

Marine Engineering Uniform Syllabus - 1998

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**MARINE ENGINEERING EXAMINATIONS  
SYLLABUS**

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**GROUP A  
COMPULSORY EXAMINATIONS (7 REQUIRED)**

**98-Mar-A1 Applied Thermodynamics and Heat Transfer**

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.

*Recommended Texts:*

F.P. Incropera & David, DeWitt, Introduction to Heat Transfer, latest edition, John Wiley & Sons.  
Y. Cengel & M. Boles, Thermodynamics An Engineering Approach, 2<sup>nd</sup> edition, McGraw-Hill.

**98-Mar-A2 Fundamentals of Naval Architecture**

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.

*Recommended Texts:*

*Prime Text:*

Edward V. Lewis ed., Principles of Naval Architecture. The Society of Naval Architects and Marine Engineers, Chapters 1, 2, 3, Volume 1, 1988.

*Supplementary Texts:*

Barnaby, Kenneth C., Basic Naval Architecture, 2<sup>nd</sup> Ed. Hutchinson's Scientific and Technical Publications,

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1954.

Van Lammeren, W.P.A. ed., Buoyancy and Stability of Ships. The Technical Publications H. Stam, 1969.

Attwood, Edward L. et al., Theoretical Naval Architecture. Longmans, Green and Co., 1953.

de Heere, R.F. Scheltema, Buoyancy and Stability of Ships. Technical Publications H. Stam, 1969.

### **98-Mar-A3 Fluid Mechanics and Applications**

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.

#### *Recommended Texts:*

F.M., White. Fluid Mechanics, 4<sup>th</sup> edition, McGraw-Hill, 1998.

### **98-Mar-A4 Kinematics and Dynamics of Machines**

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.

#### *Recommended Texts:*

William T. Thomson, Marie Daleh, Theory of Vibration with Applications, latest edition, Prentice Hall, ISBN #0-13-651-068-X.

### **98-Mar-A5 Advanced Strength of Materials**

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.

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

*Recommended Texts:*

Ansel Ugural & Saul Fenster, Advanced Strength & Applied Elasticity, Prentice Hall. Englewood Cliffs, New Jersey, 07632, latest edition, 1995.

R.G. Budynas, Advanced Strength & Applied Stress Analysis, McGraw-Hill, 1998, 2<sup>nd</sup> edition.

### **98-Mar-A6 Design and Manufacture of Machine Elements**

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.

*Recommended Texts:*

Kalpakjian, Manufacturing Engineering & Technology, 3<sup>rd</sup> edition, Addison Wesley. ISBN# 1-201-53846-6.

Shigley & Mischke, Mechanical Engineering Design. McGraw-Hill, 5<sup>th</sup> edition (Metric/English edition) 1993.

### **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.

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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.

*Recommended Texts:*

*Prime Text:*

Harrington, Roy L. (ed.), Marine Engineering. The Society of Naval Architects and Marine Engineers, 1971.

*Supplementary Text:*

Sullivan, James A., Fluid Power Theory and Applications, 3<sup>rd</sup> edition. Prentice Hall, Inc., 1989. ISBN 0-13-323080-5.

Henke, Russell W., Introduction to Fluid Power Circuits and Systems. Addison-Wesley, 1970, LCC Card No. 0-13-323080-5.

Labbarton, J.M. (ed.), Marine Engineers' Handbook. McGraw-Hill, 1945.

I.R. Cameron, Nuclear Fission Reactors. Plenum Press, 1982. ISBN 0-306-41073-7.

J.R. Lamarsh, Introduction to Nuclear Engineering, 2<sup>nd</sup> Edition. Addison-Wesley, 1983. ISBN 0-201-142007.

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**GROUP B**  
**ELECTIVE EXAMINATIONS (3 REQUIRED)**

**98-Mar-B1 Advanced Machine Design**

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.

*Recommended Texts:*

Shigley and Mischke, Mechanical Engineering Design, 5<sup>th</sup> edition (Metric/English edition) McGraw Hill. ISBN 0-017-056899-5.

**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.

*Recommended Texts:*

*Prime Texts:*

McQuiston and Parker, Heating Ventilating and Air Conditioning Analysis and Design. Wiley & Sons, 1982.

Irwin and Graf, Industrial Noise and Vibration Control. Prentice-Hall, 1979.

*Supplementary Texts:*

Jennings, Environmental Engineering. International Text Book Co., 1970.

Carrier and Trane Systems Manuals. (ASHRAE Handbooks).

ASHRAE: Environmental Control Principles: an Educational Supplement to ASHRAE Handbook Fundamentals Volume.

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### **98-Mar-B3 System Analysis and Control**

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.

*Recommended Texts:*

J. Van de Vegte, Feedback Control System, Prentice-Hall, 1989. latest edition

Dorf, Modern Control Systems, 7<sup>th</sup> edition. Addison-Wesley, 1980.

Raven, Automatic Control Engineering, 4<sup>th</sup> edition, McGraw-Hill, 1997.

### **98-Mar-B4 Ship Production and Shipyard Management**

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.

*Recommended Texts:*

*Prime Texts:*

Buffa, Modern Production Operations Management, 6<sup>th</sup> edition. Wiley, 1980.

Juran and Gryna, Quality Planning and Analysis, 2<sup>nd</sup> edition. Wiley & Sons, 1980.

Taggart ed., Ship Design and Construction The Society of Naval Architects and Marine Engineers, Chapter 15, 1980.

*Supplementary Texts:*

Chase and Aquilano, Production and Operations Management: A Life Cycle Approach, 3<sup>rd</sup> edition. Erwin, 1981.

Halpern, The Assurance Sciences: An Introduction to Quality Control and Reliability. Prentice-Hall, 1978.

Kennedy and Nelville, Basic Statistical Methods for Engineers and Scientists, 2<sup>nd</sup> edition. Harper and Row, 1979.

Duncan, Quality Control and Industrial Statistics, 4<sup>th</sup> edition. Erwin, 1974.

Sule, D.R. (Dileep R.), Manufacturing Facilities. PWS-KENT Publishing Co., 1988. ISBN 0-534-91971-5.

Riggs, James L., Production Systems, 3<sup>rd</sup> edition. John Wiley & Sons, Inc., 1988.

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### **98-Mar-B5 Fluid Machinery**

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.

#### *Recommended Texts:*

R.L. Dougherty, J.B. Franzini, E.J. Finnemore, Fluid Mechanics with Engineering Applications, 8<sup>th</sup> edition, McGraw-Hill.

S.L. Dixon, Fluid Mechanics, Thermodynamics of Turbomachinery, 3<sup>rd</sup> edition, Pergamon Press.

V.L. Streeter, Y.E.B. Wylie, Fluid Mechanics, 8<sup>th</sup> edition, McGraw-Hill.

### **98-Mar-B6 Electrical and Electronics Engineering**

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.

#### *Recommended Texts:*

R.J. Smith & R.C. Dorf, Circuits, Devices & Systems, 5<sup>th</sup> edition, John Wiley & Sons Inc. 1992.

### **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.

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### *Recommended Texts:*

Introduction to Shipping, Fairplay Publications Limited, 1985.

Heureigel Slocum and Woodman, Organizational Behaviour, 5<sup>th</sup> edition. West Publishing. ISBN 0-314-47013-1.

Organizational Theory and Design, Draft 5<sup>th</sup> edition. West Publishing. ISBN 031404452-3.

**The Association of  
PROFESSIONAL ENGINEERS AND GEOSCIENTISTS  
of British Columbia**

1998 MARINE ENGINEERING SYLLABUS  
Checklist for Self Evaluation  
(Not required for candidates who are assigned  
confirmatory exams)

Name: \_\_\_\_\_

Exam Number	Exam Name	Applicant-s Self- Evaluation - Course Equivalent	For Office Use Only
<i>Basic Studies (6 Required)</i>			
98-BS-1	Mathematics		
98-BS-2	Probability and Statistics		
98-BS-3	Statics and Dynamics		
98-BS-4	Electric Circuits and Power		
98-BS-6	Mechanics of Materials		
98-BS-7	Mechanics of Fluids		
<i>Basic Studies (2 required)</i>			
98-BS-5	Advanced Mathematics		
98-BS-8	Digital Logic Circuits		
98-BS-10	Thermodynamics		
98-BS-11	Properties of Materials		
<i>Group A (7 required)</i>			
98-Mar-A1	Applied Thermodynamics and Heat Transfer		

98-Mar-A2	Fundamentals of Naval Architecture		
98-Mar-A3	Fluid Mechanics and Applications		
98-Mar-A4	Kinematics and Dynamics of Machines		
98-Mar-A5	Advanced Strength of Materials		
98-Mar-A6	Design and Manufacture of Machine Elements		
98-Mar-A7	Marine Engineering		
<b><i>Group B (3 Required)</i></b>			
98-Mar-B1	Advanced Machine Design		
98-Mar-B2	Environmental Control in Ships		
98-Mar-B3	System Analysis and Control		
98-Mar-B4	Ship Production and Shipyard Management		
98-Mar-B5	Fluid Machinery		
98-Mar-B6	Electrical and Electronics Engineering		
98-Mar-B7	Maritime Management		
<b><i>Complementary Studies (All Required)</i></b>			
98-CS-1	Engineering Economics		
98-CS-2	Engineering in Society - Health, Safety, and the Environment		
98-CS-3	Management Concepts for		

	Engineers		
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