

1.2.2 Description of courses

B.Eng (Civil Engineering) and B.Eng (Environmental Engineering)

Year 2

CV2000 Essential Mathematics

AUs: 3, Prerequisites: NIL, Semester 1

Complex Numbers, Vectors, Analytic Geometry, Limits, Continuity, Derivatives, Applications of Derivatives, Integration, Applications of Integrations.

CV2001 Engineering Probability and Statistics

AUs: 3, Prerequisites: NIL, Semester 1

Introduction to Statistics, Basic Concepts of Probability, Rules and Theorems of Probability, Random Variables, Discrete Probability Distribution, Continuous Probability Density Function, Expectations, Inferential Statistics, Regression and Correlation, Applications.

CV2002 Computational Methods

AUs: 3, Prerequisites: FE1007, Semester 2

Introduction to Matrix Algebra, Basis, Rank and Linear Independence, Linear Transformation, Determinant and Inverse, Solutions of Linear Equations, Matrix Norm and Matrix Conditioning, Eigen Values and Eigenvectors, Introduction to Numerical Methods, Numerical Solution of Ordinary Differential Equations, Numerical Solution of Partial Differential Equations, Computational Applications.

CV2003 Civil Engineering Materials

AUs: 3, Prerequisites: NIL, Semester 2

Civil engineering materials and environmental considerations. Concrete technology: concrete-making materials, properties of fresh and hardened concrete, mixing, placing, and curing, mix design, destructive and non-destructive tests, quality control, durability, and special concrete. Masonry. Steel: basic metallurgy, properties and applications, welding technology and corrosion. Wood and timber: classification, properties affecting design, mechanical strength and defects. Polymers, plastics, and fibre-reinforced composites. Highway materials: bitumen, cutbacks, emulsified asphalt, road aggregates and asphalt concrete. Selected topics.

HW210 Technical Communication

AUs: 2, Prerequisites: NIL, Semester 2

Principles of technical communication, conveying technical information in writing and orally, types of technical reports, technical writing style.

CV2101 Mechanics of Materials

AUs: 4, Prerequisites: NIL, Semester 1

This course covers both the statics of particles and rigid bodies and basic topics on the mechanics of materials. The principal topics are statics of particles, equilibrium of rigid body, analysis of simple trusses and beams, analysis and design of structural members subjected to tension, compression, torsion, and bending, including such fundamental concepts as stress, strain, and elastic behaviour. Other topics of general interest are the transformation of stress and strain, combined loading and the stability of columns.

CV2102 Structures I

AUs: 3, Prerequisites: CV2101, Semester 2

Bar forces in simple, compound and complex trusses. Bending moment, shear and axial forces of beams and frames. Principle of superposition. Principle of virtual work. Energy theorems. Displacements of elastic determinate structures: eometric methods, principle of virtual work, energy theorems.

CV2301 Soil Mechanics

AUs: 3, Prerequisites: NIL, Semester 1

Soil formation and composition. Physical properties of soils: clay minerals and soil structure, soil indices, soil classification. Soil compaction. Water in soils and seepage: permeability, one-dimensional flow. Stress in soil: effective stress concept, Mohr circle. Compressibility and consolidation of soils: oedometer tests, preconsolidation stress, compression indices and settlement calculation, Terzaghi's one-dimensional consolidation theory, pore pressure dissipation and degree of consolidation. Shear strength of soils: Mohr-Coulomb failure criterion, direct shear and triaxial tests, volume change and pore pressure responses.

CV2302 Geotechnical Engineering

AUs: 3, Prerequisites: CV2301, Semester 2

Site investigations: subsurface exploration, drilling, sampling, field and laboratory testing, design parameters. Flow in soils: two-dimensional flow, flownets, seepage forces, groundwater control, dewatering. Limit equilibrium and earth pressure theory: active and passive pressure, limit analysis of retaining walls and slopes. Slope stability: drained and undrained analysis, infinite slopes, method of slices, slope stabilisation, field performance monitoring. Soil improvement: objectives and overview, shallow surface compaction, deep densification, deep stabilisation.

CV2601 Fluid Mechanics

AUs: 3, Prerequisites: NIL, Semester 1

Fluid Statics, Elementary Fluid Dynamics, Momentum Equation and its Application, Dimensional Analysis and Similitude, Internal Flows, Piping and Pump Systems.

CV2602 Water Resources Engineering

AUs: 3, Prerequisites: CV2601, Semester 2

Concept of boundary layer, open channel hydraulics: steady uniform flow, specific energy diagram, channel transitions and controls, hydraulic jump. Engineering hydrology: hydrologic cycle, sub-surface flow, surface runoff, unit hydrograph, reservoir yield and storage, and flood routing.

CV2701 Lab 2A

AUs: 1, Prerequisites: NIL, Semester 1

Laboratory experiments and projects related to areas in civil engineering such as fluid mechanics, environmental engineering, soil mechanics and mechanics of materials.

CV2702 Lab 2B

AUs: 1, Prerequisites: NIL, Semester 2

Laboratory experiments and projects related to areas in civil engineering such as civil engineering materials, environmental engineering and soil mechanics.

CV2901 Engineering Drawing and Measurement

AUs: 2, Prerequisites: NIL, Semester 1

Computer aided design and drafting (CADD), Plan and drawing interpretation, Fundamental measurement concepts, Leveling, Traversing, Global Positioning Systems (GPS).

CV2902 Engineering Innovation and Design

AUs: 1, Prerequisites: NIL, Semester 2

Entrepreneurship, Integrated civil engineering project, Cost Analysis, Scheduling.

EN2501 Environmental Chemistry

AUs: 2, Prerequisites: NIL, Semester 1

Water quality implications for environmental and engineering activities. Water characteristics. Examples of engineering and environmental problems affected by chemical processes. Order of reaction in chemical and biochemical processes.

EN2502 Environmental Processes

AUs: 3, Prerequisites: NIL, Semester 2

Mass balances, reaction thermodynamics and kinetics. Physical, chemical, and biological processes in natural and engineered environmental systems. Process modelling.

EN2503 Environmental Microbiology

AUs: 3, Prerequisites: NIL, Semester 2

Topics include introduction to microbiology, microbial evolution and molecular phylogeny, biochemistry, microbial growth, microbial ecology, microbial groups and metabolic diversity, microorganisms in environmental engineering.

EN2603 Hydrology

AUs: 3, Prerequisites: NIL, Semester 2

Hydrologic cycle and basic meteorology: precipitation, evaporation and transpiration, infiltration and sub-surface flow, surface runoff. Streamflow measurement, hydrograph analysis, and unit hydrograph. Reservoir yield and storage. Flood routing. Basic concepts of groundwater. Frequency analysis of hydrologic data.

EN2703 Lab 2C

AUs: 1, Prerequisites: NIL, Semester 2

Laboratory experiments and projects related to areas in civil engineering and environmental engineering.

Year 3

CV3101 Structures II

AUs: 3, Prerequisites: CV2102 (Structures I), Semester 1

This course embraces classical and modern methods for the analysis of statically indeterminate structures. Principal topics are the force method using consistent deformation and conservation of energy. Deformation of indeterminate structures and the method of influence lines are taught. Displacement technique involving slope-deflection equations and moment distribution approach are introduced for structures with/without sway. A mini-project involving fabrication and testing is included and where the appreciation of the computer as an analysis tool is encouraged.

CV3201 Reinforced Concrete Design

AUs: 3, Prerequisites: CV2102, Semester 1

In this course, students will learn to understand the behavior of simple reinforced concrete structures and how to design them. The course, which builds on existing knowledge of engineering materials, analysis and design from previous courses, is split into two parts. In the first part, an understanding of how steel and concrete work together to resist forces will be developed. Methods for estimating the ultimate strength, deflection of slabs, beams and columns subjected to various combinations of flexure, shear and axial load will be developed. The second part of the course uses understanding of the strengths of members developed to design members in a simple structure <not sure what this sentence means>. A realistic framed structure will be designed and detailed as part of a design project.

CV3202 Steel Design

AUs: 3, Prerequisites: CV2102, Semester 1

This course develops an understanding of Limit State Design as applied to structural steel members and connections based on British Standard Code of Practice BS5950.

CV3203 Structural Design

AUs: 4, Prerequisites: CV2102, Semester 1

Part one: Concrete Design Basic structural members and structural systems. Loads and load effects. Section analysis and design for bending. Design for shear, torsion, and bond. Design of compression members. Design of slab systems. Design of foundation. Part two: Steel Design Limit state design. Material properties and structural responses. Local buckling and section classification. Fully restrained beams. Tension and compression members. Connection design.

CV3301 Foundation Engineering

AUs: 3, Prerequisites: CV2301, Semester 1

Evaluation of soil parameters for foundation design. Shallow foundation: bearing capacity and settlement. Deep foundation: pile types, axial and lateral capacity, and load tests. Retaining walls: gravity walls, embedded walls and braced excavation systems.

CV3401 Transportation Engineering

AUs: 3, Prerequisites: NIL, Semester 1

Transportation systems. Transportation planning and management. Traffic flow studies. Geometric design of roads and intersections. Design of flexible and rigid pavements.

CV3501 Environmental Engineering

AUs: 3, Prerequisites: NIL, Semester 1

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

CV3901 Industrial Attachment

AUs: 10, Prerequisites: Year 3 standing and completed at least four semesters of study (two semesters for direct entry students), Semester 2

A six-month training attachment in the civil engineering industry covering practical aspects of civil engineering planning, design, construction and operation. Supervised by a tutor each from industry and the university.

EN3502 Water Supply Engineering

AUs: 3, Prerequisites: CV2601, Semester 1

General features of water supply systems. Water distribution systems. Water treatment principles and design. Advanced water treatment methods. Water reuse.

EN3503 Wastewater Engineering

AUs: 3, Prerequisites: NIL, Semester 1

Wastewater and stormwater systems. Wastewater generation. Wastewater treatment: physical, chemical, and biological unit processes. Advanced wastewater treatment. Sludge treatment.

EN3504 Solid Waste Management

AUs: 3, Prerequisites: NIL, Semester 1

Integrated solid waste management. Waste sources, characteristics, generation, collection, transfer and transport. Waste recycling, reuse, recovery, treatment and disposal. Industrial waste management issues and productivity. Hazardous treatment and disposal.

EN3505 Geoenvironmental Engineering

AUs: 3, Prerequisites: NIL, Semester 1

Physical properties of soils and soil classification, permeability and seepage, effective stress principle, components of waste containment systems, contaminant fate and transport in soil and aquifer, field investigation and remedial technologies.

EN3601 Hydraulics

AUs: 3, Prerequisites: CV2601, Semester 1

Concept of boundary layer: surface roughness, velocity distribution in turbulent flow, law of the wall. Open channel hydraulics: uniform flow, critical flow, application of energy and momentum principles, hydraulic jumps, gradually varied flows, backwater computation.

EN3901 Industrial Attachment

AUs: 10, Prerequisites: Year 3 standing and completed at least 4 semesters of study (2 semesters for direct entry students), Semester 2

A six-month training attachment in the civil engineering industry covering practical aspects of civil engineering planning, design, construction and operation. The attachment is supervised by a tutor each from industry and the university.

Year 4

CV4000 Engineers and Society

AUs: 3, Prerequisites: NIL, Semester 1

This course explores the social, economic, historical and political environments in which the engineering profession operates and the current issues relevant to them. Students present and discuss these issues during tutorials and participate in community projects.

HW310 Professional Communication

AUs: 2, Prerequisites: 83AUs (excluding GE/UE) and completed six or more semesters of study (51AUs (excluding GE/UE) and completed four semesters for direct entry students), Semester 2

Business and professional communication competence; workplace oral and written communication skills; interpersonal communication in professional settings; cross-cultural communication; job search skills; successful communication in groups and teams; conflict resolution management; negotiation skills; projecting a professional image.

CV4151 Structures III

AUs: 3, Prerequisites: CV3101, Semester 1 or 2

Theory and applications of modern structural analysis. Concept of equilibrium, compatibility and force-displacement relationship. Direct stiffness method. Matrix formulation of trusses, beams and frames. Unit displacement method. Spring supports. Introduction to stability. Formulation of stability concepts associated with columns and frames. Elastic stability analysis of framed structures.

CV4152 Advanced Steel Structures

AUs: 3, Prerequisites: CV3202 Steel Design, Semester 1 or 2

Introduction and classification of plate girders, moment capacity of plate girders, buckling of web in shear and bending, design of web with tension field action, design of end-post and end-panel, design of intermediate and load bearing stiffeners, shear buckling and plate girder design, introduction to plastic analysis, plastic hinge concept, theory of plastic analysis, plastic analysis of portal frame and instantaneous centre of rotation, portal frame design, introduction to multi-storey rigid frames, design of multi-storey rigid frames, introduction to moment connections, analytical techniques in moment connections, introduction and behaviour of hollow sections, design of circular hollow sections, design of rectangular hollow sections.

CV4153 Numerical Modelling of Civil Engineering Structures

AUs: 3, Prerequisites: CV3101, Semester 1 or 2

Introduction to the finite element method for civil engineers. Finite element formulation for 3D frame structures, plane stress and plane strain problems. Simple thin plate bending finite elements. Structural modelling of 3D frame, flat slab, frame/ shear wall and tall building structures. Practical problem formulations and computer modelling. Accuracy and convergence studies. Results presentation and interpretations.

CV4154 Bridge Engineering

AUs: 3, Prerequisites: CV3101, CV3201, CV3202, Semester 1 or 2

History of bridge-building; types of bridges; Materials for modern bridges. Loads on bridges – standard truck and lane loading. Impact loads. Longitudinal and centrifugal forces. Wind and seismic loads. Thermal loads. Serviceability criteria – deflection and fatigue. Reinforced Concrete Bridges. Slab bridges – longitudinally reinforced bridges. Concrete Slab-Steel Stringer Bridge Design. Non-composite vs. Composite Design. Design Aids. T-Beam. Plate Girder Bridges – general approach. Box Girder Bridges. Prestressed Concrete Bridges. Optimum Bridge Proportioning. Bridge Aesthetics, Inspection, Rehabilitation.

CV4201 Civil Engineering Management

AUs: 3, Prerequisites: 80AUs (excluding IA, excluding GE/UE) and completed five or more semesters of study (49AUs (excluding IA, excluding GE/UE) and completed three semesters for direct entry students)
Year 4 standing, Semester 1

The course content comprises main bodies of knowledge in engineering management with essential components in management principles, relevant government legislations, contract law, project planning and control techniques, financial management, resources management, and an overview of civil engineering procedures.

CV4202 Human Resources Management and Entrepreneurship

AUs: 3, Prerequisites: NIL, Semester 2

Socio-economic organisations and society. People-centred management. Industrial relations in Singapore. Performance appraisal. Compensation and reward systems. Quality management and productivity. Group dynamics and interpersonal relationships. Motivation and leadership. Communications and team building. Entrepreneurship: essentials of entrepreneurs, business opportunities and market needs, funding, financial reporting, legal and statutory requirements.

CV4251 Civil Engineering Construction Technology

AUs: 3, Prerequisites: 80AUs (excluding IA, excluding GE/UE) and completed five or more semesters of study (49AUs (excluding IA, excluding GE/UE) and completed three semesters for direct entry students)
Year 4 standing, Semester 1 or 2

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, coastal structures, appraisal of concrete structures, retrofitting of buildings, automation and robotics in construction, buildability scores and concern.

CV4252 Engineering Economics and Finance

AUs: 3, Prerequisites: Year 3 standing, Semester 1 or 2

Introduction. Concepts and Principles of Engineering Economics. Time Value of Money. Economic Evaluation of Alternatives. Financial Accounting. Depreciation Accounting. After-tax Economic Analysis. Effects of Inflation on Economic Evaluation. Replacement Analysis. Sources of Finance. Decision Making under Uncertainties.

CV4253 Tall Buildings

AUs: 3, Prerequisites: CL411/CV3101, Semester 1 or 2

Philosophy and design criteria of tall buildings. Structural forms for tall buildings. Framed, shear wall, tubular and coupled structures. Lateral loads - wind and seismic. Structural analysis. Simplified analytical models. Drift analysis. Computer applications to the analysis of tall building structures.

CV4254 Prestressed Concrete

AUs: 3, Prerequisites: CV3201 RC Design, Semester 1 or 2

Basic concepts of prestressing. Materials and prestressing systems. Prestressed losses and time dependent deformation. Behaviour and design of members subjected to flexure, shear and combined axial and bending action. Composite members. Indeterminate structures. Compression members.

CV4352 Excavation and Retaining Walls

AUs: 3, Prerequisites: CV3301, Semester 1 or 2

Open and supported excavation: overview of open and braced/ anchored excavations in soil, groundwater control, stability of excavations, design of excavation support systems, ground movements associated with excavation, construction monitoring. Earth retaining structures: overview of earth retention systems, concrete retaining walls, reinforced soil walls and anchored bulkheads.

CV4353 Ground Engineering

AUs: 3, Prerequisites: CV2302 Geotechnical Engineering, Semester 1 or 2

Soil improvement: shallow surface compaction; deep densification; deep stabilisation; soil reinforcement; preloading and vertical drains. Slopes and embankments: methods of slope stability analysis; reinforced embankments over soft clay; principles of slope stabilisation.

CV4451 Traffic Engineering

AUs: 3, Prerequisites: CV3401, Semester 1 or 2

Statistical analysis of traffic data. Traffic flow analysis. Highway and intersection capacity. Traffic signal control. Traffic management. Parking.

CV4452 Highway Engineering

AUs: 3, Prerequisites: CV3401, Semester 1 or 2

Analysis and design of flexible and rigid pavements. Pavement management. Design of roadside facilities. Highway drainage. Environmental aspects.

CV4453 Airport Engineering

AUs: 3, Prerequisites: CV3401, Semester 1 or 2

Airport master planning. Aircraft performance characteristics and their effects on airport design. Determination of runway length. Aids to navigation. Airport capacity and delay. Airport configuration. Design of airport pavements. Aircraft noise.

CV4551 Water Supply Engineering

AUs: 3, Prerequisites: CV3501, Semester 1 or 2

General features of water supply systems. Water distribution systems. Water treatment principles and design. Advanced water treatment methods. Water reuse.

CV4552 Wastewater Engineering

AUs: 3, Prerequisites: CV3501, Semester 1 or 2

Wastewater and stormwater systems. Wastewater generation. Wastewater treatment: physical, chemical, and biological unit processes. Advanced wastewater treatment. Sludge treatment and disposal.

CV4553 Solid Waste Management

AUs: 3, Prerequisites: NIL, Semester 1 or 2

Integrated solid waste management. Waste sources, characteristics, generation, collection, transfer and transport. Waste recycling, reuse, recovery, treatment and disposal. Industrial waste management issues and productivity.

CV4554 Air Pollution Control Engineering

Acad Unit: 3, Pre-Requisites: NIL, Semester 1 or 2

Introduction to air pollution control. Characteristics of air pollutants. Air pollution effects and legislations. Measurement, emission estimates and meteorology. Air pollution concentration models. Control of

particulates, volatile organics and hydrocarbons. Control of sulphur oxides and nitrogen oxides. Control of vehicle emissions and odorous compounds. Indoor air pollution

CV4555 Surface Water Quality

AUs: 3, Prerequisites: Year 3 standing, Semester 1 or 2

Surface water quality characterisation, sampling, analysis, monitoring and assessment. Surface water quality guidelines and standards. Dissolved oxygen balance and eutrophication. Transformations of contaminants in surface waters. Surface water quality modelling and management.

CV4651 Environmental Hydraulics

AUs: 3, Prerequisites: CV2602, Semester 1 or 2

Introduction to pollutant transport processes. Diffusion and dispersion. Mixing in reservoirs, rivers, estuaries and coastal waters. Wastewater discharge: turbulent jet and plume. Design of ocean wastewater discharge system.

CV4652 Applied Hydrology

AUs: 3, Prerequisites: CV2602 or EN2603, Semester 1 or 2

Hydrologic processes and measurements: rainfall, infiltration, and surface runoff. Hydrograph analysis and synthesis. Hydrologic and hydraulic flood routing. Drainage design: rainfall curves, flood peak estimation, highway drainage. Flood mitigation: detention ponds, channel improvements.

CV4653 Sediment Transport

AUs: 3, Prerequisites: CV2602 or EN3601, Semester 1 or 2

Review of open channel flow. Sediment properties, criteria for incipient sediment motion. Geometry of fluvial channel; resistance to flow and bed forms. Sediment discharge formulae. Stable channel design. Local scour phenomena around hydraulic structures; scour protection.

CV4751 Coastal Engineering

AUs: 3, Prerequisites: CV2602 or EN3601, Semester 1 or 2

Wind-generated waves: wind wave generation, statistics and forecasting. Mechanics of wave motion: linear wave theory, wave kinematics, pressure, energy and power, wave group celerity, shoaling, refraction, diffraction and reflection of waves, wave breaking and runups. Coastal wave level fluctuations: tides, seiches, surges, wind setup and basin oscillations. Coastal zone processes: beach profiles, longshore transport and sediment budget. Coastal structures: fluid loading, breakwater design.

CV4752 Offshore Engineering

AUs: 3, Prerequisites: CL312 or CV3202, Semester 1 or 2

Overview of history and development, design criteria and loadings, conceptual design, computer modelling and analysis, in-place analysis and code compliance, fatigue analysis, seismic analysis, dynamic analysis, miscellaneous design, marine studies, certification and inspection.

CV4753 Offshore Hydrodynamics

AUs: 3, Prerequisites: CV2602 or EN3601, Semester 1 or 2

Review of fluid statics. Equations of fluid flows. Boundary layer analysis. Elementary potential flow. Elements of water wave theory. Applications in offshore engineering.

CV4901 Final Year Project

AUs: 10, Prerequisites: 80AUs (excluding IA, excluding GE/UE) and completed five or more semesters of study (49AUs (excluding IA, excluding GE/UE) and completed three semesters for direct entry students), Semesters 1 and 2

Final-year 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. A formal report will be required. Each student is required to make an oral presentation.

CV4902 Integrated Design

AUs: 3, Prerequisites: Year 4 standing, Semester 1

A project-based course in which students are required to undertake several group projects covering both the conceptual and detailed aspects of design. It involves different areas of the civil engineering discipline such as ground investigation, planning, architectural design, transportation design, social, economic evaluation and environmental assessment of possible solutions, foundation design, structural design, and consideration of buildability of the construction.

EN4554 Air Pollution Control Engineering

AUs: 3, Prerequisites: NIL, Semester 2

Introduction to air pollution control. Characteristics of air pollutants. Air pollution effects and legislations. Measurement, emission estimates and meteorology. Air pollution concentration models. Control of particulates, volatile organics and hydrocarbons. Control of sulphur oxides and nitrogen oxides. Control of vehicle emissions and odorous compounds. Indoor air pollution control.

EN4555 Surface Water Quality

AUs: 3, Prerequisites: Year 3 standing, Semester 1 or 2

Surface water quality characterisation, sampling, analysis, monitoring and assessment. Surface water quality guidelines and standards. Dissolved oxygen balance and eutrophication. Transformations of contaminants in surface waters. Surface water quality modelling and management.

EN4556 Membrane Technology

AUs: 3, Prerequisites: NIL, Semester 1 or 2

Introduction to membrane technology. Membrane fundamentals including working principles, process control and design. Microfiltration, ultrafiltration, nanofiltration and reverse osmosis. Prevention and control of membrane fouling. NEWater production. Recovery and reuse of secondary effluent. Membrane desalination. Membrane-bioreactor.

EN4559 Biotechnology in Environmental Engineering

AUs: 3, Prerequisites: Year 3 standing, Semester 1 or 2

Biotechnology basics, growth concepts, biomass measurements, cultivation, public health biotechnology, aerobic processes, anaerobic processes, nutrient removal and recovery, biotransformation and biodegradation, lagoons and wetlands, bioremediation, treatment of airborne pollutants, microbial products in environmental engineering, molecular biotechnology.

EN4651 Environmental Hydraulics

AUs: 3, Prerequisites: CV2602 or EN3601, Semester 1

Introduction to pollutant transport processes. Diffusion and dispersion. Mixing in reservoirs, rivers, estuaries and coastal waters. Wastewater discharge: turbulent jet and plume. Design of ocean wastewater discharge system.

EN4654 Applied Hydraulics

AUs: 3, Prerequisites: EN3601, Semesters 1 and 2

Similitude and hydraulic modelling. Design of scale models, distorted and movable-bed models. Hydraulic structures: intakes, spillways, stilling basins, energy dissipation. Channel transition: Culverts, bridge piers. Hydraulic transients in pipelines.

EN4852 Integrated Environmental Management

AUs: 3, Prerequisites: Year 3 standing, Semester 1 or 2

Integrated environmental management (history, issues and challenges, and consequences of mismanagement). Environmental management system. Industrial Ecology. Life cycle analysis. Environmental impact assessment. Environmental health and safety.

EN4901 Final Year Project

AUs: 10, Prerequisites: Year 4 standing, Semesters 1 and 2

Final year students will carry out project work in any Environmental Engineering area. The project should belong to one or more of the following areas: computing and analysis; design; laboratory investigation; field testing and instrumentation; or case studies. The project duration is over the entire academic year or calendar year. A formal report will be required. Each student is required to make an oral presentation.

EN4902 Integrated Design

AUs: 3, Prerequisites: Year 4 standing, Semester 2

A project-based course in which students are required to undertake several group projects covering both the conceptual and detailed aspects of design and planning. It can involve different areas of the environmental engineering discipline such as water and wastewater treatment; solid waste management; and air, noise, and ground pollution. The project scope can include investigation, planning, design, social impact, economic evaluation and environmental impact assessment studies.

Bachelor of Science in Maritime Studies

Year 1

HW110 Effective Communication

AUs: 2, Prerequisites: NIL, Semester 1

This is an introductory course on communication skills involving students in a range of oral and written activities through group work, interaction, role-play and presentations. It introduces students to the key communication processes and skills that shape their perceptions when interacting in various situations ranging from intrapersonal, interpersonal and intercultural communication to mass communication.

MB101 Accounting

AUs: 3, Prerequisites: NIL, Semester 1

The emphasis of this course is on the role and impact of information on business, and introduces students to the accounting process of measuring, controlling and attesting information for this purpose.

Students will be introduced to strategy and the business environment, an understanding of the role of contracts, the role of information in decision-making and the role of accounting in providing information for negotiation, execution, and monitoring of contracts. They will be given an overview of both financial and non-financial performance measures relied on by internal and external users for decision-making. By the end of the course, students should be able to appreciate that accounting is a process of measuring, disclosing and attesting to information that facilitates the control of an organisation's processes and improves the economic decisions made by organisational agents and stakeholders. Topics covered include the role of information and performance measurement (financial and non-financial) in the context of value creation, the business environment, and business processes; agency problems; the accounting cycle and recording system; preparation and interpretation of financial statements.

MB106 Fundamentals of Management

AUs: 3, Prerequisites: NIL, Semester 1

The course is designed for non-business students, aiming to equip them with the knowledge, skills, and competencies in various aspects of management.

MB107 Business Law

AUs: 3, Prerequisites: NIL, ; Semester 2

The aim of this course is to instill in today's accountancy and business professionals a keen understanding of the legal aspects of their decisions and responsibilities in the daily practice of their profession. This course will provide an understanding of legal methodology and the main principles of law relating to business transactions. The course will also demonstrate how commercial law and business practices inter-relate and often influence each other in shaping modern commerce and industry. In particular, key legal topics will be explained and illustrated from a business perspective.

HE191 Principles of Economics

AUs: 3, Prerequisites: NIL, Semester 2

This course aims to teach students the "economic facts of life" in an interactive fashion. Lectures will introduce the theoretical framework of both micro and macroeconomics. Tutorials will serve as discussion forums. E-learning tools will be heavily relied upon not only to disseminate and announce information but also as an instrument of learning through promoting and rewarding active involvement of participants.

MT1101 Mathematics I for Maritime Studies

AUs: 3, Prerequisites: NIL, Semester 2

Function and graph. Limits and continuity. Mathematics of finance: interest, geometric series, investment appraisal. Differential. Optimisation of business functions. Indefinite and definite integrations. Application of integrals in business and economics. Partial and total differentiation. Production function analysis. Double integrals. Applications of double integrals in ship technology.

MT1202 Introduction to Maritime Industry

AUs: 3, Prerequisites: NIL, Semester 1

Facts and figures highlighting the importance of shipping; Brief introduction to types of ships; Geographical origins and destination of major cargo; Role of Broker, Charterer, Shipper, Carrier, Consignee, Distributor, Retailer and End-user; Contracts of carriage; Insurance (marine insurance, cargo insurance, P and I); Port operations; Maritime logistics, Shipping economics; Ship operations and management; Legal Infrastructure;

Maritime Safety and Security; Marine pollution; International framework of shipping and Marine Environmental issues.

MT1201 Transport Liability and INCO Terms

AUs: 3, Prerequisites: NIL, Semester 2

Introduction to international trade terms; Introduction to applicable insurance covers; International sale contracts and the challenge of transporting goods internationally; Inco terms and their importance to the sales contract; Contracts of sea carriage; Bills of Ladings; Carriers Liability for sea transportation and the Hague Visby Rules. Importance of sale contract and the contract with the carrier, Inter-modal and multi-modal transports, Agreements of sale and purchase, INCO terms 2000, Methods of Payment of freight, Characteristics and bills of lading – liability and limitations, Risk and insurance of vessels and cargo, Basic Chartering and Ship Broking Terms, Legal aspects and some commercial aspects of chartering contracts, Carriage of Goods by Sea e.g., Hague Rules, Hague/Visby Rules, Carrier's Liabilities and Limitations, Exceptions, Defenses available, Burden of Proof .

MT1301 Maritime Technology I

AUs: 3, Prerequisites: NIL, Semester 2

Hull forms. Displacement and flotation. Centres for buoyancy and gravity. Transverse and longitudinal stabilities. Ship system. General arrangement. Ship Stresses and Major Structural Items. Basic Shipbuilding. Maritime organisations.

Year 2

MT2101 Mathematics II for Maritime Studies

AUs: 3, Prerequisites: Mathematics I for Maritime Studies (MT1101), Semester 1

Basic matrix operation. Matrix inversion. Linear equations. Cramer's Rule. Gauss-Jordan elimination. Ordinary differential equations. Applications of linear equations and ordinary differential equations in business, finance and economics. Optimisation theory. Linear programming programme formulation and applications in business. Network analysis and network flow problems. Introduction to queuing models.

MT2201 Shipping Economics

AUs: 3, Prerequisites: NIL, Semester 1

Patterns of maritime trade and cargo; Economic organisation of shipping market; Four major shipping markets and market cycle; Demand for and supply of maritime transport; Market structure; Pricing mechanism and freight revenue; Shipping cost; Economies of scale in shipping; Bulk cargo and tramp shipping; General cargo and liner shipping; Conference, alliance and Case studies. Maritime trade and cargo. Shipping market. Market cycle. Supply and demand. Freight and cost structure. Tramp shipping. Liner shipping.

MT2202 Ship Accounting

AUs: 3, Prerequisites: Accounting I (MB101), Semester 1

Shipping Accounting; Proposed accounting plan for shipping businesses; Account analysis and function: Fixed assets accounts; Circulating assets; Stock accounts; Claim accounts; Liquid assets accounts; Liabilities accounts; Expenses accounts; Income accounts; Vessel operation accounts; Development of foreign exchange accounts; Accounting of special issues relevant to vessel operation and Integration of analytical accounting with general accounting accounts. Account analysis and function: Fixed assets accounts. Circulating assets. Stock accounts. Claim accounts. Liquid assets accounts, Liabilities accounts. Expenses accounts. Income accounts. Vessel operation accounts. Development of foreign exchange accounts. Accounting of special issues relevant to vessel operation. Integration of analytical accounting with general accounting accounts. Focus is on the conceptual framework of IRS and special focus will be on the tax laws impact on international shipping companies.

HW210 Technical Communication

AUs: 2, Prerequisites: NIL, Semester 2

Principles of technical communication; conveying technical information in writing and orally; types of technical reports; technical writing style.

MT2203 Organisation to a Ship Owning Entity

AUs: 3, Prerequisites: NIL, Semester 1

Pools and joint ventures; legal, strategic, administrative or commercial aspects of shipping; Laws and regulations applicable to ship owning entity; Shipowner and taxes, national and international tax laws and

sale taxes; Ship registration and classification and New building of ships and repair contracts. Scrapping of vessels.

MT2204 Shipping Management

AUs: 3, Prerequisites: NIL, Semester 2

Principle of shipping market, demand for and supply of shipping services; Organisation of shipping services – trade categories; Shipping operations, vessel categories and transport capacity; Cargo and cargo handling technology; Cost and prices in shipping; Dynamics of shipping business cycle and International shipping and trade policies. Fleet and ship management; ship management companies; crew management; technical management; managing ships' husbandry. Marketing management for the shipping firm: concepts, functions, and strategy. Tools for financial analysis of shipping investments.

MT2205 Port Economics

AUs: 3, Prerequisites: Principle of Economics (HE191), Semester 2

International trade and port; The function of port; The role of port in economic development; Demand and supply of port services; Users of port services; Port ownership, structure and administration; Port cost; Port pricing; Layout, structure, facilities and basic operations of terminals; Port productivity; Port competitiveness and competition; International professional terminal operator; Policy issues and Case studies of the largest ports in the world.

MT2206 International Framework of Shipping

AUs: 3, Prerequisites: NIL, Semester 2

International society (purposes and needs leading to the establishment of International associations – historical review); Modern International organisations (international, regional); International community and international law. Specialised organisations with shipping interests. History of Shipping, Shipping powers (historical to present day), Evolution of modern shipping laws, Choice of courts and jurisdiction, International conventions e.g. SOLAS, MARPOL, STCW, COLREGS, etc. Ratification of conventions, Laws of the seas (UNCLOS), International maritime regulatory bodies e.g., ILO, UNCTAD, OECD, IACS etc. Functions of BIMCO, Port state controls, Flag states control etc.

MT2301 STATISTICS (CV2000)

AUs: 3, Prerequisites: NIL, Semester 1

Introduction to Statistics. Basic Concepts of Probability. Rules and Theorems of Probability. Random Variables. Discrete Probability Distribution. Continuous Probability Density Function. Expectations. Inferential Statistics. Regression and Correlation. Applications.

MT2302 Maritime Science I

AUs: 3, Prerequisites: NIL, Semester 2

Energy source and heat distribution; Atmospheric circulation and weather; Properties of water/seawater; Structure of the earth, ocean; Ocean circulation and currents; Waves, tides. Structure of the ocean, chemical properties, physical properties, ocean circulation patterns, thermohaline circulation, waves and tides, the earth's atmosphere, atmospheric circulation and weather phenomenon.

Year 3

MT3201 Ship Chartering

AUs: 3, Prerequisites: NIL, Semester 2

Operation of freight markets and chartering in ocean going shipping; Basic types of freight markets (dry cargo – tankers); Function of market; Factors determining the freight rate; Shipping marketing; Charter parties; Types of chartering; Freight calculations; Special calculations: mixed time and voyage charter and marginal calculations; Marginal calculations in the liner market; Time charter calculations; Tanker calculations; The Worldscales Index establishment; The connection of freight to the cost and supply of shipping services; Distribution of risk in freight fluctuations; Use of future charter parties and Rate of shipping return.

MT3202 Maritime Law

AUs: 3, Prerequisites: NIL, Semester 1

Introduction to international Maritime Law; Ships, nationality and registration; The importance of the flag. Ship control and classifications; Shipbuilding and repair contracts; Sale and purchase of ships; Mortgages;

The ship owner legal liabilities and right of limitation. The carrier's liability to passengers and crew claims. Oil pollution and environmental liability. Liability for collisions. Salvage and general average.

MT3203 Introduction to Marine Insurance

AUs: 3, Prerequisites: NIL, Semester 1

Insurance markets. Introduction to the law of marine insurance. Insurance covers. Hull and machinery insurance. Loss of hire insurance. P & I insurance.

MT3301 Maritime Technology II

AUs: 3, Prerequisites: Maritime Technology I (MT1301), Semester 1

Ship resistance; Model basin theory; Estimate power; Rudder force and maneuvering; Dynamic stability; Design of vessels; Ship construction; Ship repair; Port technologies; Major ship equipment; Review and summary. Components of resistance. Model basin theory. Estimated power. Choosing propulsion system. Rudder force and maneuvering. Rolling, pitching and yawing. Design of vessels: Criteria and options. Ship construction. Ship repair. Port technologies. Major ship equipments (Engine, generator, etc.).

MT3304 Information Technology and Management

AUs: 3, Prerequisites: NIL, Semester 1

Introduction to Technology Applications. E-Commerce and E-Business Concepts. Personal Technology Use. Enterprise Systems Technology and Infrastructure: The Wired World. Technology Convergence. Disruptive Technologies. Technical Solutions and Standards. Building E-commerce Solutions. Managing Business Value of Information Technology and E-commerce. E-commerce and Consumer Behavior. E-commerce and Technology Use. Ethical, Social and Political Issues. Testing and Evaluating E-commerce Solutions.

MT3203 Introduction to Marine Insurance

AUs: 3, Prerequisites: NIL, Semester 1

Insurance markets; Introduction to the law of marine insurance; Insurance covers; Hull and machinery insurance; Loss of hire insurance and P and I insurance.

MT3204 Quality Management in Shipping

AUs: 3, Prerequisites: NIL, Semester 2

Financial approaches and economics. The cost-benefit method. Investment return calculation in connection with safety. Economic evaluation of human life. Cost of vessels. Safe management and the protection of quality in shipping. Factors contributing to the creation of the International Safety Management Code. The ISM Code. The need to upgrade quality. Shipping and quality standards and its benchmarking with other regulated industries. Quality systems guides: A/ ISO 9000, B/ ISO 9004. Ensuring quality in shipping: A/ Introduction ISO 9002, B/ Definitions, C/ Adaptation of ISO 9002/14001:2004/OHSAS 18000:1999 to shipping. Registers and quality. Evaluation of shipping safety standards post ISM era. Concepts of Quality Circle, Total Quality Management and quality assessment. Concepts of Environmental Management System and Life Cycle Costing.

MT3302 Maritime Science II (EM101)

AUs: 3, Prerequisites: NIL, Semester 2

Sustainable environmental quality. Nature and sustainable development. Waste minimisation. Legislation and regulations. Air quality control. Water quality control. Marine environment and pollution control.

MT3303 Spatial Information Science (CV8801)

AUs: 3, Prerequisites: NIL, Semester 2

Geographical Information System (GIS) and Global Positioning System (GPS). Spatial Data Structures. Data Acquisition and Management Techniques. Geo-Referencing. Solving Spatial problems. Applications with GPS and GIS.

MT3502 Professionals in Society

AUs: 3, Prerequisites: NIL, Semester 2

Pre-independence history of Singapore; social and political development issues; Economic and industrial development issues; National cohesion and total defence; History of the maritime industry; professional ethics. Our neighbours and international relations; Challenges of globalisation and the new economy; Contribution of the maritime professionals in the new millennium.

MT3401 Industrial Immersion

AUs: 4, Prerequisites: Year 3 standing and completed at least four semesters of study (two semesters for direct entry students), during Year 3 Semester 2 vacation
Training attachments of 10 weeks for the B.Sc. (Maritime Studies) and 12 weeks for the B.Sc. (Maritime Studies with Business Major) covering practical aspects of the maritime industry. Students will not only acquire real-life work experience but also interact with professionals in the working environment, setting up valuable contacts necessary to give them an edge in the working world upon graduation. The attachment is supervised by a tutor each from industry and the university.

Year 4

HW310 Professional Communication

AUs: 2, Prerequisites: Year 4, Semester 1
Business and professional communication competence; workplace oral and written communication skills; interpersonal communication in professional settings; cross-cultural communication; job search skills; successful communication in groups and teams; conflict resolution management; negotiation skills; projecting a professional image.

MT4201 Shipping Logistics

AUs: 3, Prerequisites: NIL, Semester 1
Key logistics activities; Total cost concept; The supply chain system; Shipping value chain; Just-in-time concept; Risk pooling; Logistical strategic partnerships; Bullwhip effect; Global logistics; Current trends in shipping logistics and Logistics arms of shipping-related companies.

MT4203 Shipping Strategy

AUs: 3, Prerequisites: NIL, Semester 1
Strategic planning in shipping and supply chains; Generic strategies; Sustainable competitive advantage; Resource-based view, core competencies and resource capabilities; Globalisation and international strategy; Business process improvement; Partnering, alliances and system integration.

MT4202 Essentials of Project Management

AUs: 3, Prerequisites: NIL, Semester 2
Purposes of Project Management, Project process, selection/ estimating. Project organisation. Project planning and scheduling. Project control and monitoring. Tools and methodology. Project closure/termination.

MT4401 Research Project

AUs: 10, Prerequisites: Year 4 standing, Semesters 1 and 2
Final year students will carry out project work from any discipline in Maritime Studies. The project should belong to one or more of the following disciplines: maritime logistics; shipping management; maritime technology; maritime science, shipping strategy; ship chartering; case studies; etc. The project duration is over the entire academic year or calendar year. A formal report will be required. Each student is required to make an oral presentation.

MT4502 Human Resources Management and Entrepreneurship

AUs: 3, Prerequisites: NIL, Semester 1
Socio-economic organisations and society. People-centered management. Industrial relations in Singapore. Performance appraisal. Compensation and reward systems. Quality management and productivity. Group dynamics and interpersonal relationships. motivation and leadership. Communications and team building. Entrepreneurship: essentials of entrepreneurs, business opportunities and market needs, funding, financial reporting, legal and statutory requirements.

MT4252 Engineering Economics and Finance (CV4252)

AUs: 3, Pre-requisites: NIL, Semester 1
Introduction. Concepts and Principles of Engineering Economics. Time Value of Money. Economic Evaluation of Alternatives. Financial Accounting. Depreciation Accounting. After-tax Economic Analysis. Effects of Inflation on Economic Evaluation. Replacement Analysis. Sources of Finance. Decision Making under Uncertainties.

MT4351 Intermodal Transportation

AUs: 3, Prerequisites: NIL; Semester 1
Concepts and operational specifics of commercial intermodal transportation pertaining to freight movement.

Intermodal services, terminals, equipment and information systems. Interactions between individual modes and intermediaries. Advantages and disadvantages of intermodalism. Intermodal operations management. Business strategies for intermodal management.

MT4352 Distribution and Warehousing

AUs: 3, Prerequisites: NIL, Semester 2

The distribution environment. Distribution requirements planning. Warehouse planning. Warehousing and distribution: receiving, put-away, storage, order-picking and shipping. SKU handling and internal transportation. Warehouse productivity.

MT4353 Port Planning and Operations

AUs: 3, Prerequisites: NIL, Semester 2

Characterization of port system. Geographical location of ports and related planning and operational issues. Methods and processes for port planning and design. Inland connectivity, port's linkage to transport infrastructure, intermodal connections. Marine operations in ports. Traffic management. VTS (vessel traffic system). Pilotage and Tugs. Port Navigational System. Cargo handling. Terminal operations. Facilities and equipment. Port security.