SEMESTER IV

UG11P3401	COMPUTER MICRO PROCESSORS AND PLC LABORATORY	72 HRS

A) To study the Logic Training Board

B) Programmable Logic controller

1. System Hardware Identification
2. PLC system configurations, installations
3. PLC to I/O Device interface
4. PLC programming
5. Speed control of mini DC motor using DAC
6. Study of SCADA system (architecture) and demonstration of P,PI, PD, PID Controls

C) Microprocessor 8085

Programming using kit/simulator for

1. Table look up
2. Copying a block of memory
3. Shifting a block of memory
4. Packing and unpacking of BCD numbers
5. Addition of BCD numbers
6. Binary to ASCII conversion
7. Speed control of mini DC motor using DAC

D) Study of 8051 Micro controller kit and writing programs for the following tasks using the kit

1) Table look up
2) Basic arithmetic and logical operations
3) Interfacing of Keyboard and stepper motor

SEMESTER IV

UG11P3402	WORKSHOP PRACTICALS – IV	54 HRS

1. Study of Workshop layout.
2. Rectangular block making by Shaping Machine.
3. Key Way making by Milling Machine.
4. Reciprocating Pump Overhauling.
5. Centrifugal Pump Overhauling.
6. Air Compressor Overhauling.
7. Water tube Boiler Familiarisation.
8. Machine Shop Job: Making a specimen for tensile test.
9. Double-V Weld.
10. T-Weld (inner & outer).
11. Pipe repair & Fabrication.
12. Diesel Engine Familiarisation & Overhauling.
13. Familiarisation with CNC & VMC machines.
14. Additional practicals to be included to help in understanding of modern day ship systems.

SEMESTER – IV

UG11P3403	CONTROL ENGINEERING LABORATORY	36 HRS

Study of Operation of Control Equipments:

1. Operation and utility of a 3 Term (P + I + D) Pneumatic controller for Temperature, Pressure, Flow and Level on SCADA unit.
2. Operation of Automatic Viscosity Controller
3. Operation of boiler automatic controller (Level, Pressure and Temperature)
4. Study hydraulic trainer unit to be familiar with, hydraulic equipments.
5. Study pneumatic equipments on pneumatic trainer unit.
6. To study the functioning of a Mist Detector.
7. Calibration of Pressure Gauge.
8. Operation of an Automatic flow controller and measuring the flow from a given pipe.
9. Microprocessor controlled DC & AC machines.

MAT LAB

1. Generation of periodic, exponential, sinusoidal , damped sinusoidal, step and impulse .
2. Ramp signal using MATLAB in both discrete and analog form .
3. Evaluation of convolution integral, Discrete Fourier transform for periodic and non periodic.
4. Signals and simulation of difference equations using MATLAB.
5. Cascade connection of second order system using MATLAB.
6. 20 Determination of Laplace Transform and inverse Laplace transform using MATLAB.
7. Programs to implement structure union and function.

SEMESTER IV

UG11T3401	MARINE BOILERS	54 HRS

OBJECTIVE: *To develop knowledge of cadets on (construction & operation) of various types of boilers.*

Smoke Tube Boilers/ Aux Boiler: General consideration governing the design of boilers , comparison of smoke tube and water tube boilers; Vertical auxiliary boilers- Cochran spheroid, Aalborg, Sunrod, Thimble tube & Spanner Boilers - general description with sketches.

8 Hrs

Water Tube Boilers : general description with sketches of principal types of boilers in marine use, -Foster Wheeler ESD-I,II,III,IV, ESRD Boilers , Babcock MR Boilers and Kawasaki UFE Boilers. Dual Fired (Oil & LNG) Boilers. Double Evaporation Boiler. Superheater, Economizer, Air & Steam pre-heater; Water walls, circulation and use of unheated down comers in highly rated boilers; superheat temperature control, Attemperators and De-superheaters.

10 Hrs

Waste Heat Boilers: waste heat recovery calculation, economizer, exhaust gas boiler, Cochran exhaust gas composite boiler, Aalborg sun rod exhaust gas and composite boiler. Forced water circulation boiler.

6 Hrs

Boiler Mountings: List of Mountings for water tube and Smoke tube Boilers. Safety valves - improved high lift, full bore type and consolidated safety valves. Gauge glasses - tubular type & plate types and remote Water Level Indicator . Automatic feed regulator of Single, Two and Three element types, and retractable type soot blowers.

8 Hrs

Feed System: Open Feed System, Closed Feed System, Feed pump, 3 Stage Air Ejector, De-aerator etc. Boiler water testing.

4 Hrs

Operation, Care and Maintenance : pre- commissioning procedures, steam raising and operating procedures, action in the event of shortage of water & contamination by oil. Blowing down of boiler, laying up a boiler; general maintenance, external and internal tube cleaning. Tube renewals and tube plugging. Inspection and survey of boilers.

6 Hrs

Refractory: purpose of refractory , types of refractory , installation & fixing of refractory & fire bricks. Refractory failure – causes & prevention.

3 Hrs

Oil Burning Process: procedure of liquid fuel burning in open furnace, Various types of atomizer, Furnace arrangement for oil burning, combustion control system i.e. master control, fuel control, air control and viscosity control.

6 Hrs

Tests on Boiler: Destructive and non destructive tests on boiler plates, welded seams, Classification Societies requirements for boilers construction, hydraulic tests.

3 Hrs

REFERENCE BOOKS:

1. Marine steam boilers -J.H.Milton
2. Marine boilers - G.T.H. Flanagan
3. Running & Maintenance of Marine Machinery - Cowley, I.M.E Publication
4. Boiler Control System - David Lindsley
5. Steam Engineering Knowledge for Marine Engineers - Reeds Volume:9
6. Steam – Its generation and Use - Babcock Engineering
7. Boiler Plant Instrumentation - Kent Gunn

SEMESTER IV

UG11T3402	DIGITAL ELECTRONICS AND PLC	54 HRS

OBJECTIVE: *The course is designed for the basic understanding of Digital Electronics and PLC.*

Digital Circuits : Logic systems and Gates. Boolean Algebra, Simplifications, Binary and BCD codes, Flip-flops; Counters; Registers and Multiplexers. 14 Hrs

Converters (A-D and D-A) : Analog to Digital and Digital to Analog Convertors and their use in Data-Loggers. 2 Hrs

TTL & CMOS GATES: Digital Integrated Circuits, Semi-conductor Memories-ROM, RAM and PROM. 4 Hrs

Programmable Logic Controller 14 Hrs

Concept of a generalized PLC configuration

CPU, Power Supply, Rack, I/O Modules- DI, DO, AI, AO, specialty modules, PLC Rack Power Supply, Addressing, Serial communication Network, Remote Input Output Terminals (RTU), PLC Programming, Programmable Logic Controller (PLC) Overview, PLC and Control System Components, Number Systems and Codes, Creating Relay Logic Diagrams,

PLC Programming

Programming Logic Gate Functions in PLCs, PLC Timer Functions, PLC Counter Functions, PLC Math Functions, PLC Logic Functions, PLC Compare, Jump, and MCR (Master Control Reset) Functions, PLC Subroutine Functions, Sequencer Functions, PLC Networks in Manufacturing, Troubleshooting and Servicing the PLC System

Case Studies

Motor Drive Logic, Fault Annunciation Logic, Flap Gate Operation Logic, Sequence Operation Logic

SCADA

Overview, Traditional Control, Distributed Control, What do SCADA Provide? , Generic Software, Architecture and SCADA functions

Microprocessor 8085 14 Hrs

Architecture, Memory , Instruction Set, Interfacing Assembly Language programming

Electronic Instruments and Measuring Devices : Cathode Ray Oscilloscope, Digital Voltmeters and frequency-meters, Multimeters; signal Generators, Signal generator as used on-board ship (like measuring and controlling various variables)

Transducers and its application in the measurement of rpm, pressure, flow, temperature, strain etc. Q-meters, IC tester, LCD.

6 Hrs.

REFERENCE BOOKS:

1. Microprocessor Architecture, Programming & Application-R. Gaonkar, Wiley
2. Advanced Microprocessor & Peripherals-Ray & Bhurchandi, MH
3. Microcontroller, Deshmukh, MH
4. Programmable Logic Controllers, by W. Bolton,
5. Microprocessor & interfacing, Hall, MH
6. Fundamental of microprocessor, Uday Kumar, Pearson
7. Digital Design by Morris Mano

SEMESTER IV

UG11T3403	MECHANICS OF MACHINES-II	72 HRS

***OBJECTIVE*:** *To impart the knowledge to the student on Balancing, Vibrations : Torsional, forced and transverse.*

Balancing : Balancing of masses rotating in different planes, dynamic forces at bearings; Primary and secondary balance of multi-cylinder in-line Engines and Configurations. Primary

and secondary balance of multi-cylinder V - type Engines and Configurations.
15 Hrs

Vibration :Free Harmonic Vibrations, Linear motion of an elastic system, Angular motion of an elastic system. Differential equation of motion. Free Vibration of springs in series and parallel. Simple and Compound pendulums. Single and two degrees of freedom.

10 Hrs

Torsional vibrations : Single rotor system, rotor at end and rotor in the middle. Effect of inertia of Shaft, Two rotor system, rotors at both ends and rotors at one end. Three rotor and multirotor system. Torsionally equivalent shafts, Geared system. 7 Hrs

Forced Vibrations : Forced Linear and angular Vibrations, Periodic force transmitted to support, Periodic movement of the support. 7 Hrs

Transverse Vibrations of Beams : Single Concentrated load, effect of the mass of the beam, Energy method-several concentrated Loads uniformly distributed load, Dunkerley's empirical method for several Concentrated loads. 8 Hrs

Whirling of Shafts-Whirling of shafts, critical speed, effect of slope of the disc, effect of end thrust. 7 Hrs

Damped Vibrations : Idea of Viscous and Coulomb damping, Linear and angular vibrations with Viscous damping, Forced damped linear and angular Vibrations, Periodic movement of support.
8 Hrs

Forced Damped Vibration : To write differential equation of motion and find amplitude, frequency. 10 Hrs

REFERENCE BOOKS :

1. Advanced Mechanics of Machines - J. Hannah & R.C. Stephens
2. Theory of Machines – P. L. Ballaney
3. Engineering Mechanics – S. Timoshenko & D. H. Young

SEMESTER - IV

UG11T3404	ELECTRICAL MACHINES -II	72 HRS

OBJECTIVE: *To expose the students to the concepts on AC Motors, Alternators and principles of operation of synchronous motors*

Three phase Induction Motor:

Construction, Theory and Operation of Poly Phase Induction Motors: Construction, Principle of Operation, Equivalent Circuit and Performance, No-Load and Blocked – Rotor test, circle Diagram, losses and Efficiency, Operating Characteristics and Influence of machine Parameters on the Performance of the Motor, induction Generator.

12 Hrs

Starting, Speed Control and Braking of Poly-Phase Induction Motors: Starting of Squirrel Cage Motors, Starting of Wound Rotor Motors, Speed Control of Three Phase Induction Motor, Electrical Braking of Poly-Phase Induction Motors.

10 Hrs

The Single-Phase Induction Motor: Theories of Operation, Double Revolving Field Theory, Voltage Equations and Equivalent Circuit, Determination of Parameters by Tests, Split-Phase starting, Shaded-Pole Starting, Repulsion Motor Starting, Capacitor Motor, A.C Tachometers, Two-Phase Control Motor, Cross Field theory.

10 Hrs

Special Induction Machines: Induction voltage Regulator, Synchronous induction Motor, Power Synchros, Position Synchros, Linear Motor.

4 Hrs

Synchronous Machines:

Alternators or Three Phase Synchronous Generators:

Basic Principle, Construction and EMF Equations of Alternators: Introductions, constructional features of cylindrical and salient pole rotor, armature winding, Chording of windings, Pitch factor, Distribution or breadth factor, EMF equations, Shape of the emf wave.

8 Hrs

Steady State Operation of Alternators: Phasor diagram, Voltage regulation, Determination of Voltage Regulation by EMF, MMF and Potier method of three phase synchronous generator.

4 Hrs

Parallel Operation and Stability of Alternators: Losses and Efficiency, Parallel operation of alternators, Synchronizing current, Synchronizing power and torque, Connected to infinite bus-bars, Effect of unequal voltages, Load sharing between alternators, Hunting of alternators, Time period of oscillation, Maximum power output.

8 Hrs

Synchronous Motors:

Construction, Starting and Excitation of Synchronous Motors: Introduction, Characteristics features, Construction, Principle of operation, Method of starting, Equivalent circuit, Effect of load, Torque developed, Power developed, Effect of excitation on armature current and power factor

(V-curves) 8 Hrs

Performance of Synchronous Motors: Synchronous condensers, Motor ratings, Hunting of synchronous motor, Applications, Advantages and disadvantages, Comparison between synchronous and induction motors. 4 Hrs

Special Electromechanical Devices: Switched reluctance motor, Permanent magnet machines, Brushless D.C machines, Stepper motor, Tacho generators, Synchros & resolvers. AC servo motors. Inductors Generators (only elementary aspects of the above types are expected). 4 Hrs

REFERENCE BOOKS:

1. Hughes Electrical & Electronic Technology – Revised by I McKenzie Smith
2. Electric Motor drives – Berde
3. Electricity applied to Marine Engineering – W.Law
4. Dr. P. S. Bimbhra: "Electrical Machinery", Khanna Publishers.
5. M. G. Say: Performances & Design of A.C. Machines; CBS Publishers & Distributors.
6. D. P. Kothari & I. J. Nagrath: "Electric Machines", Tata McGraw Hill.
7. P. K. Mukherjee & S. Chakraborty: "Electrical Machines", Dhanpat Rai Publications.
8. Smarajit Ghosh, "Electrical Machines", Person Publications.
9. S. K. Sen: "Electrical Machines", Khanna Publishers.
10. Parker Smith: "Problems in Electrical Engineering", CBS Publishers & Distributors.
11. B. L. Theraja & A. K. Theraja: "Electrical Technology", S Chand.

SEMESTER IV

UG11T3405	FLUID MECHANICS	72 HRS

***OBJECTIVE*:** *To impart the knowledge of Fluid properties and effect of various forces acting on different places and surfaces, the inviscid flow and real viscous flow*

Fluid Properties, Pressure and its Measurement:

Definition of Fluid. Different properties, i.e. Capillarity, Surface tension, viscosity. Pressure and its Measurement-Various type of pressure, Measurement of pressure, Manometer and Mechanical gauges, Different type of simple manometers, Different type of differential manometers, Different type of mechanical gauges. Applied problems. 10 Hrs

Hydrostatics Forces and Buoyancy:

Total pressure and centre of pressure on immersed plane surface in different positions and Curved surfaces. Total force and center of pressure on immersed surfaces such as Tanks, Bulkheads, Lock Gates, Centre of buoyancy, Meta-centre, Condition of equilibrium of a floating and submerged bodies. Experimental and theoretical methods to find GM value. Applied problems.
12 Hrs

Fundamental of Fluid Flow and Equation of Motion : Types of fluid flow, Description of flow pattern, Energy of flowing fluid, pressure energy, potential energy, kinetic energy, total energy; Euler's Equation of motion, Bernoulli's Equation for steady motion and its application, Kinetic Energy correction factor, Pressure velocity relationship, Pitot Tube, Orifice-meter, Measurement of flow rate by Venturimeter, Flow through an Orifice, Hydraulic Coefficients, Time of emptying a tank through an Orifice. Applied problems.

10 Hrs

Impact of Jets and Jet Propulsion:

Impulse Momentum Principle, Force exerted by jet on stationary flat plate, Force exerted by jet on inclined stationary flat plate, Force exerted by jet on stationary curved plate at centre, Force exerted by jet striking tangentially on stationary curved plate. Force on vertical flat plate moving in the direction of jet. Force on inclined flat plate moving in the direction of jet. Jet propulsion, Jet propulsion of ships. Applied problems.
10 Hrs

Flow and Losses in Pipes and Fittings : Losses of energy in pipe lines; Losses due to sudden increase in pipe diameter, Losses due to sudden contraction in diameter, Friction losses, Shock

losses, derivation of Darcey's and Chezy's formula; Hydraulic Grade Line and Energy Line, Pipes in series and in parallel. Equivalent pipe. Transmission of power by pipe line; Condition for maximum power transmission. Time of emptying a reservoir through pipe. Surge pressure.

10 Hrs

Viscous Flow: Flow of viscous fluid through circular pipe and between parallel planes Kinetic energy correction and momentum correction factors, Boundary layer, resistance co-efficient, variation of resistance co-efficient with Reynold's number, Viscous resistance and Power absorbed in viscous flow for Journal Bearing, Foot-step Bearing and Collar Bearing. Loss of head due to friction in viscous flow-Hagen Poiseuille Equation. Method of determination of co-efficient of viscosity. Applied problems.

10 Hrs

Vortex Motion and Radial Flow: Free Vortex flow, Forced Vortex Flow, Equation of motion of forced vortex flow. Vortex flow for open cylinder. Vortex Force exerted on top of closed cylinder. Radial flow. Spiral free Vortex Motion, Spiral forced vortex Motion. Applied problems.

10 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 IV

UG11T3406	MARINE HEAT ENGINES AND AIR CONDITIONING	72 HRS

OBJECTIVE: *To impact the knowledge of Marine Steam Turbine, Gas Turbine and Marine Refrigeration and Air-conditioning plants with accessories and its performances.*

Marine Steam Turbines : Compounding of steam turbine – pressure compounding, velocity compounding and pressure-velocity compounding, types of turbines, impulse, reaction concepts, Velocity diagrams for simple impulse and impulse – reaction turbine, forces on blades, work done by blades, axial thrust, effect of friction on blades, maximum energy transfer conditions. Problems associated with steam turbines – diagram work output, diagram efficiency, degree of reaction, stage efficiency, overall efficiency, re-heat factor and condition curve.

18 Hrs

Boilers and Evaporators : Boiler calculations, boiler thermal efficiency and equivalent evaporation of a boiler, basic calculations on the effect of condenser leakage and impure feed, dissolved solids and scale in boilers; density of water and its control in boilers and evaporators. Basic calculations on the performance of single – effect, multi-effect and flash type evaporators; applied problems

10 Hrs

Marine Gas Turbines: Constant volume or explosion cycle gas turbine plant, constant pressure cycle or Joule – Brayton cycle Gas turbine plant. Deviation of Actual Gas-Turbine Cycles from Idealized Ones. Methods of gas turbine cycle efficiency - Brayton cycle with regeneration, Brayton cycle with intercooling, reheating and regeneration. Combined gas - vapor cycles, topping and bottoming cycles concepts.
General constructional of design features for marine plants, material of construction. Heat exchangers & Reheater arrangements, comparison of free piston engine, gasifiers of conventional air steam combustion chambers.

16 Hrs

Marine Refrigeration : Refrigeration cycles, refrigerators and heat pumps, reversed Carnot cycle, Vapor compression cycles – Ideal and Real cycles, Refrigerating effect, COP, capacity rating of a refrigerating plant, methods of improving COP, use of vapor tables and applied problems. Types of marine refrigerating plants with multiple compression and Evaporator system, heat pump systems, Selecting refrigerant, gas refrigeration cycles, absorption refrigeration systems, refrigeration in liquefied gas carriers, Reefer ships and containers.

16 Hrs

Air Conditioning : Principles of Air conditioning, dry air and atmospheric air (water vapor mixture), Adiabatic saturation and wet bulb temperatures, specific humidity, relative humidity, dew point, unsaturated and saturated air, study of Psychrometric chart and numericals based on air conditioning. Human comfort and air conditioning, Air conditioning processes – Heating, Cooling, Humidification, De-humidification, evaporative mixtures, adiabatic mixing, ventilation, recirculation. Thermal load assessment of accommodation, compartments. 12 Hrs

REFERENCE BOOKS:

1. Marine Engineering- Robert Taggart (Editor), SNAME
2. Principles of Naval Engineering, NAVPERS 10788B- Bureau of Naval Personnel
3. Turbine Main Engines- John B Main, F R Harris and C W Herbert
4. Marine Steam Engines and Turbines- S C McBirnie
5. ASHRAE Hand Book, HVAC Fundamentals SI Units
6. Steam : Its generation and use – by Babcock & Wilcox Company
7. Heat and Mass Transfer : Fundamentals & Applications - Yunus A Cengel and Afshin J Ghajar
8. A Heat Transfer Textbook, J H Leinhard IV / J H Leinhard V
9. Fundamentals of Engineering Thermodynamics- MJ Moran, HN Shapiro, DD Boettner & MB Bailey
10. Applied Thermodynamics for Engineering Technologists- T D Eastop and A McConkey
11. Basic and Applied Thermodynamics - P K Nag

SEMESTER – IV

UG11T3407	**APPLIED MARINE CONTROL AND AUTOMATION**	**54 HRS**

OBJECTIVE: *To enable the students to the concepts of Basic Automatic control system and its application to ship board automation.*

Introduction to Control System: Concept of feedback and Automatic Control, Effects of feedback, Objectives of control systems. Definition of linear and nonlinear systems. Elementary concepts of sensitivity and robustness. Types of control systems.

4 Hrs

Mathematical Modeling of Dynamic Systems: Electrical analogy of Mechanical systems, Mechanical couplings, Transfer Function concepts, Block diagram representation of Control Systems. Signal Flow Graph.

Time domain analysis and frequency domain analysis and Stability of linear second order control systems. 6 Hrs

Correcting Units: Detailed study of Diaphragm actuators, Valve-positioners, Piston actuators, Electro-hydraulic actuators & Electric actuator control valves.

6 Hrs

Signal Transmitting Devices: Flapper Nozzle system, Electro pneumatic signal converter, Pneumatic types of Controllers; Hydraulic, electric and electronic process flow logic, Variable inductance and capacitance transducer, Force balance transducer, Synchros**.** 8 Hrs

Control System Performance Measures: PI, PD and PID controllers. Two Step (On – Off) Control, Modulating Control, Off Set or Droop, Desired Value, Set Value, Action Controllers, Stacked type controllers, Controller adjustments, Split Range control, Ratio control and Cascade Control, System Response, Distance Velocity, Measurement and Transfer Lags. 10 Hrs

Measuring Sensors: Pressure, Temperature, Level and Flow measuring devices. Miscellaneous Instruments; Tachometers (Electric and Mechanical), Salinity Indicator (Dionic Gauge), Oil in

Water Monitor, Photo Electric Cells, Photo Conductive Cells, Photo Voltaic Cells, Viscosity Sensors, Oil Mist Detector, Flaw detector – Ultrasonic and Magnetic. 8 Hrs

Application of Controls on Ships: Marine Boiler – Automatic Combustion control, Air – Fuel ratio control, Boiler water level control- single and two element, Steam pressure control, Fuel oil viscosity control, Lubricating oil temperature control, Jacket/piston cooling temperature control, Instruments for UMS classification.

Proportional controller for Boiler Feed water control 8 Hrs

Manipulator Element: Principles, Operation & Application, Electrical Servomotor, Hydraulic servomotor. 4 Hrs

REFERENCE BOOKS:

1. D. A. Taylor, "Marine Control Practice", Butterworth & Co (Publishers) Ltd.
2. Ogata, K, "Modern Control Engineering", Pearson Education
3. Roy Choudhury, D., "Control System Engineering", PHI.
4. Kuo, B.C., "Automatic Control System", PHI.
5. Reeds Volume:10,Instrumentation and Control Systems