SEMESTER – V

UG11P3501	MATERIAL SCIENCE LABORATORY	54 HRS

1. To determine the behavior of different materials when subjected to Tension and to obtain the following tensile properties of materials on Universal Testing Machine:

   i) UTS

   ii) Yield Stress

   iii) Young's Modulus

   iv) Breaking Stress

   v) Percentage Elongation

   vi) Percentage reduction in area

   vii) Plotting of Curve of- Stress vs Strain.

2. To conduct IZOD impact test on impact test machine and calculate value of energy absorbed.

3. Calculate hardness of a material on Brinnel's hardness testing machine.

4. Determination of behavior of ductile materials when subjected to torsion and to obtain
   (i) Maximum Torsion Stress,

   (ii) Modulus of Rigidity and

   (iii) Plotting of curve of Angle of Twist vs Torque.

5. To determine the stiffness of springs for

   (a) Round wire and

   (b) Square section wire when subjected to compression.

6. To study grain structure of various ferrous & Non Ferrous material under microscope.

7. To conduct Dye Penetrant Test for detection of crack in material.

8. To conduct Magnetic Particle test for crack detection.

9. To conduct flaw detection test by Ultrasonic Equipment.

10. To study behaviour of a material under fatigue on Fatigue testing machine.

SEMESTER V

UG11P3502	**VIBRATION LABORATORY AND FLUID MECHANICS LABORATORY**	**54 HRS**

VIBRATIONS EXPERIMENTS

The following experiments in vibrations are performed with VIBLAB APPARATUS:

1. To verify the relation $T = 2\pi \sqrt{l/g}$ in case of a simple pendulum and to plot the graph T^2 vs L.

2. To verify the relation $T = 2 \pi \sqrt{(K^2 + OG^2) / g.OG}$. in case of a compound pendulum, and find the radius of gyration and equivalent length of compound pendulum.

3. To determine the method of Tortional oscillation, the radius of gyration of a body, about the centre of gravity by using the relation, $T = 2 \pi \sqrt{(K/a) \times L/g}$

4. To verify the relation, $T = 2 \pi \sqrt{W/Kg}$ and plot a graph T^2 vs W.

5. Study of undamped natural vibrations of a beam pivoted at one end supported by tension spring at the other end.

6. To find out the natural frequency of a beam with and without load and to verify the Dunkerley's Rule.

7. Study of forced vibrations for various amounts of damping of beam pivoted at one end and supported by tension spring at the other end and to plot a graph of amplitude factor vs frequency ratio. (Longitudinal Vibration).

8. To study the forced vibrations for various amounts of damping and to plot a graph of amplitude factor vs frequency ratio (Lateral Vibration)

9. Experimentally prove the relation $T = 2 \pi \sqrt{(I / Kt)}$ and study the relationship between the periodical time and shaft length.

10. To measure circular and linear displacements of cam and follower in case of
    (i) Plate cam-Reciprocating follower
    (ii) Tangent cam-with roller oscillating follower and plot the displacement curves hence differentiate the velocity and accelerating curves

FLUID MECHANICS EXPERIMENTS

1. To determine the meter Constant of the Venturimeter.
2. To determine the efficiency of a Pelton wheel.
3. To determine the friction co-efficient for the flow of water through a pipe.
4. To determine 'GM' (Metacentric Height) of a floating body.
5. Study various types of impellers on board a ship. Impellers of pumps for practical demonstration specially required for Design Work.
6. To study various hydraulic circuits using hydraulic trainer unit.

7. To study the operation of various transparent hydraulic flow control directional valves (3/2, 4/2, 5/2 etc.,).
8. To demonstrate / determine the lube oil pressure distribution at various points on a loaded journal bearing rotating at different speeds and loads.
9. To study the lube oil pressure at different points on a thrust bearing rotating at different speeds.
10. To find the efficiency of a centrifugal pump.
11. To determine the co-efficient of velocity of contraction & co-efficient of discharge of water through the various orifices.

SEMESTER V

UG11P3503	**MARINE POWER PLANT OPERATION – I**	**54 HRS**

Study of the following Marine Equipments:

1. Cylinder liner of Marine Diesel Engine and its calibration
2. Piston / Piston ring of Marine Diesel engine and its calibration
3. Cylinder head and mountings
4. Jerk Type Fuel pump
5. Air starting valves
6. Fuel injectors
7. Cylinder relief valves
8. Turbocharger familiarization
9. Purifier demonstration

10. Plate heat exchanger / Shell & tube heat exchanger and its maintenance
11. 4 ram & 2 ram Steering gear
12. Steam Turbine Familiarization
13. Thrust bearing
14. Oily water separator
15. Any other machinery found onboard a modern ship

[Every student / cadet will study equipment and its working as per instruction sheet and draw sketches of the components where required, dismantling & assembling may be part of this practical training. Assessment will be done on student / cadet's understanding of the equipment.]

SEMESTER V

UG11T3501	**MATERIAL SCIENCE**	**72 HRS**

OBJECTIVE: *To impart knowledge on metal, its behaviour, interactions with environment & suitability of usage.*

Atom and Crystal Structure:

Atomic packing - directionally and non directionally bonded atoms, crystal structure, space lattice. Ionic and molecular crystals; interfacing in crystals, Non-crystalline solids; elastomer; long chain and molecular compounds.

6 Hrs

Solid Solution:

Properties of solid solutions and alloys. Types of Binary alloys, Thermal Equilibrium Diagrams, Cooling curves, Eutectic, Eutectoid and Peritectic reaction, Eutectic & Peritectic alloys, Inter metallic compounds.

8 Hrs

Phases of Iron :

Allotropy of Iron, Explanation about Different phases of iron carbon such as delta iron, austenite, cementite etc. Iron-carbon Equilibrium diagrams. Equilibrium Diagrams for Ferrous and Non-ferrous metals and alloys.

6 Hrs

Heat Treatment: Heat treatment principles and processes and purposes for Ferrous and non-ferrous metals and alloys. Effect on structures and properties. Deformation and Fracture of materials in services.

8 Hrs

Fatigue and Creep : Fatigue loading, Mechanisms of fatigue, fatigue curve, Fatigue tests. Design criteria in fatigue. Stress concentration. Creep phenomena and creep-resisting alloys. Creep curve. Short time and long time creep tests. Development of creep resisting alloys.

12 Hrs

Corrosion Control and prevention:

Corrosion Principles, Factors influencing corrosion, electrochemical aspects of corrosion, environmental & metallurgical effects on corrosion, mechanism of corrosion-galvanic or two metal corrosion. Types of corrosion – crevice corrosion, atmospheric corrosion, pitting & inter granular corrosion, selective leaching, erosion corrosion, stress corrosion, hydrogen damage and fatigue corrosion. Corrosion due to biofouling, microbial corrosion. Corrosion rate expressions, corrosion rate measurements. 4 Hrs

Corrosion Prevention: Materials selection-alteration of environments - comparison of cathodic and anodic protection .protective coating - metallic coating and other inorganic coat inorganic coating-.protection by means of paints-antifouling paints-corrosion protection system of hull

structure- bio-fouling control. corrosion inhibitors-anodic inhibitor-marine coating -corrosion resistant materials for propellers, pumps, system, heat exchangers, hulls.

4 Hrs

Uses of Materials in Shipboard Application: Chromium, Ceramic, Titanium, PTFE in Shipboard Systems. Characteristics of above materials. 4 Hrs

Selection of Materials in Shipbuilding and Marine Engineering : Boilers, Steam and Gas turbine, Purifiers and Diesel engine components, Pumping Machinery, Components and Piping System, Engine seating. Propellers and Rudders. Composition, Strength value and other requirement for materials used. 6 Hrs

Metals and Alloys : Different types of iron and steel; properties and uses in Industry. Alloys of iron and steel, Non ferrous metals and alloys, Effects of various elements on steel and cast iron. Shipbuilding steels.

8 Hrs

Miscellaneous Engineering Materials: Insulating Materials, Plastics & Rubber, PVC, Resins, Adhesives and bonding plastics, paints. Properties and selection for various engineering applications. Polyurethane foam.

6 Hrs

REFERENCE BOOKS:

1. Metallurgy for Engineers - E.C.Rollason
2. Material Science & Engineering - William Smith, Ravi Prakash
3. Material Science - Hazra Choudhary
4. Material Science - V K Manchanda
5. Material Science - R S Khurmi

SEMESTER – V

UG11T3502	SHIP STRUCTURE AND CONSTRUCTION	72 HRS

OBJECTIVE: *To impart knowledge on ship's terms, ship structure and its construction.*

Ship Types / General Classification of Ships:

Tankers, Bulk Carriers, General Cargo Ships, Container Ships, Car Carriers, LNG, LPG and Chemical Carriers, LASH ships, Passenger ships, Reefer Ships, Dredgers & Tugs.OBO, Cattle Carrier, Vessels for Offshore Industry such as OSV, MSV, DSV, PSV, GTV, TIV, Pipe laying ship and Cable laying ship. 2 Hrs

Ship's Terms:

Various terms used in ship construction. Main dimensions. Freeboard, rise of floor, flare, sheer, camber, rake and similar terms

4 Hrs

Stresses in Ship's Structure:

Stresses due to bending, Shear, racking, pounding and panting. Strength members to counter act these stresses.

4 Hrs

Materials and Sections Used:

Different materials used in shipbuilding. Various grades of steel used in ship construction Type of section like plates, flat bars, T-Bars, angles, bulb plates, Flanged plates etc.

6 Hrs

Welding:

Welding techniques and machines in ship building process. Defects in welds, testing of welds. Fabricated components.

4 Hrs

Bottom and Side Framing:

Double bottoms, Water tight floors, solid and bracket floors, Transverse framing, Longitudinal framing, Tank side brackets, Beam Knees, Web frames. 6 Hrs

Shell & Decks:

Plating systems for shell plating including keel, bilge strake, sheer strake. Deck plating & deck girders. Discontinuities, such as hatches and other openings. Supporting & closing arrangements, midship section.

7 Hrs

Bulkheads & Deep Tanks:

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

7 Hrs

Fore-End Arrangements:

Stem construction. Arrangements to resist panting. Forepeak – Collision bulk head, Bulbous bows. Anchor and cable arrangements, Chain locker

6 Hrs

Aft-End Arrangements:

Types of sterns, Stern frame and rudder. Types of rudder. Rudder support. Rudder carrier bearing, shaft tunnel, shaft bearings. Aft peak tank. 6 Hrs

Load Line and Tonnage:

Definition of freeboard conditions for assignment, List of closing appliances,

Load line Surveys. Details of markings permanently carved. Tonnage regulations. 4 Hrs

Shipyard Practice:

Shipyard layout. Hull construction processes and assembly stages. Outfitting and machinery installation. Tests and trials. Role of surveyors in ship construction. Use of computers.

5 Hrs

Offshore Technology:

Drilling ships and platforms, Supply/support vessels, Dynamic positioning. Cable laying vessels.

3 Hrs

Ship Surveys:

Survey rules, Functioning of ship classification societies. Surveys during construction.

Periodical surveys as per statutory regulations. Constructional features and rule guidelines for merchant vessels as per. Various IMO conventions and codes.

4Hrs

Ship Systems:

Ventilation, bilge piping, HP air, LP air, fuel system, sea water system, pumps and piping system.

4 Hrs

REFERENCE BOOKS:

1. Ship Construction – Reeds Volume:5
2. "Ship Construction", D. J. Eyres, Butter worth – Heinemann, Oxford.
3. Merchant Ship Construction – H.J. Pursey
4. Merchant Ship Construction – D.A. Taylor
5. Principles of Naval Architecture Vol I (Editor Lewis) SNAME Publication
6. Ship Construction – Gilmor Bruce

SEMESTER-V

UG11T3503	MARINE INTERNAL COMBUSTION ENGINES - I	72 HRS

OBJECTIVE: *To develop knowledge in marine diesel engines construction, fundamentals and latest developments.*

Performance Characteristics of I.C. Engines: 4-Stroke and 2-Stroke cycles; Deviation from Ideal Condition in actual engines; Limitation in parameters, 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 Practical heat balance diagrams and thermal efficiency.

10 Hrs

General Description of I.C. Engines: Marine Diesel Engine of M.A.N- B&W., Sulzer-make, Constructional Details of I.C. Engines: Principal Components: Jackets and Liners, Cylinder heads. Pistons, Cross heads, Connecting rods, Bed Plates, A-frames, Welded construction for Bed plates & frames. Tie rods, hydraulic exhaust valves. Crank-shafts, Cam-shafts,

13 Hrs

Starting Systems: Starting system of various types of 4 stroke diesel engines.

3Hrs

Scavenging and Supercharging System : Scavenging arrangements in 2-stroke engines; Air charging and exhausting in 4-stroke engines; Various types of Scavenging in 2-stroke engines; Uni-flow, loop, cross loop and reverse loop scavenging, their merits and demerits, Scavenge pumps for normally aspirated engines; under piston scavenging, Scavenge manifolds.

5 Hrs

Supercharging Arrangements: Pulse and constant pressure type; Their relative merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders. Turbocharger and its details. Two stage turbocharging. Turbocharger surging

7 Hrs

Combustion of Fuels in I.C. Engines: Fuels, Combustion Process – fundamentals, Grades of suitable fuels. Preparation of fuels for efficient combustion. Fuel atomization, Ignition quality, Fuel injectors, and its details. Ignition delay, after burning. Basic definitions Flash point. Fire point. Ignition point. Compression pressure ratio and its effect on engines. Reasons for variation in compression pressure and peak pressure. Design aspects of combustion chamber.

13 Hrs

Cooling of I.C. Engines: Various Cooling media used; their merits and demerits, cooling of Pistons, cylinder jackets & cylinder heads, Bore cooling, maintenance of coolant and cooling system. 5 Hrs

Safety and Prevention of Mishaps in I.C. Engines: Causes and prevention of crank-case explosions, and Scavenge fires. Detection of same and safety fittings provided to prevent damage. Uptake fires, starting air line explosion and other engine safeties.

12 Hrs

Special Features of I.C. Engines: Development of long-stroke Engines, Implication of stroke-bore ratio

4 Hrs

REFERENCE BOOKS:

1. Wood yard, Goug, "Pounder's Marine Diesel Engines". Butter Worth Heinemann Publishing, London.
2. "Slow Speed Diesel Engines" Institute of Marine Engineers
3. S H Henshall, "Medium and High Speed Diesel Engines for Marine Use". Institute of Marine Engineers, Mumbai.
4. D K Sanyal, "Principle & Practice of Marine Diesel Engines". Bhandarkar Publication, Mumbai.
5. "Marine Low Speed Diesel Engine", Denis Griffiths.
6. "Lamb's Question and Answer on Marine diesel Engine".
7. "Diesel Engines", A.J. Wharton.

SEMESTER-V

UG11T3504	FLUID MACHINES	54 HRS

***OBJECTIVE**: To impart and develop knowledge about centrifugal pumps, reciprocating pumps and turbines and dimensional analysis.*

Centrifugal Pumps: Introduction of Pumps, Types of Centrifugal pump. Priming of pump. Calculations of various heads; Losses and Efficiency, Work done per unit weight, Velocity

Diagrams at inlet and exit; Calculation of power, Torque on shafts. Performance of pumps & Characteristic Curves, Cavitation in Centrifugal pumps. Net Positive Suction Head, Minimum speed and Specific speed of pump. Applied problems.

12 Hrs

Reciprocating Pumps: Introduction and comparison with other pumps. Various types, single and double acting, single and multi cylinder, Co-efficient of discharge; Negative slip of pump Theoretical indicator Diagrams; Effect of acceleration and friction head on indicator diagram; Cavitation and separation, Maximum speed without cavitation & separation. Use of air vessel. Applied problems.

12 Hrs

Impulse and Reaction Turbines: Introduction of Turbines, Various Types of turbines, velocity triangles and work done and efficiency of various turbines. Impulse Turbine -Pelton wheels. Inward Radial flow Reaction turbine- Francis Turbine; Degree of reactions, Axial flow reaction turbine- Kaplan Turbine, Draft Tube, Specific Speed, Unit Quantities etc. and Applied problems.

15 Hrs

Physical Similarity, Dimensional and Model Analysis: : Introduction of dimensions, Types of variables, Types of forces acting in moving fluid, Ratios of Forces and Dimensionless groups, Dimensional Homogeneity. Type of Physical similarity. Methods of Dimensional Analysis. Model Laws, Model Testing. Application of Dynamic similarity and Model Analysis for Roto Dynamic Machines i.e. pumps and Turbines. Applied problems.

15 Hrs

REFERENCE BOOKS:

1. Hydraulics and Fluid mechanics - P.N. Modi, S.M. Seth
2. Fluid Mechanics & Hydraulic Machines - R.K. Rajputh
3. Fluid Mechanics (Part – I & Part – II) - J. F. Douglas
4. Fluid Mechanics & Hydraulic Machines - R. K. Bansal
5. Mechanics of Fluids - Bernard Massey & John Ward-Smith
6. Fundamentals of Fluid Mechanics - G.S. Sawhney

SEMESTER V

UG11T3505	MARINE AUXILIARY MACHINERY – I	72 HRS

OBJECTIVE *: To impart knowledge of Ship's engine room layout, piping systems and fittings and working principle, construction and operation problem of ships Auxiliary Machinery.*

Engine Room Layout: Layout of main and auxiliary machinery in engine rooms in different ships.

2 Hrs

Engine Room Piping Layout: Layout and arrangement of important Pipe lines in Engine Room with fittings and its materials of construction. These include systems like - Steam, Bilge, Ballast and Oil fuel systems, Lube oil system lines, Sea water system, Fresh water system and Fire Fighting systems etc. Fresh water / Sea water Hydrophore systems, Feed water, Distilled water, Drinking water systems and their filling lines. Colour codes and other symbols used to identify pipelines

9 Hrs

Bunker and Oil Transfer: Standard practice followed for Bunkering fuels including sampling and spill containment systems; sludge discharge to shore reception and other oil transfer procedures.

3 Hrs

Filters: strainers and filters, types of marine filters, different types of filter materials, auto-clean and Duplex filters, static filter, magnetic filter, micro filters. Priming and core maintenance of filters.

5 Hrs

Pumps: Types of pumps for various requirements, their characteristics and application in ships. Centrifugal Pumps, Gear Pumps, Screw Pumps and Reciprocating pumps. Care and Maintenance of pumps. Hydraulic pumps & motors, hydraulic line filters and systems. Automation and control of pumps & pumping systems.

8 Hrs

Air Compressors and Blowers: Operational and constructional details of compressors used on board ships. Uses of compressed air. Air Bottles, Construction, mountings, compressor safeties & associated systems.

6 Hrs

Evaporators: Construction and Operation of different types of evaporators and maintenance. Fresh Water generators distillers. Reverse Osmosis process, Conditioning arrangements of distilled water for drinking purpose.

4 Hrs

Heat Exchangers: Tubular and plate type, reasons of corrosion, tube removal, plugging, materials used and maintenance.

3 Hrs

Pollution Prevention: STOKES Law; Static and turbo separators, Oily bilge Separators their construction and operation, Use of coalescers, prevention of oil pollution and various International requirements. MARPOL Convention, Shipboard Oil Pollution Emergency Plan (SOPEP), Shipboard Marine Pollution Emergency Plan (SMPEP) & Oil Discharge monitoring and control system (ODMCS).

6 Hrs

Oil Purification: Theory of oil purifications, various methods of oil purifications, Use of settling / service tanks & precautions taken before entering / cleaning tanks. Principles of operation and construction of different Centrifuges for heavy fuel and lubricating oil such as self de-sludging & ALCAP system.

7 Hrs

Steering Gear: Operation and Constructional details of various types of steering machinery – Ram type and Rotary vane type. Telemotor systems, Variable Delivery Pumps used in steering gears - axial and radial displacement types. Hunting action of Steering gear. Emergency Steering arrangement. Safematic Steering Gear with redundancy concept as per SOLAS. Care and Maintenance of Steering Gear Plants.

5 Hrs

Propulsion Shafting System: Methods of shaft alignment, constructional details and working of Thrust blocks. Intermediate Shaft bearing and Stern tube bearing. Oil / water lubricated Stern Tubes. Shaft Sealing arrangement. Stresses in Tail End, Intermediate and Thrust Shafts. Propeller drop. Muff Coupling.

5 Hrs

Dry Docking: Methods of dry docking of ships, Inspection and routine overhauling of underwater fittings and hull; Measurement of propeller drop, removal and fittings of propeller (with and without key).

3 Hrs

Other Ship Board Equipments: Incinerators & MARPOL Annex- VI, Sewage Treatment Plant (MARPOL Annex – IV), Shore discharge / reception facilities, Different types of ship stabilizer. Bow Thrusters, Hull protection arrangements & Marine Growth Protection System.

6 Hrs

REFERENCE BOOKS:

1. Marine Auxiliary machinery - D.W. Smith
2. Marine Auxiliary machinery - H.D. McGeorge
3. Basic Marine Engineering - J.K. Dhar
4. Marine Engineering Practice - IMEI Publication
5. General Engineering Knowledge for Marine Engineers - Reeds Volume:8
6. Marine Machineries- Operation & Maintenance – T.B. Srinivasan, IMEI Publication.
7. The Running & Maintenance of Marine Machinery – J. Cowley by IMEI Publication.

SEMESTER V

UG11T3506	NAVAL ARCHITECTURE – I	72 HRS

OBJECTIVE*: To impart basic knowledge of ship hydrostatics, stability and strength.*

Geometry of Ship and Definitions: Ship geometry, Definition of hull surface – coordinate systems, graphic description – Lines plan of ships, coefficients of form, Ship forms. Displacements, deadweight, gross tonnage and net tonnage.

5 Hrs

Numerical Integration in Naval Architecture: Simpson's rules, Trapezoidal rule, mean and mid-ordinate rules, Tchebycheff's rules and their applications to calculation of areas, volumes and centroids, first and second moment of areas, displacement. 5 Hrs

Basic Ship Hydrostatics: Density, relative density, Pressure exerted by a liquid. Archimedes principle, Meaning of buoyancy, reserve buoyancy and permeability. tonne per centimetre immersion (TPCI). Effect of change in density of water, center of pressure, First and second moments of area. Conditions of equilibrium of floating bodies. Definition of stability, initial stability, meta-centric height, calculation of BM, GM, Addition and removal of masses. Effect of suspended mass, free surface effect. Inclining experiment.

20 Hrs

Hydrostatic Curves: The calculation of hydrostatic data – waterline properties, volume properties, Wetted surface area of a ship, Hydrostatic curves, Bonjean curves and their use.

4 Hrs

Statical Stability at Large Angles of Heel: Definition of large angles of heel, Righting arm, Cross curves of stability, Curve of Statical stability. Angle of loll. Dynamical stability. Influence of trim and waves on stability. Influence of ship forms on stability. Pure loss of stability, IMO code of intact stability.

12 Hrs

Flooding and Damage Stability: Definitions as per SOLAS – water tight bulkhead, bulkhead deck, assessment of ship conditions after flooding – Lost Buoyancy or Added mass, change in mean draught due to bilging, change in draughts due to bilging of end compartments, Probabilistic damage stability (MARPOL & SOLAS guidelines for damage stability)

8 Hrs

Longitudinal Stability and Trim: LCB. Centre of Flotation**,** moment to change Trim Change in draught due to addition of small masses and large masses. Change in draught due to change in density of water. 8 Hrs

Strength of Ships: Longitudinal strength. Curves of buoyancy and weight, Curves of load, shearing force and bending moment, Alternative methods. Standard conditions, still water and wave bending movements and shear forces, Approximation for maximum shearing force and bending moment, Moment of Inertia of section, Section modulus calculation. Stresses in deck and keel. Pressure on bulkhead. 10 Hrs

REFERENCE BOOKS:

Buoyancy & Stability of Ships – by IR R F Scheltema De Heere & Bakker (George Haarp & Co. Ltd. London)
Ship Hydrostatics and Stability – by Adrian B Biran
Principles of Naval Architecture -Vol I – by Edward V Lewis (SNAME)
Ship Stability for Masters & Mates – by Derrett & Barrass
Naval Architecture for Marine Engineers – Reeds Volume - 4
Introduction to Naval Architecture – Eric Tupper
Ship and Naval Architecture – R.Munro-Smith
Ship Construction – D.J.Eyers
Naval Architecture, Principles & Theory – B.Baxter

SEMESTER-V

UG11T3507	ELEMENTARY DESIGN AND DRAWING	54 HRS

OBJECTIVE: *To impart a fair knowledge about Design procedures of Engineering components and train students to draw the various components.*

1. ELEMETARY DESIGN

Procedure in Machine Design : Concepts of design, procedure & processes, Design synthesis, Ergonomic consideration in design, Feasibility, preliminary Design Alternative, Final Design alternative, Preliminary & Final Plans & Drawings.

2 Hrs

Use of Standards in design, selection of preferred sizes, common useful Materials & manufacturing considerations in design. 2 Hrs

Review of failure criteria in mechanical design, properties of materials, heat Treatment processes, BIS system of designation of Steels, Basis of good Design, deformation, wear corrosion.

2 Hrs

Common useful materials & Manufacturing considerations in design. Failure Criteria in Mechanical Design : Basis of good design. Failure of machine parts. Deformation, Wear Corrosion. 2 Hrs

Machine Design: 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 & combined loads, Fatigue strength. Dynamic Stresses. Selection of materials. Specifications: - Fit, tolerance, finish-BIS .
5 Hrs

Design and Drawing to Specifications for Parts Subjected to Direct Loads:

Fasteners: Bolts & Screws, Cotter & knuckle joints, keys & couplings, Pipe joints, Riveted & welded joints. Design of Welded machine parts. 2 Hrs

Power Transmission : Shafts & axles, Bearings, clutches & brakes, Belt drives, chain drives, design & drawing of tooth gearing like spur & Bevel gears, Rack & pinion, worm & worm wheels, helical gears.
3 Hrs

2. MARINE ENGINEERING DRAWING

Advanced Marine Machinery Assembly Drawing:

Marine Diesel Pistons 2-stroke & 4 –stroke types, 4- Ram Steering Gear, Diesel Air Starting Valve, Starting Air Pilot Valve, 4 - Stroke Diesel Piston and Rod , Automatic Valve for Starting Air System., Burner Carrier , Quick Closing Sluice Valve, Rudder Carrier Bearing, Reducing Valve ,Upper Piston & Rod , Telemotor Receiver , Turbine Flexible Coupling, Fuel Valve , Stern Tube & Tail Shaft , Michell Thrust Block , Improved High Lift Safety valve Cross head & Guide shoe, Flow regulator, Gauge Glass (Plate type) Pedestal Bearing, Piston type, stop valve, Tunnel bearing ,Valve regulator (Minimum of 9 drawings to be completed in the class. Remaining to be given as home assignment)
36 Hrs

Para 17 Annex II of DGS

REFERENCE BOOKS:

1. Machine Design – "Pandya Shaw"
2. H. G. Beck , "Reeds, Engineering Drawing for Marine Engineers".
3. H. Barr & J.G. Holburn, "Engineers MacGIBBON'S Pictorial Drawing Book for Marine"
4. Design of Machine Elements – V.B. Bhandari by TMH