Synopsis

Higher Diploma in Civil Engineering Management

International Management School

The Higher Diploma in Civil Engineering Management programme is structured on a syllabus that covers a wide range of topics that is well-rounded while maintaining high academic standards.
Students take the common engineering courses which deals with basic concepts in mathematics, science and fundamental engineering principles, followed by a balanced-mix of core courses in the civil engineering discipline.
Courses offered include basic theory of structures, geotechnical engineering, water resources engineering, engineering drawing & measurement, structural analysis, design in concrete and steel structures, and specialized courses in environmental engineering.

Civil engineering students are characterized by their ability to create solutions. Where and how to build a road, home, civic centre, or bridge can be seen as a problem in today's fast paced age, therefore these students are able to analyze the information and develop a suitable solution. Students may like to build and create projects, to use their hands and draw. Students are also required to complete a research project in any of the specializations in civil engineering

The Higher Diploma in Civil Engineering Management consists of the following modules. Participants must complete all the modules to graduate:

- Essential Engineering Mathematics
- Construction Technology: Design and Processes
- Steel Design Structure
- Reinforced Concrete Design
- Structural Design Analysis
- Civil Engineering and Sustainable Built Environment
- Environmental Engineering
- Project Planning & Management
- Introduction to Mechanical and Industrial Engineering,
- Production Technology,
- Industrial Engineering,
- Material Management
- Mechanical Engineering

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Essential Engineering Mathematics

Learning Objective

To equip students with fundamentals in calculus and complex analysis required for the upper years of studies.

Module Content

Complex numbers and analysis. Vectors and analytical geometry. Limits and continuity. Sequences and series. Derivatives. Applications of derivatives. Integration. Integration techniques. Application of integrals.

Module Outline

S/N	Topic
1	Complex numbers and analysis
2	Vectors and analytical geometry
3	Limits and continuity
4	Sequences and series
5	Derivatives
6	Applications of derivatives
7	Integration
8	Integration techniques
9	Applications of integrals

Learning Outcome

Students will be able to:

- Carry out basic complex analysis.
- Establish the equations for lines and planes based on vector operations.
- Determine the limit and continuity of functions, and convergence of sequences and infinite series.
- Understand and apply the concept of derivatives.
- Understand and apply the concept of integration.

Textbook

Weir, Maurice D., Hass, Joel. Giordano Frank R. Thomas Calculus, 11th ed., Pearson Addison-Wesley, 2005. (QA303.T456 2005)

References Goldstein L J, Calculus and its applications, 8th edition, Prentice-Hall, 1999. (QA303.G624 1999)

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Construction Technology: Design and Processes

Learning Objective

This course aims to provide students with a general understanding of various construction methodologies, machineries, and technologies used for the implementation of construction projects. Students will be exposed to various types of civil engineering works, including case studies of building and civil engineering projects in Singapore and overseas. Related legislations and industrial practices such as safety and build ability issues are also discussed.

Module Content

Construction safety and legislation; construction machinery and operations; basement construction; caisson foundations; tunneling methods, construction of high-rise buildings; prefabrication; bridge construction; dredging and land reclamation; appraisal and building retrofitting; automation and robotics; build ability aspects; use of recycled materials in buildings.

Module Outline

S/N	*Topic*
1	Construction safety & legislation
2	Construction machinery
3	Tunneling construction
4	Basement construction and caisson foundations
5	High-rise building construction
6	Building prefabrication, use of recycled materials
7	Bridge construction
8	Dredging, land reclamation and coastal works
9	Appraisal of structures and building retrofitting
10	Construction automation and robotics
11	Build ability scores and practices

Learning Outcome

Upon completion of the course, students should be able to:

(a) Appreciate the professional and moral duties of an engineer to promote and maintain good safety practices both onsite and at the higher industry level

(b) Select suitable types of machineries for different job operations onsite while understanding the basis/limitations of his/her choice

(c) Prepare method statements and sketches, and describe the construction procedures for various structures including basements, foundations, tunnels, high-rise buildings, bridges and coastal structures

(d) Describe the objectives and methods of building appraisal and retrofitting

(e) Explain the role, types and application of automation and robotics in construction and their potential impact on the construction industry

(f) Understand the underlying factors that would lead to higher level of build ability

Textbooks Peurifoy, R.L. and Ledbetter, W.B., "Construction Planning Equipment and Methods", 6th edition, McGraw-Hill, New York, 2002.

Steel Design Structure

Learning Objective

The course aims to develop an understanding of Limit State Design as applied to structural steel members and connections based on the latest EuroCode 3 – Design of steel structures with Singapore Annexes.

Module Content

Introduction to students the basic principles of reading steel structural plans, elevations and sectional views, distribute loadings on structures based on architecture plans, determine factored loads for design, design structural steel beams and columns, design bolted and welded connections and produce sketches for production drawings.

Module Outline

S/N	Topic
1	Introduction, material properties, limit state design, loading, section classifications.
2	Behaviour of compression members, local and overall buckling, column

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	slenderness and effective length concept.
3	Design of laterally restrained beams.
4	Design of lateral-torsion buckling of unrestrained beams.
5	Introduction and design of column in simple structures.
6	Simplified and more exact methods for members with axial force and moments.
7	Introduction to lattice roof construction and simplified rules for lattice truss members.
8	Introduction and basic concepts of joints design.
9	Simple beam-to-beam and beam-to-column connections.
10	Introduction to moment connections of bolted end plate connections, beam and column splices.

Learning Outcome

Upon successful completion of the course, students will be able to calculate factored design loads from structural plans, design laterally restrained and unrestrained beams, design columns in simple structures, design columns in continuous structures and design bolted and welded connections.

Textbooks/References

EuroCode 3 (BS EN 1993-1-1:2005) Part 1-1: Design of Steel Structures – *General Rules and Rules for Buildings*, British Standards Institution, London, UK.

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Reinforced Concrete Design

Learning Objective

The objective is to equip the students with basic understanding of the behaviour of reinforced concrete structures and to develop the skill to analyze and design basic concrete members.

Module Content

Basic design concepts: basic layout of concrete structures, loading; Basic material properties: concrete and reinforcing steel; Analysis of structures: limit state design, simplification of framed structures, moment redistribution; Analysis and design of flexural members; Shear; Bond and anchorage; Serviceability; One-way and two-way slabs; Compression members; Foundation: footings. Current building code and standards are referred to extensively in this course.

Module Outline

S/N	Topic
1	**Basic design concepts:** Basic layout of concrete structures, loading, basic material properties of concrete and reinforcing steel, limit state design philosophy.
2	**Analysis of structure:** Load combinations and loading arrangements, simplification of framed structures, moment redistribution.
3	**Design and analysis of flexural members:** Singly and doubly reinforced rectangular sections, flanged sections, shear, bond and anchorage, serviceability.
4	**Solid slabs:** Slab actions, design of one-way spanning slabs, two-way spanning slabs.
5	**Columns:** Classification, column behaviour, axially loaded rectangular column, uni-axially bent and bi-axially bent columns, column interaction diagram, unsymmetrical reinforced column.
6	**Footing design:** Design consideration, design of axially loaded pad footing, eccentrically loaded pad footing, eccentric footing, combined footing.

Learning Outcome

The students are expected to be able to understand the behaviour and load-carrying capacity of basic reinforced concrete members. They should be able to design beam, slab, column and footing, with confidence using existing codes of practice. It is also expected that the student would know the limitations of the design methods used.

Textbooks

Mosley, W.H., Hulse, R. and Bungey, J.H., *"Reinforced Concrete Design to EuroCode 2"*, 6th edition, Macmillan, London, 2007. [TA683.2.M912]

References

Wight, J.K., “Reinforced Concrete: Mechanics and Design”, 5th edition, Pearson/Prentice-Hall, 2009. [TA683.2.M147]

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Structural Design Analysis

Learning Objective

The learning objective of the course is to teach students some fundamental concepts of structural analysis. It aims to equip the students with basic understanding of the theory and application of structural analysis of trusses, beams and frames.

Module Content

Structural forms and classifications; Loads; Structural analysis and design; Idealized structures; Principle of superposition; Equations of equilibrium; Internal forces; Free body diagrams; Determinacy and stability; Simple applications of equilibrium equations; Determinacy and stability of trusses; Analysis of planar trusses; Shear force and bending moment functions of beams; Shear force and bending moment diagrams of beams and frames; Differential equations of deflection curve of beams; Integration of differential equation of deflection curve; Macaulay's Method; Method of superposition; Moment-area method; Deflections using energy methods for beams, trusses and frames.

Module Outline

S/N	Topic
1	Scope of the course. Structural forms and classifications. Loads. Structural analysis and design.
2	Idealized structures. Principle of superposition. Equations of equilibrium. Internal forces. Free body diagrams.
3	Determinacy and stability. Applications of equilibrium equations
4	Introduction to planar trusses. Determinacy and stability of trusses
5	Analysis of planar trusses. Method of joints. Zero force members. Method of sections
6	Introduction to beam and frame. International forces and loading
7	Analysis of simple beam. Shear force and bending moment functions. Shear force and bending moment diagrams.
8	Deflections of beams. Differential equations of deflection curve. Integration of differential equation of deflection curve
9	Macaulay's Method and Method of superposition
10	Moment-area method
11	Deflections using energy methods. Principle of conservation of energy. Principle of virtual work (PVW)
12	Deflections of trusses by PVW
13	Deflections of beams and frames by PVW

Learning Outcome

On successful completion of the course, students are expected to understand the difference between real structures and idealised systems, and the distribution of forces on structural systems. Students will be equipped with basic knowledge of loading, boundary condition, and equilibrium of systems. They will possess an understanding of the physical response of structures to loading and the effect this has on the response. They will able to perform basic calculations to determine internal forces and deflections of simple structures and appreciate the importance of structural analysis in the design of practical structures.

Textbooks/References

K.M. Leet, C.-M. Uang, A.M. Gilbert, "Fundamentals of Structural Analysis". McGraw-Hill, 3rd Edition, 2008.

Synopsis

Civil Engineering and Sustainable Built Environment

Learning Objective

The objective of the course is to provide students an overview of civil and environmental engineering activities, the importance of sustainable built development, and engineer's role in society.

Module Content

Civil engineering, built environment, and sustainability. Environmental impact of civil engineering / architectural activities. Urban planning and sustainable development. Civil and environmental engineering activities (history, practice, and future). Integrated civil and environmental engineering project. Engineers in society.

Module Outline

S/N	Topic
1	Civil engineering, built environment, and sustainability
2	Environmental impact of civil engineering activities, and architectural perspectives
3	Urban planning and sustainable development
4	Civil and environmental engineering activities (history, practice, and future) • Environmental and water resources engineering (water and wastewater, air, land, solid waste, health and safety) • Transportation engineering • Structures (roads, bridges, buildings, dams, and reservoirs) • Geo-engineering (geo-hazards, geo-environmental engineering, land reclamation, underground space creation)
5	Integrated civil and environmental engineering project – a case study
6	Engineers in society

Learning outcomes

After successful completion of the course, the students should be able to build up an overall picture of civil and environmental engineering activities, understand the importance of sustainable development, and ultimately to be able to develop a sustainable built environment.

Textbooks/References

Students can refer to the Reference Section in the National Library

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Environmental Engineering

Learning Objective

To provide the students with an overview of general environmental engineering principles

Module Content

Water quality. Physical, chemical, and biological unit processes for water and wastewater treatment. Solid waste management. Air quality and control.

Module Outline

S/N	Topic
1.	Introduction to environmental engineering.
2.	Water use and demand. Water quality and standards.
3.	Water treatment processes: preliminary treatment processes; coagulation and flocculation; sedimentation; filtration; disinfection; and other treatment processes.
4.	Wastewater characteristics, composition and generation.
5.	Fundamentals of Biological Treatment: kinetics, population dynamics
6.	Wastewater treatment processes: trickling filters, activated sludge process, sludge treatment
7.	Introduction to solid waste management: generation, minimization, collection, treatment and disposal of municipal wastes
8.	Air quality: pollutant source and characterization. Emission standards. Air pollution control

Learning Outcome

The course will equip the students with fundamentals on water and air quality. The students will be capable of designing simple unit processes for water and wastewater treatment.

Textbooks

Hammer and Hammer, “Water and Wastewater Technology”. 5th edition, Pearson Prentice Hall, 2005.

References

Viessman and Hammer, “Water Supply and Pollution Control”. 7th edition, Pearson Prentice Hall, 2004.

Synopsis

Project Planning & Management

Learning Objective

This course aims to expose students to the basic planning techniques and principles, both in theory and in practice, that are useful for the management of projects. It also aims to instill greater awareness of the planning at the design phase and project control at the implementation phase for successful implementation of projects. The other objective of this course is to provide an opportunity for students to undertake an in-depth research investigation in one of the areas in civil and environmental engineering.

Module Content

The course content comprises main body of knowledge in project planning and management with essential components in management principles, overview of government regulations, project planning and control techniques, financial management, time-cost trade off, cost estimating, scheduling and resources management and risk analysis.

Students will carry out project work from any discipline in civil engineering. The project should belong to one or more of the following areas: computing and analysis; design; laboratory investigation; field testing and instrumentation; case studies. The project duration is over the entire academic year or calendar year.

Module Outline

S/N	Topic
1	Introduction to Planning Act, Building Control Act, Code of Professional Conduct and Ethics,
2	General Principles of Planning & Management Introduction to Project Planning and Management
3	Overview of Planning Techniques for Projects, CPM network
4	Resource Management
5	Planning for Repetitive Construction work
6	Control of Project Progress
7	Financial Planning and Control
8	Cost-Time Planning
9	Cost Estimating & Construction Measurement and Quantities
10	Project Cost Control & Cost Curves
11	Introduction to Project Risks and Risk Analysis
12	Research Project or Case Study

Learning Outcome

Upon completion of the course, students should be able to:

(a) Appreciate the roles and duties of a project planner and manager to promote and maintain good planning and control of projects

(b) Select suitable planning and control techniques while understanding the basis/limitations of his/her choice

(c) Upon completion of the course, the student should acquire basic skills in tackling research in civil engineering. This includes gaining knowledge in the application of modern equipment for research, data collection and analyses, critical review of published literature, preparation of a research report and oral defense of his findings and conclusions.

Textbooks

Antill, J. M. and Woodhead, R.H. “Critical Path Methods in Construction Practice” 4th edition, Wiley, New York, 1990.

Clifford J.S. & Richard M. “Construction Management Fundamentals” McGraw Hill, Singapore 2004. – Chapter 2-4 (optional reading).

Professional Engineers Act, Planning Act, and Building Control Act, Singapore, SNP.(Note: PE Acts and Code of conducts & ethics can be read from: www.peb.gov.sg, Planning and Building Control Act can be read from website: http://www.agc.gov.sg/)

(Note: To use the latest edition available in the market)

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Introduction to Mechanical and Industrial Engineering

Learning Objective

The course aims to provide students with general understanding of **Mechanical and Industrial Engineering** management various activities in planning, decision making, managing the engineering design, managing production operations and able to control the engineering activity.

Module Content

Planning & Forecasting ; Decision Making; Organizing; Human Aspects of Organizing; Motivating & Leading Technical People; Controlling

S/N	Topic
1	Fundamental principles and concept in Mechanical Engineering
2	Fundamental in principles and concept Industrial Engineering
3	Determine the activity of Mechanical Engineering and the Industrial Engineering
4	Understand the problem, and improvement of Mechanical and Industrial Engineering

Learning Outcome

Upon completion of the course, students should able to:

(a) Understand the Mechanical Engineering
(b) Understand the Industrial Engineering
(c) Determine the activity of Mechanical Engineering and the Industrial Engineering
(d) U Understand the organisation and planning of Mechanical Engineering and the Industrial Engineering.
(e) Understand the problem, and improvement of Mechanical and Industrial Engineering

Textbooks -TR Banga, SC Sharma., "Industrial Engineering & Management", 11th Edition, Khanna Publishers, New Delhi 2009

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Production Technology

Learning Objective

The course aims to provide students with general understanding of Production technology management various activities in planning, decision making, managing the engineering design, managing production operations and able to control the engineering activity.

Module Content

Planning & Forecasting ; Decision Making; Organizing; Human Aspects of Organizing; Motivating & Leading Technical People; Controlling; Elements of Production

S/N	Topic
1	Introduction
2	Production Planning & Forecasting
3	Decision Making
4	Organizing
5	Human Aspects of Organizing
6	Motivating & Leading Technical People
7	Controlling
8	Managing Production

Learning Outcome

Upon completion of the course, students should able to:

- Understand the planning and forecasting activities of production process.
- Understand the planning of store and location to improve the logistics process.
- Able to understand the storage handling and equipment handling.
- Determine the activity of keeping the materials in the plant for production and other department to use.
- Able to understand the planning and programming of materials and equipment.
- It's determined how the inventory will help the level of production to increase the output and productivity.
- Students able to understand how the inventory will protect against variations in demand.
- Understand the improvement of the flow of production.

Textbooks -TR Banga, SC Sharma., "Industrial Engineering & Management", 11th Edition, Khanna Publishers, New Delhi 2009

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Industrial Engineering

Learning Objective

The course aims to provide students with general understanding of various industrial engineering methodologies, techniques to improve the productivity on work measurement study methods and students understand the mechanical engineering aspects by studying the automation and robotics technology.

Module Content

Plant Location; Plant Layout and material flow; Micro-motion and work measurement study; method of time study and ergonomics; productivity; automation and robotics and value engineering.

S/N	Topic
1	Plant Location
2	Plant Layout and Material Flow
3	Micro-motion and Work measurement study
4	Method of time study and Ergonomics
5	Productivity
6	Automation and Robotics
7	Value Engineering

Learning Outcome

Upon completion of the course, students should able to:

(a) Understand the important of the location of the plant to improve the cost effective and logistics process of the delivery.
(b) Understand the layout plant and work flow to speed up the work process and to reduce downtime of the production.
(c) Determine how should the job be done and how much time taken to complete the job. The best method of performing each operation and to eliminate wastage.
(d) Understand how to improve the productivity by optimum use of available resources.
(e) Determine how the productivity will improve by using effective automation and robotics systems.
(f) Understand the value engineering systematics application of recognized techniques to identify the function of a product or services, establishes value for the function and achieving the function at the lowest total cost without degradation.

Textbooks

TR Banga, SC Sharma., "Industrial Engineering & Management", 11th Edition, Khanna Publishers, New Delhi 2009.

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Material Management

Learning Objective

The course aims to provide students with general understanding of various activities in purchasing department, proper receipt, custody and issues of material from store, understand the storage handling issues and improvement, able to plan effectively on material planning, understand the management system of the inventory movement and able to known how to handle materials and equipment.

Module Content

Purchasing process and department; Storage locations and layout planning; storage handling and equipment's; material requirement planning; Inventory Management and System; Materials Handling; Material Handling Equipment.

S/N	Topic
1	Purchasing process and Department
2	Store location and Layout planning
3	Storage handling and Equipment's
4	Material Requirement Planning
5	Inventory Management and System
6	Materials Handling
7	Material Handling Equipment

Learning Outcome

Upon completion of the course, students should able to:

(f) Understand the activities carried out in purchasing department and the process of ordering and issuing materials.

(g) Understand the layout planning of store and location to improve the logistics process.

(h) Able to understand the storage handling and equipment handling. Determine the activity of keeping the materials in the plant for production and other department to use.

(i) Able to understand the planning and programming of materials and equipment. Students able to understand the material planning systems.

(j) It's determined how the inventory will help the level of production to increase the output and productivity. Students able to understand how the inventory will protect against variations in demand.

(k) Understand the improvement of the flow of material and the important of the material handing process.

Textbooks TR Banga, SC Sharma., "Industrial Engineering & Management", 11th Edition, Khanna Publishers, New Delhi 2009.

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Mechanical Engineering

Learning Objective

The course aims to provide students with general understanding of engineering and technology management various activities in planning, decision making, managing the engineering design, managing production operations and able to control the engineering activity.

Module Content

Planning & Forecasting ; Decision Making; Organizing; Human Aspects of Organizing; Motivating & Leading Technical People; Controlling; Elements of Mechanical Engineering; Managing the Research Function and Managing Engineering Design

S/N	Topic
1	Planning & Forecasting
2	Decision Making
3	Organizing
4	Human Aspects of Organizing
5	Motivating & Leading Technical People
6	Controlling
7	Managing Engineering Design
8	Elements of Mechanical Engineering

Learning Outcome

Upon completion of the course, students should able to:

- Understand the planning and forecasting activities to speed up the operations process.
- Understand the layout planning of store and location to improve the logistics process.
- Able to understand the storage handling and equipment handling. Determine the activity of keeping the materials in the plant for production and other department to use.
- Able to understand the planning and programming of materials and equipment. Students able to understand the material planning systems.
- It's determined how the inventory will help the level of production to increase the output and productivity. Students able to understand how the inventory will protect against variations in demand.
- Understand the improvement of the flow of material and the important of the material handing process.

Textbooks -TR Banga, SC Sharma., "Industrial Engineering & Management", 11th Edition, Khanna Publishers, New Delhi 2009.

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Admission Requirements

To be considered for admission into the programme, applicants should have the following qualifications.
3 O level with Maths, Science and English passed or
Mature candidate with minimum 2 years working experience in related industry

Total Course Duration

The course duration is 12 months (6 hours per week) for both Full time and Part-time students. Course duration is specified as follows:

	Duration	Face to Face Lecture per module	Tutorial per module
Part Time	12 Months	17 hours per module	Nil
Full Time	12 Months	17 hours per module	36 hours

The course is divided into the modules to be taught and allocation hours are shown in the table below.

Module Name	(Hr)
Essential Engineering Mathematics	17
Construction Technology and Processes	17
Steel Design Structure	17
Reinforced Concrete Design	17
Structural Analysis	17
Civil Engineering and Sustainable Built Environment	17
Environmental Engineering	17
Project Planning & Management	12
Introduction to Mechanical and Industrial Engineering,	17
Production Technology,	17
Industrial Engineering,	17
Material Management	17
Mechanical Engineering	17
Total Face to face lecture hours	216

Assessment and Grading

For each module, the students' level-of-understanding of the subject-areas will be assessed through a formal examination.
Grading will be given for each module, depending on the total score obtained by the student. The grading with corresponding scores is shown in the table below.

Grade	Score
A+	Score 75 and above
A	70 to 74
B+	65 to 69
B	60 to 64
C+	55 to 59
C	50 to 54
Fail	49 and below