

UNIVERSITY OF MUMBAI
No.UG/ 111 of 2004

CIRCULAR :

Attention of Principals of the affiliated colleges in Engineering is hereby invited to the Ordinances, and Regulations relating to the Bachelor of Engineering degree course vide this office Circular No.UG/513 of 2002 and No.UG/401 of 2003 dated 30th November, 2002 and 19th August, 2003 respectively and they are hereby informed that the recommendations made by the Faculty of Technology at its meeting held on 15th December, 2003 has been approved by the Academic Council at its meeting held on 3rd January, 2004 vide item No.4.23 and that in accordance therewith the scheme and syllabus prescribed for the T.E. (Marine Engg.) (Sem.V and VI) leading to the B.E. degree course is as per Appendix and that the same will be brought into the force with effect from the academic year 2004-2005.

Mumbai 400 032
18th March, 2004.

V.K.
for REGISTRAR.

To,

The Principals of affiliated colleges in Engineering.

A.C.4.23/03.01.2004.

No.UG/ 111-**Z** of 2004

18th March, 2004.

Copy forwarded with compliments for information to :-

- 1)the Dean, Faculty of Technology.
- 2)the Chairman, various Branches in Engineering.

V.K.
for REGISTRAR.

Copy to:

The Director, Board of College and University Development, the Controller of Examinations/the Deputy Registrar (Eligibility & Migration Section), the Director of Students Welfare, the Personal Assistants to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-centre, Ratnagiri, for informations.

The Controller of Examinations (10 copies), F. & A. O.. (Accounts Section) Fort, (2 copies), Record Section (5 copies), Publication Section (5 copies), D.R., (Enrollment, Eligibility & Migration Section - 3 copies), D.R., (Statistical Unit) (2 copies), D. R., (Accounts Section), Vidyamagari, (2 copies), D. R. (Affiliation Section) (2 copies), Director (U.C.C., I.D.E. Bldg., Vidyamagari Campus) (2copies), A. R., A. A. Unit (2 copies) He is requested to treat this as Action taken report on the concerned resolution adopted by the Academic Council, referred to in the above Circular; and that no separate A.T.R. will be sent in this connection. A. R. CONCOL (2 copies), EUCTU (1 copy), Dy. Acct. (Unit V) (1 copy), In charge, Central Computing Facility (1 copy), Receptionist (1 copy), Telephone Operator (1 copy), Secretary, MUASA (1 copy), Superintendent, P.C.Section (2 copies).

mm/Cir-7/09304

UNIVERSITY OF MUMBAI



Syllabus for T. E. (Marine Engineering) Semester V and VI

(with effect from the academic year 2004-2005)

UNIVERSITY OF MUMBAI
SCHEME OF EVALUATION
COURSE T.E. (MARINE)

Semester V

Sr. No.	Subject	L	P	Theory (hours)	Theory Marks	TW	P	O	Total
01.	Naval Architecture & Ship Construction I	5	-	3	100	50	-	-	150
02.	** Mechanics of Fluids I	4	2	3	100	25	-	-	125
03.	Marine Auxiliary Machinery I	4	2	3	100	25	-	-	125
04.	** Dynamics of Machines I	4	2	3	100	25	-	-	125
05.	Applied Thermodynamics (Marine) III	3	2	3	100	25	-	-	125
06.	<i>Marine Design</i>	3	3	3	100	25	-	-	125
07.	*Presentation & Communication Techniques	2	2	-	-	25	-	25	50
	TOTAL	25	13		600	200	-	25	825

Total : 38 Hrs

* Common with all branches of Engineering

** Common with Mechanical and Automobile Engineering

1 Naval Architecture & Ship Construction I

CLASS : T.E. (Marine Engineering)		Semester V	
Subject 01 : Naval Architecture & Ship Construction			
Periods per week. 1 period of 60 min	Lecture	5	
	Practical	-	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	--
	Term Work	--	50

1. BASIC SHIP STRUCTURE :

1.1 Ships Terms :

Various terms used in ship construction with reference to a ship's parameters, e.g. L.B.P., moulded depth, moulded draught etc. General classification of ships.

1.2 Stresses in Ship's Structure :

Bending, shear, hogging, sagging, racking, pounding, panting etc. and strength members to counteract the same.

1.3 Materials and Sections used in Ship Construction :

Type of sections such as angles and bulb plates. Flanged beams used in ship construction. Plating. Riveting and welding. Testing of welds. Fabricated components.

1.4.1 Bottom and Side Framing :

Plating system for bottom and side. Double bottoms, watertight floors, solid and bracket floors. Longitudinal framing. Keel. Side (transverse) framing. Tankside brackets. Beam knees. Transverse frames and web frames.

1.4.2 Shell and Decks :

Plating system for shell. Deck plating and deck girders. Discontinuities such as hatches and other openings and their supporting and closing arrangements. Midship section.

1.4.3 Bulkheads and Deep Tanks :

Watertight bulkheads. Arrangements of plating and stiffeners. Watertight sliding doors. Watertight openings through bulkheads for electric cables, pipes and shafting. Deep tanks for fuel or oil cargo. Corrugated bulkheads and their stools.

1.5.1 Fore-End Arrangements :

Stem construction. Arrangements to resist panting; panting stringers. Fore-peak collision bulkhead. Bulbous bows. Anchor and cable Arrangements. Fore-peak tank construction.

1.5.2 After-End Arrangements :

Types of sterns. Stern frame and rudder. Types of rudder. Supporting of rudder, locking pintle, bearing pintle, Pallister bearing. Shaft tunnel, tunnel bearing. After-peak tank construction.

2. SHIP CONSTRUCTION :

2.1 Shipyard Practice :

Layout of a shipyard. Mould loft. Basic principles of computer aided submerged plate cutting and edge preparation. Modern automatic welding techniques. Fabrication of sub-assemblies and assemblies. Pre-fabrication of units of construction. Role of surveyors in ship construction. Keel laying, launching and sea trials. Use of computers in ship design with cost implication.

2.2 Ship Types :

General description, features and requirements of oil tankers, bulk carriers, container ships, chemical, LNG and LPG tankers. LASH ships and passenger ships. Special purpose ships such as survey vessels, cable laying ships, dredgers, fishing vessels and tugs. High speed craft such as catamarans, hydrofoil craft and hovercraft. Floating dry docks.

2.3 Offshore Technology :

General overview of drilling ships, platforms and rigs, supply / support vessels, diving support vessels and multi-support vessels.

Term Work :

Term work shall comprise of the class assignments and a class test based on above syllabus.

Class Assignments	:	15 marks
Class Test	:	10 marks

Assignments :

1. Sketches and labeling of typical ship structures (5 Nos.)
2. Sketch with typical dimension of strengthening members used in the ship for bottom, side shell and deck.
3. Sketch of balanced rudder with supporting members.
4. Essay on general description, features and requirements of special purpose ships.
5. Sketch of a transverse section of a bulk carrier in the cargo space.

Text Books :

1. Ship Construction, D.J. Eyres, Butterworth – Heinemann, Oxford, U.K.
2. Ship Design and Construction, R. Taggart (Editor), Society of Naval Architects and Marine Engineers, Jersey City, USA.
3. Ship Construction Marine Students, E.A. Stokoe, Thomas Reed Publications, Sunderland and London, U.K.

References :

1. Structural Design of Sea-going Ships, N. Barabanov, Peace Publishers, Moscow, Russia.
2. Ships and Naval Architecture, R. Munro-Smith, Institute of Marine Engineers, U.K.
3. Statics and Dynamics of the Ship, V-Semyonov Tyan-Shansky, Peace Publishers, Moscow, Russia.

2 Mechanics of Fluids I

CLASS: T.E. (Marine Engineering)		Semester – V	
Subject 02 : Mechanics of Fluids I			
Periods per week. 1 period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	-	
Evaluation System	Theory Examination	Hours	Marks
		3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

1. Fluid Definition and Properties

Definition of a fluid, concept of continuum. Newton's law of viscosity. Types of fluids, Newtonian and Non-Newtonian. Ideal and Real fluids.

2. Fluid Statics

Definition of body forces and surface forces, static pressure, Pascal's Law, derivation of basic hydrostatic equation. Forces on surface due to hydro static pressure. Buoyancy and Archimedes principle

3. Fluid Kinematics

Understanding of Eulerian and Lagrangian approach to solutions. Velocity and acceleration in an Eulerian flow fluid. Definition of streamlines, path lines and stream tubes. Definition of steady / unsteady, uniform / non-uniform, one two and three dimensional flows. Understanding of differential and integral methods of analysis. Definition of a control volume and control surface, types of control volumes.

4. Fluid Dynamics

4.1 Equations for the Control Volume

Integral equations for the control volume, Reynolds transport theorem with proof, applications to mass, energy and momentum transport (Linear and angular), Differential equations of the control volume. Conservation of mass (two and three dimensional), Navier-Stokes equations (without proof) for rectangular and cylinder co-ordinates

Exact solutions of Navier-Stokes equations: Viscous laminar flow of a fluid through a pipe, viscous laminar flow of a fluid through planes (both stationary, one plane moving with a uniform velocity). Euler's equations in two, three dimensions; Bernoulli's equation

4.2 Ideal Fluid Flow Theory

Definition of stream functions and velocity potential functions, rotational and irrotational flows in two dimensions, definition of source, sink, vortex, circulation. Combination of simple flow patterns – e.g. flow past Rankine full body and Rankine half body, Doublet, flow past cylinder with and without circulation, Kutta-Joukowski law.

4.3 Real Fluid Flows

Definition of Reynolds number, Turbulence and theories of turbulence – Prandtl's mixing length theory, Eddy viscosity theory, k-epsilon theory. Velocity profiles for turbulent flows; one-seventh power law, universal velocity profile, velocity profiles for smooth and rough pipes, Darcy's equation for head lost in pipe flows, pipes in series and parallel, hydraulic gradient line, Moody's diagram

4.4 Boundary layer Flows

Concept of boundary layer and definition of boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Growth of boundary layer, laminar and turbulent boundary layers, laminar sub-layer, von Karman momentum integral equations for the boundary layers, analysis of laminar and turbulent boundary layers, calculation of drag, separation of the boundary layer and methods to control it, concept of streamlined and bluff bodies.

4.5 Aerofoil theory

Aerofoil theory, definition of an aerofoil, lift and drag on aerofoils, induced drag

4.6 Introduction to Computational Fluid Dynamics

Basic concepts, finite volume method of analysis, solutions to simple flow problems

Term Work:

The term work shall comprise of the class assignments, laboratory experiments and a class test based on above syllabus

Class assignments and laboratory experiments :	15 marks
Class test :	<u>10 marks</u>
Total :	25 marks

Laboratory Experiments: (at least 6 experiments from the list)

1. Calibration of Pressure gauge and vacuum gauge
2. Verification of Archimedes principle
3. Calibration of Venturimeter
4. Calibration of orifice meter
5. Verification of Energy equation (Bernoulli's Equation)
6. Verification of momentum equation
7. Determination of friction factor for a pipe
8. Flow measurement using a pitot tube
9. Determination of head loss in bends, valves etc.

Text Books:

1. Fluid Mechanics – Streeter, Wylie
2. Fluid Mechanics – B. M. Massey
3. Fluid Mechanics – F. M. White
4. Fluid Mechanics – K. L. Kumar

References:

1. Advanced Fluid Dynamics – Muralidhar and Biswas
2. Applied Hydrodynamics – Valentine
3. Fluid Mechanics – Douglas et al
4. Computational Fluid Dynamics – Anderson

3 Marine Auxilliary Machinery I

CLASS: T.E. (Marine Engineering)		Semester – V	
Subject 03 : Marine Auxilliary Machinery I			
Periods per week. 1 period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

1. Engine Room Layout, pipe line systems with filters and associated fittings

Layout of main and auxiliary machinery in engine rooms of different ships. Layout of pipe with fittings, pipe material. Valves and cocks. Piping arrangement for steam, bilge, ballast, fire, HFO, DFO, LO, seawater, fresh water, compressed air and hydrophore systems. Bunkering procedures including safety fittings. Construction, operation, and maintenance of various filters, strainers, auto cleaners. Arrangement of different types of tanks of E.R.

2. Blowers and compressors

Constructional details and operational procedures of blowers and compressors. Engine room force draft and exhaust system. Air bottles, construction, mountings and associated systems.

3. Evaporators

Construction and operation of different types of vacuum evaporators. Fresh water generators and distillers. Conditioning arrangements of distilled water for drinking purpose, membrane system

4. Pollution prevention and control arrangements, equipments

Construction, operation and maintenance of coalescers, baffles, grids. Stokes law. Static and turbulo separators, 15 ppm oily bilge separator and its measuring instruments. Control of leakage of oil in engine room and its disposal through shore connection. MARPOL Convention discharge criteria of quantity of oil from engine room. Cargo pumping arrangement of oil and chemical tankers, garbage treatment.

5. Heat Exchangers

Construction, operation and maintenance of all types of tubular and plate type heaters and coolers for FO & LO and water. Corrosion combat arrangements. Tube removal, plugging and materials used.

6. Fuels

Source of supply, study of primary fuels, coal, petroleum, natural gases. Classification of fuels. Treatment of fuels for combustion in marine IC engines and steam plants, residual fuels, emulsified fuels, merits and demerits of such fuels in marine engines. Heating process of residual fuel to get correct viscosity at IC engine and boiler.

7. Lubrication

Theories of lubrication, types of lubricants and their properties. Suitability of lubricants for various uses, solid and fluid lubricants. Additive oils and their specific uses. Terminology used in lubrication system. Loading pattern of various bearings in marine use and lubrication system adopted. Different types of bearing used for marine machinery. LO analysis and monitoring of engine through reports.

8. Fuel Oil and Lubricating Oil Treatment (Purification) Arrangements

Theory of oil purification, separation and clarification. Various methods of oil treatment, i.e. purification, filtration, separation by gravity, homogeniser. Construction, operation and maintenance of centrifuges for heavy fuel and lubricating oil, automatic desludgers. Treatment of *fuel oil* of very high density.

9. Pumps, Pumping and Control Arrangements

Types of pumps for various requirements, their characteristics and applications in ships. Construction and operation of centrifugal pumps, gear pumps, screw pumps and reciprocating pumps and control arrangements for each type, care and maintenance of pumps.

10. Deck Machinery

Various types of deck machinery used in ships, e.g. winches and windlass and their construction requirements, operation and maintenance. Deck cranes, hydraulic deck machinery, hydraulic motors, line filters and systems

11. Communication system

Sound power internal telephone, telegraph, voice pipe, ER emergency alarm and other alarm systems.

Practical Training (Assignments) on the following

1. Pipe line tracing and making sketches for steam, bilge, ballast, fire, HFO, DFO, LO, seawater, freshwater, compressed air and hydrophore systems.

2. Inspection of a starting air bottle, sketch with labeling. Overhauling of air bottle mountings. Sketch with labeling of a two stage air compressor.
3. Study of a fresh water generator, Sketch with labeling. A write-up on operation.
4. Study of a 15 ppm oily bilge separator, Sketch with labeling. A write-up on operation.
5. Overhauling of a typical cooler. Preparation of a working sketch. A write-up on maintenance and cleaning.
6. Study of all parts of a purifier. Sketch and labeling. A write-up on working principle and routine cleaning and maintenance.
7. Sketch and labeling of reciprocating centrifugal, gear and screw pumps. A write-up on routine overhaul, routine maintenance and replacement of components.
8. Study of a windlass typically used on ships, sketch and label.
9. Study of FO treatment from service tank to fuel injector. Sketch and label.
10. An essay on LO analysis and monitoring of lubrication system of a large two stroke heavy oil engine used for main propulsion.
11. An essay on communication system needed in a modern ER.

Term Work

The term work shall comprise of the assignments and a class test based on above syllabus.

Assignments	:	15 marks
Class Test	:	<u>10 marks</u>
Total	:	25 marks

Text Books

1. Marine Auxiliary Machinery, D.W. Smith, Newnes – Butterworth
2. General Engineering Knowledge, H.D. McGeorge, Butterworth Heinemann
3. General Engineering Knowledge for Marine Engineers, Reeds Practical Mathematics Series, Vol 8

Reference Books

1. Marine Engineering Practice Booklets - Institute of Marine Engineers Publications, Volume 1 to 19
2. Introduction to Marine Engineering, D.A. Taylor, Butterworth- Heinemann
3. Notes on Instrumentation & Control, G. J. Roy, Stanford Maritime, London
4. Ship Design & Construction, Society of Naval Architects & Marine Engineers, (SNAME), New York, U.S.A.

4 Dynamics of Machines I

CLASS: T.E. (Marine Engineering)		Semester – V	
Subject 04 : Dynamics of Machines I			
Periods per week. 1 period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	-	
Evaluation System	Theory Examination	Hours	Marks
		3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

1. Clutches

1.1 Clutches, Positive clutches, Friction clutches

1.2 Friction Clutches – Analysis of frictional torque, power transmission.

Power loss in : Friction in single plate, multiple plate clutch, and cone clutch

1.3 Centrifugal Clutches – Construction, working

2. Governors

2.1 Comparison between governors and flywheel

2.2 Types – centrifugal governors, inertia governors, electronics governors

2.3 Force analysis of gravity loaded governors – Watt, Porter, Proell.

2.4 Force analysis of spring loaded governors – Hartnell, Harting, Wilson Hartnel

2.5 Force analysis of spring and gravity loaded governors

2.6 Performance characteristics of governors – stability, sensibility, isochronisms

3. Gyroscope

3.1 Introduction – Gyroscopic couple and its effect on spinning bodies

3.2 Gyroscopic effect on ships during steering, pitching and rolling

3.3 Ship stabilisation with gyroscopic effect

3.4 Two wheeler and four-wheeler on curved path – effect of gyroscopic and centrifugal couples, maximum permissible speeds on curve paths.

3.5 Gyroscopic effect due to lateral misalignment of rigid disc mounted on shaft

4. Brakes and Dynamometers

4.1 Types of Brakes, Analysis of Block brakes – external and internal, Band brake – simple and differential, Band and block brake – simple and differential

4.2 Breaking of vehicles – front wheels, rear wheels, all wheels on level and inclined roads

4.3 Types of dynamometers – Absorption and transmission dynamometers

4.4 Study and analysis of absorption type dynamometer – Prony brake, rope brake dynamometers

4.5 Study and analysis of transmission type dynamometers – Belt transmission, epicyclic, torsion dynamometers

4.6 Froude hydraulic dynamometer

5. Gear Trains

5.1 Kinematics and dynamic analysis of – simple gear trains, compound gear trains, reverted gear trains, epicyclic gear trains with spur or bevel gear combination

6. Flywheel

6.1 Static and dynamic force analysis in slider crank mechanism neglecting mass of connecting rod and crank

6.2 Turning moment diagram, fluctuation in energy, function of flywheel estimating inertia of flywheel for reciprocating prime movers and machines

6.3 Static force analysis in gears – spur, bevel, helical, worm and worm gear

6.4 Static and dynamic force analysis – in linkage mechanism (upto 4 links) by virtual work method

6.5 Dynamic equivalent system to convert rigid body to two mass systems with and without correction couple

7. Belt and Rope Drive

7.1 Types – flat, V, rope belt

7.2 Kinematic Analysis – velocity ratio, slip and creep of belt length of belt for open and crossed belting. Dynamic analysis – driving tensions, centrifugal tension, initial tension

7.3 Power transmission, maximum power transmission condition

Term Work

Term work shall comprise of the class assignments, laboratory experiments and a class test based on above syllabus

Class assignments and laboratory experiments :	15 marks
Class test :	<u>10 marks</u>
Total :	25 marks

Laboratory experiments

1. Experiments on mass moment of inertia of rigid body
2. Experiments on Gyroscope
3. Experiments on Governors – Proell Governor, Hartnell Governor
4. Experiments on Dynamometers – Rope Brake Dynamometer, Torsion Dynamometer
5. Study of power transmission system in automobile

Assignments

Minimum three problems on each topic of the syllabus

Text Books

1. Theory of Machines – Thomas Bevan – CBS Publishers
2. Theory of Machines – S.S. Ratan – Tata McGraw Hill
3. Theory of Machines – P. L. Ballany, Khanna Publishers, Delhi
4. Mechanics of Machines, Elementary Theory and Examples by J. Hannah and R.C. Stephens – Arnold internal students edition
5. Mechanics of machines, Advanced Theory and Examples – by J. Hannah and R.C. Stephens – Arnold international students Edition

References

1. Dynamics of Machines – Norton
2. Theory of Mechanisms and Machines – A. Ghosh and A Malik – Affiliated East-West Press Pvt. Ltd., New Delhi
3. Theory of Machines – W. G. Green – Bluckie & Sons Ltd.
4. Theory of Machines – R. S. Kurmi – J. K. Gupta
5. Theory of Machines – R. K. Bansal
6. Mechanics & Dynamics of Machinery – J. Srinivas, Scitech

5 Applied Thermodynamics III

CLASS : T.E. (Marine Engineering)		Semester V	
Subject 05 : Applied Thermodynamics (Marine) III			
Periods per week. 1 period of 60 min	Lecturer	3	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	--
	Term Work	--	25

1. Fuels, Combustion and Dissociation :

Definition of Fuel. Combustion. Combustion Equation. Analysis of the products of Combustion, Stoichiometric Combustion, Actual Combustion, Excess Air, Mixture Strength, Dissociation, Effect of Dissociation on I.C. Engines.

2. Gas Dynamics :

One Dimensional steady flow of compressible fluids, Isentropic flow, Effect of Friction, Flow through Nozzles and diffusers, Critical conditions, Mach number, Subsonic and Supersonic Flow. Flow of steam through Nozzles and Diffusers.

3. Steam and Gas Turbines :

- 3.1 Supersaturated Flow of Steam ; Applied problems.
- 3.2 General Principles of Impulse and Reaction Turbines.
Velocity Diagrams for Simple Impulse and Impulse-Reaction Turbine.
Compounding of Impulse Turbine – Pressure and Velocity Compounding.
Force on blades. Work done by blades, Axial thrust, Blade or Diagram Efficiency. Effect of Friction on blades, Applied problems.
- 3.3 General Principles of Gas Turbines

4. Refrigeration :

Reversed Carnot Cycle, Vapour Compression Cycles, Refrigerating effect, Co-efficient of performance, Cooling capacity, rating of a Refrigerating plant, Methods of improving C.O.P. Use of vapour Tables, Applied problems.
Typical marine Refrigerating Plants with Multiple Compression and Evaporator System. Refrigeration in liquefied gas carriers and refrigerated container.

5. Transmission of Heat :

Fourier's Law of Heat Conduction: Thermal conductivity of insulating materials. Conduction through flat and cylindrical, spherical surfaces in series. Heat transfer from fluids to fluids through walls. Application of Heat Transfer in Marine Heat Exchangers, like Coolers, Heaters, Condensers. Prediction of convection Heat Transfer rates. Use of Non-Dimensional Groups. Natural and Forced Convection – use of Prandtl No., Nusselt No., Reynolds No., Stanton No., Grashoff No., Applied problems. Radiation : basics, Stefan-Boltzmann Law, Grey / Black Bodies.

6. Mass Transfer :

Mechanism of Mass Transfer : Importance of mass transfer in engineering. Introduction of Steady State diffusion of gases and liquids.

Term Work :

Term work shall comprise of the class assignments and a class test based on above syllabus.

Class Assignments	:	15 marks
Class Test	:	10 marks

		25 marks

Experiments : (at least 8 experiments from the list.)

1. Study of fuel injection system.
2. Test of fuel injectors using fuel injector Test Rig.
3. Experiment on mass flow rate of air through orifice plate or nozzle.
4. Demonstrate operation of a Steam Turbine Plant using Steam Turbine Test Rig.
5. Determine the efficiency of a Steam Turbine using Steam Turbine Test Rig.
6. Demonstrate the operation of a Refrigeration Plant using Refrigeration Test Kit.
7. Determine the C.O.P. of a refrigeration plant.
8. To determine the thermal conductivity of a metal rod.
9. To determine the thermal conductivity of an insulating material.
10. To determine Heat Transfer Co-efficient through forced convection.

Assignments :

At least 15 problems covering the above syllabus.

Text books :

1. Thermal Engineering By Ballaney, Khanna Publishers, Reprint 1994.
2. Thermodynamics By P.K. Nag – Tata McGraw Hill Co., Reprint 1992.

3. Applied Thermodynamics for Engineers and Technologies By Eastop and Mcconky Longman, 1978.
4. Thermodynamics Tables by Rogers and Mayhew.
5. Thermodynamics Tables and T-Ø diagram.

References :

1. Thermal Engineering By Kothandraman, Domkundwar, Khajuria, Arora-Dhanpatrai & Sons.
2. Thermal Engineering – R.K. Rajput.
3. Steam and gas turbine – R. Yadav.
4. Thermodynamics and Heat Engines Vol II By R. Yadav, Central Publishing House, Reprint 1994.
5. Principles of Thermodynamics By H.A. Sorensen, A Merinal Publications, 1972.]
6. Thermodynamics By Rogers and Mahew.

6 Marine Design

CLASS : T.E. (Marine Engineering)		Semester V	
Subject 06 : Marine Design			
Periods per week. 1 period of 60 min	Lecturer	3	
	Practical	3	
	Tutorial	-	
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	--
	Term Work	--	25

1. Procedure in Machine Design :

- 1.1 Concepts of design, procedure and process, Design synthesis, Economic consideration in design, Feasibility, Preliminary Design Alternative, Final Design Alternative, Preliminary and Final Plans and Drawings.
- 1.2 Use of standards in design, selection of preferred sizes, common useful materials and manufacturing considerations in design, i.e., casting, forging, fabrication.
- 1.3 Review of failure criteria in mechanical design, properties of materials, heat treatment processes, BIS system of designation of steels, I.S. Codes, Basis of good Design, Failure of machine parts. Deformation, Wear, Corrosion.

2. Machine Design :

- 2.1 Strength Consideration for Design :
Strength of materials, Reliability, Influence of size, Stress concentration, Strength under combined stresses, Static loads, Impact loads, Repeated loads, Completely reversed loads, Static plus Alternating loads, Cyclic and combined loads, Fatigue Strength, Dynamic Stresses, Selection of materials.
- 2.2 Specifications :
Tolerances, Types of fits, Selection of fits, finishing, BIS/I.S. Codes.

3 Design and Drawing to specifications for parts subjected to direct loads :

- 3.1 **Fasteners :**
Bolts and Screws, Cotter and Knuckle joints, Keys and Couplings, Pipe joints, Riveted and welded joints, Design of welded machine parts.
- 3.2 **Power Transmission :**
Shafts and axles, Bearings, clutches and brakes, Belt drives, Chain drives, Design and drawing of tooth gearing like spur and Bevel gears, Rack and pinion, worm and worm wheels, helical gears.
- 3.3 Design of power transmitting shaft.

- 3.4 Design of unfired pressure vessel – starting air bottle, cylindrical pressure vessel with dished ends.

3.5

Term Work :

Term work shall comprise of the class assignments and a class test based on above syllabus.

Design and detailed assembly drawing on half imperial drawing sheets of two mechanical units, which includes the design of elements from above topics.

Class Assignments	:	15 marks
Class Test	:	10 marks

Note :

Use of standard design data books is permitted at the examination and be supplied by the college.

Text Books :

11. Design of machine elements by V.B. Bhandari, Tata McGraw Hill Pub.
12. Machine Design – An Integrated Approach – Robert L. Norton – Pearson Education Asia.
13. Machine Design – Pandya Shah – Charotar Publishing
14. Mechanical Engineering Design – 1.E. Shigley – McGraw Hill
15. Recommended Data Books – PSG, K. Mahadevan.

References :

1. Machine Design – Reshtov – Mir Publication
2. Machine Design – Black Adams – McGraw Hill
3. Fundamentals of Machine Elements – Hawrock, Jacobson – McGraw Hill
4. Rules for the Survey & Construction of Steel Ships (Materials Machinery, Welding and Equipments Sections) – of any Recognised classification society.

7 Presentation & Communication Techniques

7 Presentation & Communication Techniques			
CLASS: T.E. (Marine Engineering)		Semester – V	
Subject 07 : Presentation & Communication Techniques			
Periods per week. 1 period of 60 min	Lecture	2	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	-	-
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25

1. Communication in a Business Organization

- 1.1 Internal Communication (Upward, Downward, Horizontal, Grapevine, Problems, Solutions)
- 1.2 External Communication – Strategies for conducting successful business meetings, Documentation (notice, agenda, minutes) of meetings, Introduction to modern communication techniques (e-mail, internet, video-conferencing etc.). Legal and ethical issues in communication (Intellectual & property rights, patents)

2. Advanced Technical Writing

- 2.1 Report-Writing and Presentation – Definition and importance of reports. Qualities of reports, language and style in reports, types of reports, formats (letter, memo, project-report), methods of compiling data. A Computer aided presentation of a project based on a technical, survey-based, reference-based or campus related topic. Topics to be assigned to a group of 8-10 students. The written reports should not exceed 20 printed pages.
- 2.2 Technical Paper-Writing
- 2.3 Writing-Proposals

3. Interpersonal Skills

Introduction to emotional intelligence, Motivation, Negotiating and conflict – resolution. Assertiveness, Leadership, Team-building, Decision-making. Time management

4. Interview Techniques

Preparing for job interviews, verbal and non-verbal communication during interviews. Observation sessions and role-play techniques may be used to demonstrate interview strategies.

5. Group Discussion

Dynamic of Group Behaviour, techniques for effective participation

Term Work

Term Work shall comprise of the class assignments and a class test

Class Assignments	:	15 marks
Class Test	:	<u>10 marks</u>
Total	:	25 marks

Assignments

1. Written
2. Assignments on Communication topics
3. Assignments on Report Writing
4. Assignments on Interpersonal Skills

Oral

Practical session on Group-discussion / Interview Skills / Project Presentation / Power Point Presentation

Oral Examination (Internal Exam)

Project Report Presentation	:	20 marks
Group Discussion	:	<u>5 marks</u>
Total	:	25 marks

Text Books

1. Report Writing for Business – Lesikar and Petit – Tata McGraw Hill Publications
2. Business Communication Building Critical Skills – Kitty O. Lockers, Stephen Kyo Kaczmarck – McGraw Hill
3. Communication in Organizations, Dalmar Fisher – Jaico Publishing House
4. Organizational behaviour – Fred Luthans – McGraw Hill International Editions

Work Book

Personal Development for Life and work – Wallace & Masters – Thomson Learning

References

1. Business Correspondence and Report Writing 3rd edition – R. L. Sharma and Krishna Mohan – Tata McGraw Hill Publications
2. Business communication – Rai Urmila, Rai S. M. – Himalaya Publishing House
3. Essential of Negotiation – Lewieki, Saunders & Minton – MGH International Editions
4. Teaching Writing for Non-native Professionals, Huckins-MGH International Editions
5. COMDEX Computer Course kit, Vikas Gupta – IDG Books Pvt. Ltd.

6. Lateral Thinking, Edward De Bono – Penguin books
7. Tough Choices and Managers Talk Ethics – Toffler –Allied Publishers Pvt. Ltd.
8. The Sunday Times "Creating Success Series"
 - a) Develop Your Assertiveness
 - b) Make Every Minute count
 - c) Successful Presentation Skills
 - d) How to Motivate People
 - e) Team Building
9. The essential Managers Manual – Dorleen Kindersley

UNIVERSITY OF MUMBAI
SCHEME OF EVALUATION

COURSE T.E. (MARINE)

Semester VI

Sr. No.	Subject	L	P	Theory (hours)	Theory Marks	TW	P	O	Total
01.	** Dynamics of Machines II	4	2	3	100	25	-	-	125
02.	Marine IC Engines I	4	2	3	100	25	-	25	150
03.	Marine Auxiliary Machinery II	3	2	3	100	25	-	25	150
04.	Marine Boilers	3	3	3	100	25	-	25	150
05.	Marine Electrical Technology	4	2	3	100	25	-	25	150
06.	Marine Machinery System Design	3	3	3	100	25	-	-	125
07.	Economics and Commercial Geography	3	-	3	100	25	-	-	125
	TOTAL	24	14	-	700	175	-	100	975

Total : 38 Hrs

** Common with Mechanical and Automobile Engineering

1 Dynamics of Machines II

CLASS: T.E. (Marine Engineering)		Semester – VI	
Subject 01 : Dynamics of Machines II			
Periods per week. 1 period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

Vibrations

1. Basic concepts of vibration

- 1.1 Vibrational oscillation, causes and effects of vibrations
- 1.2 Vibration parameters-spring, mass, damper
- 1.3 Damper models
- 1.4 Motion-periodic, non-periodic, harmonic, non-harmonic
- 1.5 Degree of freedom, static equilibrium position
- 1.6 Vibration classification
- 1.7 Steps involved in vibration analysis

2. Free undamped single degree of freedom vibration system

- 2.1 Longitudinal, transverse, tensioned system
- 2.2 Methods for formation of differential equations by Newton, Energy, Lagrangian (Rayleigh's method)
- 2.3 Effect of springs mass and shaft inertia on natural frequency
- 2.4 Effect of flexible bearings on natural frequency

3. Free Damped single degree of freedom vibration system

- 3.1 Viscous damped system-under damped, critically damped, over damped. Logarithmic decrement.
- 3.2 Coulomb's damping
- 3.3 Combined viscous and Coulomb's damping

4. Equivalent single degree of freedom vibration system

- 4.1 Conversion of multi-springs, multi masses, multi-dampers into a single spring, mass and damper with linear or rotational co-ordinate system.

5. Free Undamped Multi degree of freedom Vibration systems

- 5.1 Eigen values and Eigen vectors for liner system and torsional two degree of freedom

- 5.2 Holzer method for linear and torsional unbranched system
- 5.3 Two rotors, three rotors and geared system
- 5.4 Dunkerley and Rayleigh method for transverse vibratory system

6. Forced single degree of freedom vibratory system

- 6.1 Analysis of linear and torsional systems subjected to harmonic force excitation and harmonic motion excitation (excluding elastic damper)

7. Vibration measuring instruments

- 7.1 Principle of seismic instruments, vibrometer, accelerometer-undamped, damped

8. Vibration Isolation

- 8.1 Force isolation, motion isolation, isolators

9. Rotor Dynamics

- 9.1 Critical speed of single rotor, undamped and damped

10. Cam Dynamics

- 10.1 Cam Kinematics and Dynamics: Mathematical Model, Differential equation, Response
- 10.2 Follower Jump phenomenon

11. Balancing

- 11.1 Static and dynamic balancing of multi rotor system
- 11.2 Balancing of reciprocating masses:-
 - In-line engines
 - V-engines (excluding radial engines)

Term Work:

Term work shall comprise of the class assignments, laboratory experiments and a class test based on above syllabus.

Class assignments and laboratory experiments :	15 marks
Class Test :	<u>10 marks</u>
Total	25 marks

Class Assignments

At least 25 problems covering all above syllabus

Program development for

- frequency analysis of multi degree of freedom system by using Holzer method
- For response analysis of forced vibration

Experiments : (Minimum 10 experiments)

1. Simple Pendulum
2. Compound Pendulum
3. Bi-suspension system
4. Longitudinal vibrations of helical springs
5. Equivalent stiffness of spring in series and parallel
6. Undamped force vibration
7. Single-Rotor vibratory system
8. Two-Rotor vibratory system
9. Whirling of Shaft
10. Forced vibrations of equivalent spring-mass system
11. Damped torsional vibrations
12. Transverse vibrations (Dunkerley's Rule Expt.).
13. Balancing of multi-rotor system
14. Demonstration of balancing machine
15. Demonstration of vibration measurement
16. To check of transmissibility of isolations

Text Books;

1. Mechanical Vibrations – G. K. Grover
2. Mechanical Vibrations – V. P. Singh – Dhanpat Rai & Sons
3. Mechanical Vibrations – S. S. Rao – Addison Wesley Publishing
4. Fundamental of Mechanical Vibration – Graham Kelly – Tata McGraw Hill

References:

1. Mechanical Vibration Analysis – P. Srinivasan – Tata McGraw Hill
2. Mechanical Vibrations – Schaum's Outline series – McGraw Hill
3. Theory & Practice of Mechanical Vibrations – J. S. Rao, K. G. Gupta – New Age international Publications
4. Theory of vibrations with applications – W. T. Thomson – Prentice Hall of India
5. Mechanical Vibrations – Den, Chambil, Hinckle

2 Marine Internal Combustion Engines I		Semester – VI	
CLASS: T.E. (Marine Engineering)			
Subject 02 : Marine Internal Combustion Engines I			
Periods per week. 1 period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25

1. Performance Characteristics of IC Engines

- 1.1 4-stroke and 2-stroke cycles. Deviation from ideal condition in actual Engines. Limitation in parameters. Low speed, medium speed and high speed engines.
- 1.2 Timing Diagrams of 2-stroke and 4-stroke engines.
- 1.3 Comparative study of slow speed, medium speed and high speed diesel engines – suitability and requirements for various purposes.
- 1.4 Mean Piston speed, MCR & CSR ratings
- 1.5 Practical heat balance diagrams and thermal efficiency.

2. 2-stroke, large bore, slow speed Diesel Engines

- 2.1 General Description of IC Engines and their historical development.
 - 2.1.1 Marine Diesel Engines of various makes such as MAN-B&W and Sulzer.
 - 2.1.2 Constructional Details of IC engines. Principal components - Jackets and liners, cylinder heads, Pistons, Piston-rods and stuffing box, cross heads, connecting rods, bed-plates, A-frames, welded construction of bed plates and frames, Tie rods, crank-shafts. Cross-head, bottom-end and main bearings.

3. Scavenging and supercharging systems

- 3.1 Scavenging arrangements in 2-stroke engines. Various types of scavenging in 2-stroke engines; uniflow, loop, cross loop and reverse loop scavenging, their merits and demerits, scavenging pumps for normally aspirated engines, under piston scavenging, exhaust slide valve arrangements in cross and reverse loop engines – advantages and disadvantages. Scavenge manifolds and scavenge valves, scavenge drains, supply of scavenge air at low RPM.
- 3.2 Supercharging - Pulse and constant pressure systems, their relative merits and demerits in highly rated marine propulsion engine. Air movements inside the cylinder. Turbocharger and its details. Two stage, uncooled, radial turbocharger. Recent developments in turbo charging.

4. Combustion of Fuels in IC Engines, Compression and peak pressure characteristics

4.1 Combustion of fuels – Grades of suitable fuel. Diesel oil operation at manoeuvring and change over at full away to heavy oil, heavy oil operation at all conditions. Preparation of fuels for efficient operation. Fuel atomization, Ignition quality. Fuel injectors and its details. Ignition delay, after burning.

4.2 Compression and peak pressures – Compression pressure ratio and its effect on engines. Reasons for variation in compression and peak pressure. Design aspects of combustion chamber. Control of NOX and SOX in Exhaust emission.

5. Cooling system of IC Engines

Various cooling media used, their merits and demerits. Primary and secondary cooling system. Cooling of pistons, cylinder jackets, cylinder heads and injectors. Bore cooling. Coolant conveying mechanisms and systems. Maintenance of coolant and cooling system.

6. Safety and Prevention of mishaps in IC Engines

Causes and prevention of crank-case explosions and scavenge fires. Detection of same and safety fittings provided to prevent damage. Causes and prevention of uptake fire, starting airline explosion, thermal stresses.

7. Special features of IC Engines

Development of long-stroke Engines. Implication of stroke-bore ratio. Development in materials in construction, heat treatment of ME components

Practical Training (Assignments) on the following

1. Study and tabulation of major characteristics of one each of MAN – B & W and Sulzer latest engines of large bore, long stroke of comparable bore.
2. Sketch and labeling of major components of one each of same engines as characterized in 1 of above.
3. Study of major components of engines in Assembly shop.
4. Overhauling of a piston rod stuffing Box.
5. Overhauling of a scavenge valve
6. Overhauling of exhaust valve.
6. Overhauling of a turbo-charger.
8. Overhauling of an injector.
9. An essay on arrangements made on Main Engines to maintain the SOX and NOX values as permitted in Annex VI of MARPOL 73 / 78.
10. Study of a viscosi-meter typically installed on ME for heavy fuel operation. Sketch label and writing (on operating principle) of the equipment.
11. Study and tracing of cooling system of Main Engines on a ship and preparation of suitable sketch / sketches.
12. Study of crank-case mist detector and its system as fitted on ME of ship. Sketch and labeling.

13. Tabulation of major components of ME. Specify of physical and chemical properties.

Term Work

The term work shall comprise of the assignments and a class test based on the above syllabus

Assignments	:	15 marks
Class test	:	<u>10 marks</u>
Total	:	25 marks

Oral Examination (Internal Examination)

The oral shall be based on the above syllabus and Practical Training

Topics of the syllabus	:	15 marks
Topics on Practical training	:	<u>10 marks</u>
Total	:	25 marks

Text Books

1. Marine Diesel Engines. Pounder
2. Marine Diesel Engines, Sanyal
3. Marine Diesel Engines, Lamb
4. Motor Engineering Knowledge, Vol-12, Reed's

Reference Books

1. Marine Engineering Practice Series, 20 parts in 3 volume, Institute of Marine Engineers, London.
2. The Running and Maintenance of Marine Machinery, Cowley, Institute of Marine Engineers, London.
3. Marine Engineering, DA Taylor
4. Marine Engineering, Harrington, SNAME

3 Marine Auxiliary Machinery II

CLASS: T.E. (Marine Engineering)		Semester – VI	
Subject 03 : Marine Auxiliary Machinery II			
Periods per week. 1 period of 60 min	Lecture	3	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25

1. Steering Gears

Operation, Constructional details, care and maintenance of:-

1. Various types of steering machinery
2. Telemotor systems, transmitters and receivers
3. Variable delivery pumps used in steering gears, axial and radial displacement types.

Hunting action of steering gear, Emergency Steering arrangement. Safe –matic (single failure criteria) steering gear as per SOLAS.

2. Shafting

Methods of shaft alignment, constructional details and working of Thrust blocks. Intermediate shaft bearing and stern tube bearing. Oil, water, lubricated stern tubes. Sealing glands, stresses in Tail End, Intermediate and Thrust Shafts, R.P.M. meter, Measurement of Brake Horse power.

3. Dry Docking

Methods of dry docking of ships. Inspection and routine overhauling of underwater fittings. Hull external inspection, repair / renewal of Hull plates. Measurement of clearances and drops. Removal, repair and fitting of propellers (with and without key), rudder.

4. Other Shipboard equipments

Incinerators, Sewage treatment plant, Engine room crane, Chain blocks, tackles, Anchor chain, its testing and survey requirements.

5. Ship Stabilizer and associated topics

Different types of ship stabilizer, Bow Thrusters. Hull protection arrangements. Bad weather precaution, storage of spare parts and maintenance of E.R. Stores.

6. Refrigeration

Principles of refrigeration, overview of refrigeration cycles, different refrigeration systems, classification of refrigerators, uses of refrigeration at sea, cryogenic technology-definition, temperature range, insulation Different refrigerants, chemical formula, desired properties (general. physical, chemical, thermodynamic) comparison, effect of environment, Montreal and Kyoto protocols requirements and their enforcement through Annex VI of MARPOL 73 / 78.

Design and construction of various components of refrigeration plants, i.e., compressor, condenser, evaporator, expansion valves, control and safety equipments for domestic, refrigerated cargo spaces and refrigerated containers. Operation and maintenance of refrigeration plants, control of temperature in different chambers, charging of refrigerant / oil, purging of air, defrosting methods, trouble shooting.

Refrigeration of cargo holds, brine system and its operation & maintenance, methods of air circulation in holds, insulating materials, insulation, micro-organism, dead and live cargo, factors affecting refrigerated cargo, container ship refrigeration, preparation for loading cargo, survey of refrigeration equipments.

7. Air Conditioning

Necessity on board ships, different systems, control of room air temperature, humidity, noise, dust and purity, construction of duct and diffuser, fans, ventilation of accommodation, fire safety balancing of system. Heating of accommodation in cold regions incorporated in same or separating unit. Humidity control while in heating mode.

8. Ventilation

Ventilation of engine room, pump room, CO₂ and battery rooms, air change requirements, design consideration, maintenance.

9. Noise Pollution and Vibrations

Elements of aerodynamics and hydrodynamics sound, Noise sources on ships and noise suppression techniques. Noise level measurement in accommodation, passenger spaces and in E.R., permitted decibels. Ear protection aids.

Various modes of vibration in a ship (i.e. free, forced, transverse, axial, torsional their sources and effects), Resonance and critical speed, structure borne, and air borne vibration. Anti vibration mountings of machineries, De-tuners, Dampers with reference to torsional vibrations dampers, use of torsionographs.

Practical Training (Assignments) on the following

1. Study of all the components of a steering gear including Telemotor system. Sketch and labeling.
2. Overhauling of a variable delivery pump. Preparation of sketch, labeling. Description of working principle.

3. Sketch and labeling of a tail end shaft of a ship incorporating salient dimensions. Material specification, method of construction.
4. Sketch and labeling of a stern bearings fitted with simplex seal.
5. Sketch and labeling of a semi-balanced rudder with stock, showing the bearings. Write a short note how a rudder is unshipped, defect to look for and fitting back after repairs.
6. Study of a sewage treatment plant of a ship. Sketch and labeling. Safety precautions during operation and maintenance.
7. Analysis of all the hull protection arrangement with special emphasis on impressed current method.
8. Study of domestic refrigeration of a ship. Sketch and labeling of the system, describing the cycle and operating principle of each equipment of the plant.
9. Study of air conditioning system of a ship. Sketch and labeling of the system. How heating is incorporated in the same plant.
10. Study of ventilation arrangement of the ER of ship.
11. Write an essay on control of noise pollution of a ship.
12. Write an essay on various vibration prone areas and machineries and means for controlling the same.

Term Work

The term work shall comprise of the assignments and a class test based on the above syllabus.

Assignments	:	15 marks
Class test	:	<u>10 marks</u>
Total	:	25 marks

Oral Examination (Internal Examination)

The oral shall be based on the above syllabus and Practical Training

Topics of the syllabus	:	15 marks
Topics of the Practical Training	:	<u>10 marks</u>
Total	:	25 marks

Text Books –

Marine Aux Machinery
6th Edition

D.W. Smith (Newnes – Butherworth)

General Engineering Knowledge

H.D. McGeorge
Butterworth Heinemann

General Eng. Knowledge for
Marine Engineers

Reeds Practical Mathematics
Series Vol 8

Reference Books

- | | |
|--|--|
| 1. Marine Engg. Practice Booklets | 1 to 20 in 3 volumes |
| Inst. Of Marine Engineers Publications | |
| 2. Introduction to Marine Engg. | D.A. Taylor
Butterworth - Heinemann |
| 3. Notes on Instrumentation & Control | G. J. Roy
Stanford Maritime, London |

4 Marine Boilers

CLASS : T.E.(Marine Engineering)		Semester VI	
Subject 04. Marine Boilers			
Periods per week	Lecture	3	
1 period of 60 min	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25

Marine Boilers

1. General Considerations governing the design of boilers -

Types of Marine boilers, comparison of smoke tube and water tube boilers.
Destructive and non-destructive tests on plates, rivets, welded seams.
Classification societies requirements for boilers construction.

2. Smoke Tube Boilers

Various types in marine use. Principal dimensions and staying of flat surface of multitubular cylindrical Boilers. Fired vertical Auxiliary Boilers, Cochran vertical boiler.

3. Water Tube Boilers

General description with sketches of principal types of boilers in marine use, Double Evaporation Boiler, Superheater, Economiser, Air pre-heater, circulation and use of unheated Down comers in highly rated boilers, superheat temperature control, Attemperators and De-superheaters.

4. Waste heat smoke / water tube boilers and economizers

Waste heat recovery calculation. Lamont Exhaust gas boiler, forced water circulation boiler. Composite boiler of various make including W.T. boiler driving turbo-generator in motor ships.

5. Boiler mountings

Safety valves- Improved High Lift, Full Lift and Full Bore type. Gauge Glass – plate type and remote indicator. Automatic feed regulator, three-element control, high and low water level alarms, Main stop valves, Blow down and scum blow down arrangements, Manhole and hand-hole covers. Soot blowers for Air heaters and superheaters including retractable type.

6. Operation, care and maintenance

Precommissioning procedures, Hydraulic tests, steam raising and operating procedures. Action in the event of shortage of water. Blowing down of boiler, laying up a boiler, general maintenance. External and internal tube cleaning. Tube plugging and subsequent renewal Inspection and survey of boilers.

7. Refractory

Purposes of refractory, types of refractory, reasons for failure, and maintenance, Use of Membrane Water- wall Tubes.

8. Oil Burning

- Procedure of liquid fuel burning in open furnace.
- Various types of atomizer.
- Air Register
- Furnace arrangement for oil burning
- Boiler control system, i.e., master control, fuel control, air control and viscosity control.

Practical Training (Assignments) on the following

1. Inspection of a water tube boiler. Preparation of a sketch and labeling.
2. Inspection of a smoke tube boiler. Preparation of a sketch and labeling.
3. Inspection of a composite boiler. Preparation of a sketch and labeling.
4. Overhauling of a safety valve, preparation of a sketch and labeling.
5. Study of the burner arrangement of a Boiler, preparation of a sketch and labeling.
6. Study of a soot blower, preparation of sketch and labeling.

Term Work

The term work shall comprise of the assignments and a class test based on the above syllabus

Assignments	:	15 marks
Class test	:	<u>10 marks</u>
Total	:	25 marks

Oral Examination (Internal Examination).

The oral shall be based on the above syllabus and practical Training.

Topics of the syllabus	:	15 marks
Topics on Practical Training	:	<u>10 marks</u>
Total		25 marks

Text Books

1. Marine Boilers, Milton
2. Running and maintenance of marine Machinery, Cowley, Institute of Marine Engineers, London.
3. Steam Engineering Knowledge, Vol. 9, Reed's

Reference Books

1. Marine Engineering Practice Series, 20 parts in 3 volume, Institute of Marine Engineers, London.
2. Marine Engineering, Harrington, SNAME.

5 Marine Electrical Technology

CLASS: T.E. (Marine Engineering)		Semester – VI	
Subject 05 : Marine Electrical Technology			
Periods per week. 1 period of 60 min	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	25
	Term Work	-	25

1. Power Generation

Merits and demerits of AC and DC on board. Rules and regulations governing electrical machineries on ships. Different alternator Excitations systems on board-Indirect, direct static excitations. Brushless generator construction and operational diagram. Automatic Voltage Regulator.

2. Alternative Source of Power

Emergency Generator and Different starting method including automation. Energy batteries construction and its different types of duties. Location of emergency power source, Different Emergency loads, Rules and Regulations of emergency power, Maintenance of emergency power on board. Shore supply – specifications as per voltage / frequency, precautions while taking shore supply Shaft generator.

3. Distribution

Different electrical diagrams and their uses, electrical signals. Types of distribution, distribution network on board, Main and emergency switch board, construction, different switch gear and protection devices. Grounded and insulated neutral systems. Precaution adopted in High Voltage distribution system. Cables and temperature classification.

4. Motor and control Equipments

Types of marine motor, types of enclosures, protection devices on motors, motor characteristic curves, sequential starting (e.g. Refrigerating plants, automatic fired boiler). HT Motors.

5. Miscellaneous marine electrical equipment Alarm System

Engine Room Telegraph, rudder angle Indicator, RPM and Revolution counter, Centralized salinity Indicator, watertight door operation, Types and supply of

Alarm system for oxygen Analyzer, high and low level alarms, Navigational lights, emergency radio Operation, Electrical Deck auxiliaries.

6. Maintenance of Electrical Systems, faultfindings and Repair

Types of faults and indications on Generator, motor and distribution systems, Different Testing equipments and meters (multimeter / megger, clamp meter, salvaging a motor detection of faults on electronic circuits and cards indications and corrective arrangements, Necessary Precautions and care while fault finding and repair, preventive maintenance, Periodic surveys, spares requirement.

7. Special Electrical Practice

Rules and Regulations and operation of electro-hydraulic and electric steering gear, Diesel-electric and Turbo electric propulsion system, Pod / Antipode drive unit, superconductivity applied in propulsion, turbo alternator, special electrical practice for oil, gas and chemical Tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature class). Flame proof Ex "d" and intrinsic safety Ex "i", Ex "e" and Ex "n" equipments and their applications in zones, Maintenance of Ex-protected apparatus.

8. Safe Electrical Practice

Safe watch-keeping, points to check on electrical machineries, switch gears and equipments, microprocessor control and maintenance, Electrical-fire fighting, Precautions against electric shock and related hazards. Preferential tripping.

Practical Training (Assignments) on the following

- 1) Study of the Excitation system of the alternator of the ship by inspection and from manuals of the ship. Sketch and explain the excitation system.
- 2) Inspection and study of the emergency power of a ship. A report with sketch explaining how the system comes on load in case of trip of alternator from the main switch board, with a list of equipments and spaces where the emergency source of power is provided with load distribution. Draw a layout diagram of an emergency switchboard.
- 3) Inspection of the shore supply arrangement provided on a ship while the vessel is in dry dock. An essay with necessary sketches for the system showing how the connection is made and sequence is checked for correctness before putting the circuit breaker and mention all safety aspects.
- 4) Study of the distribution network of a ship. Sketch and description of a particular DB with protection devices.
- 5) Study of control equipment of any particular 3-phase induction motor such as fitted on Main SW pump. Sketch and describe with protection devices.
- 6) Study of any electrical equipment control system of a ship in ER. Collect material from Manual and write a report with suitable sketches.
- 7) Take the megger readings of an alternator of a ship, compare with previous record. How the insulation is improved if low.

- 8) During visit of an oil tanker study of the flame proof and intrinsic safety arrangement provided for all electrical equipments and wiring of the pump room. Write a suitable report.

Term Work

The term work shall comprise of the assignments and a class test on the above syllabus.

Assignments	:	15 marks
Class test	:	<u>10 marks</u>
Total	:	25 marks

Oral Examination (Internal Examination)

The oral shall be based on the syllabus and practical training.

Topics of the syllabus	:	15 marks
Topics of the practical training	:	<u>10 marks</u>
Total	:	25 marks

Text Books

- 1) Marine Electrical Practice, G.O. Watson
- 2) Practical Marine Electrical Knowledge, D. T. Hall
- 3) Advanced Electro technology, Reed's, Vol. 7
- 4) Electricity, Applied to Marine Engineering, Institute of Marine Engineers, London.

Reference Books

- 1) The Running & Maintenance of Marine machinery, Institute of marine Engineers, London.
- 2) International Safety, Guide for oil tankers and Terminals, Witherby Marine and Insurance Publications, London.
- 3) Rules for the Survey and Construction of steel ships (Electrical Section) of nay Recognized classification Society.

6 Marine Machinery System Design

CLASS: T.E. (Marine Engineering)		Semester – VI	
Subject 06 : Marine Machinery System Design			
Periods per week. 1 period of 60 min	Lecture	3	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

1. Design Considerations

- 1.1 Manufacturing methods, Castings, Forgings, Fabrication and Plastic Moulding, Machining Tolerances, Surface Finishes.
- 1.2 Application to basic design principles in respect of Function, Available materials, Production methods, Economics, Aesthetic appeal.
- 1.3 Initial and servicing costs, Analysis of force, Flow through an Assembly and its effect on the design.
- 1.4 Design with reference to Repairs and reconditioning specially "at sea" work with its normal restrictions and limitations.

2. Marine Machinery Component Designs and Drawing

- 2.1 Design and drawing of marine machinery components subject to combined bending, twisting and direct load like crankshafts, Propeller Shafts.
- 2.2 Design and drawing of Flywheel, Piston, connecting rod, safety valves, reducing valves, globe and other valves, compression and torsion springs, Journal bearings, thrust bearings.
- 2.3 Design of lifting equipment e.g., Engine room overhead crane, Mechanical Pilot hoist.

3. Advanced Design and Drawing of Marine Systems

- 3.1 Power Transmission system including Thrust Blocks, Intermediate shaft and Tail-End shaft.
- 3.2 Water cooling systems including pumps, filters, Heat exchangers for Diesel and steam engine plants.
- 3.3 Lubricating Oil systems including pumps, purifiers, pressure by – pass valves, heat exchangers.
- 3.4 Electro-hydraulic steering gear system including rudder, rudderstock, Tiller arm, ram and cylinder.

- 3.5 Marine Diesel Engine Air starting systems including Air receivers, Compressors and Air starting valves.
- 3.6 Marine Diesel Engine Scavenge and Exhaust System
- 3.7 Marine Diesel Engine Fuel injection system including Fuel pumps and fuel injectors
- 3.8 Design of steam Turbine Plants
- 3.9 Design of Gas Turbine Plants
- 3.10 Life boat and its launching device
- 3.11 Refrigeration Plant
- 3.12 Bulk Co₂ System
- 3.13 Fire fighting system including emergency fire pump.

Note: Latest developments and IMO requirement are to be considered in each design project

4. Computer aided design

Analysis of stress, strain, vibration, thermal stress, deflection on through method of finite element analysis by use of various software like MSC NASTRAN, I-DEAS, AUTO-CAD, Pro-engineer.

Term Work

Term Work shall comprise of the class assignments and a class test based on above syllabus.

Design and detailed assembly drawing on half imperial drawing sheets of two marine Systems, which includes the design of elements from above topics.

Class Assignments	:	15 marks
Class test	:	10 marks

Note

Use of standard design data books is permitted at the examination and be supplied by the College.

Text Books

- 1) Ship Design and Construction, Society of Naval Architects and Marine Engineers.
- 2) Rules for the Survey and Construction of Steel ships (Materials, Machinery, Welding and Equipments Sections) of any recognized Classification Society.
- 3) Engineering Drawing for Marine Engineers, Reed's, Vol. II.
- 4) Mac Gibbon's Pictorial Drawing Book for Marine Engineers, James. G. Holburn and John. J. Seaton, James Munro & Company, Limited, Glasgow.

Reference Books

- 1) SOLAS 74, International Maritime Organization.
- 2) MARPOL 73/78, International Maritime Organization.
- 3) Marine Engineering – Harrington, SNAME
- 4) Design of Machine elements, V. B. Bhandari, Tata McGraw Hill Pub.
- 5) Machine Design, Pandya Shah, Charotar Publishing
- 6) Recommended data Books, PSG, K. Mahadevan

7 Economics & Commercial Geography

CLASS : T.E.(Marine Engineering)		Semester VI	
Subject 07. Economics And Commercial Geography			
Periods per week	Lecture	3	
1 period of 60 min	Practical		
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	
	Term Work	-	25

Part A : Fundamental concepts of Economics

MICRO ECONOMICS :

1. Importance of economics in Marine Engineering study, Basic economic concepts and terms. Demand analysis, supply analysis. Elasticity of demand, elasticity of supply.
2. Factors of production, Forms of Business Organization, Economic System with reference to India.
3. Production function, Law of return, Economics of Scale, ISO-Product and ISO-Cost, Cost Concepts, Cost-Output relationship and Cost Curves in short period, long period. Revenue concept, Determination of price under free market and price control by Government. Types of market. Factors governing extent of market. Pricing under perfect competition. Monopoly, monopolistic competition and oligopoly.

MACRO ECONOMICS

- 4.1 Money : - Types, functions, standard
 - 4.2 Inflation :- Types, causes
 - 4.3 Banks : Function of commercial Banks, functions of Central Banks. Features of Money and capital market. National Income concepts.
5. **Taxation**
Direct and indirect taxes. Government Budgets. Economic development. Features of underdevelopment with reference to India. Globalization of Indian economy.

Part – B Economics as applied to Maritime Industry

6. Trade

Difference between domestic and foreign trade. Basics of International Trade. Trade theories. Free trade v/s protection. Balance of payment components.

Causes of deficit, steps to correct deficit. Free convertibility of currency with reference to Indian Rupees. Functions of I.M.F., World Bank, W.T.O.

7. Major Shipping Routes and Ports

Types, problems, factors for good port. Major ports of India and world. Port pricing. Associated problems of port management i.e. security, pollution of water, Navigational channel, Light-houses – Logistic problems, causes, remedies and maintenance. Major sea fishing zones, off-shore oil producing zones. India's overseas trade and economic importance with reference to economic zones.

8. Resources

Allocation of market resources for ships and ports in a wealth-maximising manner, Public Policy issue in marine transportation, Policy of Protection and Subsidy.

Chartering of ships. Flag of convenience, 2nd Registry.

Term Work

Term work shall comprise of class assignments and a class test based on above syllabus.

Class assignments	:	15 marks
Class test	:	<u>10 marks</u>
Total	:	25 marks

Assignments

1. Analysis of stock-market trend in India in last 5 years.
2. Analysis of Mobile telephone revolution in India. Whether it is an oligopoly or not.
3. Present direct taxation policy of India, its effect on middle and higher income group as well as on Merchant Navy officers engaged on foreign and Indian vessels.
4. Analysis on competitiveness between India and China in shipping sector.
5. Study the role of private banks in the field of commercial banking
6. Private participation in Infrastructure Development for ports and shipping
7. Disinvestments in India for ports and shipping
8. Role of W.T.O. in present trade and commerce
9. Present scenario and future prospect of ship building and manufacture of its ancillary equipments in India.

Text Books

1. Micro Economics, H.L. Ahuja
2. Monetary Economics, Suraj Gupta
3. Indian Economics, Mishra and Puri

Reference Books

1. Macro and Micro Economics, Dornbusch and Fisher
2. Business Economics, Chaturvedi, Gupta and Pal