions. 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. The course also introduce the students the area of Computer Drawing using AutoCAD. Students will learn and practice how to create and modify engineering drawings using AutoCAD package.

Course Title: Mathematical Foundation
Course Code: MATH1000
Course Description: 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.



Course Title: **Communication Skills**

Course Code: **UNIR1000**

Course Description:

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.



Semester-2

Course Title: **Applied Mechanics**

Course Code: **ENGG1010**

Course Description: 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.

Course Title: **Principles of Electrical Circuits**

Course Code: **ELEC1100**

Course Description: The course provides the necessary skills in the analysis and design of electrical circuit and components which are fundamental to the study of electrical systems, electronics, computer systems and communications systems. The course covers the fundamental parameter 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.



Course Title: **Calculus and Linear Algebra**

Course Code: **MATH1100**

Course Description: To provide 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.

Course Title: **Engineering Materials**

Course Code: **ENGG1023**

Course Description: 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.

Course Title: **Oman & Islamic Studies**

Course Code: **UNIR1001**



Course Description:

يتناول هذا المقرر دراسة شاملة للتطور التاريخي لعمان وفق الآتي: عمان في العصور الإسلامية, عمان في العصر الحديث, عصر النهضة المباركة في عمان, دور أهل عمان في نشر الإسلام والحضارة الإسلامية ، الإسهامات الفكرية والثقافية ، والإسهامات الملاحية والتجارية



Level-2

Semester-1

Course Title: : **Strength of Materials**

Course Code: **MECH2308**

Course Description: Engineers need to be familiar with the fundamental principles and concepts in materials and structures in order to be able to design structures to resist failures. This course deal with topics related to elastic and elastic-plastic behaviour; plane stress and strain; constitutive relationships, principal stress; stresses in thin cylinders; bending and shearing stresses in beams; deflections of beams; Euler buckling; short and long columns; torsion etc.

Course Title: **Manufacturing Processes**

Course Code: **MECH2118**

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, machining, grinding and abrasive cutting, heat treatment, surface processing, welding brazing and soldering.



Course Title: Instrumentation and Measurements
Course Code: ELEC2113
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.
Course Title: Calculus and Statistics
Course Code: MATH2100
Course Description: 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.



Semester-2

Course Title: Mechanical Drawing & Design Fundamentals
Course Code: MECH2108
Course Description: This course consists of two sections. The first section (Part A) covers mechanical drawing and the second (Part B) deals with design aspects of mechanical components and assemblies. Mechanical drawing cover the areas of fundamental principles of machine drawing and dimensioning, orthographic projections, Sectional views of various mechanical components, Thread fasteners, keys, cotter joint, Knuckle joints, flanged couplings and pulleys, Bearings, Rivets , Welds and Production of detail and assembly drawings of mechanical components. Drawing of mechanical components with Auto Cad software is also included in the curriculum. The second part of the course is dedicated to design of elementary mechanical systems. The objective of this part is to acquaint mechanical engineering students with the behavior and limitations of common machine parts. This part covers analysis and design of common machine components and assemblies such as Thread fasteners, Bearings, Springs, Shafts, Keys, Knuckle joints, Gear & gear trains, Belts, etc. by applying the principles of mechanics, machine drawing and strength of materials. The characteristics of useful life and failure prediction of each type of element are also studied.

Course Title: Organizational Communications
Course Code: UNIR2000:
Course Description: The purpose of the course is to equip students with the necessary skills/tools that are required in communicating within an organisation. It focuses on understanding the various types of communication that organisations use and ways in which to make and create effective communication.



Course Title: Fundamentals of Mechatronics
Course Code: METR2000
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.

Course Title: Fluids Mechanics
Course Code: MECH2413
Course Description: 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.

Course Title: Arabic Skills
Course Code: UNIR1002:
Course Description: يتناول هذا المقرر قضايا مهمة أساسية في موضوعات اللغة العربية بطريقة ميسرة ومعقولة : النحو، والصرف، والبلاغة ، والإملاء، والترقيم، والنصوص الأدبية ، والمعجم ، ويعرض لها من خلال نماذج تطبيقية ، مع مراعاة مهارات اللغة الأربعة : القراءة ، الكتابة، والاستماع، والمحادثة .



Level-3

Semester-1

Course Title: **Non Destructive Testing & Metrology**

Course Code: **MECH3800**

Course Description: 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. 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.

Course Title: **Numerical Analysis and Optimization**

Course Code: **ENGG3700**

Course Description: 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 Title: **Control System Engineering**

Course Code: **METR3200**

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.

Course Title: **Heat Transfer**

Course Code: **MECH3408**

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.



Semester-2

Course Title: Programmable Logic Controllers and Automation
Course Code: METR3013
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.

Course Title: Thermodynamics
Course Code: MECH3508
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.



Course Title: **Advanced Machine Design & Finite Elements**

Course Code: **MECH3313**

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.

Course Title: **Research Methodology**

Course Code: **UNIR3000**

Course Description: 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.



Level-4

Semester-1

Course Title: Control systems engineering
Course Code: METR3200
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.

Course Title: Signal and Image Processing
Course Code: ELEC4600
Course Description: This course covers the theory and practice of processing analogue signals on a digital computer. The course covers the complete spectrum of modern digital signal processing (DSP) techniques from signal acquisition; digital representations of time and spatial domain signals; signal processing; and digital signal conversion to analogue. The theory covered in this course is essential for the complete engineering understanding of many modern multimedia devices such as mobile phones, mp3 players, digital cameras, digital image and video storage and transmission.

Course Title: Special Topics A
Course Code: MECH4950
Course Description: Any of the specialized course is delivered as special topics. The courses which are commonly offered but not limited to are Advanced manufacturing technology, Industrial maintenance, gas dynamics, Tribology, IC Engines, Fatigue Analysis etc.



Course Title: Thesis Project A
Course Code: METR4900A
Course Description: The purpose of METR4900 is 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 Mechanical and Mechatronic Engineering. 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.

Semester-2

Course Title: Special Topics B
Course Code: MECH4960
Course Description: Any of the specialized course is delivered as special topics. The courses which are commonly offered but not limited to are Advanced manufacturing technology, Failure Analysis, Industrial maintenance, gas dynamics, Tribology, IC Engines etc.

Course Title: Renewable and Sustainable Energy
Course Code: ENGG4000
Course Description: : Energy and Sustainable Development, Non-Renewable Energy , Renewable Energy, Solar Energy, Photovoltaic, Wind Energy, OTEC Energy, Biomass Energy, Geothermal Energy, Fuel Cells, Hydrogen Economy, Energy Systems, Climate Change & Energy, Life Cycle Analysis, Atmospheric Pollution, Energy Sustainability Metrics, Energy Conservation & Optimization, Energetics / Exergetics, Sustainability and Business, Energy Storage & Management.



Course Title: **Refrigeration and Air Conditioning**

Course Code: **MECH4500**

Course Description: This course is a study of thermodynamics as applied to refrigeration and air conditioning .The lectures on refrigeration deal with analysis of air refrigeration cycles, simple vapor compression refrigeration systems, p-h charts, comparison of theoretical and actual cycles, performance improvement in simple vapor compression system, compound vapor compression systems, vapor absorption refrigeration systems, cascade refrigeration systems, classification of refrigerants and properties, components of VCR etc.

Air conditioning deals with Psychrometry, thermodynamics for human comfort, sensible heating & cooling, Psychrometric processes, various air-conditioning systems, Winter air conditioning, summer air conditioning, heating & cooling load calculations, year round air conditioning, unitary and central systems, principles of air distribution etc.

Course Title: **Thesis Project B**

Course Code: **METR4900B**

Course Description: The purpose of METR4900 is 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 Mechanical and Mechatronic Engineering. 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.