

UNIVERSITY OF MUMBAI

No. UG/261 of 2009

CIRCULAR :-

A reference is invited to the Ordinances, Regulations and syllabi relating to the Bachelor of Engineering degree course vide this office Circular No.UG/111 of 2004, dated 18th March, 2004 and the Principals of the affiliated colleges in Engineering are hereby informed that the recommendation made by the Faculty of Technology at its meeting held on 1st April, 2009 has been accepted by the Academic Council at its meeting held on 27th May, 2009 vide item No. 4.23 and that, in accordance therewith, the syllabus for the Third Year Marine Engineering (Sem. V and VI) of the B.E. degree course is revised as per Appendix and that the same has been brought into force with effect from the academic year 2009-2010.

MUMBAI - 400 032
7th July, 2009

PRIN. K. VENKATARAMANI
REGISTRAR

The Principals of the affiliated colleges in Engineering .

A.C./4.23/27/05/2009

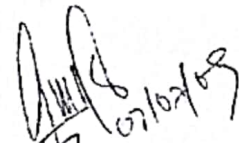
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7th July, 2009

Copy forwarded with compliments for information to :-

- 1) The Dean, Faculty of Technology,
- 2) The Chairman, Board of Studies in Mechanical Engineering .
- 3) The Controller of Examinations,
- 4) The Co-Ordinator, University Computerization Centre,



(D. H. KATE)
DEPUTY REGISTRAR
U.G./P.G. Section.

Copy to :-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration), the Director of Students Welfare, the Executive Secretary to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri, for information .



UNIVERSITY OF MUMBAI



Revised Syllabus for the Third Year Marine Engineering (Semester V & VI)

(With effect from the academic year 2009-2010)

SCHEME OF INSTRUCTIONS AND EXAMINATION (R-2007)
UNIVERSITY OF MUMBAI

COURSE: B.E. (MARINE ENGINEERING)

SEMESTER: V

Sr. No.	Subjects	No. of periods of 1 Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	Naval Architecture & Ship Construction -I	3	--	--	3	100	25	--	--	125
2	Mechanics of Fluids -I	4	2	--	3	100	25	--	--	125
3	Marine I.C. Engines -I	3	2	--	3	100	25	--	25	150
4	Dynamics of Machines -I	4	2	--	3	100	25	--	25	150
5	Environmental Studies	2	--	1 #	2	50	25	--	--	75
6	Presentation & Communication Techniques	2	2	--	--	--	50	--	--	50
7	Marine Electrical Technology	3	3	--	3	100+2 PE	25	25	25	175
	TOTAL	21	11	1	--	550	200	25	75	850

Each Term work Journal shall consist of Practical write-up / tutorial problems, assignment (if Any) and test paper.

(PE) - Practical Examination # Class wise tutorial

COURSE: B.E. (MARINE ENGINEERING)

SEMESTER: VI

Sr. No.	Subjects	No. of periods of 1 Hour			Duration of Theory Paper in Hours	Marks				
		Lecture	Practical	Tutorial		Theory Paper	Term Work	Practical	Oral	Total
1	Naval Architecture & Ship Construction -II	4	--	--	3	100	25	--	--	125
2	Mechanics of Fluids -II	3	2	--	3	100	25	--	--	125
3	Marine I.C. Engines -II	3	2	--	3	100	25	--	--	125
4	Dynamics of Machines -II	4	2	--	3	100	25	--	--	125
5	Marine Auxiliary Machinery II	3	2	--	3	100	25	--	25	150
6	Applied Thermodynamics (Marine) III	3	2	--	3	100	25	--	--	125
7	Marine Machinery and System Design	2	3	--	3	100	25	--	--	125
	TOTAL	22	13	--	--	700	175	--	25	900

Each Term work Journal shall consist of Practical write-up / tutorial problems, assignment (if any) and test paper.

CLASS: T.E. (Marine Engineering)		Semester V	
SUBJECT : 01: Naval Architecture and Ship Construction - I			
Periods per week 1 period of 60 min	Lecture		3
	Practical		-
	Tutorial		-
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

Sr. No.	Details	Hrs.
Module 01	1. BASIC SHIP STRUCTURE	09
	1.1 Introduction Types of ships. Terms connected with ships. Measures of ship size – displacement, deadweight, light weight, tonnage. Main dimensions of a ship. Moulded and extreme dimensions.	
	1.2 Stresses in Ship Structure Stresses in ship structure and their causes – static and dynamic loads, weight and buoyancy, hydrostatic pressure, longitudinal and transverse bending, panting, pounding (slamming), torsion, racking, sloshing, whipping and springing. Stresses due to docking, launching, mooring, grounding, collision and flooding. Elements of ship structure to withstand these stresses. Main components of ship structure – shell, inner bottom, decks, bulkheads and their stiffening arrangements. Transverse and longitudinal framing systems. Structural continuity.	
	1.3 Materials and Sections used in Ship Construction Materials used in hull construction. Shipbuilding steels and their properties. Higher strength steels. Special steels. Aluminium alloys used in shipbuilding. Fibre reinforced plastics. Rolled sections used in ship construction. Built-up sections.	
Module 02	2.1 Bottom Structure Bottom shell plating. Keel, garboard and bilge strakes. Single and double bottom structure. Centre and side girders. Watertight, solid (plate) and open (bracket) floors. Inner bottom plating. Margin plate. Bottom longitudinals. Ceiling. Drain wells.	09
	2.2 Side Structure Side shell plating. Sheer strake. Single and double side structures. Transverse framing. Side longitudinals. Web frames. Tank side (bilge) brackets. Sparring and cargo battens.	
	2.3 Decks Deck plating. Deck stringer. Deck girders and deck beams. Beam knees. Tripping brackets. Hatch end beams. Half beams. Hatch coamings.	

	Strengthening of decks in way of openings. Different types of hatch covers. Scuppers. 2.4 Bulkheads Functions of bulkheads. Watertight and non-watertight bulkheads. Transverse and longitudinal bulkheads. Bulkhead stiffeners and their end connections. Corrugated bulkheads. Bulkhead stools. Deep tank bulkheads. Watertight doors in bulkheads. Bulkhead penetrations by pipes, ducts, cables and shafts.	
Module 03	3.1 Forward End Structure Strengthening of bottom forward. Arrangements to resist panting. Collision bulkhead. Anchor and cable arrangement. Chain locker construction. Deep floors. Wash bulkhead. Perforated flat. Stem construction. Breast hooks. Bulbous bow construction. Arrangement for bow thrusters. 3.2 After End Structure Types of stern. Cant frames and beams. Transom stern construction. Stern frame. Aft-peak construction. Coffin plate. Rudder trunk. Steering gear flat. Types of rudder. Rudder horn. Rudder construction. Pintles and gudgeons. Rudder stock and rudder coupling. Rudder carrier bearing. Propeller shaft brackets and bossings for twin screw ships. Spectacle frames. 3.3 Miscellaneous Structural Elements Pillars and stanchions. Bulwarks and railings. Freeing ports. Duct keel. Bilge keels. Shaft tunnel. Machinery seatings. Fenders. Superstructures and deckhouses. 3.4 Structural Arrangements of Different Types of Ships General cargo ships. Oil tankers. Bulk carriers. Container ships.	09
Module 04	4 SHIPBUILDING 4.1 Shipbuilding Cycle Stages in ship design. Contract and specifications. Production information. Mould left and computer aided methods. Steel work – parts preparation, minor, major and block assemblies. Outfitting and engineering work – advance outfitting. Launching and float out. Tests and trials. Delivery. Shipyard layout. Role of classification society and statutory bodies in ship design and construction. 4.2 Shipbuilding Processes Steel stockyard. Plate and section preparation. Plate cutting processes. Plate and section forming. Joining of structural parts. Riveting and welding. Advantages and disadvantages of welding. Types of welded joints. Edge preparation. Types of welding procedures. Welding defects. Testing of welded joints. Joining dissimilar materials, e.g. steel and aluminium. Assembly processes. Painting. Outfitting processes and machinery installation.	09
Module 05	5. DIFFERENT SHIP TYPES 5.1 Merchant Ships General description, features and requirements of oil tankers, bulk carriers, container ships, chemical tankers, liquefied gas tankers, ro-ro ships, barge carrying ships, car carriers and passenger ships. 5.2 Special Purpose Ships	05

	Survey vessels, research ships, cable laying ships, dredgers, fishing vessels and tugs. Floating docks.	
Module 06	6.1 High Speed Craft Multi-hull ships, planning craft, hydrofoil craft, hovercraft and wing-in-ground effect craft. Hybrid concepts. 6.2 Offshore Technology Ocean resources. Offshore oil exploration and recovery. Drill ships, platforms and rigs. Supply vessels, diving support vessels and multi-support vessels. Floating storage ships. Submersibles, remotely operated vehicles and autonomous underwater vehicles.	04

List of Assignments : (All Five)

1. Sketches and labeling of typical ship structures (5 nos.)
2. Sketch with typical dimensions of a midship section.
3. Sketch of a 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 way of a hold.

Theory Examination :

1. The question paper will comprise of a total of seven questions, each of 20 marks.
2. Only five questions need to be answered.
3. Question 1 will be compulsory, and based on the maximum part of the syllabus.
4. The remaining questions will be mixed in nature (for example, suppose Q. 2 has Part (a) from Module 3, then Part (b) will be from any module other than Module 3).
5. In the question paper, the weightage of each module will be proportional to the number of lecture hours for that module mentioned in the syllabus.

Term Work :

Term work shall consist of five assignments and one or more written tests. The distribution of marks for term work shall be as follows :

Assignments	:	15 marks
Written tests	:	10 marks
TOTAL	:	25 marks.

Text Books :

1. Ship Construction, D.J. Eyres, Butterworth-Heinemann, Elsevier,
2. Ship Construction for Marine Students, E.A. Stokoe, Thomas Reed Publications, Sunderland and London, U.K.

References :

1. Ship Design and Construction, T. Lamb (Editor). Society of Naval Architects and Marine Engineers, Jersey City, U.S.A.
2. Structural Design of Seagoing Ships, N. Barabanov, Peace Publishers, Moscow, Russia.

CLASS: T. E. (Marine Engineering)			Semester-V
SUBJECT: - 02 : Mechanics of Fluids I			
Periods per week 1Period of 60 min.	Lecture	04	
	Practical	02	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	----
	Oral Examination	----	25
	Term Work		25

Sr. No.	Details	Hrs.
Module 01	Fluid Definition, Properties Definition of a fluid, concept of continuum. Newton's law of viscosity. Types of fluids, Newtonian and Non-Newtonian. Ideal and Real fluids. 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's principle	09
Module 02	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.	09
Module 03	Fluid Dynamics 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 stationery, one plane moving with a uniform velocity). Euler's equations in two, three dimensions; Bernoulli's equation	10
Module 04	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.	10
Module 05	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	10

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

Introduction to Computational Fluid Dynamics

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

List of Experiments: (at least 6 experiments from the list)

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

Theory Examination:

1. Question paper will comprise of total seven question, each of 20 Marks
2. Only five question need to be solved.
3. Question one will be compulsory and based on maximum part of syllabus.
4. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral will be based on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum 06 experiments, (assignments) and one or more written test. The distribution of marks for term work shall be as follows:

Laboratory work (experiments/assignments) :	15Marks.
Test (at least one) :	10 Marks.
TOTAL :	25 Marks.

Text Books:

1. Fluid Mechanics – R. K. Rajput
2. Fluid Mechanics –Bansal
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

CLASS: T. E. (Marine Engineering.)			Semester-V
SUBJECT: - 03: Marine Internal Combustion Engines I			
Periods per week 1Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	-	
Evaluation System	Theory Examination	Hours	Marks
	Practical	3	100
	Oral Examination	--	--
	Term Work	--	25
	Total	--	25
		150	

Sr. No.	Details	Hrs.
Module 01	Performance Characteristics of IC Engines Timing Diagrams of 2-stroke and 4-stroke engines. Comparative study of slow speed, medium speed and high speed diesel engines – suitability and requirements for various purposes. Mean Piston speed, MCR & CSR ratings	05
Module 02	Two Stroke, large bore, slow speed Diesel Engines Marine Diesel Engines of various makes such as MAN-B&W and Sulzer. 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.	10
Module 03	Scavenging and supercharging systems 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. 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.	08
Module 04	Combustion of Fuels in IC Engines, Compression and peak pressure characteristics 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. 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 NO _x and SO _x in Exhaust emission.	08
Module 05	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.	05

Module 06	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. 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	09
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Practical Training (Assignments) on the following (Any Seven)

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.
7. 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.

Theory Examination:

6. Question paper will comprise of total seven question, each of 20 Marks
7. Only five question need to be solved.
8. Question one will be compulsory and based on maximum part of syllabus.
9. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
10. In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral will be based on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum Seven experiments, (assignments) and one or more written test. The distribution of marks for term work shall be as follows:

Laboratory work (experiments/assignments)	:	15 Marks.
Test (at least one)	:	10 Marks.
TOTAL	:	25 Marks.

Text Books:

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

References:

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

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

Sr. No.	Details	Hrs.
Module 01	1.1 Clutches Clutches, Positive clutches, Friction clutches Friction Clutches – Analysis of frictional torque, power transmission. Power loss in : Friction in single plate, multiple plate clutch, and cone clutch Centrifugal Clutches – Construction, working 1.2 Brakes and Dynamometers Types of Brakes, Analysis of Block brakes – external and internal, Band brake – simple and differential, Band and block brake – simple and differential Breaking of vehicles – front wheels, rear wheels, all wheels on level and inclined roads Types of dynamometers – Absorption and transmission dynamometers Study and analysis of absorption type dynamometer – Prony brake, rope brake dynamometers Study and analysis of transmission type dynamometers – Belt transmission, epicyclic, torsion dynamometers Froude hydraulic dynamometer	06
Module 02	2. Governors Comparison between governors and flywheel Types – centrifugal governors, inertia governors, electronics governors Force analysis of gravity loaded governors – Watt, Porter, Proell. Force analysis of spring loaded governors – Hartnell, Harting, Wilson Hartnell Force analysis of spring and gravity loaded governors Performance characteristics of governors – stability, sensibility, isochronisms	10
Module 03	3. Gyroscope Introduction – Gyroscopic couple and its effect on spinning bodies Gyroscopic effect on ships during steering, pitching and rolling Ship stabilisation with gyroscopic effect Two wheeler and four-wheeler on curved path – effect of gyroscopic and centrifugal couples, maximum permissible speeds on curve paths. Gyroscopic effect due to lateral misalignment of rigid disc mounted on shaft	10

Module 04	4. Gear Trains Kinematics and dynamic analysis of – simple gear trains, compound gear trains, reverted gear trains, epicyclic gear trains with spur or bevel gear combination	09
Module 05	5. Flywheel Static and dynamic force analysis in slider crank mechanism neglecting mass of connecting rod and crank Turning moment diagram, fluctuation in energy, function of flywheel estimating inertia of flywheel for reciprocating prime movers and machines Static force analysis in gears – spur, bevel, helical, worm and worm gear Static and dynamic force analysis – in linkage mechanism (upto 4 links) by virtual work method Dynamic equivalent system to convert rigid body to two mass systems with and without correction couple	16
Module 06	6. Belt and Rope Drive Types – flat, V, rope belt 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 Power transmission, maximum power transmission condition	09

Laboratory experiments (All five)

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

Theory Examination:

11. Question paper will comprise of total seven question, each of 20 Marks
12. Only five question need to be solved.
13. Question one will be compulsory and based on maximum part of syllabus.
14. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
15. In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral will be based on maximum portion of the syllabus.

Term Work

Term work shall comprise of the class assignments five laboratory experiments and one or more a class test based on above syllabus

Class assignments and laboratory experiments	:	15marks
Class test	:	10 marks
	:	25 marks

Total

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 international 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-Wes 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

University of Mumbai

CLASS: T.E.
Marine Engineering

Semester - V

SUBJECT: Environmental Studies

Periods per week
(each of 60 min.)

Lecture 2
Practical -
Tutorial 1*

Evaluation System

Theory Examination
Practical examination
Oral Examination
Term Work
Total

Hours	Marks
2	50
-	-
-	-
-	25
	75

* Class wise Tutorial

Objective: This course is to create environmental awareness, of variety of environmental concerns.

Module	Contents	Hrs
1	The Multidisciplinary nature of environmental studies Definition, scope and importance Need for public awareness	1
2	Natural resources Renewable and non-renewable resources Natural resources & associated problem. a. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. b. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d. Food resources: World food problems overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	4
3	- Ecosystems - Concepts of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem.	3



	• Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)	
4	Biodiversity and its conservation • Introduction-Definition: genetic species and ecosystem diversity • Bio-geographical classification of India • Value of biodiversity : Consumptive use, productive use, social, ethical, aesthetic and option values • Bio-diversity at global, national, local levels • India as a mega diversity nation • Hot spots of bio-diversity • Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts • Endangered and endemic species of India • Conservation of biodiversity: In- situ and Ex-situ conservation of biodiversity	4
5	Environmental Pollution Definition – • Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear Hazards • Solid waste management: Causes, effect and control measures of urban and industrial wastes • Role of an individual in prevention of pollution • Pollution case studies • Disaster management: floods, earthquake, cyclone and land slides	4
6	Social issues and environment • From unsustainable to sustainable development • Urban problems related to energy • Water conservation, rain water harvesting, watershed management • Re-settlement and rehabilitation of people: Its problems and concerns. Case studies. • Environmental ethics: issues and possible solution • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. • Wasteland reclamation • Consumerism and waste products • Environment protection act • Air(Prevention and control of pollution) act • Water (Prevention and control of pollution) act • Wildlife protection act	4

	• Forest conservation act • Issues involved in enforcement of environmental legislation • Public awareness	
7	Human population and the environment • Population growth, variation among nations • Population Explosion- family welfare program • Environment and human health • Human rights • Value education • HIV/AIDS • Women and child welfare • Role of information technology in environment and human health • Case studies	4
8	Understanding Existence and Co-existence Interrelation and Cyclicity between Material order, Bio-order, Animal order and Human order Understanding the human conduct: Relationship in Family, Justice in Relationship, Relationship of Human with Nature (Environment), Human Behavior, Human Values, Nature and Morality Understanding the human society Dimensions of Human Endeavor and Objectives, Interrelationship in Society, Mutual Fulfillment and Cyclicity in Nature.	6

Theory Examination:

1. Question paper will be comprising of total 7 questions, each of 10 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and covering the all modules.
4. Remaining questions will be mixed in nature. (e.g.- suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
5. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term work:

Term work shall consist of minimum five projects (PROJECTS SHALL BE DESIGNED ON THE SAME GUIDE- LINE OF GIVEN TEXT BOOK) and a written test.

The distribution of marks for term work shall be as follows,

Laboratory work (Tutorial/Project and Journal) : 15 marks.

Test (at least one) : 10 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Recommended Books:

1. Erach Bharucha, text book of environmental studies, Universities Press/Orient Blackswan
2. Jagdish Krishnaswami, R J Ranjit Daniels, 'Environmental Studies', Wiley India Private Ltd. New delhi
3. Anindita Basak, 'Environmental Studies', Pearson
4. Deeksha Dave, "Text book of , 'Environmental Studies", Cengage learning, Thomason India edition
5. Benny Joseph , 'Environmental Studies", Tata McGRAW HILL
6. D L Manjunath, , 'Environmental Studies", Pearson
7. R Rajgopalan, , 'Environmental Studies", Oxford
8. Alok Debi, 'Environmental science and Engineering", University press
9. A. Nagraj, Jeevan Vidya- A Primer.

CLASS: T.E (Marine Engineering)		Semester - V	
SUBJECT: 06:-Presentation and Communication Techniques			
Periods per week (each of 60 min.)	Lecture	2	
	Practical	2	
	Tutorial	-	
Evaluation System		Hours	Marks
	Theory Examination	--	--
	Practical examination	--	--
	Oral Examination	--	--
	Term Work	--	50
	Total		50

Detailed Syllabus		Lectures/ Week
1.	Communication in a business organization: Internal and external communication, Types of meetings, strategies for conducting successful business meetings, documentation (notice, agenda, minutes, resolution) of meetings. Introduction to modern communication techniques. (e-mail, internet, video-conferencing, etc.) Legal and ethical issues in communication (Intellectual property rights: patents, TRIPS, Geographical indications).	06
2	Advanced technical writing: Report writing: Definition and importance of reports, qualities of reports, language and style in reports, types of reports, formats (letter, memo, project-reports). Methods of compiling data for preparing report. A computer-aided presentation of a technical project report based on survey-based or reference based topic. The topics are to be assigned to a group of 8-10 students. The written report should not exceed 20 printed pages. Technical paper-writing, Writing business proposals.	08
3	Interpersonal skills: Introduction to emotional intelligence, motivation, Negotiation and conflict resolution, Assertiveness, team-building, decision-making, time-management, persuasion	04
4	Presentation skills: Elements of an effective presentation, Structure of a presentation, Presentation tools, Audience analysis, Language: Articulation, Good pronunciation, Voice quality, Modulation, Accent and Intonation.	04
5	Career skills: Preparing resumes and cover letters. Types of Resumes, Interview techniques: Preparing for job interviews, facing an interview, verbal and non-verbal communication during interviews, observation sessions and role-play techniques to be used to demonstrate interview strategies (mock interviews).	04

6	Group discussion: group discussions as part of selection process. Structure of a group discussion, Dynamics of group behavior, techniques for effective participation, Team work and use of body language.	04
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Term work: Part-I (25 Marks): Assignments;

1. Two assignments on communication topics
2. Three assignments on report-writing
3. Three assignments on interpersonal skills
4. Two assignments on career skills

At least one class test (written)

Distribution of term work marks will be as follows:

Assignments	: 15 marks
Written test	: 10 marks
TOTAL	: 25

Term work: Part-II (25 Marks): Presentation;

Distribution of term work marks will be as follows:

Project report presentation	: 15 marks
Group discussion	: 10 marks

The final certification and acceptance of term-work ensures the satisfactory performance of laboratory work and minimum passing in the term-work.

Books recommended:

1. Fred Luthans: Organizational behavior, McGraw Hill
2. Lesikar and Petit, Report writing for business, Tata McGraw Hill
3. Huckin & Olsen, Technical writing and professional communication, McGraw Hill
4. Wallace & Masters, Personal development for Life & work, Thomson Learning.
5. Heta Murphy, Effective Business Communication, McGraw Hill
6. Raman and Sharma, Report writing.

CLASS: TE (Marine Engineering)			Semester-V		
07-SUBJECT: - 07 Marine Electrical Technology					
Periods per week Period of 60 min.	Lecture				
	Practical		3		
	Tutorial		3		
				-	
Evaluation System	Theory Examination		Hours	Marks	
	Practical		3	100	
	Oral Examination		2PE	25	
	Term Work		-	25	
			-	25	

Sr. No.	Details	Hrs.
Module 01	1.1 Power Generation and Alternative Source of Power 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. Emergency Generator and different starting method including automation. Emergency 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.	(10)
Module 02	2.1 Distribution Different electrical diagrams and their uses, electrical signals. Types of distribution, distribution network on board. Main and emergency switchboard, construction, different switchgear and protection devices relays, fuses. Grounded and insulated neutral systems. Precaution adopted in High Voltage distribution system. Cables and temperature classification, Preferential tripping.	(07)
Module 03	3.1 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. Direct on line (DOL) Starters, Star-Delta and Auto Transformer starters.	(07)
Module 04	4.1 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.	(06)
Module 05	5.1 Maintenance of Electrical Systems, fault findings 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, Breakdown, Planned maintenance & condition monitoring, Periodic	(07)

	surveys, spares requirement.	
Module 06	6.1 Special Electrical Practice and Safe Electrical Practice Rules and Regulations and operation of electro-hydraulic and electric steering gear, Diesel-electric and Turbo electric propulsion system, Pod / Azipode 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. Safe watch-keeping, points to check on electrical machineries, switchgears and equipments, microprocessor control and maintenance, Electrical-fire fighting. Precautions against electric shock and related hazards.	(08)

Practical Training (Experiment / task) on the following

- 1) Overhaul of an alternator & study of the rotor, excitation system of the alternator. Sketch and explain the excitation system and structure of rotor.
- 2) Overhaul of induction motor & study the stator, rotor, capacitor (start/run). Sketch and explain.
- 3) Take the Meggar readings of a motor. How the insulation resistance value is improved, if low.
- 4) Study of an Over current & Earth fault relay. Sketch & explain.
- 5) Study of a Reverse Power relay. Sketch & explain.

Theory Examination:

16. Question paper will comprise of total seven question, each of 20 Marks
17. Only five question need to be solved.
18. Question one will be compulsory and based on maximum part of syllabus.
19. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
20. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Practical and Oral Examination :

Practical and oral examination will be based on one experiment performed from the list of experiment given in the syllabus and the oral will based on the same experiment.

Term Work:

Term work shall consist of minimum 04 experiments (task) and one or more written test.

The distribution of marks for term work shall be as follows:

- Laboratory work (experiments/assignments):15.....Marks.
- Test (at least one): 10... Marks.
- TOTAL:25 Marks.**

Laboratory (Assignments) (Shall be performed by ship visit)

Six assignments based on above syllabus. Suggestive assignments are as follows (but may be changed by teacher) :-

- 1) Inspection and study of the emergency power of a ship. Sketch explain how the system comes on load in case of tripping of an alternator from the main switchboard. Draw a layout diagram of an emergency switchboard.

- 2) Inspection of the shore supply arrangement provided on a ship. An essay with necessary sketches for the system showing how the connection is made and sequence is checked for correctness of all safety aspects.
- 3) Study of the distribution network of a ship. Sketch and description of a particular DB with protection devices.
- 4) Study of control equipment of any particular 3-phase induction motor such as fitted. Sketch and describe with protection devices.
- 5) Study of different measuring instruments like meggar, clamp meter, multimeter, HV live line tester. Sketch & explain the function of each meter.
- 6) Study of a MCCB and ACB. Sketch & explain the function of each electrical conducting parts.

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.
- 5) Marine Electrical Technology, E.. A. Fernandez

References:

- 1) The Running & Maintenance of Marine machinery, Edited by Dr. J. Cowley.
- 2) International Safety, Guide for oil tankers and Terminals. Written by Marine and Insurance Publications, London.
- 3) Rules for the Survey and Construction of steel ships (Electrical Section) of any Recognized classification Society.

CLASS: T.E. (Marine Engineering)		Semester VI	
SUBJECT : 01:Naval Architecture and Ship Construction - II			
Periods per week 1 period of 60 min	Lecture		4
	Practical		-
	Tutorial		-
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical	-	-
	Oral Examination	-	-
	Term Work	-	25

Sr. No.	Details	Hrs.
Module 01	1. SHIP FORM CALCULATIONS AND HYDROSTATICS Lines plan. Numerical integration – Trapezoidal, Simpson's and Tchebycheff's rules and their application to the calculation of areas, volumes and first and second moments. Hydrostatic particulars. Wetted surface. Deadweight-displacement scale. Bale and grain capacities. Tank capacity. Sounding and ullage. Capacity plan.	15
Module 02	2. SHIP STABILITY 2.1 Equilibrium Conditions of equilibrium – weight and buoyancy, centres of gravity and buoyancy. Effect of adding, removing and moving weights. Tonnes per cm immersion. Flooding of a compartment amidships. 2.2 Intact Stability Concept of stability – positive, negative and neutral stability. Conditions for initial stability. Transverse and longitudinal metacentres. Rolling period and metacentric height. List and its correction. Effect of suspended weights and free surfaces on stability. Inclining experiment. Transverse stability at large heel angles. Righting lever. Cross curves of stability. Dynamical stability. Angle of loll. Intact stability criteria. Moment to change trim 1 cm. Trimming moments due to adding, removing and moving weights. Effect of change in density of water on draught and trim. Effect of grounding and docking on stability.	16
Module 03	3 Damage Stability Effects of damage. Subdivision. Floodable length and permissible length. Damage stability. Damage stability requirements for different types of ships. Probabilistic approach to damage stability requirements.	09
Module 04	4. Load Line Freeboard and reserve buoyancy. Type A and Type B ships. Calculation of freeboard. Reduced freeboard for Type B ships. Conditions of assignment. List of closing appliances. Load line marking and load line survey. Timber load lines.	06
Module 05	5. Tonnage Tonnage regulations. Gross tonnage and net tonnage. Calculation of tonnage.	04
Module 06	6. Statutory And Classification Society Surveys Of Ships Introduction to IMO and flag survey rules. Functioning of classification societies. Surveys during construction. Periodical surveys as per statutory rules and class rules. Statutory certificates and their validity. Enhanced survey requirements.	10

List of Assignments : (All Five)

1. Determination of metacentric height of a floating body.
2. Experimental study of the effect of adding weights on the draught, trim and heel of a floating body and comparison with calculated results.
3. Experimental study of the effect of free surfaces and suspended weights on metacentric height.
4. Essay on Load Line.
5. Study of statutory survey requirements.

Theory Examination :

6. The question paper will comprise of a total of seven questions, each of 20 marks.
7. Only five questions need to be answered.
8. Question 1 will be compulsory, and based on the maximum part of the syllabus.
9. The remaining questions will be mixed in nature (for example, suppose Q. 2 has Part (a) from Module 3, then Part (b) will be from any module other than Module 3).
10. In the question paper, the weightage of each module will be proportional to the number of lecture hours for that module mentioned in the syllabus.

Term Work :

Term work shall consist of five assignments and one or more written tests. The distribution of marks for term work shall be as follows :

Assignments	:	15 marks
Written tests	:	10 marks
TOTAL	:	25 marks.

Text Books :

1. An Introduction to Naval Architecture, E.C. Tupper.
2. Basic Ship Theory, K.J. Rawson and E.C. Tupper,
3. Ships and Naval Architecture, R. Munro-Smith,

References :

1. Principles of Naval Architecture, E.V. Lewis (Editor), Society of Naval Architects and Marine Engineers, Jersey City, U.S.A.

CLASS: T. E. (Marine Engineering)			Semester-VI
SUBJECT: - 02 Mechanics of Fluids II			
Periods per week 1Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	-	
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical	--	--
	Oral Examination		--
	Term Work		25

Sr. No.	Details	Hrs.
Module 01	Dimensional Analysis and Dynamical Similarity Use of Dimensions for finding conversion factors; Dimensions of Common quantities; Dimensional equations; Method of finding dimensionless groups; Geometrical and dynamical similarity. General principle; Dynamical similarity problems. Non-dimensional performance characteristics of roto dynamic machinery. Detailing of characteristics.	10
Module 02	Turbines Definition of hydro turbines. Application of momentum equation to stationary and vanes moving with linear velocity. Series of moving vanes. Application of angular momentum principle to turbine rotor. Euler's velocity. Expression for work done.	07
Module 03	Pelton Turbines:- Parts of turbine, salient features. power developed. Hydraulic, Volumetric, Mechanical and Overall efficiencies.	07
Module 04	Characteristics of turbines, Cavitation : Mechanism of cavitation, types of cavitation. Thoma cavitation parameter. Governing of turbines: methods employed in Pelton, Francis and Kaplan turbines. Pumped Storage Plants: Tubular turbines and Deriaz turbines.	07
Module 05	Pumps Classification of pumps; - positive displacement and non positive displacement, priming of pumps Positive displacement pumps: types and application. general features of rotary pumps; like, gear pumps, screw pumps. vane pumps; general features of reciprocating pumps, various types. single and double acting. single and multi cylinder, definition of head, coefficient of discharge. work done and efficiency, theoretical indicator diagrams. effects of acceleration and friction, use of air vessel.	07
Module 06	Centrifugal pumps; application, components of the pump. correction factors for the head losses and efficiency, velocity diagrams at inlet and exit, calculation for power input, torque on shafts, cavitations in centrifugal pumps. NPSH, series and parallel operation of pumps, radial thrust and axial thrust, methods used to balance them. seals used in centrifugal pumps, trouble shooting in centrifugal pumps, self priming pumps, pump characteristics and basic principle of selection of a pump.	07

List of Experiments: (at least 06 of the following list)

1. Variable speed and constant speed characteristics of Pelton turbines.
2. Variable speed and constant speed characteristics of centrifugal pumps.
3. Characteristics of reciprocating pumps
4. Characteristics of gear pumps
5. Characteristics of self-priming pumps.
6. Study and draw schematic sketch of the complete pumping system of a ship's engine room for SW, FW, LO and FO lines, showing types of pumps used for each fluid.
7. determine NPSH of Centrifugal Pumps
8. performance characteristics of other Positive displacement pumps, excluding Reciprocating pumps.

Theory Examination:

21. Question paper will comprise of total seven question, each of 20 Marks
22. Only five question need to be solved.
23. Question one will be compulsory and based on maximum part of syllabus.
24. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
25. In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall consist of minimum Six experiments, (assignments) and one or more written test. The distribution of marks for term work shall be as follows:

Laboratory work (experiments/assignments)	:	15 Marks.
Test (at least one)	:	10 Marks.
TOTAL	:	25 Marks.

Text Books:

1. Hydraulic Machinery- Jagdish Lal
2. Fluid Mechanics and Hydraulic Machines - R.K.Bansal - Lakshmi Publications.
3. Fluid Mechanics :- R. K. Rajput

References:

- 1) Hydraulic Machines – Vasandani
- 2) Fluid Flow Machines, N.S. Govinda Rao, Tata Mc. Graw Hill Publishing Corpan. Ltd.
- 3) Fluid Mechanics – Douglas, Et.Al.

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

Sr. No.	Details	Hrs.
Module 01	Fuel Injection Equipments and Metering Devices Unit injection and common rail systems; fuel injection systems, basic principles of fuel injection pumps, helical groove and spill valve type fuel pumps; systems for burning heavy oil in slow and medium speed Marine engines, V.I.T. and electronics injection systems, characteristics of fuel cam, drive for camshaft, fuel injection valve, fuel pump setting, measuring equipments and its working principle, effects of viscosity on liquid fuel combustion, emission control.	7
Module 02	Starting and Reversing Starting and Reversing systems of different Marine Diesel Engines with safety provisions. Indicator Diagrams and Power Calculation. Construction details of indicator instruments, Indicator power and draw diagrams, power calculations, fault detection, Light spring indicator diagrams, power balancing, performance characteristic curves; Test bed and sea trials of diesel engines.	12
Module 03	Lubrication Systems Lubrication arrangement in diesel engines including coolers and filters, cylinder lubrication, Liner wear and preventive measures, contamination of lubricating oil – its effect and preventive measures, treatment of oil, lubricating oil properties, Test analysis of used oils for effectiveness and for monitoring engine performance, additives in lubricating oils. Microbial Degradation of Lubricating Oils.	4
Module 04	Medium Speed Engines Construction details and principal components of medium speed diesel engines, including V types, used for main propulsion, coupling and reduction gearing. Construction details of medium speed diesel engine used for electric power generation.	4
Module 05	Governors Governors and their basic function, constant speed and overspeed governors, constructional details and hunting of governor, general concept of hydraulic governors, general concept of electronic governors.	4

Module 06	Automation in Modern Diesel Engine Plants Remote operation, alarm and fail safe systems; computerized monitoring and diagnostic application in propulsion engines, the intelligent engine concept, NOx control of diesel engines, improvement in design for increased TBO (Time Between Overhauls.) Maintenance of Diesel Engines Inspection, Repair / Replacement of various component / members such as piston, piston ring, piston rod stuffing box, cylinder head, liner, bearings, driving chains/gears, cross head, gudgeon pin, piston and connecting rods, crankshaft, cam shaft, crankshaft deflection and alignment, Engine holding down arrangement, tie rods. Hot & Cold Corrosion, Crankshaft web –slip , X-head bearing problem. Modern Trends and Development in Diesel Engine: Current developments in SULZER, MAN-B&W, SEMT PILLSTICH, WARTSILA; Intelligent Engine (Cam less concept), improvement in design for increase in TBO, UMS operation in diesel plant Emulsified fuel injection.	14
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List of Experiments:

- Practical (Assignments) on the following (Practicals min.5 and study / demonstration min.1):- (Total 6 minimum)
1. Tracing of fuel injection systems of Main Engines of a Ship and preparation of suitable sketch and labeling.
 2. Overhauling a helical groove / spill valve type fuel pump of Main Engine of a Ship, preparation of a suitable sketch and labeling.
 3. Tracing the starting and reversing systems of Main Engine of Ship, preparation of suitable sketch and labeling.
 4. Trace out the Cylinder lubrication System of a large two stroke marine diesel engine used for propulsion of a ship showing labeled sketch of lubricator and quill.
 5. Trace remote operation of Main Engine and Auxiliaries of a motor ship from Engine Room and Bridge Control Station (if provided). Sketch and label of the system.
 6. Assist and watch the routine overhauling of a unit of slow speed two stroke main engine of a motor ship. Sketch and label the piston ring and groove measurements.
 7. Working principle and write-up of a cross-head bearing of a motor ship. Sketch and label the parts.
 8. Carry out the power calculation from a set of indicator Diagrams of the Main Engine of a Ship.
 9. Study and compare by writing a report about the comparison between 4 stroke Medium Speed diesel engine and 2 stroke large bore slow speed diesel engine as propulsion unit of a Ship.
 10. Study of working Principle and write-up of a governor typically fitted on board a motor ship. Draw and label the parts of this governor.
 11. Write an essay on modern development of slow speed two stroke main engine of motor ships.

Theory Examination:

26. Question paper will comprise of total seven question, each of 20 Marks
27. Only five question need to be solved.
28. Question one will be compulsory and based on maximum part of syllabus.
29. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

30. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term Work:

Term work shall consist of minimum Six experiments, (assignments) and one or more written test. The distribution of marks for term work shall be as follows:

Laboratory work (experiments/assignments)	:	15 Marks.
Test (at least one)	:	10 Marks.
TOTAL	:	25 Marks.

Text Books:

1. Marine Diesel Engines, Pounder, Elsevier
2. Marine Diesel Engines, Synyal
3. Marine Diesel Engines, Lamb
4. Motor Engineering Knowledge, Vol-12, Reed's Thomas Reed Publication, London.

References:

1. Marine Engineering Practice Series, 20 parts in 3 volumes, Institute of Marine Engineers, London
2. The Running and Maintenance of Marine Machinery, Cowley, Institute of marine Engineers, London
3. Marine Engineering, D. A. Taylor .Elsevier
4. Marine Engineering, Harrington, SNAME.

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

Sr. No.	Details	Hrs.
Module 01	Vibrations 1.1 Basic concepts of vibration Vibrational oscillation, causes and effects of vibrations Vibration parameters-spring, mass, damper Damper models Motion-periodic, non-periodic, harmonic, non-harmonic Degree of freedom, static equilibrium position Vibration classification Steps involved in vibration analysis 1.2 Free undamped single degree of freedom vibration system Longitudinal, transverse, tensioned system Methods for formation of differential equations by Newton, Energy, Lagrangian (Rayleigh's method) Effect of springs mass and shaft inertia on natural frequency Effect of flexible bearings on natural frequency 1.3 Free Damped single degree of freedom vibration system Viscous damped system-under damped, critically damped, over damped. Logarithmic decrement. Coulomb's damping Combined viscous and Coulomb's damping	16
Module 02	2.1 Equivalent single degree of freedom vibration system Conversion of multi-springs, multi masses, multi-dampers into a single spring, mass and damper with linear or rotational co-ordinate system. 2.2 Free Undamped Multi degree of freedom Vibration systems Eigen values and Eigen vectors for liner system and torsional two degree of freedom Holzer method for liner and torsional unbranched system Two rotors, three rotors and geared system Dunkerley and Rayleigh method for transverse vibratory system	13
Module 03	3. Forced single degree of freedom vibratory system Analysis of linear and torsional systems subjected to harmonic force excitation and harmonic motion excitation (excluding elastic damper)	07

Module 04	4.1 Vibration measuring instruments Principle of seismic instruments, vibrometer, accelerometer-undamped, damped 4.2 Vibration Isolation Force isolation, motion isolation, isolators	07
Module 05	5.1 Rotor Dynamics Critical speed of single rotor, undamped and damped 5.2 Cam Dynamics Cam Kinematics and Dynamics: Mathematical Model, Differential equation, Response Follower Jump phenomenon	09
Module 06	6.1 Static and dynamic balancing of multi rotor system 6.2 Balancing of reciprocating masses:- In-line engines V-engines (excluding radial engines)	08

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 7 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

Theory Examination:

31. Question paper will comprise of total seven question, each of 20 Marks
32. Only five question need to be solved.
33. Question one will be compulsory and based on maximum part of syllabus.
34. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)

35. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

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	:	10 marks
Total	:	25 marks

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

CLASS: T. E. (Marine Engineering)			Semester-VI
SUBJECT: - 05: : Marine Auxiliary Machinery II			
Periods per week 1 Period of 60 min.	Lecture	3	
	Practical	3	
	Tutorial	2	
Evaluation System		Hours	Marks
		Theory Examination	3
		Practical	--
		Oral Examination	--
		Term Work	--
			100
			25
			25

Sr. No.	Details	Hrs.
Module 01	Steering Gears Main & Auxiliary Steering Systems Operation, Constructional details, care and maintenance of:- Various types of steering machinery & Steering Systems Telemotor systems, transmitters and receivers 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 74	6
Module 02	2.1 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. 2.2 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. Statutory Requirements.	10
Module 03	3.1 Pollution Prevention & Environment Protection & Equipments Incinerators, Sewage treatment plant, Engine room crane, Chain blocks, tackles, Anchor chain, its testing and survey requirements. 3.2 Ship Stabilizer and associated topics Different types of ship stabilizer, Bow Thrusters, hull protection arrangements.	9
Module 04	4. Refrigeration Uses of refrigeration at sea, cryogenic technology-definition, temperature range, insulation Effect on environment, Montreal and Kyoto protocols requirements and their enforcement through Annex VI of MARPOL 73 / 78. 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	8

	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.	
Module 05	5.1 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. Bacteria in Ventilation Duct. 5.2 Ventilation Ventilation of engine room, pump room, CO₂ and battery rooms, air change requirements, design consideration, maintenance:	8
Module 06	6. 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.	4

Practical Training (Assignments) Any Five of 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.

Theory Examination:

36. Question paper will comprise of total seven question, each of 20 Marks
37. Only five question need to be solved.
38. Question one will be compulsory and based on maximum part of syllabus.
39. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
40. In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Oral Examination:

Oral will be based on maximum portion of the syllabus.

Term Work:

Term work shall consist of minimum Five experiments, (assignments) and one or more written test. The distribution of marks for term work shall be as follows:

Laboratory work (experiments/assignments)	:	15 Marks.
Test (at least one):	:	10 Marks.
TOTAL	:	25 Marks.

Text Books:

Marine Auxilliary Machinery	D. W. Smith , Newnes - Butterworth
General Engineering Knowledge	H.D. McGeorge Butterworth Heinemann
General Eng. Knowledge for Marine Engineers	Reeds Practical Mathematics Series Vol 8
Refrigeration and Airconditioning	C. P. Arora TATA McGraw Hill

References:

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

CLASS: T. E. (Marine Engineering)			Semester-VI
SUBJECT: - 06: Applied Thermodynamics (Marine) III			
Periods per week 1Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	-	
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	---	25

Sr. No.	Details	Hrs.
Module 01	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.	05
Module 02	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.	09
Module 03	Steam 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.	10
Module 04	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	07
Module 05	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, Stephen-Boltzman Law, Grey / Black Bodies.	12
Module 06	Mass Transfer : Mechanism of Mass Transfer : Importance of mass transfer in engineering. Introduction of Steady State diffusion of gases and liquids.	02

Experiments : (at least 5 experiments from the list.)

1. Demonstrate the operation of a Refrigeration Plant using Refrigeration Test Kit.
2. Determine the C.O.P. of a refrigeration plant.
3. To determine the thermal conductivity of a metal rod.
4. To determine the thermal conductivity of an insulating material.
5. To determine Heat Transfer Co-efficient through forced convection.
6. Study of Steam turbine power plant.
7. Experiment on parallel and counter - flow heat exchanger.

Assignments :

At least 15 problems covering the above syllabus.

Theory Examination:

41. Question paper will comprise of total seven question, each of 20 Marks
42. Only five question need to be solved.
43. Question one will be compulsory and based on maximum part of syllabus.
44. Remaining questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
45. In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

Term Work

Term work shall consist minimum 5 experiments (assignment) and one or more written tests. The distribution of marks shall be as follows: -

Class Assignments	:	15 marks
Class Test	:	10 marks
Total	:	25 marks

Text books :

1. Thermal Engineering By Ballaney, Khanna Publishers,
2. Thermodynamics By P.K. Nag – Tata McGraw Hill Co.,
3. Applied Thermodynamics for Engineers and Technologies By Eastop and Mcconky Longman,
4. Thermodynamics Tables by Rogers and Mahew.
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,
5. Principles of Thermodynamics By H.A. Sorensen, A Merinal Publications]
6. Thermodynamics By Rogers and Mahew.

CLASS: T. E. (Marine Engineering)			Semester-VI
SUBJECT: - 07: Marine Machinery and System Design			
Periods per week 1 Period of 60 min.	Lecture	2	
	Practical	3	
	Tutorial	-	
Evaluation System		Hours	Marks
		Theory Examination	100
		Practical	---
		Oral Examination	--
		Term Work	25

Sr. No.	Details	Hrs.
Module 01	Procedure in Marine Machinery & System 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 consideration in design.	06
	Review of failure criteria in mechanical design, properties of materials, BIS system of designation of steels, I.S. Codes. Basis of good Design, Failure of machine parts, Deformation, wear, Corrosion.	
Module 02	Strength Consideration for Machines 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 Alternative loads, cyclic and combined loads, fatigue strength, Dynamic Stresses. selection of materials.	06
Module 03	Design and Drawing - Power Transmission: shaft and axles, Bearing, Clutches and brakes, Belt drivers, Chain drives, Design and drawing of tooth gearing like spur and Bevel gears, Rack and pinion, worm and worm wheels, helical gears.	04
Module 04	Design and Drawing - power transmitting shafts such as tail-end-shaft	03
Module 05	Design and Drawing - unfired pressure vessels such as starting air bottle with dished ends.	03
Module 06	System Design and Drawing - 6.1 Water cooling systems including pumps, filters, Heat exchangers for Diesel and steam engine plants. 6.2 Lubricating Oil systems including pumps, purifiers, pressure by-pass valves, heat exchangers. 6.3 Electro-hydraulic steering gear system including rudder, rudderstock, Tiller arm, ram and cylinder. 6.4 Marine Diesel Engine Fuel injection system including Fuel pumps and fuel injectors	08

List of Assignment : Design and Drawing of two Mechanical units and one of System design on half imperial drawing sheets.

Theory Examination:

46. Question paper will comprise of total seven question, each of 20 Marks
47. Only five question need to be solved.
48. Question one will be compulsory and based on maximum part of syllabus.
49. Remaining questions will be mixed in nature (for example suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
50. In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

Term Work:

Term work shall comprise of three class assignments and one or more class test based on above syllabus.

Laboratory work (experiments/assignments)	:	15	Marks.
Test (at least one)	:	10	Marks.
TOTAL	:	25	Marks.

Note:- Use of slandered design data books is permitted at its examination and be supplied by the college.

Text Books:

1. Design of Machine Elements by V. B. Bhandari
2. Machine Design – An Integrated approach –Robert Norton-Pearson Education Asia.
3. Machine Design- Pandya Shah, Charota Publishing
4. Machine Engineering Design- I. E. Shigley, Tata McGraw Hill
5. Reed's Engineering Drawing for Marine Engineers by H. G. Beck, Thomas reed publication.
6. Mac Gibbon's Pictorial Drawing Book for Marine Engineers by James. G. Holburn and John. J. Seaton. James Munro & Company, Limited,
7. 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 Surrey and Construction of steel ships (Materials, Machinery, Welding, unfired pressure vessels and Equipment sections)- of any Recognized classification society.

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