# SCHEME OF INSTRUCTION & SCHEME OF EXAMINATIONS
## M.E. (MARINE ENGINEERING & MECHANICAL HANDLING)

### I SEMESTER

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Course</th>
<th>Periods L/T/Lab</th>
<th>Exam Hours</th>
<th>Sessional Marks</th>
<th>Exam Marks</th>
<th>Total</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MEMH1.1</td>
<td>Advanced Engineering Mathematics</td>
<td>4</td>
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<td>MEMH1.2</td>
<td>Principles of Material handling devices</td>
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<td>MEMH1.3</td>
<td>Advanced Mechanics of solids</td>
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<td>MEMH1.4</td>
<td>Marine Engineering-I</td>
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<td>MEMH1.5</td>
<td>Theory of vibrations</td>
<td>4</td>
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<td>MEMH1.6</td>
<td>Mechanics and Design of Cargo handling equipment **</td>
<td>4</td>
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** Viva-Voce Examination with a committee consisting of Head of the Department, concerned teacher & one examiner. No written Examination.

### II SEMESTER

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<tr>
<th>Subject Code</th>
<th>Course</th>
<th>Periods L/T/Lab</th>
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<th>Sessional Marks</th>
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<tr>
<td>MEMH 2.1</td>
<td>Structural Design of Mechanical Handling equipment</td>
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<td>MEMH 2.2</td>
<td>Marine Instrumentation &amp; Stress Analysis</td>
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<td>MEMH 2.5</td>
<td>Introduction to Computational Fluid Dynamics</td>
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## III SEMESTER

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## IV SEMESTER

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<th>Grading of Thesis</th>
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<tr>
<td>Dissertation (continued from 3rd semester)***</td>
<td>Award of grading such as, A,B,C and F for the thesis.</td>
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<tr>
<td></td>
<td>(A= excellent;</td>
</tr>
<tr>
<td></td>
<td>B= Very good;</td>
</tr>
<tr>
<td></td>
<td>C= Good</td>
</tr>
<tr>
<td></td>
<td>F= not accepted.)</td>
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**Elective** (2nd Semester):
1. Naval Architecture
2. Industrial Management
3. Control Engineering

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*** Pre-examination appraisal through Seminar by a committee consisting of BOS Chairman, Head of the Department and Guide.

*** Final presentation followed by Viva-Voce Examination with the following members.

1. Chairman, Board of Studies.
2. Head of the Department.
3. External Examiner (External to the college)
4. Internal Guide
5. (And) External Guide (if any)

The award of class will be given based on CGPA obtained in theory/practical/lab and award a separate grading, such as, A,B,C and F for the thesis. (A= excellent; B= Very good; C= good and F= not accepted.)

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SYLLABUS

M.E.(MARINE ENGINEERING & MECHANICAL HANDLING)
I SEMESTER
MEMH 1.1 ADVANCED ENGINEERING MATHEMATICS

Periods per week: 4 Examination: 70 Marks
Credits: 4 Sessionals : 30 Marks


Text books:
MEMH 1.2 PRINCIPLES OF MATERIAL HANDLING DEVICES

Periods per week: 4
Credits: 4
Examination: 70 Marks
Sessionals: 30 Marks

(a) Principles of Material Handling: Classifications of the materials handling equipment, their characteristics and application, principles, packaging and storage of materials, operation analysis and study of travel diagrams and flow process charts. Preparation of a new proposal for an integrated materials handling system. Protective devices handling of fluids and multiphase systems. Handling of refrigerated cargo.

(b) Theory and construction of the various parts of Mechanical Handling devices, wire ropes and chains, hooks, shackles, grabs, ladles and lifting electromagnets, sheaves, sprockets and drums, runners and rails, buffers and limit switches.

(c) Design of simple mechanical handling devices, viz., screw jacks, pulley blocks, winches, hoists and capstans, windlasses.

Text Books:
MEMH 1.3 ADVANCED MECHANICS OF SOLIDS

Periods per week: 4     Examination: 70 Marks
Credits: 4      Sessionals : 30 Marks

1. Three dimensional stress and strain - Principal stresses and strains-Mohr's circle representation of triaxial state of stresses and strains, theories of failure. Elementary treatment of contact stresses for point and line contacts

2. Shear Centre: Shear Centre for sections having one axis of symmetry - open channel sections, I-sections, t-sections.


4. Torsion: Torsional resistance of bars having rectangular sections - Membrane analogy.

5. Beams on elastic foundation: Beams on continuous elastic foundation, Infinite beams and semi-infinite beams.

6. Buckling of columns, beams and shafts.

7. Elementary treatment of flat plates: Rectangular and circular plates freely supported and clamped edges.


Text books:
MEMH 1.4 MARINE ENGINEERING –I

Periods per week: 4          Examination: 70 Marks
Credits: 4                   Sessionals : 30 Marks


Text Books:

2. Marine I.C Engines-A.B Kane
3. Principles and practice of Marine Diesel Engines – D.K Sanyal
5. Marine Steam Boilers- Milton J.H.
MEMH 1.5 THEORY OF VIBRATIONS

Periods per week: 4
Credits: 4
Examination: 70 Marks
Sessionals : 30 Marks


5. Ship vibration : Introduction to ship hull vibration-- Mathematical basis of ship vibration - calculation of ship hull vibration.

Text books:
1. Mechanical Vibrations - G.K. Grover
2. Elements of Mechanical Vibration : Merovitch
3. Theory of Vibrations with applications: W.T. Thomson
4. Ship Hull Vibrations: Todd
5. Mechanical vibrations, Schaum's outline series- William W. Seto
MEMH 1.6 MECHANICS AND DESIGN OF CARGO HANDLING EQUIPMENT

Periods per week: 4       Examination: 70 Marks
Credits: 4                  Sessionals: 30 Marks

Kinematic, dynamic analysis and design procedures of various components, mechanisms of (a) scraper, apron and flight conveyors, (b) roller and belt conveyors, (c) belt and chain bucket elevators (d) screw and ribbon conveyors (e) overhead chain trolley conveyors and (f) vibrating trough and shaker conveyors, rope ways.

Kinematic and dynamic analysis of the various components, mechanisms and design procedures of (a) floor and wall mounted jib cranes (b) hand chain and electric operated overhead travelling cranes (c) Stationary and travelling rotary jib cranes with fixed adjustable level luffing arrangements (d) Goliath and semi goliath cranes, (e) Derrick Cranes (f) tower cranes (g) mobile cranes (h) Telphers.

Text books:
3. Conveyors and related equipment - A Spirakovsky and V.Dyachkov, Mir Publications
MEMH 2.1 STRUCTURAL DESIGN OF MECHANICAL HANDLING EQUIPMENT

Periods per week: 4 Examination: 70 Marks
Credits: 4 Sessionals : 30 Marks

Analysis of forces of determinate, indeterminate and redundant framed structure, detailed force analysis and design of overhead travelling crane structures. Analysis of force and detailed design of the Jib of fixed and luffing types of rotary jib cranes. Design of structures pertaining to derricks, gantries, columns, portals and supporting trusses for belt conveyers.

Text books:
2. Materials Handling Equipment - N. Rudenko

MEMH 2.2 MARINE INSTRUMENTATION & STRESS ANALYSIS

Periods per week: 4 Examination: 70 Marks
Credits: 4 Sessionals : 30 Marks


Stain gauges – Photo elastic, Electrical, resistance gauges, cements and cementing of Gauges – Bridge circuits – balanced and unbalanced, Calibration gauge rosettes – Evaluation of Principal stresses – Static and dynamic gauges for various applications.

Stress analysis – Whole field techniques by photo elasticity, brittle coatings, Grid methods & Moire – Applications to the solution of engineering problems.

Text Books:
3. Experimental methods for engineers. - J.P Holman
MEMH 2.3 MARINE ENGINEERING II

Periods per week: 4     Examination: 70 Marks
Credits: 4      Sessionals : 30 Marks

1. Engine room arrangements for different power plants – Functions of Auxiliary equipment – Bilge and ballast systems – Other Auxiliaries.

2. Piping – Piping fittings and valves – Control valves, materials and corrosion in pipes – Colorcodes – Steam traps, Drains and glands.


7. Steering gear- Types Steam steering gear, Telemotor gear, Hand steering gear, Hydraulic systems, Electro hydraulic steering gear – Electrical steering gear.

Text Books:
1. The running and maintenance of marine Machinery - J Cowley.
3. Marine Auxiliary machinery and systems - M Khetaguroo
4. Theory and design of steam and gas turbines - Lee.
ELECTIVE
MEMH 2.4(1). NAVAL ARCHITECTURE

Periods per week: 4     Examination: 70 Marks
Credits: 4      Sessionals : 30 Marks

1. Introduction: Types of ships, Geometry of ship, Displacement, TPC, Coefficient of form, Wetted surface area.

2. Area Volume, First and second moments using Simpson’s rule, Center of gravity, Effect of addition of mass, Effect of movement of mass, Effect of suspended mass.


4. Trim: Change on draughts due to added masses, Change of mean draught and end draughts due to density, Change in mean draught and end draughts due to bilging.


8. Rudder theory: Force on rudder, Torque on stock, angle of heel due to force on rudder, angle of heel on turning.


Text Books:
1. Reed’s Naval Architecture for Marine Engineering.
2. Naval Architecture for Marine Engineers by W.Muckle.
ELECTIVE
MEMH 2.4 (2) INDUSTRIAL ENGINEERING AND MANAGEMENT

Periods per week: 4
Credits: 4
Examination: 70 Marks
Sessionals: 30 Marks


2. Facilities location and Layout: Factors for selection of a location, Urban, Suburban and rural locations, Types of layouts, process and product layouts, Line balancing, Shipyards and port layouts.

3. Material Handling: Principles of material handling, Types of material handling equipment, Selection of material handling equipment.

4. Inventory control: Costs of inventory, ABC Analysis, Economic order quantity, Economic lot-size quantity, Basic inventory models.

5. Quality Control: Quality and product design, Control charts.

6. Network analysis: Network techniques of program management, CPM and its advantages, Difference in PERT & CPM, steps in CPM technique, Steps in the technique of PERT planning, Estimation of activity duration. Float or slack, Latest finish time, resource leveling program, crash of the project.


Text Books:
1. Industrial engineering and management - O.P Khanna

References:
ELECTIVE

MEMH 2.4 (3) CONTROL ENGINEERING

Periods per week: 4  Examination: 70 Marks
Credits: 4      Sessionals : 30 Marks

Introduction, automatic control systems, on/off controllers, step controllers, continuous controllers, basic equation of a servo mechanism, transient analysis, transfer - function analysis, the laplace transformation.

Equations of physical systems: Introduction, mechanical system - translational, rotational, mechanical systems, thermal, hydraulic, pneumatic and electrical systems.

Transient analysis of servo mechanisms, block diagram concept of a control system, analysis of proportional error, servo mechanism time and frequency responses. Transfer functions: Definition, deviation of transfer functions - algebra of block diagrams and transfer functions.

Graphical representation of transfer functions: The frequency response concept and transfer function, basic relationship between amplitudes and phase, logarithm of the transfer functions, bode diagrams, diagrams of the basic terms.

Analysis of servo mechanism performance, absolute stability, general discussion, instability from inspection of the differential equation, roth's criterion. Nyqists, criterion steady state and transient performance from transfer function plots.

Control system components: Error detectors, controllers, servo motors for DC, AC, Mechanical, hydraulic, pneumatic and thermal systems (one example each).

Text Books:
1. Thalore and Bronz, Analysis and design of feed back control systems - International students edition ( chapters 1, 2, 4, 5, 6, 7) and appendix B.C.D)
MEMH 2.5 Introduction to Computational Fluid Dynamics

Periods per week: 4  Examination: 70 Marks
Credits: 4          Sessionals : 30 Marks

I Introduction and Basic Numerical Methods:
Introduction to CFD, Approximation and interpolation, Numerical integration, Finite
difference approximations of derivatives

II The Finite Volume Method for Model Problems:
1-D diffusion, Thomas algorithm for tri-diagonal systems, 1-D convection-diffusion, 2-D
model problems

III Modelling Navier Stokes Equations:
Governing equations for fluid mechanics, Staggered grids, Pressure-velocity coupling –
the SIMPLE algorithm, Steady flows, Unsteady flows, Implementation of boundary
conditions
Commercial CFD codes, Reynolds averaged Navier-Stokes (RANS) equations and
turbulence modeling

Text Books:
1. Introduction to CFD the finite volume method by Malalasekera & Versfeeg
2. Computational FM and heat transfer by Anderson, Tennehill and Pletcher.
MEMH 2.6 SEMINARS
Periods per week: 4
Credits: 2

The student has to give at least three seminars on relevant topics of his choice but related to Marine Engineering and Mechanical handling.
M.E.(MARINE ENGINEERING & MECHANICAL HANDLING) III SEMESTER
Dissertation (to be continued in 4th semester)**

M.E.(MARINE ENGINEERING & MECHANICAL HANDLING) IV SEMESTER
Dissertation (continued from III semester)**

** Pre-examination appraisal thro’ Seminar by a committee consisting of BOS
Chairman, Head of the
Department and Guide.

** Final presentation followed by Viva-Voce Examination with the following members.

1. Chairman, Board of Studies.
2. Head of the Department.
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