### I SEMESTER

<table>
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<tr>
<th>Subject Code</th>
<th>Course</th>
<th>Periods</th>
<th>Exam Hours</th>
<th>Sessional Marks</th>
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### IV SEMESTER

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<td>Dissertation (Final)</td>
<td>Viva-Voce</td>
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Grades for Dissertation (Preliminary and final) Viva Voce are A, B, C and F (A= excellent; B= Very good; C= Good F= not accepted.)

Dissertation Preview Viva-Voce Examination will be conducted with a committee consisting of Head of the Department, Chairman BOS and Guide.

Dissertation Final Viva-Voce Examination will be conducted with a committee consisting of Chairman, Board of Studies, Head of the Department, Internal Guide, External Guide (Approved by the University Administration).
SYLLABUS

M.Tech (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                      Examination: 70 Marks
Credits: 4                                Sessionals : 30 Marks

1. 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.

2. 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.

3. 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, l-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:

1. Marine Power plant Engineering - Akimov P
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 Elective - I

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. Ship Hull Vibrations: Todd
2. Mechanical vibrations, Schaum's outline series- William W. Seto
MEMH 1.5 Elective - I

Wave Engineering


5. Mass transport velocity.

6. Introduction to Random and directional waves.

Text Books:

References:
MEMH 1.6 Elective - II
Advanced Finite Element Analysis

1. Overview of finite element method, Discretization of the domain, Interpolation models, Higher order and isoparametric elements, Derivation of element matrices and vectors, Assembly of element matrices and vectors and derivation of system equations, Numerical solution of finite element equations, Analysis of trusses, beams, and frames

2. Analysis of plates and Shells

3. Three-dimensional problems

4. Vibration Analysis - Modal and Harmonic analysis

5. Fluid flow problems - Basic equations of fluid mechanics, Inviscid and incompressible flows

Textbooks


2. Finite Element Modeling for Stress Analysis - R D Cook - John Wiley
MEMH 1.6 Elective - II
MECHANICS AND DESIGN OF CARGO HANDLING EQUIPMENT

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

1. 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.

2. 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) Stationery 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
1. **Ship Structural Analysis using FEA Packages:** Modelling, Meshing and solving using FEM packages. Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- Application of FEA packages in the analysis of ship components.

2. **CASD (Computer Aided Ship Design)**

3. Exposure to CASD packages like Rhino, NAPA, TRIBON, Shipflow etc.

4. **Generation of ship hull parametric model using Modelling Softwares**

### MEMH 1.8

**Seminars**

Each student has to present at least 4 seminars on a topic that is approved by the concerned teacher. The final seminar should be presented before a committee constituted by the Head of the Department.
MEMH 2.1 STRUCTURAL DESIGN OF MECHANICAL HANDLING EQUIPMENT

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

1. Analysis of forces of determinate, indeterminate and redundant framed structure
2. Detailed force analysis and design of overhead travelling crane structures.
3. Analysis of force and detailed design of the Jib of fixed and luffing types of rotary jib cranes.
4. 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
Credits: 4
Examination: 70 Marks
Sessionals: 30 Marks

4. 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.
5. 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.
MEMH 2.4 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.
5. Resistance: Frictional, residuary and total resistance, admiralty Coefficient, fuel Coefficient and Consumption.
7. Rudder theory: Force on rudder, Torque on stock, angle of heel due to force on rudder, angle of heel on turning.
8. Launching: Launching curves, Ground ways and sliding ways, Dynamics of launching Docking stability – Launching lubricants and their properties.

Text Books:
1. Reed’s Naval Architecture for Marine Engineering.
2. Naval Architecture for Marine Engineers by W.Mucke.
MEMH 2.5 ELECTIVE - III
INDUSTRIAL ENGINEERING AND MANAGEMENT

Periods per week: 4  Examination: 70 Marks
Credits: 4  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:
MEMH 2.5 ELECTIVE - III

Subsea Piping

1. **Introduction**: Material properties, pipe production, pipe fabrication, specifications, Methods of increasing corrosion resistance, CR alloys and their manufacturing, Evaluating corrosion resistance and external protection, Welding of pipelines, welding sequence, Manual, semiautomatic and automatic welding

2. **Flexible and Composite Pipelines**: Introduction, Fabrication techniques, Internal and external corrosion, sour service, Failure modes of flexible pipes, Composite pipelines


4. **External Corrosion and pipeline hydraulics**: External corrosion and coatings, Cathodic protection, concrete weight coatings, thermal insulation, Single-phase flow Newtonian fluids, heat transfer and flow temperature, hydrates, multiphase flow

5. **Strength and stability**: Introduction, Design to resist Internal and external pressures, Longitudinal stress, Bending, Indentation, and Impact, Design currents and waves, Hydrodynamic forces, lateral resistance, Stability design

6. **Marine pipeline construction and Shore approaches**: Lay-Barge construction, reel construction, pull and tow, trenching, coastal Environment, site Investigation, horizontal drilling, Tunnels and tidal flat

**Reference:** Plamer, Andrew C. (Andrew Clennel), 1938-Subsea Pipeline engineering, / Andrew C. Palmer and Roger A
MEMH 2.6 Elective IV

Introduction to Computational Fluid Dynamics

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

1. Introduction and Basic Numerical Methods:
2. Introduction to CFD, Approximation and interpolation, Numerical integration, Finite difference approximations of derivatives
5. 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 Pletchen.
MEMH 2.6 ELECTIVE - IV
CONTROL ENGINEERING

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

1. 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.
2. Equations of physical systems: Introduction, mechanical systems - translational, rotational, mechanical systems, thermal, hydraulic, pneumatic and electrical systems.
3. Transient analysis of servo mechanisms, block diagram concept of a control system, analysis of proportional error, servo mechanism time and frequency responses.
4. Transfer functions: Definition, deviation of transfer functions - algebra of block diagrams and transfer functions.
5. 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.
7. Control system components: Error detectors, controllers, servo motors for DC, AC, Mechanical, hydraulic, pneumatic and thermal systems (one example each).

Text Books:
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 2.7 CFD Lab

Periods/week: 3          Ses : 50          Exam: 50
Examination Theory: 3hrs.          Credits: 2

1. Exposure to CFD packages like Star-CCM+, Ansys
2. Geometry creation of simple 2-D and 3-D Objects
3. Mesh Generation
4. Boundary conditions
5. Solution for varying parameters like Reynolds Numbers, Froude Number etc
6. Application to Ship Drag calculation (pressure and Friction)
7. Presentation of results of ship drag compared with IITC values

MEMH 1.8

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