CIUJ: UC1101 Introduction to Engineering Profession

SUT: HEF1000 Professional Engineering

Credit Points:12.5

Contact Hours: 6 Hours per Week

Duration: 1 Semester

Campus: CIUJ

Prerequisites: Nil

Teaching Method

* Lectures, guest lecturers, tutorials , laboratories . Invited lecturers from industry.
Aims & Objectives

- To develop investigation, teamwork and time management .
  * To develop understanding and basic knowledge of Engineering and Science, including ethical, social and environmental aspects of engineering, presentation and engineering report writing, graphical communication of ideas & designs using engineering standards and conventions.
- To develop abilities and skills in critical analysis , problem solving , professional communication and report writing.

Content

* History, current challenges and future of a particular engineering discipline
* History, current challenges and future trends of an engineering education of a particular branch of engineering
* Fundamentals of engineering communication (graphical, written and oral)
* Interview fundamental and functions
* Engineering projects phases and stakeholders
* Fundamentals of engineering design
* Fundamentals of project management
* Problem-solving process and strategies
* Professionalism in engineering and professional associations
* Engineering ethics
* Social and environmental aspects of engineering activities
* Sustainable development

Reading Materials

Textbook
To be advised.
Recommended Reading
Johnston, S, et al., Engineering & Society: An Australian Perspective, 2nd edn,

CIUJ: UC1102 Mechanics of Structures

SUT: HES1125 Mechanics of Structures

Credit Points: 12.5

Contact Hours: 60 Hours

Duration: 1 Semester

Campus: CIUJ

Prerequisites: Nil

Corequisites: Nil

Teaching Method

* Lectures (24 Hours),
* Tutorials (22 Hours).

* Laboratory (2 Hours).

* Class Tests (8 Hours), Four scheduled class tests (mandatory) for approximately 50 minutes duration. The following week of each test, all tests are marked and handed back to the students for feedback.

Assessment

Examinations (80%), Lab Reports (5%), Practical Examination (15%)

Aims & Objectives

This subject, introduces the basic principles of equilibrium and the behaviour of structural members under applied loads, In particularly, axial load, shear force and bending actions.

Content

Forces and Equilibrium (15%)
* Scalars and Vectors, Addition of Vectors, Resultant Calculations, Moment of a Force, Conditions of Equilibrium, Free Body Diagrams (2D and 3D), Two and Three Force Members, Calculations of Simple External Reactions, Principles of Friction.
Structural Analysis of Trusses and Design of Simple Connections (25%)
* Free Body Diagrams and External Reactions Calculations.
* Analysis of Trusses by Method of Joints and Method of Sections, and Zero Force Members.
* Simple Analysis of Truss Connections by axial and shear stress, with an introduction in allowable stress vs. ultimate stress.
Internal Loadings – Shear Force and Bending Moment Diagrams (30%)
* Analysis of point loads, uniformly distributed loads, and non-uniformly distributied loads.
* Internal Actions of Beams: Axial Forces, Shear Forces and Bending Moments.
* Axial Force, Shear Force and Bending Moment Diagrams.
* Relationships between loads, shear and bending moments.

Section Properties of Structural Members (10%)
* Location of Centroids (Centre of Gravity or Area) for Composite Bodies/Areas
* Second Moments of Area (Moments of Inertia) by Integration.
* Second Moments of Area (Moments of Inertia) by the Parallel Axis Theorem for Composite Areas.
Internal Stresses – Shear and Bending Stresses (20%)
* The Flexural Formula and Bending Stresses in Beams, Bending Stress distributions across Beam Sections.
* The Shear Formula and Shear Stresses in Beams, Shear Stress distributions across Beam Sections.

Reading Materials

Textbook
Hibbeler, RC, Statics and Mechanics of Materials, Prentice Hall.

CIUJ: UC1121 Project 1

SUT: HES1105 Civil Engineering Project

Contact Hours:60 Hours

Duration:1 Semester

Campus:CIUJ

Prerequisites:Nil

Corequisites:Nil

Teaching Method

Briefing Sessions - Lectures (12 Hours). To provide minimum information on the design project and its elements, necessary to make requisite progress.
This includes:

Guest lecturers from industry

Design Sessions - Tutorials (48 Hours). Design sessions will follow a format of a real-life design team discussion/consultation.

Consultations with Experts and Technical Personnel (up to 5 hrs per group of 4 students). Each group responsible for a particular part of the project will be able to request consultation with expert in the relevant field (structural, geo-technical, road/traffic, water and environmental engineering as well as technical personnel to assist design model development).
Assessment

Students will be required to communicate once a week with the subject coordinator via e-mail and report on the expected outcomes. Students are required to keep a Design file which will contain: a copy of weekly emails to the subject coordinator: notes taken during design briefings and design sessions; each group responsible for a particular part of the project will be required to coordinate and develop an integrated part of a Scaled Model representing the design; at the end of the project students will be required to submit a Self Assessment reporting on their and other group members contribution to the project design and proposed construction method: at the end of the project students will be required to compile a complete set of design documentation (one per group) and present the project to the project stakeholders.

Aims & Objectives

This course aims:
* To provide students with the opportunity to further develop ability to graphically communicate ideas and designs, to further improve skills in relevant areas.

* To provide students with a unique opportunity to perform real-life engineering tasks

* To provide students with a unique opportunity to interact with experts in different sub-disciplines of civil engineering

Content

* Basic elements of civil engineering systems including roads, bridges, water engineering and structural systems
* Basic functions of civil engineering systems
* Fundamentals of civil engineering construction methods
* Fundamentals of land surveying
* Principles of project management in Civil Engineering
* Design principles and process (from a Design Brief to Design Communication)
* Basic loading and capacity calculation
* Scaled model development

Reading Materials

Students will be advised of sources of readings from the libraries and Internet.

CIUJ:UC1123 Material Properties, Structures & Applications

SUT:HES1230 Materials and Processes

Credit Points:12.5

Contact Hours:60 Hours

Duration:1 Semester

Campus:CIUJ

Prerequisites:Nil

Corequisites:Nil

Teaching Method

The current modes of delivery include:
* Lectures (36 hours), Tutorials (12 hours), Laboratory (6 hours) practical laboratories – Tensile test, recrystallisation and recovery, stress concentration factor.

Assessment

Examination (75%), Laboratory submission (5%) Laboratory quizzes (10%), Online Lecture Quizzes (10%)

Aims & Objectives

Aims of the course can be identified as follows:
* To develop an awareness within students of the the structure of materials at the nano, micro and macro level and their properties , particularly for metals, polymers and ceramics.
Concepts involved in the designing the structure of a material to achieve a predetermined set of properties
Laboratory experience on the structure/property relations of materials and their effect on performance to work in small groups and carry out a research project on the structure/property relations of materials used in well known products, and present their findings in peer reviewed oral presentations.
* To develop an understanding of the principles of materials selection and importance of new material.
To bring students to the realisation that materials and technology can cost-effectively contribute to building an ecologically friendly and sustainable environment. Develop understanding on the environmental impacts of material. .

Content

Structure of Materials
* Atomic structure, electron configuration, bonding.
* Crystal structure, unit cells, planes and direction, x-ray diffraction, density.
* Amorphous structures, composition.
* Dislocation theory, critical resolved shear stress.

* Mechanical test of Metals, polymers, ceramics; mechanical testing
* Mechanical properties of Engineering materials.

Structure and mechanical properties of metals: elastic, plastic, tensile properties, shear, slip.
* Structure and mechanical properties of polymers and ceramics
* Phase transformations in isomorphous systems recovery, recrystallisation, grain growth
* Failure
* Fatigue, ductile, brittle, impact, tensile, creep
* Material degradation and recycling
* Corrosion: composition cell, stress cell, concentration cell, dry corrosion, and corrosion protection
* Materials selection strategies
* Typical properties, properties by class of material, relationship between properties and failure modes, materials selection

Reading Materials

Complementary notes will be provided.

Textbook
Callister, WD Jnr., Materials Science & Engineering: An Introduction, 6th edn, Wiley, 2003.

Ashby, M & Jones, DRH, Engineering Materials, Vol. 2, 2nd edn, Pergamon, Oxford, 1998.
Kalpakjan, S & Schmid, SR, Manufacturing Engineering & Technology, 4th edn, Prentice-Hall, N.J., 2001.

CIUJ:UC1211 Structural Mechanics

SUT:HES2120 Structural Mechanics

Course/s with this subject

A subject in

Credit Points: 12.5 Credit Points

Contact Hours: 60 Hours

Duration: 1 Semester

Campus: CIUJ

Prerequisites: UC1102

Corequisites: Nil

Teaching Method

* Lectures,
* Tutorials,
* Laboratory,

Assessment: Examinations, Laboratory Projects, Tests

Aims & Objectives

During the course, we aim:
* To develop an understanding of structural and material behaviour.
* To develop skills in analysis of statically determinate and indeterminate structures.
* To understand basic design formulae against structural and material failure.
At the completion of this subject, students should be able to:
* develop an understanding of structural and material behaviour.
* analyse statically determinate and indeterminate structures.
* apply the failure theories in design simple structures and machine components.

Content

Structural behaviour (8%):
* Modelling of structures; equilibrium, statical and kinematic determinacy; stability of structural form.
* Loads on structures; load paths.
Section properties (17%):
* Centroids, second moment of area, section modulus, principal axes.
Stress and strain (17%):
* Distributions in beams; elastic and plastic behaviour plastic section modulus. Failure theories:

maximum shear stress (Tresca) maximum principal stress (Rankine) and maximum shear strain energy (Von Mises).
* Principal stresses, Mohr's circle.
* Behaviour of composite structures.
Structural theories (17%):
* Concept of work, conservation of energy, principle of virtual work, energy methods and moment area methods.
Statically determinate structures (17%):
* Analysis for reactions, shear force, bending moment and axial force diagrams for beams and frames; analysis of trusses.
* Deflection of beams.
Statically indeterminate structures (17%):
* Analysis for reactions, shear force and bending moment diagrams for beams and frames
* Deflection of beams.
Column buckling (7%):
* Euler buckling
* Design formulae for Euler buckling

Reading Materials

Textbook
Beer, F.P., Johnson, E.R. and Dewolf, J.T., Mechanics of Materials, 3rd edn, McGraw Hill, 2002.
References
Fleming, J.F., Analysis of Structural Systems, Prentice-Hall, New Jersey, 1998.
Schodek, D.L., Structures, 2nd edn, Prentice-Hall, New Jersey, 1992.

CIUJ:UC1212 Surveying and Analysis

SUT:HES2131 Topographical Engineering

Credit Points: 12.5

Contact Hours: 5 Hours per Week

Duration: 1 Semester

Campus: CIUJ

Prerequisites: Substantial completion of first year, includingUG1111, UG0122, and UC1121

Corequisites UG0212

Teaching Method

Lectures, Tutorials, Field practical exercises, Assignments, Graphic presentations.

Assessment

Examination (70%), Practical Projects (30%)

Aims & Objectives

* To provide the students with sufficient Surveying knowledge to appreciate the importance and precision of measurement, and to develop basic skills in tools and processes .
.
* To be able to analyse a data set and make the necessary decision to accept or reject

* It is based on practical requirements.
* To undertake the necessary calculations to prove or disprove data accuracy.
* To be able to undertake field exercises and apply the survey theory and computations in a practical manner.

At the end of this subject the students will be able to:
* Measure a distance to an accuracy of 1:6000 or better.
* Measure an angle/Bearing to an accuracy of 10” of arc or better.
* Be able to competently use an automatic level.
* Be able to traverse using a Total Station.
* Be able to collect digital data and process it.

Content

* Types of Survey and required accuracies and precisions
* Leveling

* Contouring
* Angles and Bearings
* Measurement Principals and application
* Data collection using Electronic Total Station
* Digital data processing

Reading Materials

The following Items will be acquired from SUT and made available to CIUJ students.
1-HES2131 Topographical Engineering: Tutorials and Practical Notes, Swinburne University Press (Reviewed annually).
2- HES2131 Topographical Engineering: Lecture Series, Swinburne University Press (Reviewed annually).
3- Survey Field Book (Student Bookshop).
student are required to have a full scientific alpha-numeric calculator.

CIUJ: UC1221Concrete Structure Design and Technology

SUT: HES2125 Design of Concrete Structures

Credit Points: 12.5

Contact Hours: 4 Hours per Week

Duration: 1 Semester

Campus: CIUJ

Prerequisites: UC1102, UC1211

Corequisites

Teaching Method

Lectures (24 hours),
Tutorials (20 hours),
Assignments (4 hrs).
* Lecture, tutorial and assignment materials available online from SUT may be borrowed.
* Educational video is shown to highlight placement of reinforcement, pouring and finishing of concrete and typical site practices.

Assessment

Examination (70%) Concrete Design Project (20%), Lab Report (5%), Test (5%)

Aims & Objectives

The aims of this subject are to:
* Develop the appreciation for design the ability to recognise indeterminate structures and analyse them using manual methods and to apply their analysis skills in developing simple conceptual designs.
Develop knowledge on reinforced concrete properties and behaviour and ability to design them based on current standards.

Content

Analysis of Indeterminate Structures
* Idealisation of structures and determination of degree of statical indeterminacy.
* Elastic beam theory and virtual work method.
* Flexibility method for analysis of indeterminate beams and frames.
* Moment distribution method.

Design Philosophy
* Purpose of structure, design requirements and design process.
* Limit states design and working stress design methods.
* Regulations (Building Code of Australia – BCA) and standards.
* Types and definitions of loads in accordance with AS/NZS 1170.

* Structural elements, structural systems and structural forms.

Concrete Technology
* Properties and influence of concrete constitutes (Portland cement, water, aggregate, admixtures).
* Properties of fresh concrete (slump test, bleeding, shrinkage, compaction, curing).
* Properties of hardened concrete (cracking, durability, corrosion, creep, strength).
* Steel specifications and properties of reinforcing.

Design of Concrete Members
* Ultimate bending moment capacity of beams using a simplified stress-strain relationship for concrete.
* Design of beams for durability and fire in accordance with AS3600.
* Capacity of beams in shear.
* Analysis of continuous beams and one-way slabs using the simplified method.
* Deflections and crack control in beams and one-way slabs.
* Detailing of reinforcement for beams and one-way slabs.
* Design of short reinforced concrete columns.
* Introduction to prestressed concrete technology and bending capacity of prestressed concrete beams.
* Use of design charts.

Reading Materials

Textbooks and Notes
Appropriate material from Iranian, International and Australian standards for Civil Engineer will be adopted

Lecture and study notes as provided by course coordinator.

Recommended Reading
Hibbeler, RC, Structural Analysis, 4th edn, Prentice Hall.
Warner, RF, Rangan, BV, Hall, AS & Faulkes, KA, Concrete Structures, Longman, 1998.
Standards Australia, HB71 Reinforced Concrete Design in Accordance with AS3600-2001 Handbook, 4th edn.
Standards Australia, HB64 2002 Guide to Concrete Construction, 2nd edn.

Useful Websites
Cement and Concrete Association of Australia: www.ccaa.com.au
Concrete Institute of Australia: www.coninst.com.au
Steel Reinforcing Institute of Australia: www.sria.com.au
Smorgon ARC: www.smorgonarc.com.au
OneSteel reinforcing: www.reinforcing.com

More international websites will be added

CIUJ: UC1223 Geo mechanics

SUT: HES2155 Geo mechanics

Credit Points: 12.5

Contact Hours: 48 Hours

Duration:1 Semester

Campus: CIUJ

Prerequisites:UC1102,UC1211

Corequisites:Nil

Teaching Method

* Lectures (24 hrs),tutorials (18 hrs),laboratory (6 hrs). Practical laboratories on:
(i) Mechanical Analysis of Soil,
(ii) Atterberg Limits (Index Tests),
(iii) Direct Shear Test on Dry Sand,
(iv) Unconfined Compression Test on Clay,
(v) Unconsolidated Undrained Triaxial Test on Clay,
(vi) Demonstration of the Vane Shear Test and Pocket Penetrometer Devices,
(vii) One-Dimensional Consolidation Test on Clay.

Assessment

Laboratory Practical Test (5%), Examinations (50%), Investigation Project (10%), Research Assignment (10%), Oral presentation (10%), Class Tests (15%)

Aims & Objectives

To introduce students to basic geology, geological principles, engineering properties of soils and their importance to civil engineering projects. Students should be able to identify rock/soil specimens, construct simple geological cross sections, carry out a basic site classification, and determine strength and compressibility parameters of soils
Content

Basic Geology and Geological Mapping (20%)
* Introduction to Geology, Geomechanics and Geotechnical Engineering and their role in Civil Engineering projects.
* The Rock Cycle – the role of magma, the formation and identification of igneous rocks, the weathering process, formation of sediments, formation and identification of sedimentary rocks, and the formation and identification of metamorphic rocks.
* Basic Structural Geological Formations and Basic Geological Mapping.
* Brief Geological Overview of Victoria and Melbourne areas.

Engineering Properties and Classification of Soils (20%)
* Definition of Soil (Clay, Silt, Sand, Gravel, Cobbles and Boulders) as per Australian Standard.

* Structure of Soil by Phase Relationships, including Weight – Volume Relationships, Water Content, Void Ratio, Porosity, Degree of Saturation, and Specific Gravity
* Mechanical Analysis of Soil (particle size determination) and classification of coarse-grained soils.
* Consistency of fine grained soils by index tests and classification of fine grained soils.
* Overall Soil Classification in accordance with Australian Standard: AS1726-1993.

Soil Hydraulics (10%)
* Water flow through soils, including the Bernoulli's principle and the determination of soil permeability coefficients from field and laboratory methods.
* Basic flow net analysis.

Geostatic Stresses and the Shear Strength of Soil (30%)
* Effective Stress Law (Total Stress, Effective Stress and Pore Pressures).
* Stresses in a Soil Mass – caused by point loads and loaded areas.
* Normal and Shear Stress on a Plane: Pole Method and Mohr-Coulomb Failure Criteria.
Laboratory and Field Tests to Determine Shear Strength of Soils: Direct Shear Test, Unconsolidated Undrained Triaxial Test, Consolidated Drained Triaxial Test,
* Consolidated Undrained Triaxial Test, Unconfined Compression Test, Vane Shear Test and Penetrometer Tests.

Compressibility of Soils (20%)
* Immediate Settlement based on Elastic Theory.
* Consolidation Theory and One-Dimensional Consolidation Test.
* Consolidation Settlement, Time Rate of Consolidation and Coefficient of Consolidation.

Reading Materials

Textbook
Standards Australia, SAA HB2.1 Australian Standards for Civil Engineering Students, Part 1: Materials and Testing, Standards Australia, 1998or an International Standard text.

References
Coduto, DP, Geotechnical Engineering, Prentice Hall, 1998.
Craig, RF, Soil Mechanics, 6th edn, E & FN Spon, 1997.
Das, BM, Principles of Geotechnical Engineering, 4th edn, PWS, 1998.
Holtz, RD & Kovacs, WD, An Introduction to Geotechnical Engineering, Prentice Hall, 1981.
Whitlow, R, Basic Soil Mechanics, 4th edn, Prentice Hall, 2001.

CIUJ:UC1224 Fluid Mechanics

SUT:HES2340 Fluid Mechanics

Credit Points: 12.5

Contact Hours: 60 Hours

Duration: 1 Semester

Campus: CIUJ

Prerequisites:UG0112, UG0122

Corequisites: Nil

Teaching Method

* Lectures
* Tutorials
* Laboratory
* Assignments

Assessment

Examinations, Labs, Class Tests

Aims & Objectives

During the course we aim:
* To develop the fundamentals of fluid mechanics the design principles in fluid systems
* To develop the ability to analyse existing fluid systems and contribute to new designs.

Content

Fluid Properties (10 %): Density, specific weight, specific gravity, enthalpy, viscosity, heat capacity, internal energy, elasticity, vapour pressure.

Fluid Statics (10%): Static pressure, dynamic pressure, total pressure, gauge pressure, absolute pressure, pressure heights, manometry.

Fluids in Motion (8%): Lagrangian and Eulerian viewpoints, streamlines, uniform and non-uniform flow, steady and unsteady flow, 1-D, 2-D and 3-D flows, flow rate and continuity, flow acceleration, continuity equation, rotation and vorticity, separation, vortices & turbulence.

Pressure Variation in Flowing Fluids (8%): Variations due to weight and acceleration, Euler's equation, Bernoulli's equation, separation and its effect on pressure variation, cavitation, applications. Hydraulic and energy grade lines.

Momentum Principle (16%): Momentum equation, application of the momentum equation, forces

on nozzles and bends, moment of momentum, introduction to the Navier-Stokes equations.

Flow Measurement (8%): Orifice, anemometers, venturi meters, weirs.
Dimensional Analysis & Similitude (8%): Dimensions in equations, Buckingham PI theorem, common dimensionless numbers, similitude and model analysis, pressure coefficient.

Flow in Conduits (16%): Shear stress distribution across a pipe section, laminar & turbulent flow in pipes, criteria for laminar and turbulent flow, resistance, Moody diagram, empirical relationships, primary and secondary losses, pipe systems, pipe networks, non-circular conduits.

Channel flow (16%): Uniform flow, specific energy, Froude number, hydraulic jump, gradually-varied flow.

Reading Materials

- Textbook
  Crowe, CT, Roberson, JA & Elgar, Engineering Fluid Mechanics, 7th edn, John Wiley, 2001.

  References
  Daugherty, RL, Franzini, JB & Finnemore, EJ, Fluid Mechanics with Engineering Applications, SI metric edn, McGraw-Hill, 1989.