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BACHELOR OF ENGINEERING TECHNOLOGY
CRS1201286

Common stream

SEMESTER 1					
5 common subjects	**HEETCM100** Professional Engineering Technologist	**HEETCM101A** Engineering Mathematics I	**HEETCM102A** Introduction to Digital Electronics & Programming	**HEETCM103** Engineering Measuring Equipment	**HEETCM104** Engineering Design and Practice
PRE-REQUISITE					
SEMESTER 2					
5 common subjects	**HEETCM201** Material Science	**HEETCM202A** Engineering Mathematics II	**HEETCM203A** Engineering Mechanics (Statics)	**HEETCM204A** Engineering Mechanics (Dynamics)	**HEETCM205** Engineering Practice II
PRE-REQUISITE	***HEETCM100***	***HEETCM101A***	***HEETCM101A***	***HEETCM101A***	***HEETCM104***
SEMESTER 3					
5 common subjects	**HEETCM301A** Engineering CAD 2	**HEETCM302** Industrial Automation	**HEETCM303** Strength of Materials	**HEETCM304A** Programmable Logic Controller (PLC)	**HEETCM305** Engineering Practice III
PRE-REQUISIT	***HEETCM104***	***HEETCM101A HETCM102A***	***HEETCM101A HEETCM201 HEETCM203A***	***HEETCM101A HEETCM102A***	***HEETCM104 HEETCM205***

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Common stream

Semester 1

- HEETCM100 – Professional Engineering Technologist
- HEETCM101A – Engineering Mathematics 1
- HEETCM102A – Introduction to Digital Electronics and Programming
- HEETCM103 – Engineering Measuring Equipment
- HEETCM104 – Engineering Design and Practice

Semester 2

- HEETCM201 – Materials Science
- HEETCM202A – Engineering Mathematics 2
- HEETCM203A – Engineering Mechanics (Statics)
- HEETCM204A – Engineering Mechanics (Dynamics)
- HEETCM205 – Engineering Practice II

Semester 3

- HEETCM301A – Engineering CAD 2
- HEETCM302 – Industrial Automation
- HEETCM303 – Strength of Materials
- HEETCM304A – Programmable Logic Controller (PLC)
- HEETCM305 – Engineering Practice III

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Subject information

HEETCM100 – The Professional Engineering Technologist
4 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
Nil

Subject Lecturer
Arthur Winzenried

Synopsis
The practice of engineering does not exist outside the domain of societal interests. Engineering has an inherent impact on society. It is part of the daily activities of an Engineering Technologist to interact with the public, clients, employers and fellow engineers. With an engineering qualification comes a high degree of professional responsibility. To assist the new Engineering Technologist navigate through his/her new role there are laws and codes of professional conduct in place. It is not enough for the Engineering Technologist to be aware of these codes but to internalise them and realise they have a personal stake in their application.

This subject focuses on the Engineering Technologist as a key player in not only responding to societal norms but in shaping them. The student will gain an understanding of engineering fields, how they impact on society and the responsibilities and obligations that come with the profession.

The content will focus on:

- Fields of engineering
- Safety and welfare of the public and clients
- Professional ethics
- Product liability and professional negligence
- Protection of Intellectual Property
- Legal responsibilities of the Engineering Technologist
- Environmental responsibilities of the Engineering Technologist
- Effective Communication

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Describe the main fields of engineering, typical activities associated with each field, and the role of the Engineering Technologist in Society.

(b) Analyse scenarios of conflicting obligation in carrying out engineering tasks and form justified opinions on the actions to be taken.

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(c) Demonstrate an understanding of Engineers Australia Code of Ethics.

(d) Summarise the Safety, Ethical, Legal and Environmental responsibilities of engineering technologists.

(e) Examine and understand the issues associated with protection of Intellectual Property.

Assessment

- Continuous assessment – 60%
- Final exam – 40%

Workload requirements
A combination of lectures and tutorials (3 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Dowling, D Carew, A & Hadgraft 2015, *Engineering your Future: An Australian Guide*. Wiley & Sons. Milton

Recommended reading:

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM101A – Engineering Mathematics 1
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
Nil

Subject Lecturer
Ravi Rami

Synopsis
The prime role of engineering technologists is to bring a highly effective problem-solving approach to challenges that are presented to them. Their problem solving tools include a thorough knowledge of mathematical principles combined with a rigorous engineering science and technology knowledge base. A thorough knowledge of mathematical principles is also essential to understand the more advanced engineering and technology content.

As technology has become more complex, engineering software has taken over much of the tedious repetitive mathematical calculations and so computational software skills together with a clear understanding of the underlying mathematics and the ability to validate (intuitively estimate) quantitative outcomes of computer based simulations are also becoming increasingly important.

This, the first of a series of three engineering mathematics subjects, will develop the fundamental engineering mathematics skills essential for all engineering technologists. Each mathematical topic is developed in conjunction with examples of its technological applications, using a team-teaching approach.

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Apply basic mathematics from first principles to tackle problems in the fields of mechanical and mechatronics engineering technology.
(b) Recall basic mathematical modelling techniques and employ these techniques for analysis and design mechanical and mechatronics engineering technology.
(c) Recognise results, calculations or proposals that may be mathematically ill-founded., identify the source of error and take corrective action.
(d) Detect possible sources of mathematical inaccuracy and quantify their significance to the conclusions drawn.

Assessment

- Continuous assessment – 60%
- Final exam – 40% (Hurdle)

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Workload requirements
A combination of lectures and tutorials (4 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Stroud, K & Booth D 2013, *Engineering Mathematics*, 7th edn, Industrial Press, New York, N.Y. ISBN 9780831133276

Recommended reading:

Cardarelli, F 2003, *Encyclopaedia of Scientific Units, Weights and Measures: Their SI Equivalences and Origins* Springer-Verlag London, London, England.

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HEETCM102A – Introduction to Digital Electronics and Programming
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
Nil

Subject Lecturer
Madara Lakshika

Synopsis
BASIC CIRCUIT COMPONENTS

- Resistors, Capacitors, Inductors, Semiconductor, Transistors, Integrated circuits, Diode circuits, Rectifiers, Amplifiers, Oscillators

ELECTRICAL FUNDAMENTALS AND PROTECTIVE DEVICES

- Direct Current, Alternating current fundamentals, DC machines, DC Motor, Generator, Applications, Need for Protection, Protective Devices

DIGITAL THEORY

- Digital electronics: number systems, Logic gates, Elements of Boolean algebra, Logic operations, Truth Table, Combinational Circuits

BASIC PROGRAMMING CONCEPTS

- Current, Voltage, Power, Energy
- Passive components: Resistors - Types of resistors - Fixed Resistors – Variable resistors, resistor tolerance, colour coding, power rating of resistors.
- Capacitors: Types of capacitors: Fixed capacitors, Mica, Paper, Ceramic and Electrolytic capacitors, Variable capacitors, voltage rating of capacitors.
- Inductors: Fixed and Variable inductors.
- Semiconductor Components: Definition of insulators, semiconductors and conductors, types: Intrinsic and extrinsic, p and n type materials, pn junction, Classifications: Germanium, Silicon, Zener, LEDs.
- Transistors: Transistor Characteristics, CE, CB, CC Configurations, Biasing, NPN working principle.
- Integrated circuits: Advantages, classification, Linear and Digital ICs.

ELECTRICAL FUNDAMENTAL, MOTORS, GENERATORS AND PROTECTIVE DEVICES

- Classification of Currents: Alternating Current and Direct Current
- Direct Current: source of generation, application
- Alternating current fundamentals, generation of AC –frequency, period, average and r m s value, form factor, peak factor, phasor representation– power and power factor, Electromagnetic Induction.
- DC machines: principle of operation of DC generator, types of generators. DC motor, principle of operation of DC motor, types of motors, losses and efficiency.

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- Mechanical characteristics of motors - motors for particular applications like textile mill, steel mill, paper mill, mine, hoists, crane etc., size and rating of motor, electric traction.
- Need for protection-nature and causes of fault -zones of protection-protective devices-switches, relays, contactors, classification of protective relays based on technology and function

DIGITAL CIRCUITS

- Digital electronics: number systems - binary, octal and hexadecimal – conversion – BCD, conversion, representation of negative numbers using 1's compliment and 2's compliment method, Arithmetic using signed and unsigned numbers, Floating point representation, ASCII code.
- Logic gates:
- Elements of Boolean algebra- Logic operations- AND, OR, NOT, NAND, NOR, XOR gates, Truth Table, De Morgan's Theorem- Realisation of combinational circuits using SOP and POS forms, K-map.

PROGRAMMING

- Programming: Machine language, Assembly language, High level language, System Software, Operating systems, Compilers and Assemblers.

Outcomes

Upon successful completion of this subject, students should be able to:

(a) Demonstrate a knowledge of digital, analogue circuitry.

(b) Develop programs in machine language and high level language, system software, Operating systems, Compilers and Assemblers.

(c) Demonstrate an understanding of the key components in the operation of DC motors.

(d) Demonstrate understanding of protection circuits.

Assessment

- Continuous assessment – 40%
- Final exam – 60% (Hurdle)

Workload requirements

A combination of lectures and tutorials (5 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings

Prescribed reading:

Bolton, W 2015, Mechatronics: Electronic control systems in mechanical and electrical engineering 6th edn, Pearson Education, United Kingdom 978-0-273-7486-9

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HEETCM103 – Engineering Measuring Equipment
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
Nil

Subject Lecturer
Brian Carter

Synopsis
This subject focuses on engineering measuring and inspection equipment and their operating procedures. Measurement is the language of science that we use to communicate size, quantity, position, condition, and time. Engineering technologists engaged in any engineering industry should have hands-on skills in the use of appropriate measuring and inspection instruments.

This subject will provide an overview of and develop skills in the use of engineering measuring instruments including electrical and electronic instruments. It also expands on the toolmaker's microscope and coordinate measuring machine operating procedures.

The subject content will focus on, but not be restricted to:

- Introduction to Metrology and Measurement
- Instruments: types and characteristics
- Electrical Measuring Instruments
    - Digital Ammeter, Voltmeter, Multimeter (Lab)
    - Insulation and resistance measurement (Lab)
    - Digital Oscilloscope (Lab)
    - Power supplies (Lab)
    - Function generators (Lab)
- Limits and Fits
- Gauges
    - Gauge blocks: usage and maintenance
    - Sine bar and plates, usage
    - Angular measurements, protector, universal bevel protractor, angular gauge blocks
    - Micrometres, usage, care;
    - Vernier callipers, depth gauge
- Temperature Measurements
    - History and overview
    - Thermostats, Bimetallic Strip Thermometers

- Thermocouples, principle of work, types of mounting, types
- Resistance Temperature Detectors (RTD), principle of work, types
- Thermistors, principle of work, characteristics,

- Pressure measurements
  - Concepts, Terms, Definitions
  - Units and conversions
  - Methods and measurements
  - Liquid column instruments
  - Mechanical deformation instruments

Outcomes

Upon successful completion of this subject, students should be able to:

(a) Specify and utilize appropriate measuring and inspection instruments for engineering applications

(b) Analyse fits and tolerances for linear measurement

(c) Identify and implement basic measuring tasks

(d) Analyse and calibrate measuring equipment.

Assessment

- Continuous assessment – 50%
- Final exam – 50% (Hurdle)

Workload requirements

A combination of lectures and tutorials (2 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings

Prescribed reading:

Boundy, A 2012, *Engineering Drawing 8*th edn. McGraw-Hill, Australia Pty Limited.

Raghavendra N & Krishnamurthy L 2013, Engineering metrology and measurements, Oxford University Press, India

Dotsun, C 2006, *Fundamentals of Dimensional Metrology* 5th edn, Delmar Publishers Inc. Albany, New York

Recommended reading:

Bewoor, V 2009, *Metrology & Measurement* McGraw-Hill Company, India

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM104 – Engineering Design and Practice
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
Nil

Subject Lecturer
James Shen
Kulasiri D Ranpati Devage

Synopsis
A key feature of this subject is the authentic group engineering project which continues through Engineering CAD II and Engineering Practice II. In addition to supporting the development of Engineering Design and Practice skills, this feature seeks to illustrate the roles and responsibilities of professional engineering technologists and the people with whom they interact; to illustrate how disciplinary knowledge is applied in the solution of engineering problems; and to target the development of the knowledge skills and attitudes essential in professional engineering technology.

Engineering drawing and sketching are crucial skills enabling professional engineers and engineering technologists to communicate complex technical details of proposed plant and product designs and modifications between all members of the extended engineering team, including tradesmen, purchasing managers, contractors and clients. Whilst manual drafting skills have long been replaced by Computer Aided Design using 2D CAD software, the principles, standards, construction format, conventions and linear and geometric tolerancing associated with manual drawings continue.

The subject content will focus on, but not be restricted to:

- Introductory and standards information (Electrical and Welding Symbols & Fits and tolerances etc.)
- Freehand Sketching
- Project team skills
- Geometrical constructions
- Projections
- Isometric Views
- Detail and assembly drawing
- Dimensioning
- Sectioning
- Engineering solution generation and evaluation.
- CAD software (Solidworks)
- Geometric construction methods
- CAD drawings & system use

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- Specific Procedures
- Methodology for creating layers & variables
- ISO standards and advanced drawings (Mechanical, Electrical, Civil, Architectural & Survey)

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Identify and perform selected skills associated with hand tools, lathes, milling and grinding machines whilst complying with OH&S requirements.

(b) Make dimensioned freehand sketches of engineering plant and products.

(c) Critically analyse and interpret engineering drawings.

(d) Analyse the required functional interaction of assembly parts to enable appropriate limits and fits to be specified.

(e) Apply ISO and Australian Standards.

Assessment

- Continuous assessment – 65%
- Final exam – 35% (Hurdle)

Workload requirements
A combination of lectures and tutorials (3 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Shen, J 2015, 3D **Solid Modeling** with **SolidWorks, Chisholm Institute**

Shen, J 2015, Assembly and Engineering Drawing with SolidWorks, Chisholm Institute

James S 2015, Engineering Drawing Workbook, Chisholm Institute

Boundy, A 2012, Engineering Drawing 8th edn. McGraw-Hill, Sydney, NSW
Ruiz, A, Jack, G 2010, SolidWorks 2010: no experience required 1st edn. Wiley Technology Publisher, Hoboken, NJ

Recommended reading:

Australian Drawing Standards AS1100, available on line at Chisholm library website

Williams, R.A. 1993, Engineering Drawing Handbook 3rd edn. SAA HB7 Standards Australia, Sydney, NSW. ISBN: 0726285862 (A joint publication with Engineers Australia.)

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM201 – Material Science
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
HEETCM100

Subject Lecturer
Md Abdus Sattar

Synopsis
Material Science is a field of study involving the properties of matter and its applications to various areas of science and engineering. It is a fundamental enabling science for mechanical and mechatronics technologists. Studying material properties, their structure and strength, manufacturing processes, and applications will enable the technologist to select the most appropriate material for a product, plant, piece of equipment or other application for optimum performance, cost and manufacture. Technology is a progressing rapidly. Many technological developments and breakthroughs critically depend on the development of new and tailor-made materials with improved properties.

The subject will introduce the fundamentals of material science; such as material structure, classification, and properties. It then expands into various types of materials; such as polymers, ceramics and composites, their applications, and manufacturing processes.

The systematic classification of processes and methodologies involved in manufacturing systems and methodologies will underpin the student's capacity to assess and evaluate the most appropriate available or, if required, alternative manufacturing process to fulfil a design specification in the most efficient and cost effective fashion.

In reflecting upon the constraints that available manufacturing technologies pose to the design specification the student will explore the possibility of alternatives for both the design and manufacturing phases of the process under study.

The subject follows an introduction to engineering practices and provides substantial underpinning scientific knowledge for the commencement of studies in Material and Process Selection.

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Identify and classify the materials currently used in the engineering industry products.

(b) Discuss current manufacturing processes Identify and discuss thermal processes used in manufacturing industries.

(c) Demonstrate an awareness of laboratory and testing procedures relevant to materials science.

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Assessment

- Continuous assessment – 50%
- Final exam – 50% (Hurdle)

Workload requirements
A combination of lectures and tutorials (3 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Callister Jr., W D 2014, *Materials Science and Engineering, An Introduction* 9th edn, John Wiley & Sons

Recommended reading:

Bolton, W & Higgins, R.A 2014, *Engineering Materials Technology*, 3rd edn, Butterworth-Heinemann: Sydney
Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM202A – Engineering Mathematics 2
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
HEETCM101A

Subject Lecturer
Pinkee Dey

Synopsis
The problem solving tools of an engineering technologist include a sound knowledge of mathematical principles combined with a rigorous engineering science and technology knowledge base. A sound knowledge of mathematical principles is also essential in developing an advanced engineering and technology knowledge base.

This, the final of a series of two engineering mathematics subjects, will further develop the engineering mathematics skills essential for all engineering technologists. Each mathematical topic is developed in conjunction with examples of its technological applications, using a team-teaching approach.

The subject content will focus on, but not be restricted to:

- Linear algebra encompassing
  - Matrices and inverse matrices
  - Linear mapping
  - Determinants
  - Solution of linear equations
- Differential equations encompassing:
  - First order differential equations
  - Partial differential equations
  - Numerical techniques
- Variables encompassing:
  - Graphs, level curves and surfaces
  - Partial derivatives; chain rule; directional derivative
  - Maxima and minima
- Sequences and series encompassing:
  - Algebraic and Fourier series, convergence; Taylor's Theorem
  - Power series manipulation
- Number encompassing:

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- Integer, irrational and complex numbers
- Number systems
- Arithmetic operations
- Accuracy and stability

- Statistics encompassing:
  - Assembly, representation and analysis of data
  - Fitting distribution to data
  - Non-parametric statistics
  - Tests of significance for means, variance and extreme values
  - Correlation

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Apply from First Principles a sound intermediate level of mathematical knowledge to tackle representative problems in the fields of mechanical and mechatronics technology.

(b) Apply mathematical modelling techniques for analysis and design in the fields of mechanical and mechatronics engineering technology and demonstrate understanding of their applicability and limitations.

(c) Recognise results, calculations or proposals that may be mathematically ill-founded, identify the source of error and take corrective action.

Assessment

- Continuous assessment – 60%
- Final exam – 40% (Hurdle)

Workload requirements
A combination of lectures and tutorials (6 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Stroud, KA & Booth, DJ 2011, *Advanced Engineering Mathematics*, 5th edn, Industrial Press.

Recommended reading:

Kreyszig, E 2011, *Advanced Engineering Mathematics* 10th edn, Hoboken: John Wiley and Sons.

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM203A – Engineering Mechanics (Statics)
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
HEETCM101A

Subject Lecturer
Md Abdus Sattar

Synopsis
Statics is a branch of Mechanics. Statics is the branch that deals with *forces* and with the *effects* of forces acting on rigid bodies at rest. The study of statics is essentially one of analysis of forces and force systems. The subject will focus on, but not be restricted to:

- General Principles
- Force Vectors
- Equilibrium of a particle
- Force System Resultants
- Equilibrium of a Rigid Body
- Structural Analysis
- Internal Forces
- Centre of Gravity and Centroid

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Demonstrate sound knowledge of essential engineering statics concepts in applying mathematics and engineering mechanics to the analysis and solution of engineering statics problems.

Assessment

- Continuous assessment – 40%
- Final exam – 60% (Hurdle)

Workload requirements
A combination of lectures and tutorials (4 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

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Hibbeler, RC 2015, *Engineering Mechanics: Combined Statics and Dynamics*, 14th edn, Pearson, Australia.

Recommended reading:

Bedford, AM & Fowler, W 2007, *Engineering Mechanics: Statics and Dynamics*, 5th edn, Pearson, Australia.

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM204A – Engineering Mechanics (Dynamics)
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
HEETCM101A

Subject Lecturer
Md Abdus Sattar

Synopsis
Dynamics is a branch of Mechanics. Dynamics is the branch which deals with the effects of forces acting on rigid bodies in motion. The study of statics is essentially one of analysis of forces and force systems. The subject will focus on, but not be restricted to:

- Kinetics of a particle
  - Newton's laws of motion and of gravitational attraction
  - Equation of motion
  - Force and acceleration
  - Work and energy
  - Power and efficiency
  - Conservation of energy
  - Impulse and momentum
- Planar kinetics of a rigid body
  - Force and acceleration
  - Work and energy
  - Conservation of energy
  - Impulse and momentum
  - Conservation of momentum
- Three-dimensional kinetics of a rigid body
  - Moments and products of inertia
  - Angular momentum
  - Kinetic energy
  - Gyroscopic motion

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Outcomes

Upon successful completion of this subject, students should be able to:

(b) Demonstrate sound knowledge of essential engineering dynamics concepts in applying mathematics and engineering mechanics to the analysis and solution of engineering dynamics problems.

Assessment

- Continuous assessment – 50%
- Final exam – 50% (Hurdle)

Workload requirements

A combination of lectures and tutorials (4 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings

Prescribed reading:

Hibbeler, RC 2015, *Engineering Mechanics: Combined Statics and Dynamics*, 14th edn, Pearson, Australia.

Recommended reading:

Bedford, AM & Fowler, W 2007, *Engineering Mechanics: Statics and Dynamics*, 5th edn, Pearson, Australia.

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM205 – Engineering Practice II
4 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
HEETCM104

Subject Lecturer
Adrian Armstrong

Synopsis
In Engineering Practice II students will gain knowledge and skills in metal joining using various welding process, brazing and soldering to appropriate OH&S standards. Welding plays a key role in many industries such as automotive, structural, general engineering, aeronautical, chemical plants, piping industry, civil, etc. Welding skills are also important in repair and maintenance of engineering works. Sometimes welding processes provide a faster more economical and robust way to join metal than fasteners. Engineering technologists must be knowledgeable in the main welding processes and brazing, to make decisions on metal joining related tasks. Soldering skills are essential for technologists engaged in electronic industries.

This unit builds on the foundation unit Engineering Design and Practice and CAD II. Students will gain welding, brazing and soldering skills in this unit and build the group project they designed in Engineering Design and Practice and Engineering CAD II.

This subject will expand the student's application of OH&S procedures and practices in the workshop, oxy-acetylene and arc welding processes special purpose welding processes such as T.I.G and M.I.G as well as brazing and soldering.

The subject follows significant learning in engineering practices and CAD Skills, and provides substantial underpinning knowledge for the commencement of studies in Engineering Practice III.

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Select appropriate Oxy-Acetylene welding equipment and perform welding processes.

(b) Select appropriate Arc-Welding equipment and perform welding processes.

(c) Identify and undertake Brazing and Soldering operations.

(d) Identify and undertake T.I.G Welding processes.

(e) Identify and undertake M.I.G Welding processes.

Assessment

- Continuous assessment – 60%
- Final exam – 40% (Hurdle)

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Workload requirements
A combination of lectures and tutorials (4 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Sacks, R. & Bohnart, E 2011 *Welding: Principles & Practices*, 3rd Edn, McGraw- Hill: Sydney

Recommended reading:

Geary, D. 2011, *Welding*, 2nd edn, McGraw-Hill: Sydney

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM301A – Engineering CAD II
6 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisite
HEETCM104

Subject Lecturer
James Shen

Synopsis
CAD is used for detailed engineering of 3D models and/or 2D drawings of physical components. It is also used throughout the engineering process from conceptual design and layout of plant and products, through strength and dynamic analysis of assemblies including computational fluid dynamics and even to the definition of manufacturing methods of components and links to computer numerical controlled machine tool (CADCAM).

This unit builds on the foundation unit Engineering Design and Practice to develop significant competency in parametric 3D CAD and integrated simulation software as well as associated commercial software. It also expands on the tolerancing concepts of the foundation unit to develop the more complex skills of analysing and applying geometric tolerancing.

In addition this unit progresses the authentic engineering project introduced in the prerequisite foundation unit to the complete CAD design package stage. This will be followed by the build stage in the subsequent five-week unit Engineering Practice II.

This unit will be delivered primarily through CAD lecture/tutorials in which students will develop extensive skills in parametric 3D CAD. They will also develop skills in use of the integrated simulation software and in geometric *tolerancing*. Through assessment based exercises student will reinforce these skills through group and personal study.

The subject content will focus on, but not be restricted to:

- Designing applications
- Using other commercial programs
- Manipulation of shapes
- Multiple three dimensional views
- Movement through space
- Creation of views
- Editing
- Display of three dimensional view
- Apply core engineering simulation software integrated into the CAD software.
- Geometric Tolerancing

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- 2D to 3D

Outcomes

Upon successful completion of this subject, students should be able to:

(a) Function effectively in a team environment.

(b) Create 2D and 3D CAD drawings: manage data handling, use inbuilt designs, manipulate shapes and drawing planes, relocate coordinate systems, edit, and convert between 2D and 3D drawings.

(c) Create a CAD drawing package including bill of materials. Display 3D views in various alternative forms such as wireframe, isometric, oblique and perspective.

(d) Use engineering simulation packages integrated into the Solidworks CAD software.

(e) Analyse the required functional requirements of geometric alignment to enable appropriate geometric tolerances to be applied and to correctly apply the appropriate geometric tolerance drawing conventions.

Assessment

- Continuous assessment – 60%
- Final exam – 40% (Hurdle)

Workload requirements

A combination of lectures and tutorials (8 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings

Prescribed reading:

Ruiz, A &Jack, G 2010, *SolidWorks 2010: no experience required* 1st edn, Wiley Technology Pub., Hoboken, NJ (This was prescribed reading for Engineering Design and Practice.)

Boundy, AW 2007, *Engineering Drawing* 7th edn, McGraw-Hill, Sydney, NSW, ISBN: 9780070138186

(This was prescribed reading for Engineering Design and Practice and is required for the study of Geometric Tolerancing)

Recommended reading:

Kurowski, PM 2009, *Engineering Analysis with SolidWorks Simulation 2009* SDC Publications, Mission, Kansas, ISBN 987-1-58503-576-2

Mattson, JE 2010, *An Introduction to SolidWorks Flow Simulation 2010* SDC Publications, Mission, Kansas, ISBN 987-1-58503-589-2

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM302 – Industrial Automation
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisites
HEETCM101A
HEETCM102A

Subject Lecturer
Haque Md Ziaul

Synopsis
Industrial automation is the use of control systems and information technologies to reduce the need for heavy, repetitive and tedious human intervention. The optimal application of industrial automation can reduce variation in product quality, enhance occupational health and safety and is vital for producing manufactured products that can compete on price and quality in a global marketplace.

The subject content will focus on, but not be restricted to:

- Part 1: Introduction to Industrial Automation Technologies:
  - Basic pneumatic and hydraulic systems
  - Pumps, compressors, cylinders, motors, accumulators
  - Control valves
  - Pneumatic and hydraulic circuits
  - Pneumatic logic
  - Fluidics
  - Electrical and electronic controls
  - Transfer devices and feeders
  - Introduction to robotics:
    - Robot classification by control method
    - Sensors and end effectors
    - Robot Programming
    - Robotic applications
- Part 2: Industrial Automation Systems:
  - Discrete, Batch, and Continuous Process Control
  - Advanced Process Control and Optimisation
  - Simulation and Modelling
  - Safety and Security Management Systems

- Supervisory Control and Data Acquisition (SCADA) Systems
- Quality Management
- Asset Management
- Manufacturing Execution Systems

- Automation System Integration

Outcomes

Upon successful completion of this subject, students should be able to:

(a) Demonstrate a functional understanding of the key technologies supporting industrial automation.

(b) Design, build and test a hydraulic or pneumatic system.

(c) Specify a robotic system for a given industrial task and program the robot.

(d) Apply a functional understanding of the changing industrial automation environment and its interoperation with other functions of an enterprise.

Assessment

- Continuous assessment – 50%
- Final exam – 50% (Hurdle)

Workload requirements

A combination of lectures and tutorials (5 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings

Prescribed reading:

Text for part 1: Gupta, A K and Arora, S K. (2015) *Industrial Automation and Robotics,* Laxmi Publications, New Delhi, India.

Text for part 2: Martin, P and Hale, G. (2009) *Automation Made Easy: Everything You Wanted to Know about Automation – and Need to Ask.* International Society of Automation, North Carolina, USA

Recommended reading:

Parr, EA 2011, *Hydraulics and Pneumatics* 3rd edn, Oxford: U.K, Butterworth-Heinemann

Parr, EA 2000, *Industrial Control Handbook* 3rd edn, Oxford, U.K. Ed Newnes

Glaser, A2008, *Industrial Robotics: How to Implement the Right System for Your Plant* New York, N.Y, Industrial Press Inc.

Colestock, H 2008, *Industrial Robotics* McGraw-Hill, North Ryde, NSW

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HEETCM303 – Strength of Materials
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisites
HEETCM101A
HEETCM201
HEETCM203A

Subject Lecturer
Masoud Goudarzi

Synopsis
'Strength of Materials' is a branch of applied mechanics that deals with the behaviour of solid bodies subjected to various types of loads. Other names for this field include 'Mechanics of Materials' and 'Mechanics of Deformable Bodies'. It is a critical engineering science within the disciplines of mechanical engineering, mechatronics, structural engineering, chemical and process engineering, aeronautics, astronautics and a number of other engineering disciplines.

It refers to methods of calculating stresses in structural members, such as beams, columns, shafts and pipelines under the action of transverse, torsional and axial loads – and combinations of all three - and is used to predict their ability to withstand applied stresses without failure. It is essential for the safe design of all types of structure from aeroplanes and spacecraft to manufacturing plant and pipelines. A sound conceptual understanding of this subject is essential to avoid major engineering disasters!

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Describe the physical response of materials under load

(b) Comprehensively apply an understanding of load paths through simple structures and components, and common analysis methods to determine resulting stresses, strains and deflections. The ability of common engineering structures and components to withstand applied loads without failure.

(c) Demonstrate an understanding stress concentrations, elastic instability, fatigue loading and fracture mechanics in relation to common failure mechanisms of structures and components.

Assessment

- Continuous assessment – 50%
- Final exam – 50% (Hurdle)

Workload requirements
A combination of lectures and tutorials (5 hours per week), and self-directed study (3 hours per week).

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Prescribed and recommended readings
Prescribed reading:

Beer, Johnston, et al 2014, Mechanics of Materials, 6th edn, McGraw Hill.

Recommended reading:

Hibbeler RC 2015 *Engineering Mechanics: Statics* 14th edn, Singapore, Pearson Prentice Hall. (text book of prerequisite subject - for revision)

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM304A – Programmable Logic Controller (PLC)
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisites
HEETCM101A
HEETCM102A

Subject Lecturer
Rao Mylangam

Synopsis
Programmable Logic Controllers (PLC's) are an essential component of automation in industry. They are used in a wide range of applications from the control and monitoring of single devices to complex industrial processes. They are ideally suited where changes to the system would be expected during its operational life. PLCs have substantial computing power but are specifically designed to withstand industrial environments where noise, dust, temperature etc. may be considerations.

PLCs have extensive Input/output (I/O) arrangements ranging from a single I/O Module to an array of I/O racks. As well as responding to a range of digital inputs from sensors and switches they can respond to analog process variables such as temperature and pressure. They very often form part of an industrial communications network operating a Supervisory Control And Data Acquisition (SCADA) system.

Students will familiarise themselves with the operations, programming, interfacing and applications of PLC's and learn effective fault finding strategies and techniques.

The subject provides a foundation in PLC programming, interfacing and applications and provides the underpinning knowledge required for studies in advanced PLC's, data acquisition and the respective industrial projects.

The subject content will focus on:

- PLC Usage in Industry and their industrial applications Introduction to Flow diagrams and grafcet programming
- Number Systems and Boolean Algebra
- Typical Programming Languages: Ladder Logic, Sequential Function Chart (SFC), Instruction Text.
- PLC Types: Allen Bradley (Micrologix, and Compactlogix) and Omron
- PLC CPU's and Input & Output modules (Digital and Analogue)
- PLC Wiring and installation
- PLC Communication Interfaces
- Industrial Protocols for PLC's
- Programming Softwares: Allen Bradley RS Studio 5000 and Omron

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- Memory mapping and Memory Devices
- Advanced Logic Concepts, combinational and sequential Logic
- Ladder Contact Types, Timers & Counters, Interlocks & Latches, Control Functions
- LV Electrical Control Systems Design Basics
- Hardware Fault Location & trouble shooting
- Software Fault Locations and rectification
- Human Machine Interface/SCADA
- Industrial Communication Networks

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Examine programmable logic circuits and ladder diagrams, their interfaces and communication protocols.

(b) Connect a PLC to an external environment and test its operation.

(c) Develop and document PLC programs and alter existing programs.

(d) Apply the PLC to a range of industrial applications and fault-find and solve PLC hardware and software problems.

Assessment

- Continuous assessment – 40%
- Final exam – 60% (Hurdle)

Workload requirements
A combination of lectures and tutorials (8 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Supplied manufacturer specific PLC manuals.

Erickson, K.T. (2011) Programmable Logic Controllers: An Emphasis on Design and Application (2nd Ed). Dogwood Valley Press, LLC.

Recommended reading:

Petruzella, F. D. (2010) Programmable Logic Controllers (4th Ed) McGraw-Hill Education.

Current journal articles and useful websites will be made available within the booklist of each subject and revised at the commencement of each cohort of students.

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HEETCM305 – Engineering Practice III
11 credit points

Offering(s)
Semester 1 & Semester 2 (On-campus)

Prerequisites
HEETCM104
HEETCM205

Subject Lecturer
Fabian D'souza

Synopsis
Computer Numerical Controlled (CNC) machines are used to perform operations such as milling, turning, cutting and drilling with precision and at high speeds. It is essential that engineering technologists understand the operating parameters of these machines and can undertake programming tasks, tooling set-up, and basic fault finding.

Blow moulding and injection moulding are manufacturing processes used to produce hollow objects from thermoplastic materials.

This subject introduces the student to these widely used manufacturing processes. It builds on the subjects of Engineering Design & Practice, Engineering Practice II and Engineering CAD II. Students will undertake design and programming tasks, operate a CNC machine, carry out blow moulding and injection moulding operations, and apply troubleshooting techniques.

The subject will extend the students application of OHS practices as they apply to these manufacturing processes.

The subject content will focus on, but not be restricted to:

- OH&S procedures to operate computerised Numerical Machines and moulding machines.
- Introduction to CNC Machining
  - Calculate coordinates for all points on the part being produced
  - Write CNC programs manually using standard ISO codes
  - Plan machining process required
  - Edit programs to add additional machining operations
  - Write CNC programs for different machines/controls
- Blow Moulding
  - Introduction
  - Blow moulding moulds and structure
  - Blow moulding machines
  - Operating procedures
  - Machine gauges, dials, and control valves

- Mould setting and operating procedures
- Troubleshooting methods
- Blow moulding materials

- Injection Moulding
  - Introduction
  - Injection moulding moulds and structure
  - Injection moulding machines
  - Machine controls and operating procedure
  - Injection mould setting and operating procedure
  - Troubleshooting methods
  - Injection moulding materials

Outcomes
Upon successful completion of this subject, students should be able to:

(a) Create a drawings and perform Computer Numerical Control programming for milling and lathe machines.

(b) Perform Computer Numerical Control machining.

(c) Determine blow moulding requirements and perform blow moulding.

(d) Determine injection moulding requirements and perform injection moulding.

(e) Apply troubleshooting methods in blow moulding and injection moulding processes.

Assessment

- Continuous assessment – 50%
- Final exam – 50% (Hurdle)

Workload requirements
A combination of lectures and tutorials (6 hours per week), and self-directed study (3 hours per week).

Prescribed and recommended readings
Prescribed reading:

Black, J T & Kohser, RA 2013, *De Garmo's Materials and Processes in Manufacturing*, 10th edn, Wiley Publishing Company, Australia.

Chisholm Unit Guide, 2010 *Write basic NC/CNC Programs*, Chisholm Institute, Melbourne.

Recommended reading:

Kalpakjian, S & Schmid, S 2013, *Manufacturing Engineering and Technology*, Prentice Hall.