

# Gain key expertise in fundamentals of Engineering Maths, Physics and Chemistry

## ENGINEERING STUDIES PREPARATION COURSE

# FUNDAMENTALS OF ENGINEERING MATHS, PHYSICS AND CHEMISTRY

## 3 MODULES OVER 4 MONTHS

For upcoming commencement dates, please view our course schedule at: <http://www.eit.edu.au/schedule>

### WHAT YOU WILL GAIN:

- Key know-how in maths, physics and chemistry knowledge that is applicable to engineering
- The ability to confidently work with engineering chemistry, maths and physics concepts
- A warm up to the perhaps forgotten world of study

On completion of this course, 50% of the course fees can be used as a credit towards your fee for an EIT Advanced Diploma course

Course Designer

**Dr Steve Mackay**

Dean of Engineering



### WHAT YOU WILL LEARN:

#### MODULE 1 - MATHEMATICS

- Algebra
- Trigonometry
- Permutations and Combinations
- Probability
- Functions and Graphs
- Differential and Integral Calculus
- Complex Numbers
- Financial Math

#### MODULE 2 - PHYSICS

- Motion 1D and 2D
- Heating and Cooling
- Light and Optics
- Elasticity
- Electricity
- Sound
- Nuclear Physics

#### MODULE 3 - CHEMISTRY

- Matter and Material
- Structure and Bonding
- Analytical Chemistry
- Gases and Solutions
- Equilibrium
- Acids and Bases
- Industrial Chemistry

**ENROL NOW:** Fax the enrolment form to us, or email [enquiries@eit.edu.au](mailto:enquiries@eit.edu.au)



# BENEFITS OF LIVE E-LEARNING

- Attend lessons in an online classroom with your instructor and fellow students
- Upgrade your skills and refresh your knowledge without having to take valuable time away from work
- Receive information and materials in small, easy to digest sections
- Learn while you travel - all you need is an Internet connection
- Have constant support from your course instructor and coordinator for the duration of the course
- Interact and network with participants from around the globe and gain valuable insight into international practice
- Learn from international industry experts, based around the globe
- Live interactive webinars, not just a 'book on the web'
- Receive a certificate of completion for CPD purposes

## PRESENTATION FORMAT

The course programme uses a multi-pronged approach involving interactive on-line webinars and self-study assignments. The core topics will be presented using live interactive webinars with a professional instructor. For each topic you will receive initial coursework (which will be delivered to you in electronic format in advance of the online presentations). You will have ongoing support from the instructors via phone, fax and e-mail.

## LEARNING FORMAT

Each one of the three modules will be presented using live, interactive webinars with a professional instructor. Each webinar will last for up to 90 minutes and will provide you with the opportunity to interact with your classmates and ask questions. Electronic coursework will be provided which should be studied before each of the live webinars. You will also receive a series of set assignments or quizzes which need to be submitted to the instructor for review. The course materials can be interactive, dynamic and interesting and will make the learning process enjoyable.

## ASSESSMENT

You will be provided with a range of self-marked practice quizzes, so that you can test your new knowledge. There will be 2 marked exams during the course, which are conducted online. These will consist of short answers, calculations and multiple choice questions. For marks over 50% you will receive a certificate of completion for the course.

## HARDWARE AND SOFTWARE REQUIREMENTS

All you need to participate is an adequate Internet connection, PC, speakers and a microphone. The software package and setup details will be sent to you on the commencement date of the course.

## PRESENTED BY SENIOR EIT INSTRUCTORS

Your learning in this course will be made more relevant and enjoyable by regular contact with your senior EIT instructors. They are experienced in teaching these fundamental concepts and are eager to help you on your way to further engineering studies. Indeed, the ability to cut through to the key basics is a special skill and you can be confident that our instructors know what is required after many years of experience. The live, interactive sessions will allow you to review and clarify key concepts and gain additional practice in problem-solving. You will have the opportunity to talk to the instructors directly to gain help with your own specific issues. In fact, we are confident that you will look forward to each weekly session once you appreciate just how valuable this interaction can become.

## 3 MODULES OVER 4 MONTHS

## WHO SHOULD COMPLETE THIS COURSE?

Many engineering professionals tend to get a little rusty with their knowledge on mathematics, physics and chemistry - which are key underpinning subjects for most engineering courses including the EIT Advanced Diploma Courses. This preparation course has been designed to fill this gap and enable you to approach the Advanced Diploma courses with confidence and a solid foundation. This course distils the relevant key concepts into 4 hard-hitting months.

## MODULE OVERVIEW

The objective of each module is to cover the key concepts with useful practical exercises. The topics covered will provide students with an excellent background and working knowledge. Each module is an online refresher for engineers and technicians who have an existing knowledge of these topics.

### MODULE 1 - MATHEMATICS (2 months)

This module will cover the fundamental concepts of mathematics that are applicable to engineering. Upon completion of the course you will have revised mathematical concepts and regained confidence in math skills.

### MODULE 2: PHYSICS (1 month)

This module will cover the fundamental concepts of physics that can be applied in engineering. Upon completion you will have revised their physics skills and regained confidence in this area.

### MODULE 3 - CHEMISTRY (1 month)

The objective of this module is to cover the key concepts of chemistry with useful practical exercises. The topics covered will provide an excellent background and working knowledge of basic chemistry concepts relevant to engineering.



## LIVE WEBINARS

During the program you will participate in live, interactive sessions with the instructor and other participants from around the world. All you need to participate is an adequate Internet connection and a headset with a microphone.

If you are unable to join a particular webinar a recording may be made available by arrangement with your Coordinator.

The software package and setup details will be sent to you prior to the course. Session time(s) to be confirmed at course commencement.

## COURSE MATERIALS:

You will receive an electronic course manual which you may print out at your convenience.

## CERTIFICATION

Participants who attend over 70% of the live webinars and achieve 50% or more for their exams, will receive the Engineering Institute of Technology Certificate in Fundamentals of Engineering Maths, Physics and Chemistry



# COURSE OUTLINE

## MODULE 1 - MATHEMATICS

### TOPIC 1

#### INTRODUCTORY SESSION

- Study skills for engineers and technicians

### TOPIC 2

#### ALGEBRA

- Systems of linear equations - Long division; Partial fraction decomposition; Solving equations using Echelon form; Solving linear equations; Sequences and series; The binomial theorem; Mathematical induction

### TOPIC 3

#### TRIGONOMETRY

- Triangles - Definitions of trigonometric functions; Sine and cosine rule; Angle of elevation and depression
- Analytical trigonometry - Trigonometric identities; Solving trigonometric equations;  $R \sin (\theta \pm \alpha)$  form; Inverse trigonometric functions
- Quiz and/or Assignment

### TOPICS 4 & 5

#### PRE-CALCULUS

- Permutations and combinations - Permutations; Combinations; Sum of all combinations
- Probability - Event; Conditional probability; Independent and dependent events; Mutually exclusive events
- Functions and graphs - Piecewise defined functions; Inverse functions; Rational functions; Points of inflection
- Plane analytical geometry - The parabola; Polar coordinates; Curves in polar coordinates; Equi-angular spiral
- Quiz and/or Assignment

### TOPIC 6

#### DIFFERENTIAL AND INTEGRAL CALCULUS

- Derivatives - Derivative from first principle; Rules of derivatives (the product rule, chain rule, quotient rule); Derivative of an inverse function; Implicit differentiation
- Vectors - Vector notation; Cross product of 2 vectors; Variable vectors; Vector calculus
- Differentiation - Differentiating trigonometric functions; Differentiating inverse trigonometric functions; Derivative of the logarithmic function; Derivative of the exponential function
- Quiz and/or Assignment

### TOPIC 7

#### INTEGRATION

- The indefinite and definite integral
- Power formula
- Integrating exponential and logarithmic functions
- Integrating trigonometric functions
- Integration by parts
- Differential equations

### TOPIC 8

#### GENERAL MATH

- Complex numbers - Complex numbers-basic definitions; Polar form; Exponential form; Products and coefficients; Powers and roots
- Summary statistics - Mean, median, mode and range; Standard deviation
- Financial math - Purchasing by installments; Compounding; Depreciation
- Quiz and/or Final Assignment

## MODULE 2 - PHYSICS

### TOPIC 1

#### MOTION - 1D

- Equations of motion - Newton's laws of motion; Example problems on momentum; Worked examples on potential energy and kinetic energy

#### MOTION - 2D

- Projectile motion - Equations and problems
- Circular motion - Centripetal force in a horizontal plane; Uniform circular motion
- Rotatory motion - Angular momentum vs. torque; Principle of moments; Stable, unstable and neutral equilibrium
- Periodic motion - Simple harmonic motion; Damped and derived oscillations
- Universal gravitation - Newton's law of universal gravitation; Kepler's laws and satellite motion; Escape velocity and orbital velocity
- Quiz and/or Assignment

### TOPIC 2

#### HEATING AND COOLING

- Worked examples on pressure, volume and density; Heat and internal energy; Entropy; Kinetic theory of gases; Laws of thermodynamics; Specific heat; Calorimetry; Latent heat; Transfer of heat energy

#### LIGHT AND OPTICS

- Reflection and refraction; Huygen's Principle; Diffraction of light; Optic lens; Optical centre, principal axis, principal focus and focal length; Lenz's formula - positive and negative; Optical fibers
- Quiz and/or Assignment

### TOPIC 3

#### ELASTICITY

- Hooke's law; Elastic potential energy; Poisson's ratio; Strain energy

#### ELECTRICITY

- Introduction - Ohm's law; Series and parallel circuits; Alternating current and applications
- Electromagnetism - Right-hand grip rule; Current flowing through a long straight wire, a short coil and a solenoid; Force on a conductor in magnetic field; Forces effecting current carrying conductors
- Electromagnetic induction - Electric motor operation; Transformer
- Quiz and/or Assignment

### TOPIC 4

#### SOUND

- Properties of sound; Relationship between velocity, wavelength and frequency; Worked examples on time period, frequency and wavelength; Reflection and refraction; Beats and Doppler effect; Nodes and anti-nodes; Resonance

#### NUCLEAR PHYSICS

- Mass defect and binding energy - Einstein's equation; Isotopes; Radioactivity; Nature and properties of radiation; Half-life; Fission and fusion; Chain reactions; Nuclear reactors; Applications
- Quiz and/or Final Assignment

## MODULE 3 - CHEMISTRY

### TOPIC 1

#### MATTER AND MATERIAL

- Atomic structure - Atomic Structure; Nuclear Model of the Atom
- Chemical Elements - Properties of Elements; Periodic Table [ Trends within a Period, Trends within a Group]
- Radio-Isotopes and Radioactivity - Isotopes; Radioactivity; Radioactive Decay; Half Life; Emission Spectra and Ionisation Energy; Binding Energy & Mass Defect; Einstein's Equation
- Quiz and/or Assignment

### TOPIC 2

#### STRUCTURE AND BONDING

- Chemical Bonds - Ionic Bonds; Covalent Bonds; Hybridization
- Intermolecular Forces - Hydrogen Bonding; Intermolecular Forces; Polarity of Molecules
- Structure and Properties of Solids - Bonding Types of Solids; Properties of Solids

#### ANALYTICAL CHEMISTRY

- Reactions - Chemical Reactions; Redox Reactions
- Quantities in Chemistry - Avogadro's Constant and the Mole; Masses and Volumes of Reactants and Products; Empirical Formulas and Molecular Formulas; Structural Formulas
- Quiz and/or Assignment

### TOPIC 3

#### GASES AND SOLUTIONS

- Gases in the Atmosphere - Boyle's Law; Charles's Law; The Ideal Gas Equation
- Solutions - Concentration; Solubility; Colligative properties of solutions

#### EQUILIBRIUM & ACIDS AND BASES

- Chemical Equilibrium - Chemical Equilibrium; Yields, Rates; Le Chatelier's Principle
- Acids and Bases - Strengths of Acids and Bases; Ionic Product of Water; pH Scale; Acid-Base Volumetric Analysis
- Quiz and/or Assignment

### TOPIC 4

#### INDUSTRIAL CHEMISTRY

- Organic Compounds - Alkanes, Alkenes & Alkynes; Alcohols and Organic Derivatives of H<sub>2</sub>O; Naming of Organic Compounds; IUPAC Rules for Nomenclature; Isomers
- Hydrocarbons. I: Alkanes & Alkenes - Structure & Physical Properties; Chemical Reactions
- Hydrocarbons. I: Alcohols (Alkanols) - Structure & Physical Properties of Alcohols; Chemical Reactions
- Quiz and/or Final Assignment

