INTRODUCTION

Seventeen engineering disciplines are included in the Examination Syllabus issued by the Canadian Engineering Qualifications Board of Engineers Canada.

Each discipline examination syllabus is divided into two examination categories: compulsory and elective. A full set of Marine Engineering examinations consists of ten, three-hour examination papers. Candidates will be assigned examinations based on an assessment of their academic background. Examinations from discipline syllabi other than those specific to the candidates' discipline may be assigned at the discretion of the constituent Association/Ordre.

Before writing the discipline examinations, candidates must have passed, or have been exempted from, the Basic Studies Examinations.

Information on examination scheduling, textbooks, materials provided or required, and whether the examinations are open or closed book, will be supplied by the constituent Association/Ordre.

MARINE ENGINEERING EXAMINATIONS

GROUP A

COMPULSORY EXAMINATIONS (SEVEN REQUIRED)

98-Mar-A1 Applied Thermodynamics and Heat Transfer (98-Mec-Al)

Applied Thermodynamics: Review of fundamental laws and their applications to closed and open systems. Vapour cycles for power and refrigeration; cycle modifications including reheat, regeneration. Gas cycles; spark ignition and compression ignition cycles. Gas turbine cycles, including modifications such as regeneration and intercooling; effects of component efficiency on performance.

Heat Transfer: Conduction in one and two-dimensional systems; steady state and transient regimes. Natural- and forced-convection problems. Radiation heat exchange between black, gray, and real surfaces. Thermal design of heat exchangers.

98-Mar-A2 Fundamentals of Naval Architecture (98-Nav-Al)

Hull form definition: principal dimensions, ships' lines, coefficients of form. Hull form characteristics: integration methods, Bonjean curves, wetted surface, hydrostatic curves. Equilibrium conditions. Initial stability, metacentric height, cross curves of stability, GZ curve, free surface effect, effects of changes in weight on stability, stability criteria, inclining experiment. Dynamical stability. Trim, moment causing trim, effect of added weights on draft, trim and heel. Submerged equilibrium, trim dive. Stability when grounded. Intact stability of unusual ship forms. Free communication effect. Subdivision and damage stability calculations. Stability criteria for damaged stability. Load line regulations, tonnage regulations. Use of computers in ship's calculations.

98-Mar-A3 Fluid Mechanics and Applications (98-Mec-A2)

Review of basic concepts; elementary two-dimensional potential flow, vorticity and circulation, one-dimensional compressible flow of an inviscid perfect gas, isentropic flow through nozzles, shock waves, frictional compressible flow in conduits, equations of viscous flow, laminar and turbulent boundary layers. Bernoulli's equation and Navier-Stokes equations. Dimensional analysis and similitude. Application to pumps, fans, compressors, hydraulic turbines; pump system matching, pump/turbine similarity analysis, and idealized velocity diagrams and head calculations; limitations due to unsteady flow, stalling, and cavitation.

98-Mar-A4 Kinematics and Dynamics of Machines (98-Mec-A3)

Kinematic and Dynamic Analysis: Graphical and analytical methods for kinematic analysis of space mechanisms and elementary body motion in space, static and dynamic force analyses of mechanisms, gyroscopic forces, dynamics of reciprocating and rotating machinery, cam and gear mechanisms and specifications.

Vibration Analysis: Free and forced vibration of underdamped lumped systems with multidegrees of freedom, analytical and numerical techniques of solution, viscous damping, vibrational isolation, vibration measurement, and control.

98-Mar-A5 Advanced Strength of Materials (98-Mec-A4)

Stress-Strain Analysis: Stress and strain, graphical representation by Mohr's circles of biaxial and triaxial cases, generalized Hooke's law, equations of equilibrium and compatibility, plane strain and plane stress problems. Euler critical loads for columns, shear flow in beams with thin sections, torsion of non-circular members, shear centre, membrane analogy, thick-walled cylinders and rotating discs, curved beams, contact stresses, strain gauges and application, stress concentrations. Failure theories and limit analysis.

Energy Methods: Strain energy principles, virtual work, Castigliano's theorem. Applications to cases in axial, bending, and torsional loadings. Applications to statically indeterminate problems.

98-Mar-A6 Design and Manufacture of Machine Elements (98-Mec-A5)

Stress, strain and material properties. Fundamentals of machining, metal forming, plastic moulding, and powdered metallurgy processes; non-traditional material removal processes: electric discharge machining, laser beam cutting and machining. Load analysis, static body stresses, elastic strain, deflection, and stability. Failure theories, safety factors, and reliability. Fatigue of machine elements, effect of surface treatments, notches, holes, cracks, and other stress raisers. Applications to the design of: threaded fasteners, power screws, bolted connections, welded joints, springs, roller bearings, gears, rotating shafts.

98-Mar-A7 Marine Engineering

Ship system formulations, main propulsion system requirements, main propulsion system trade-off studies, arrangement of machinery, piping diagrams, auxiliary systems.

Characteristics of internal combustion engines, marine uses for such engines. Marine steam generators, selection and design of boilers. Main propulsion steam engines. Main propulsion steam turbines. Main propulsion gas turbines. Electric propulsion drives.

Propeller shafting and shafting system vibration analysis. Pumps, blowers, compressors, ejectors, condensers, heat exchangers, distilling plants. Hull machinery design considerations and machinery installations, machinery foundation designs, hydrostatic power transmission equipment and systems.

Machinery for environmental control and waste treatment. Electric generating plants, switchboards and panels, lighting and power distribution, power equipment, lighting fixtures. Electronics navigation and radio communication. Automation systems. Safety considerations.

Fundamentals of pressurized-water nuclear steam supply systems for use in marine propulsion, reactor design considerations, nuclear fuels, reactor coolants, reactor control, shielding, safety, health physics, economics.

GROUP B

ELECTIVE EXAMINATIONS (THREE REQUIRED)

98-Mar-B1 Advanced Machine Design (98-Mec-BI)

Stress analysis and design of machine elements under conditions of: shock, impact, inertial forces, initial and residual stresses, corrosion environments, wear, elevated temperatures (creep), and low temperatures (brittle fracture). Hydrodynamic lubrication. Applications to the design of: journal bearings, clutches, brakes, couplings, and linkages. Introduction to probabilistic methods in mechanical design.

98-Mar-B2 Environmental Control in Ships

Heating, Ventilation and Air Conditioning: Psychometrics, heating load, cooling load, comfort, ventilation and room air distribution. Humidifying and dehumidifying, duct and fan design, piping and pump design. Heating, ventilating and cooling systems and components. Refrigeration.

Noise Control: Sound wave characteristics, measurement instruments. Sources of noise, absorption and transmission. Free field and reverberant conditions. Noise control techniques in ships.

Energy Management Technology: Energy resources and supplies, control systems and instrumentation, lighting, systems operation, engineering/economic analysis principles, energy audit procedures.

Shipboard waste management, collection systems. Environmental pollution and management. Water quality; principles involved in design and operation and physical, chemical and biological treatment processes. Shipboard waste treatment.

98-Mar-B3 System Analysis and Control (98-Mec-B4)

Open-loop and feedback control. Laws governing mechanical, electrical, fluid, and thermal control components. Mathematical models of mechanical, hydraulic, pneumatic, electric and electronic processes, and control devices. Block diagrams, transfer functions, response of servomechanisms to typical input signals (step function, impulse, harmonic), stability analysis, and stability criteria.

98-Mar-B4 Ship Production and Shipyard Management (98-Nav-B5)

General aspects of shipyard organization and management; history and background of modern industry; industrial tendencies; principles of organization; principles of management. Plant location, layout and construction; handling of materials, production engineering and inspection, quality control, procedure control and systems. Control of production, time and motion study. Material control, plant safety. Industrial relations, personnel management, training, human relations and labour organizations. Drydocking and maintenance of ships.

98-Mar-B5 Fluid Machinery (98-Mec-B6)

Review of dimensional analysis and similitude. Performance characteristics. Specific speed and machine selection. System characteristics and operating point and matching. System regulations, momentum and energy transfer, thermodynamic analysis, and efficiency definitions. Two-dimensional cascade analysis and performance. Axial-flow compressors and turbines, impulse and reaction designs, radial-flow machines, secondary flows and losses. Performance limits due to cavitation.

98-Mar-B6 Electrical and Electronics Engineering (98-Mec-A6)

Steady state and transient analysis of electric circuits. Time domain and frequency domain analyses. Single phase and polyphase circuits. Introduction to analogue and digital semiconductor devices. Transistor amplifiers and switches. Power semiconductor devices, rectifiers, dc power supplies and voltage regulation. Operational amplifiers and application circuits. Combinational and sequential digital logic circuits. Protection of electrical apparatus and systems. Electrical safety. Practical approach to electronic instrumentation, measurement systems and transducers. Magnetic circuits and transformers, DC machines: motors and generators. AC machines: induction motors, synchronous motors, and alternators. Power factor correction.

98-Mar-B7 Maritime Management

Overview of management systems and theories including management economics founded on micro and macro economic theories, financial management procedures and marketing processing including the effects of national and international policies on the processes. Examples of management organizational structures and control systems, the planning and decision making techniques with emphasis being placed on a study of basic group dynamics including staff-crew development and labour relations, union affairs and labour laws, motivation, communication, leadership styles, human development, achievement, motivation and personal appraisal techniques. Topics such as family dynamics, alcohol and drugs, stress management, and problems of individuals.