National Diploma in Technology

Curriculum

Marine Engineering Technology

Institute of Technology
University of Moratuwa

August 2004

First Year Syllabi

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Second Year Syllabi

1. DCE 102 Engineering Mechanics and Strength of Materials

Code : DCE 102		Division: Mechanical Eng. & Civil Eng.			
Title : Engineering Mechanics and Strength of Materials					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
2x30	**2x15**	**2x15**	**2**	**2/2**	**2/2**
Method of Assessment : - 3 Hour Question Paper & Course Works					

General Objectives

On completion of this module, the students will be able to

- gain sufficient theoretical knowledge to deal with Statics and Dynamics of Mechanical Engineering components in machinery and
- apply the principles of strength of materials on simple objects under different load conditions.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1	**Engineering Mechanics** Introductory Topics	04	04
2	Energy	04	-
3	Friction and Friction Drives	12	06
4	Gears	02	
5	Dynamics	08	04
6	**Strength of Materials** Elasticity of Materials under Different Load Conditions	11	06
7	Sectional Properties	03	-
8	Shear Force and Bending Moment Diagrams for Beams	10	-
9	Torsion in Simple Practical Applications	04	06
10	Slope and Deflection of Beams	02	04
	Total	**30**	**30**

Summary Syllabus

Engineering Mechanics

1. Introductory Topics (04 hours)

- Review - Units and dimensions, statics of a rigid body
  - Scalar and vector quantities.
  - Force, couple and moment with graphical representation.
  - The principle of equilibrium
  - Necessary and sufficient conditions for the equilibrium
  - Free body diagrams
- Simple Machines
  - Load, effort, mechanical advantage, velocity ratio, and mechanical efficiency.
  - Introduction to simple machine, lifting machine and reversible machine, self-locking machine and compound machine.
  - Condition for the self-locking machine.
  - Law of a simple machine $P = aW + b$.
  - Maximum mechanical advantage and maximum mechanical efficiency

2. Energy – Work & Power (04 hours)

- Introduction, work, energy.
- Potential energy, Kinetic energy and strain energy.
- Kinetic energy of rotating body, rotating about a fixed axis.
- Power, efficiency law of conservation of energy theore

3. Friction (12 hours)

- Introduction, dry friction, fluid friction, semi lubricated friction.
  - Static friction, dynamic friction
  - Laws of dry friction, coefficient of static and kinetic friction
  - Rolling and slipping
- Screw friction
  - Introduction, pitch, thread angle, lead, no of starts.
  - Friction formulae for square and V-threads
  - Mechanical efficiency and the maximum efficiency.
  - Engineering applications, such as screw jack, nuts and bolts, turn buckles, presses and power screws.
- Simple clutches
  - Introduction, type of clutches
  - Simple clutch in uniform wear and uniform pressure conditions.
- Bearings
  - Introduction, frictional losses in thrust bearings
  - Flat pivot and collar bearings with uniform wear and uniform pressure.
- Belt drives
  - Introduction, frictional formulae for flat belt and ‘V’ belts drives
  - Power transmission, via belts, band brakes

4. Simple Gar Dives (02 hours)

- Introduction, spur gearing between parallel shafts, external and internal gearing
- Pitch, module, pitch circle diameter, dedendum circle, addendum circle

5. Dynamics (08 hours)

- Kinematics
  - Introduction, kinematics of a particle in linear motion with constant acceleration condition, graphical representation of velocity and acceleration.
  - Kinematics of a particle in curvilinear motion in polar co-ordinates.
- Kinetics
  - Introduction, rigid body in motion.
  - Newton' laws of motion, De Alembert's principle.
  - Newton's second law for system of particles.
  - Motion of a particle in a circular motion.
- Inertia
  - Introduction, mass moment of inertia, radius of gyration
  - Parallel axis theorem, perpendicular axis theorem.
  - Motion of a rotating body about a fixed axis, plane motion of a rigid body.

Strength of Materials

1. Elasticity of Materials under Different Load Conditions (11 hours)

- Review of fundamentals
  - The nature of rigidity, elasticity and plasticity of materials, Hooke's law, Linear elastic stress strain analysis.
- Composite members
  - Principles of elasticity in stress-strain analysis of composite bars under; direct tensile or compressive loads and thermal stresses.
- Shear stress and shear strain
  - Complementary and diagonal shear stresses.
  - Shear modulus.
  - Applications of shear – lap joints and butt joints (design & analysing)
- Volumetric stress and strain
  - Bulk Modulus, Poisson's Ratio and Relationship between the elastic moduli.

2. Sectional Properties (03 hours)

- First moment of area and second moment of area.
- Perpendicular axes theorem and parallel axes theorem.
- 2^{nd} moment of area for different standard shapes and their combinations.

3. Shear Force and Bending Moment Diagrams for Beams (10 hours)

- Types of loads and supports.
- Shear force and bending moment.
- Relationship between load, shear force and bending moment.
- Shear force and bending moment diagrams for different conditions of loads and supports.
- Bending of beams.
- Bending formula for simple applications.

4. Torsion in Simple Practical Applications (04 hours)

- Torsional shear stresses in solid and hollow circular shafts.
- Applications of torsion, Transmission of power and Helical springs.
- Torsion formula for closed coil helical spring.

5. Slope and Deflection of Beams (02 hours)

- Slope and deflection of cantilevers and simple supported beams.

List of Practicals : (30 hours)

Engineering Mechanics (14 hours)

1. Rotating Beams Apparatus
2. Inclined Plane
3. Compound Pendulum
4. Worm and Wheel Drive
5. Belt and Rope Friction
6. Screw Jack

Strength of Materials (16 hours)

1. Tensile test - Stress strain relationship of mild steel
2. Beam Deflection - Determination of Young's Modulus of timber
3. Torsion test - Determination of Modulus of Rigidity of steel
4. Helical Springs - Deformation of a helical spring under axial tension

Recommended Text Books :

1. Engineering Mechanics – Dynamics; R S Hibbler
2. Engineering Mechanics – Statics; J L Meriam and L G Kraige
3. Applied Mechanics; H Hannah, M J Hillier
4. Applied Mechanics and Strength of Materials; R S Khurmi
5. Theory of Machines; R S Khurmi and J K Gupta
6. Strength of Materials; G H Ryder
7. Strength & Elasticity of materials and Theory of Structures; W H Brooks
8. Mechanics of Solids and Structures; P P Benham and F V Warnock
9. Strength of Materials; John Case and A H Chilver
10. Problems in Strength of Materials; W V Sirk

2. DEE 102 Electrical Measurements and Basic Electronics

Subject Code : DEE 102			Division : Electrical & Electronic Engineering Technology		
Title : Electrical Measurements and Basic Electronics					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**30**	**2**	**1**	**2/2**
Method of Assessment :- 3 Hour Question Paper & Course Works					

General Objective

On completion of this module the student will be able to:

- acquire the fundamental knowledge of Electrical Measuring Instruments and Basic Electronics.
- form a basis for advanced studies in Electrical Engineering to be undertaken in the 2nd Year.

	Subject Outline	Lecture (hr.)	Practical (hr.)
	Measurements		
01.	Moving Coil Instrument	04	03
02.	Moving Iron Instruments	04	03
03.	Electro-dynamic Instruments	04	03
04.	Electrostatic Voltmeter	04	-
05.	Sensitivity & Accuracy	04	03
06.	Kelvin's Double Bridge	04	03
07.	Meg-ohm Meter	02	03
	Basic Electronics		
08.	Semiconductor diodes	04	03
09.	Power Supplies and Rectifiers	04	03
10.	Smoothing Circuits	04	03
11.	Bipolar Junction Transistor	06	-
12.	Transistor Biasing	04	03
13.	Field Effect Transistors	04	-
	Digital Electronics		
14	Combinational Logic	04	-
15	Sequential Logic	04	-
	Total	**60**	**30**

Summary Syllabus

Electrical Measurement

1. Moving Coil Instrument (04 hours)

- Review of conversion of an ammeter to a Voltmeter
- Review of extension of ammeter range, extension of Voltmeter range
- AC theory and rectification, average, rms values and form factor of sinusoidal wave,
- Circuit diagram of a multi range ac Voltmeter-Ammeter
- Use of a moving coil meter as a Ohmmeter

2. Moving Iron Instruments (04 hours)

- Attraction type Moving Iron instrument, Repulsion type Moving Iron Instrument, its non linear scale and how to correct it

3. Electro-dynamic Instruments (04 hours)

- Operation of Electro-dynamic Instruments, Conversion into a ammeter / Voltmeter / Wattmeter, Connection Errors in Electro-dynamic Watt meters
- Errors due to inductance of watt meter coils

4. Electrostatic Voltmeter (04 hours)

- Operation of Electrostatic Voltmeter

5. Sensitivity and Accuracy (04 hours)

- Sensitivity and accuracy of Measuring Instruments & loading effects of Voltmeters

6. Kelvin's Double Bridge (04 hours)

- Operation of Kelvin's double bridge, Estimation of errors involved

7. Meg-Ohm Meter (02 hours)

- Crossed coil principle to use it as a ratio meter, also as a Meg-Ohm meter

Basic Electronics

8. Semiconductor Diodes (04 hours)

- Properties of semiconductors, PN junction, Extrinsic or impure semiconductors (n type & p-type), Current flows in a p-n junction, Diode characteristics
- Load line analysis,

9. Power Supplies & Rectifiers (04 hours)

- Half wave & full wave rectifiers
- Accumulators – Charging, discharging, Ampere-hour capacity

10. Smoothing Circuits (04 hours)

- C filter, LC Filter Section

11. Bipolar Junction Transistor (BJT) (06 hours)

- BJT Symbols & codes to identify BJTs, Transistor parameters, Leakage currents in BJTs

12. Transistor Biasing (04 hours)

- Biasing arrangement in C-B and C-E circuits of BJT, Load line equation for transistor circuits, Q-point analysis

13. Field Effect Transistors (04 hours)

- JFET and its Output characteristics

- MOSFET
- MOSFET & its drain characteristics, Equation for drain current, FET Biasing circuits
- DC load line and analysis
- AC load line in FET circuits

Digital Electronics

14. Combinational Logic (04 hours)

- Number systems & codes
- Basic logic gates and Boolean algebra
- Combination logic circuits & Minimisation techniques, k-maps
- Introduction to TTL & CMOS
- Transistorised Monostables, Bistable & Astable devises

15. Sequential Logic (04 hours)

- Sequential logic circuits, Optimization techniques

List of Practicals: (30 hours)

1. Measurements on Kelvin's Double Bridge
2. Measurements of power in single phase circuits
3. Study of moving coil meter
4. Study of non-linear resistor
5. Continuity and Insulation testing
6. Familiarization of electronic components
7. Semiconductor diode and its application
8. Smoothing and regulating circuits
9. Bipolar junction transistors
10. Field effect transistors

Recommended Texts :

1. Electrical Fundamentals; John Ryder, Prentice Hall International
2. Electrical Measurements & Measuring Instruments; E W Golding
3. Hughes Electrical Technology Revised; Ian McKenzie
4. Electrical Technology; H Cotton
5. Electrical Technology; Schaum Series
6. Electronic Engineering; Schelling & Belove
7. Electronic Principles; Gray & Searle, Wily International
8. Electronic Circuits; Milman & Haukias
9. Principles of Electronics; J E Holding & M R Garvin
10. Digital Systems; R J Tocci, Prentice Hall International
11. Pulse & Digital circuits; Milman & Taub, Mcgraw Hill
12. Digital Computer fundamentals; Douglas Lewin, Thomas Nelson (UK)
13. Electronics Engineering; Schaum Series

3. DEE 103 Principles of Electricity

Subject Code : DEE 103			Division : Electrical & Electronic Engineering Technology		
Title :- Principles of Electricity					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**30**	**2**	**1**	**2/2**
Method of Assessment :- 3 Hour Question Paper & Course Works					

General Objectives :

On the completion of this module the student will be able to:

- acquire the fundamental knowledge of Basic Electricity.
- form a basis for advanced studies in Electrical Engineering to be undertaken in the 2nd Year.

	Subject Outline	Lecture (hr.)	Practical (hr.)
01	**Basic Electricity** SI Units	01	-
02	Fundamental Laws of Electricity	01	05
03	Electric Power & Energy	01	-
04	Temperature Effects of Resistors	01	05
05	Network Theorems	04	-
06	DC Distribution Systems	03	05
07	**Electrostatics** Electric Field	02	-
08	Electron Ballistics	03	-
09	Charging and Discharging Phenomena	03	05
10	**Magnetism** Magnetic Field	03	-
11	Electromagnetism	02	-
12	Magnetic Circuits	03	-
13	Inductance in DC Circuits	03	-
14	Mutual Inductance	01	-
15	**Alternating Theory** Alternating Voltages & Currents	08	05
16	Single Phase Circuits	04	-
17	Effect of Frequency in AC Circuits	03	-
18	Three Phase Circuits	12	-
19	Electrical Installation	02	05
	Total	**60**	**30**

Summary Syllabus

Basic Electricity

1. SI Units (01 hour)

- SI units for Force, Work, Power, Charge, Current, Resistance & Voltage

2. Fundamental Laws of Electricity (01 hour)

- Ohm's law, resistivity, conductivity and their units
- equivalent resistance of a series and parallel circuits
- Kirchoff's lows (current law and voltage law)
- ideal voltage and current source, practical voltage & current sources

3. Electric Power and Energy (01 hour)

- Efficiency of energy conversion

4. Temperature Effects of Resistors (01 hour)

- Temperature coefficient of resistance (+ve & -ve)

5. Network Theorems (04 hours)

- Active and positive networks, superposition theorem, Thevenin's theorem
- Norton's theorem

6. DC Distribution Systems (03 hours)

- Radial & Ring main systems
- Power loss in the distributors

Electrostatics

7. Electric Fields (02 hours)

- Static electricity, parallel plate capacitor, types of capacitors, Dielectric Strength
- Charge Vs applied voltage, parallel & series connected capacitors
- Electric force and Electric flux density, potential gradient, composite dielectric capacitors

8. Electron Ballistics (03 hours)

- Force on an isolated charge in an electric field
- Movement of a free electron in an electric field

9. Charging and Discharging Phenomena (03 hours)

- Charging & discharging current for series CR circuit. Time Constants, Stored energy in a capacitor, Force between oppositely charged plates

Magnetism

10. Magnetic Fields (03 hours)

- Magnetic poles, field strength, Magnetic Potential gradient, lines of magnetic flux, magnetic Induction and magnetic screening

11. Electromagnetism (02 hours)

- Right hand grip rule or cork screw rule
- Solenoid, toroid and force on a conductor carrying current in a magnetic field, Flemming's left hand rule, Lenz's law

12. Magnetic Circuits (03 hours)

- Mmf, magnetizing force, Magnetic flux
- Permeability of free space &r magnetic materials
- Relative permeability, absolute permeability
- Reluctance of a magnetic circuits, magnetic leakage and fringing
- Kirchoff's laws for the magnetic circuits
- B-H curve, Hysterisis

13. Inductance in DC Circuits (03 hours)

- Inductive and non inductive circuits, inductance of a coil, inductance of a long straight solenoid and a toroid coil
- Step response for LR circuit (Charging & decaying), energy stored in an inductive circuit, time constant of an inductive circuit

14. Mutual Inductance (01 hour)

- Mutual inductance, Self inductance, coupling coefficient

Alternating Theory

15. Alternating Voltages and Currents (08 hours)

- Sine wave, Phase angle (lead/lag), frequency, speed and no. of pole pairs Amplitude Alternating emf (single phase), Average, Peak and rms values of an alternating current, rotating vector, Manipulations with AC quantities, vector diagrams using rms values

16. Single Phase Circuits (04 hours)

- Analysis of ac circuits with R, L, C, RLC in series & RLC in parallel, Phasor diagrams, Power in ac circuits

17. Effect of Frequency in AC Circuits (03 hours)

- Series resonance, parallel resonance, active power and reactive power
- power factor using phasor diagrams

18. Three Phase Circuits (12 hours)

- Three phase generation, star and delta connection, line and phase voltage and currents in a star connected system & delta connected system
- power in three phase system with balanced load

19. Electrical Installations (02 hours)

- IEE wiring regulations, safety and Electrical shock, earthing, distribution systems, circuit breakers and fuses, basic domestic wiring installations
- Two way switch, Ring circuits of socket outlets, Radial circuit of socket outlets

List of Practicals : (90 hours)

1. Efficiency of Energy Conversion
2. Determination of RC – Time Constants
3. Study of Simple AC Circuits
4. Verification of Kirchoff's laws
5. Study of MCB's & Fuses
6. Study of 2-wire DC line Model

Recommended Text Books :

1. Electrical Fundamentals; John Ryder, Prentice Hall International
2. Electrical Measurements & Measuring Instruments; E W Golding
3. Electrical Engineering; G Hughes
4. Electrical Technology; H Cotton
5. Electrical Technology; Schaum Series

4. DIS 101 English

Subject Code : DIS 101		Division: Interdisciplinary Studies			
Title : English					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**-**	**2**	**1**	**-**
Method of Assessment :- Nine Assignments & 3 Hour question paper at the year end examination					

General Objectives

On Completion of this module the students will be able to

- Learn technical vocabulary and language necessary for scientific enquiry.
- Deal with concepts used in scientific discussion and writing in English.
- Develop an understanding of the English grammatical system at work.
- Produce language which look / sound natural.
- Develop writing skills.
- Get accustomed to various speech styles / situations and extract meaning.
- Achieve basic speaking skills needed to survive in speech situations.
- Achieve proficiency in social interaction.
- Develop presentation skills.
- Read and understand text.
- Read for specific information.
- Appreciate literary texts.

No.	Subject Outline	Lectures (hr.)	Practicals (hr.)
1	Core-Text - Basic English for Science	10	-
3	Listening	-	10
4	Speaking	10	20
5	Reading	15	-
6	Writing	25	-
	Total	**60**	**30**

* The first stage (foundation) of the course, which is the basic stage, is conducted prior to the commencement of the academic year & the 'foundation syllabus' is annexed.

Summary Syllabus

1. Technical vocabulary & concepts used in scientific discussion and writing in English.

(10 hours)

Core-Text - Basic English For Science (Peter Donovan - Oxford University Press)

- Giving simple instructions
- Reporting actions, observations & results, stating conclusions, accounting for results
- Understanding explanations, describing apparatus & experiments, interpreting results, describing attributes
- Describing experiment, stating results, describing & accounting for phenomenon
- Description of processes in detail

2.. Listening (10 hours)

- Listening activities
- Listening & Note-taking

4. Speaking (30 hours)

- Language of discussion
- Group discussions
- Basic Presentation skills
- Formal Presentations –individual / group

5. Reading (15 hours)

- Reading Comprehension
- Extracting contextual meaning of words
- Stated main ideas / implied main ideas
- Skimming and scanning a text to extract main idea / specific details
- Appreciating literary texts
- Reading & Note-taking

6. Writing (25 hours)

- Construction of sentences
- Paragraph writing – topic sentence / supporting details
- Simple compositions –narrative, descriptive, explanatory etc.
- Task-based assignments - report of experiment, description of process etc.
- Notices, invitations, notes, messages.
- Letter writing - Personal & Formal letters
- Report writing
- Job applications

Recommended Text Books :

1. Basic English for Science; Peter Donovan, OUP.
2. English for Physical Science; Allen & Widdowson, OUP.
3. Intermediate English Grammar; Raymond Murphy, Cambridge.
4. Advanced English Grammar; Raymond Murphy, Cambridge.

5. DIS 102 Introduction to Information Technology

Subject Code : DIS 102			Division : - Interdisciplinary Studies		
Title : Introduction to Information Technology					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
15	**-**	**15**	**1/2**	**-**	**1/2**
Method of Assessment: - Through Continues Assessment					

General Objective

On completion of this module the students will be able to:

- acquire a fundamental knowledge of computer systems and computer programming
- create professional quality spreadsheets and technical drawings.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Introduction to Computers	02	-
2.	Data Representation	01	-
3.	Secondary Storage Devices	01	-
4.	Categories of Software	01	-
5.	Spreadsheet Applications	-	02
6.	Use of CAD in Engineering	02	08
7.	Fundamentals of Computer Programming	05	05
8.	Introduction to PC Network and Internet	03	-
	Total	**15**	**15**

Note: The subject will be evaluated by assignments and not by a year-end examination.

Summary Syllabus

1. Introduction to Computers (02 hours)

- Types of computers
- Main Components of a Computer
  - Central Processing Unit
  - Main Memory
  - Input and Output Devices

2. Data Representation in the Computer (01 hour)

- Numerical Data Representation
- Character Representation
- Memory Capacity
- Information storage in the main memory.

3. Secondary Storage Devices (01 hour)

- Use of secondary storage devices.
- Hard Disks, Floppy Disks, Optical Disks and Magnetic Tapes

4. Categories of Software (01 hour)

- Hardware, Software and Firmware
- System Software and Application Software.
- Types of system software
- Packaged Software and Custom-Written Software

5. Spreadsheet Applications* (02 hours)

- Work sheet, work book, row number, column letter, cell and an active cell, reference area.
- Numbers, Label and Formulae.
- Copying data, moving data, inserting, deleting, moving columns and rows, formatting cells
- Functions.
- Macros.
- Multiple work sheets.
- Charts.

6. Use of CAD in Engineering* (10 hours)

- Components of the AutoCAD window.
- Giving commands
- Function keys
- Creating a new drawing.
- Basic entities
- Basic Editing
- Display Control
- Aids to construction
- Drawing limits
- Advanced Editing
- Object Snap
- Layers
- Polylines
- Blocks
- Hatching
- Simple three-dimensional views

7. Fundamentals of Computer Programming* (10 hours)

- Visual development environment
- Event driven programming
- Variables and variable types.
- Input and Output
- Sequence control structure, Selection control structure and Loop control structure.
- Arrays.
- Modular programming.

8. Introduction to PC Networks and Internet (03 hours)

- Introduction to a PC Network
- Types of networks
- Network based applications and advantages of networks.
- Hardware requirements and software requirements.
- Internet its resources.

List of Practicals: (15 hours)

* Topics covered are listed under items 5, 6 and 7

Recommended Text Books :

1. Developing Applications With Visual Basic, P R Reed JR,
2. Teach Yourself Visual Basic 6 in 21 Days, G Perry.
3. Using the World Wide Web D A Wall
4. AutoCAD For Architects and Engineers: A Practical Guide to Design, John M Albright.& Elizabeth H Schaeffer
5. An AutoCAD workbook, A Yarwood
6. Computer Networks - Second Edition, Tanenbaum, S Andrew
7. Microsoft Office 97 Professional Edition, M L Swanson
8. Information Technology; A practical course, Harriet.Hraper
9. Introducing Computers: Concepts, Systems and Applications.
10. Computer and Information Processing, D D Spencer

6. DIS 103 Mathematics

Subject Code: DIS 103			Division : Interdisciplinary Studies		
Title : Mathematics					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
90	**30**	**-**	**3**	**1**	**-**
Method of Assessment :- 3 Hour Question Paper					

General Objectives

On completion of this module the students will be able to:

- understand the basic concepts of mathematics
- develop rational thinking in formulating engineering problems
- use mathematical symbols and formulae
- apply mathematical knowledge in solving practical problems
- appreciate tidiness and orderliness

No.	Subject Outline	Lecture (hr.)	Tutorial (hr.)
	Algebra and Differential Equations		
1.	Determinants and Matrices	15	05
2.	Ordinary Differential Equations	15	05
3.	Vector Algebra	08	03
4.	Complex Numbers	06	02
	Calculus		
5.	Functions	04	01
6.	Application of Differentiation	06	02
7.	Application of Integration	04	01
	Probability and Statistics		
8.	Probability	05	02
9.	Statistics	12	04
	Numerical Methods		
10.	Numerical Methods	15	05
	Total	**90**	**30**

Summary Syllabus

Algebra and Differential Equations

1. Determinants and Matrices (15 hours)

- Determinants
- Types of matrices,
- Algebra of matrices,
- Adjoint
- Method of inversion,
- Solution of simultaneous equations,
- Echelon form,
- Gauss elimination method,
- Consistency

2. Ordinary Differential Equations (15 hours)

- Formulation,
- Solution of first order differential equations and second order differential equations with constant coefficients,
- Use of D-operators, simple applications

3. Vector Algebra (08 hours)

- Vector notations,
- Scalar and vector products,
- Triple products,
- 3-D geometrical applications

4. Complex Numbers (06 hours)

- Algebra of complex numbers,
- De Moivre's theorem,
- Argand diagram,
- Roots of complex numbers
- Algebraic equations

Calculus

5. Functions (04 hours)

- Exponential,
- Hyperbolic and logarithmic functions,
- Inverse functions and implicit functions.

6. Application of Differentiation (06 hours)

- Stationary points and curve sketching,
- Mean value theorem,
- L'Hospital's rule for limits,
- Leibnitz's theorem,
- Partial differentiation and error calculations,
- Taylor series in one or two variables.

7. Application of Integration (04 hours)

- Areas and volumes,
- Moments,
- Lengths of arcs,
- Radius of curvature.

Probability and Statistics

8. Probability (05 hours)

- Elementary probability theory,
- Conditional probability and Bayer's theorem.

9. Statistics (15 hours)

- Classification, tabulation and presentation of data,
- Measures of location and dispersion,
- Discrete and continuous probability distributions: Binomial, Poisons and Normal with simple applications.

Numerical Methods

10. Numerical Methods (15 hours)

- Solution of equations in one variable
- Successive substitution method
- Method of false position
- Simple iterative method
- Newton-Raphson method
- Solution of simultaneous linear equations; Jacobi method, Gauss – Seidal method
- Finite differences and interpolation,
- Numerical differentiation,
- Numerical integration: Trapezoidal and Simpson's rules,

Recommended Text Books :

1. Advanced Calculus; Murray R Spiegel, Schaum's Outline Series
2. College Algebra; Murray R Spiegel, Schaum's Outline Series
3. Fourier Series; Murray R Spiegel, Schaum's Outline Series
4. Laplase Transforms; Murray R Spiegel, Schaum's Outline Series
5. Probability and Statistics; Murray R Spiegel , Schaum's Outline Series
6. 1st Year College Mathematics; Frank Ayres, Schaum's Outline Series
7. Calculus; Frank Ayres, Schaum's Outline Series
8. Differential Equations; Frank Ayres, Schaum's Outline Series
9. Matrices; Frank Ayres, Schaum's Outline Series
10. Engineering Mathematics; K A Stroud, Macmillan
11. Introduction to University Mathematics; J L Smyrl, Hodder and Stoughton
12. Intermediate Mathematics; Blakey, Oxford Press

7. DME 101 Applied Thermodynamics & Fluid Mechanics

Subject Code : DME 101		Division : Mech. Eng. Tech. & Maritime Studies			
Title : Applied Thermodynamics & Fluid Mechanics					
Annual Workload			Weekly Workload		
Lectures	Tutorials	Practicals	Lectures	Tutorials	Practicals
60	30	30	2	2/2	2/2
Method of Assessment :- 3 Hour Question Paper & Course Works					

General Objectives

Section A - Applied Thermodynamics

On completion of this module the students will have

- an understanding of the fundamentals of thermodynamics.
- an exposition of the principles of thermodynamics.

Section B - Fluid Mechanics

On completion of this module, the students will be able to;

- understand the basic principles of Hydrostatics and Hydrodynamics as applied to flow through pipes and orifices.
- understand the basic principles and characteristics of Hydraulic Machinery such as pumps and turbines.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	**Applied Thermodynamics** Fundamental Concepts	02	02
2.	First Law of Thermodynamics	02	-
3.	Non Flow and Flow Processes	02	-
4.	Second Law of Thermodynamics	05	-
5.	Properties of Fluids	04	02
6.	Application of Non Flow Processes to Particular Fluids	05	-
7.	Application of Flow Processes to Particular Fluids	03	-
8.	Air Standard Cycles	04	04
9.	Combustion of Fuels	03	06
1.	**Fluid Mechanics** Fundamental Concepts	01	-
2.	Hydrostatic Pressure	05	02
3.	Impact of Jets	03	02
4.	Buoyancy of Bodies in a Fluid	03	02
5.	Pipe Flow	09	04
6.	Discharge through Small Orifices	05	02
7.	Discharge through Large Orifices	02	-
8.	Notches & Weirs	02	04
	Total	**60**	**30**

Summary Syllabus

Applied Thermodynamics

1. Fundamental Concepts (02 hours)

- Properties used to specify the state, or condition of a substance, units in which the property is measured and usual symbols.
- The terms “system” and “boundary”.
- Thermodynamic properties.
- Reversibility and reversible work.

2. First Law of Thermodynamics (02 hours)

- Conservation of energy.
- Cyclic process.
- First law of thermodynamics.
- Corollaries of first law of thermodynamics.

3. Non Flow and Flow Processes (02 hours)

- Non flow energy equation and reversibility.
- Non flow processes.
- Steady flow energy equation.
- Open systems with steady flow.
- Non steady flow processes.
- Practical applications of steady flow process

4. Second Law of Thermodynamics (05 hours)

- Cycle efficiency of a cyclic process.
- Heat engine and Heat pump.
- Second law of thermodynamics.
- Corollaries of second law thermodynamics.
- Entropy.

5. Properties of Fluids (04 hours)

- Properties of a prefect gas
- Properties of liquids and vapours
- Tables of properties
- Diagrams of properties such as temperature – entropy diagram, enthalpy – entropy diagram, pressure – enthalpy diagram

6. Application of Non Flow Processes to Particular Fluids (05 hrs)

- Constant volume process for a perfect gas and steam.
- Behavior of the steam and perfect gas in constant pressure process.
- Isothermal process for steam and perfect gas.
- Characteristics of steam and perfect gas in adiabatic process.
- Behavior of steam and perfect gas on polytropic process.

7. Application of Flow Processes to Particular Fluids (03 hours)

- Steady flows in boilers and condensers.
- Adiabatic steady flow processes in nozzles, diffusers, turbines and rotary compressors.
- Irreversible steady flow process in throttle valves.
- Isothermal steady flow process in reciprocating compressors.
- Non steady flow

8. Air Standard Cycles (04 hours)

- Carnot cycle with carnot efficiency.
- Constant pressure cycle (Joule cycle).
- Air standard cycle for petrol engine (Otto cycle).
- Diesel cycle.

9. Combustion of Fuels (03 hours)

- Fuels and their combustion processes.
- Chemical equations of combustion.
- Stoichiometric air fuel ratio.
- Practical analysis of combustion products.

Fluid Mechanics

10. Fundamental Concepts (01 hour)

- Historical back ground
- Density, Specific gravity and Specific weight.
- Surface tension
- Viscosity - Dynamic viscosity and Kinematic viscosity

11. Hydrostatic Pressure (05 hours)

- Action of pressure within a liquid
- Measurement of pressure – absolute pressure & gauge poressure.
- Applications of pressure - Hydraulic jack, lock gates, sluice gates etc.
- Action of pressure on vertical, non vertical and curved surfaces.
- Pressure diagram.

12. Impact of Jets (03 hours)

- Pressure on a fixed flat plate
- Pressure on a moving flat plate
- Pressure on a curved fixed vane
- Pressure on a curved moving vane
- Jet propulsion

13. Buoyancy of Bodies in a Liquid (03 hours)

- Archimede's principle
- Principle of buoyancy of bodies in a liquid.
- Terminology in connection with buoyancy, such as Metacentre, center of gravity, Metacentric height, Center of buoyancy
- Stability of a floating body.
- Metacentric height of a floating object by Moment method, Oscillation method and Analytical method

14. Pipe Flow (09 hours)

- Principles of pipe flow (3 Hrs)
  - Continuity and mass balance in a flowing liqud.
  - Energy stored in a liquid flowing through a pipe
  - Pressure head, Velocity head, Datum head and Total head of a flowing liquid
  - Bernauli's principle – proof
  - Limitations of Bernaulli's principle and the assumptions used in the derivation.
  - Applications of Bernauli's principle in various practical situations.
- Flow measuring devices (1Hr)
  - Pitot tube
  - Venturimeter
- Frictional flow in pipes(4Hrs)
  - Laminar flow and Turbulent flow
  - Reynolds Number
  - Reynolds Number as a criterion to separate Laminar flow and Turbulent flow
  - Darcy's law for friction
  - Moody Diagram (Nikuradse's Chart) to find λ value in the formula to find the head loss due to friction.
  - Formulae derived from Moody Diagram to find λ.
  - Apply head loss due to friction in various practical situations
- Hydraulic Syphons (1 Hr)
  - Saturation vapour pressure (SVP)
  - Application of SVP to determine the pressure at which dissolved air in water is released, such as in pipe flow over summits.

15. Discharge through Small Orifices (05 hours)

- Description of small orifice
- Terminology connected with orifice discharge such as; Vena Contracta, Coefficient of contraction (C_c), Coefficient of velocity (C_v), Coefficient of discharge (C_d)
- Calculations to determine (C_c) ,(C_v) & (C_d) , using constant and falling head methods
- Time of emptying tanks
  - Time of emptying a simple tank through an orifice
  - Time of emptying a spherical tank through an orifice
  - Time of flow from one tank to another
  - Time of emptying a tank with inflow
  - Application of the time of emptying tanks in few practical situations

16. Discharge through Large Orifices (02 hours)

- Discharge through an open orifice
- Discharge through a submerged orifice
- Discharge through a partially submerged orifice

17. Notches and Weirs (02 hours)

- Discharge through sharp crested weirs – rectangular, V shape & Trapezoidal
- Velocity of approach

List of Practicals : (30hours)

Applied Thermodynamics (14 hours)

1. Calibration of Pressure Gauge
2. Redwood Viscometer
3. Separating and Throttling Calorimeter
4. Orast's Apparatus
5. Thompson's Calorimeter
6. Boys' Calorimeter

Fluid Mechanics (16 hours)

1. Analysis of Metacentre & Metacentric Height using a Pontoon
2. Analysis of Hydrostatic Pressure on a Plane Surface
3. Flow Measurements in Pipes
4. Frictional flow through pipes
5. Flow through Nothes & Weirs
6. Pelton wheel (Impact of jets)

Recommended Text Books :

Thermodynamics

1. Applied Thermodynamics for Engineering Technologists - S.I.Units; T.P.Eastop, A.McConkey; Longman, ISBN No.:0 582 44197-8
2. Engineering Thermodynamics – Work and Heat Transfer, G.F.C.Rogers, Y.R.Mathew; ELBS, ISBN No.:0 582 05376 5

Fluid Mechanics

1. Hydraulics & Fluid Mechanics; E H Lewitt, English Language Book Society & Sir Isaac Pitman and Sons Ltd.
2. A Text Book of Hydraulics; R S Khurmi, S Chand and Company Ltd., New Delhi.
3. A Text Book of Hydraulics; K N Karna, Khanna Publishers, New Delhi.

8. DME 103 Engineering Drawing

Subject Code : DME 103			Division : Mech. Eng. Tech. & Maritime Studies		
Title :- Engineering Drawing					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
30		**90**	**1**	**-**	**3**
Method of Assessment: - 4 Hour Question Paper & Continuous Assessments					

General Objectives

On completion of this subject the students will be able to:

- understand the need of Engineering Drawings in Industry.
- read and understand Engineering Drawings.
- produce Engineering Drawings conforming to Engineering Drawing Standards.
- express ideas on paper quickly and clearly by sketches.

No.	Subject Outline	Lecture (hr.)	Practical* (hr.)
1.	Introduction to Engineering Drawing & Equipment	01	03
2.	Orthographic Projection	02	06
3.	Dimensioning	01	03
4.	Completing Third View from Two Given Views	01	09
5.	Sectional Views	02	12
6.	Screw Threads & General Engineering Terms	01	03
7.	Assembly Drawings	10	21
8.	Conic Sections	02	06
9.	Pictorial Views	02	06
10.	Loci - Rectification of Arcs, Involutes & Cycloids	02	03
11.	Helix & Mechanisms	01	03
12.	True Lengths & Inclinations	01	03
13.	Developments	02	06
14.	Interpenetration Curves	02	06
	Total	**30**	**90**

* **Practicals** – Drawing Office Practice

Summary Syllabus

1. Introduction to Engineering Drawing and Equipment (01 hour)

- Engineering Drawing as a International Language, graphical communication
- Standards used – *SLS 409:1977 – Engineering Drawing Practice and ISO Standards Handbook on Technical Drawing*
- Types of Line, Lettering used in Engineering Drawing Standards
- Use and care of Drawing equipment
- Layout of drawing paper

2. Orthographic Projection (02 hour)

- Principles of Orthographic Projection
- First Angle Projection, labeling of views and standard symbol of projection
- Third Angle Projection, labeling of views and standard symbol of projection
- Freehand sketching of Orthographic Views from pictorial views of simple objects
- Setting out an Orthographic Views of simple solids

3. Dimensioning (01 hour)

- Principles and terms used in dimensioning of engineering component
- Properties of dimensioning and why they are needed
- Principles of dimensioning according to SLS and ISO standards

4. Completing Third View from Two Given Views (01 hour)

- Projecting details from one view to the other and completing the third view when two views are given

5. Sectional Views (02 hour)

- Sectioning of engineering parts in terms of clarification of interior details
- Imaginary cutting plane, direction of view, labeling a Sectional View and Section lines
- Rules governing cutting plane through Web/Rib, Standard parts and common features etc.
- Local sectioning, Half section, Thin section, Successive sections, Revolved section and Section in two intersecting planes

6. Screw Threads and General Engineering Terms (01 hour)

- Screw threads and ISO Metric Thread designations
- Internal and external screw threads and to draw them using standard methods
- Application of General Engineering Terms

7. Assembly Drawings (10 hours)

- Temporary and Permanent fastening methods
- Nuts, Bolts and Washers using standard ratios used for drawing purposes
- Section plane through assembled component
- Exploded Views – use and applications
- Couplings, Bearings, Valves use and applications
- Assembly when the parts are scattered in a given drawing

8. Conic Sections (02 hours)

- Conic Sections – Cone, Section Plane and True Shape – Section of a cone
- Conics using locus of point, fixed point, fixed straight line and eccentricity and to draw tangents and normal
- Parabola using Rectangular method and to find the Focus
- Ellipse by common construction methods

9. Pictorial Views (02 hours)

- Principles of Pictorial projection
- Isometric Views
- Explain Isometric Scale

10. Loci - Rectification of Arcs, Involutes & Cycloids (02 hours)

- Involutes and applications, Involute of a circle
- Cycloids and applications

11. Helix and Mechanisms (01 hours)

- Helix and applications
- Locus of a point on a moving mechanism and profile of safety guard for a mechanism

12. True Lengths & Inclinations (01 hour)

- Point and Line in space
- True length of a line and inclination to Vertical Plane and Horizontal Plane

13. Developments (02 hours)

- Use and applications of Developments
- Developments be the following methods
  - - Parallel line method
  - - Radial line method
  - - Triangulation method

14. Interpenetration Curves (02 hours)

- Interpenetration Curves
- Interpenetration line of two plane surfaces – two prisms
- Construct Interpenetration Curves: Cylinder to Cylinder, Cone and Cylinder, Cone and Plane, Cone and Sphere, Sphere and Plane, Machine Parts

<u>List of Practicals</u> (Drawing Office Practice): (90 hours)

Machine Drawing

1. Solids 1
2. Solids 2
3. Bracket
4. Bearing
5. Bearing Bracket
6. Steering Gear Bracket
7. Column Bearing
8. Carburetor Body
9. Disc Crank
10. Plummer Block
11. G Clamp
12. Machine Vice
13. Cross Head for a Vertical Steam Engine
14. Gate Valve

Graphics

15. Conics
16. Ellipse
17. Isometric Views
18. Loci
19. Helix & Mechanisms
20. True Lengths & Inclinations
21. Developments
22. Interpenetration Curves

Recommended Text Books :

1. Sri Lanka Standard 409: 1977 Engineering Drawing Practice
2. Technical Drawing; A Yardwood
3. Technical Drawing for G.C.E. & C.S.E ; J N Green
4. Engineering Drawing I with worked examples ; F Pickup & M A Parker
5. Engineering Drawing II with worked examples ; F Pickup & M A Parker
6. Engineering Drawing Volume I; K R Gopalakrishna
7. Engineering Drawing Volume II; K R Gopalakrishna
8. Engineering Drawing with Problems & Solutions; K R Hart
9. Engineering Drawing for Technicians Volume 1; O Ostrowsky
10. Engineering Drawing for Technicians Volume 2; O Ostrowsky
11. Engineering Drawing with CAD Applications; O Ostrowsky

9. DME 104 Workshop Technology I

Subject Code : DME 103			Division : Mech. Eng. Tech. & Maritime Studies		
Title : Workshop Technology I					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
30	**-**	**90**	**1**	**-**	**3**
Method of Assessment :- 3 Hour Question Paper & Continuous Assessments					

General Objectives

On completion of this module, students will be able to;

- understand the fundamentals of workshop theory and practice
- describe and appreciate the methods of production and properties of engineering materials
- gain skills and experience in handling machine tools and carrying out metal cutting and welding operations

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Introduction to Workshop Technology	01	-
2.	Safety	01	-
3.	Engineering Materials	04	-
4.	Production of Pig Iron, Cast Iron and Steels	04	-
5.	Mechanical Properties of Materials	04	-
6.	Heat Treatment of Metals	04	-
7.	Classification of Manufacturing Processes	02	-
8.	Metal Cutting	03	-
9.	Screw Threads	01	-
10.	Machine Tools	04	-
11.	Joining of Materials	02	-
12.	Carpentry and Joinery	-	21
13.	Sheet Metal, Welding and Smithy	-	21
14.	Machining	-	24
15.	Fitting	-	24
	Total	**30**	**90**

Note:- Engineering Safety will be covered in relevant practical classes.

Summary Syllabus

1. **Introduction to Workshop Technology and Practice (01 hour)**
   - Techniques of manufacturing
2. **Safety (01 hour)**
   - Causes of accidents, precautions to be taken and safety practices
3. **Introduction to Engineering Materials (04 hours)**
   - Metals, non-metals, composites and their applications
   - Ferrous metals : Cast iron, plain carbon steels, alloy steels
   - Non-ferrous metals and alloys
4. **Production of Pig Iron, Cast Iron and Steels (04 hours)**
   - Constructional details and operation of Blast furnace, Cupola, Electric arc furnace and other common furnaces
5. **Mechanical Properties of Materials (04 hours)**
   - Tensile, compressive and shear forces
   - Elasticity, plasticity, malleability, ductility, hardness, brittleness and toughness
   - Stress – strain curve, ultimate tensile strength, yield strength.
6. **Heat Treatment of Metals (04 hours)**
   - Iron – carbon diagram
   - Heat treatment and surface treatment processes of metals
7. **Classification of Manufacturing Processes (02 hours)**
   - Classification of manufacturing processes
   - Casting, forging, bending, rolling, drawing, extruding and shaping by cutting
8. **Metal Cutting (03 hours)**
   - Cutting tool materials, characteristics of cutting tools, cutting tool geometry, tool life, machinability
   - Gas and electric arc cutting processes
9. **Screw Threads (01 hour)**
   - Elements, forms, uses, production and thread cutting calculations.
   - Types and uses of tapers and production methods.
10. **Introduction to Machine Tools (04 hours)**
    - Lathe and classification of lathes, components and their functions
    - Holding and supporting the work piece and the cutting tool
    - Grinding machines, abrasives, bond types and wheel classification.
    - Drilling machines, drills and drilling operations.
11. **Joining of Materials (02 hours)**
    - Joining by deformation
    - Soldering, Brazing and Welding
    - Adhesives

List of Practicals : (90 hours)

1. Carpentry & Joints
   - Construction of ten different joints

2. Sheet Metal, Welding, Smithy and Casting
   - Construction of Funnel and Gauge
   - Arc and Gas welding practices
   - Construction of Chisel and Mild Steel Ring

3. Machining
   - Turning, Thread cutting, Taper Turning and Knurling

4. Fitting
   - Construction of a Cube, Nut & Bolts

Recommended Text Books :

1. Workshop Technology Part I, Part II and Part III; W A Chapman
2. Production Technology , Processes Materials and Planning; W Bolton

10. DMR 101 Marine Engineering Knowledge

Subject Code : DMR 101		Division: Mech. Eng. Tech. & Maritime Studies			
Title : Marine Engineering Knowledge					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practical**
120	**-**	**-**	**4**	**-**	**-**
Method of Assessment :- 3 Hour Question Paper					

General Objectives

On completion of this module the students will be able to demonstrate basic level of knowledge related to:

- different types of ship and their construction.
- construction, operation, maintenance and troubleshooting of marine machinery on board ships.

No.	Subject Outline	Lecture (hr.)	Practicals (hr.)
1	Ship Types	04	-
2	Ship Terms	04	-
3	Ship Parts	06	-
4	Prime Movers	04	-
5	Engine Room Layout	04	-
6	Auxiliaries and Systems	16	-
7	Marine Boilers	16	-
8	Steam Turbines	04	-
9	Internal Combustion Engines	16	-
10	Power Generators	02	-
11	Air Compressors	04	-
12	Thrust Block	02	-
13	Refrigeration and Air Conditioning	10	-
14	Steering Gears	08	-
15	Fire Fighting	14	-
16	Main Deck Machinery	02	-
17	Instruments and Instrumentation	04	-
	Total	**120**	**-**

Summary Syllabus

1. Ship Types (04 hours)

- Categorisation of ships according to their function and their specific features, Passenger vessels, Cargo liners, Cargo tramps, Oil tankers, Bulk/Ore carriers, OBO carriers, Colliers, Container vessels, Liquified gas carriers, Ro-Ro vessels, LASH vessels
- Essential requirements of ships

2. Ship Terms (04 hours)

- Basic ship terms
  - LOA, FP, AP, LBP, Amidships, Midship section, B mld., B ext., D mld., D ext., d mld., d ext., Displacement, Deadweight, Gross and net tonnage, Freeboard, Load lines,
- Classification societies,
- Surveys,
- Trim, Heel.

3. Ship Parts (06 hours)

- Main parts of a ship, their functions and locations
  - Hull, shell plating, keel, frames, deck plating, double bottom, deep tank, bulkheads, fore peak, after peak, chain locker, hatchway, super structures, shaft tunnel, stern frame, rudder, propeller, stern tube, steering gear, lifeboats, anchor.

4. Prime Movers (04 hours)

- Types of system used for ship propulsion
  - Steam reciprocating engines, steam turbines, diesel engines, diesel-electric drives, gas turbines, turbo-electric drives, nuclear powered systems.
  - Main features of the different propulsion systems and their advantages and disadvantages.

5. Engine Room Layout (04 hours)

- Main equipment and machinery in the engine room
  - Location of these items in the engine room and their function

6. Auxiliaries and Systems (16 hours)

- Systems for main engine operation
  - Different systems supporting the prime mover, their functions and operation
  - Fuel oil system, lub oil system, starting air system, engine cooling system, feed system (steam plants)
- Auxiliary Systems
  - Auxiliary systems on board ships their functions and operation
  - Electrical power system, steering gear system, bilge and ballast systems, deck wash and sanitary water system, drinking water system.
- Filters, Strainers and Centrifuges
  - Different types of filters and strainers, their constructional details, functions and operating principles
  - Operating principle and operating procedure of centrifugal purifiers
- Heat Exchangers
  - Types of heat exchanger used in ships, their constructional details, operating principles, maintenance procedures and their relative advantages

- Valves
  - Types of valves and cocks used on board ships and their methods of operation
  - Why and where these valves are used on board.
  - Arrangement of valves for Deep Tanks, Fire Main, Bilge Suction Valve Chest.
  - Valves fitted to Main Bilge Injection purposes.
  - Oil and Water Filling Arrangement for D.B. Tanks.
- Pumping and Transferring
  - Pumping and Transferring systems in a vessel
- Safety Precautions when Entering a Tank
  - Recommendations applied when entering an enclosed space
  - Gas Free Certificate
- Pipes, Joints and Fastenings
  - Important aspects of piping systems on board, methods of piping joints, problems encountered and maintenance procedures.
- Packing and Jointing
  - Function and application of packings and jointings, types of material used and the procedures of replacing them.

7. Marine Boilers (16 hours)

- Construction and operation of a Smoke Tube Boilers
- Construction and operation of Water Tube Boilers
- Functions, constructional details and operation of Boiler Mountings
- Constructional details and operation of Boiler Feed water Systems

8. Steam Turbines (04 hours)

- Describe the operation and construction of Impulse, Reaction and Astern Turbines
- Function and construction of Reduction Gears in a turbine installation.
- Lubrication system of a turbine installation

9. Internal Combustion Engines (16 hours)

- 4-stroke cycle and 2-stroke cycle diesel engines
- Valve timing diagram of a 4-stroke cycle engine
- Scavenging methods of 2-stroke cycle engines
- Slow, Medium and High Speed Engines
- Combustion of Fuel in Diesel Engines
- Air Starting System
- Constructional Details of Diesel Engines

10. Power Generators (02 hours)

- Functions and operation of power generators on board ships

11. Air Compressors (04 hours)

- Functions, constructional details, operating principle and maintenance of air compressors on board ships

12. Thrust Block (02 hours)

- Functions, constructional details, operating principle and maintenance of thrust block on board ships.

13. Refrigeration and Air Conditioning (10 hours)

- Vapour compression Cycle of a refrigeration system.
- Cooling Methods, type and the properties of Refrigerants
- Typical provision room system
- Construction and operation of Central Type Air Conditioners
- Construction and operation of Window Type Air Conditioners

14. Steering Gears (08 hours)

- Terms used in Steering Gear System, various components of a steering gear system, different types of steering control systems

15. Fire Fighting (14 hours)

- Types & Causes of Fires
- Fire extinguishing methods
- Methods used for Detection & Prevention of Fires.
- Appliances used in Fire Fighting systems.

16. Main Deck Machinery (02 hours)

- Functions of major deck machinery on board ships, their methods of operation and safety precautions to be taken.

17. Instruments and Instrumentation (04 hours)

- Purpose / function of various instruments used on board ships and their methods of operation.

<u>Recommended Text Books</u> :

1. Marine Internal Combustion Engines; Butterworth.
2. Red Book, Vol. 1; Paferson.
3. General Engineering Knowledge; Reed Series, Vol. 8.

11. DME 206 Mechanical Engineering Technology

Subject Code : DME 206		Division : Mech. Eng. Tech. & Maritime Studies			
Title : Mechanical Engineering Technology					
Annual Workload			Weekly Workload		
Lectures	Tutorials	Practicals	Lectures	Tutorials	Practicals
60	60	45	2	2	3/2
Method of Assessment :- 3 Hour Question Paper & Course Work					

General Objectives

Section A - Engineering Mechanics
On completion of this subject the students should have a sufficient theoretical knowledge in Mechanical Engineering components in Machinery.

Section B - Thermodynamics
On completion of this subject the students will gain a knowledge of practical applications of thermodynamic systems.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	**Engineering Mechanics** Mechanisms	05	06
2.	Turning Moment Diagrams	03	-
3.	Friction	06	06
4.	Balancing of Rotors	03	03
5.	Gear Drives	05	-
6.	Vibration	05	06
7.	Governors	02	-
8.	Cams	01	-
9.	**Thermodynamics** Steam Power Cycles	06	09
10.	Refrigeration	04	03
11.	Air Compressors	04	06
12.	Internal Combustion Engines	03	06
13.	Gas Turbine	04	-
14.	Heat Transfer	04	-
15.	Steam Turbine	05	-
	Total	**60**	**45**

Summary Syllabus

Section A – Engineering Mechanics

1. Mechanisms (05 hours)

Introduction to machine elements
Classification of pairing
Degrees of freedom and definition of mechanisms/ Grubler's equation
Kinematics of plane Mechanisms
- Instantaneous center of rotation method
- Velocity diagram method
- Acceleration diagram method
- Analytical method

Kinetics of plane Mechanisms
- Estimation of loads on elements including inertia effects

2. Turning Moment Diagram and Flywheel (03 hours)

Introduction to turning moment diagram.
Engine torque, load torque and accelerating torque in a simple drive
Cyclic fluctuation of speed , work done and work absorbed per cycle, mean speed, coefficient of fluctuation of speed and energy.
Moment of inertia of flywheel and design of fly wheel.

3. Friction (06 hours)

Screw friction
- Friction formulae for square and 'v' threads and applications
- Efficiency and maximum efficiency of a screw thread.

Clutches
- Introduction to clutches.
- Plate clutches, cone clutches, and centrifugal clutches under uniform wear and uniform pressure condition.

Belt Drives
- Frictional formulae for flat and 'v' belts
- Power transmission via belts
- Centrifugal tension, initial tension, creep and slip
- Band brakes and applications.

4. Balancing of Rotors (03 hours)

Introduction to balancing of rigid rotors
Static and dynamic balancing of rigid rotors.
Force and couple polygon method
Resolution method and applications.

5. Gear Drives (05 hours)

Introduction to gear drives.
Types of gears, Gearing between parallel shafts, external and internal gearing.
Basic definition and equations (Pitch circles, pitch point, circular pitch, and module pitch.)
Speed- torque relationship, power equation and efficiency in gear trains.
Introduction to Epi-cyclic gearing.
- Rotation table method and angular velocity method for determining speed ratios.
- Acceleration of gears, equivalent moment of inertia and determination of torque.

6. Vibrations (05 hours)

Introduction to vibration.
Equivalent mass, equivalent stiffness and damping.
Natural vibration of one- degree of freedom systems.

- Un damped vibration
- Viscous damped vibration
- Analytical solutions and the corresponding phase-plane diagrams.

Forced vibration of viscous damped one-degree of freedom system for harmonic excitation, dynamic magnification, and transmissibility.
Response of viscous damped one- degree of freedom system for ground vibration
Free vibration of two degree of freedom un-damped and damped systems.
Torsional vibration.

7. Governors (02 hours)

Function of a governor.
Comparison between function of a fly wheel and a governor.
Classification of governors and types of governors.

8. Cams (01 hour)

Function of a cam.
Classification of cams and followers

Section B - Thermodynamics

9. Steam Power Cycles (06 hours)

Introduction to Steam Power Plant
Revision of Carnot Cycle
Rankine Cycle and Rankine Cycle with super heated steam
Reheat Cycle
Regenerative Cycle

10. Refrigeration (10 hours)

Reversed Heat Engine
Vapour Compression Refrigeration

- Ideal cycle, Refrigerating load, Compressor work and Coefficient of performance
- Modifications to the ideal cycle
- Use of flash chamber and Multi-stage compression

Introduction to Absorption Refrigerators

11. Air Compressors (04 hours)

Introduction to Positive Displacement Compressors
Single Stage Reciprocating Air Compressors
- Indicated work done, shaft work, mechanical efficiency and input power
- Isothermal compression & isothermal efficiency
- Reciprocating compressors including clearance
- Volumetric efficiency

Multi-Stage Air Compressors with Complete Inter-cooling
- Ideal intermediate pressure
- Minimum work condition

Introduction to Rotary Air Compressors

12. Internal Combustion Engines (03 hours)

Introduction to Reciprocating IC Engines
Four Stroke Cycle & Two Stroke Cycle
Criteria of Performance
- Indicated power, Brake power. Friction power & Mechanical efficiency
- Brake mean effective pressure, Thermal efficiency & Fuel consumption
- Volumetric efficiency

Comparison of Real Cycles with the Air Standard Cycle

13. Gas Turbine (04 hours)

Practical Gas Turbine Cycle
- Net work output, Thermal efficiency, Work ratio & Isentropic efficiency

Practical Gas Turbine Cycle with High Pressure and Low Pressure Turbines
Modifications to Basic Cycle
- Inter-cooling, Reheating & Heat exchangers

14. Heat Transfer (04 hours)

Basic Methods of Heat Transfer
Fourier's Law of Conduction
Newton's Law of Cooling
Steady State Heat Flow through Composite Wall, Cylinder & Sphere
Introduction to Convection & Radiation

15. Steam Turbine (05 hours)

Classification of Axial Flow Turbines
- Impulse turbines
- Impulse-reaction turbines

Simple Impulse Turbine
- Velocity diagram
- Stage Efficiency

Effects of Pressure Compounding and Velocity Compounding in Impulse Turbine
Impulse Reaction Turbine
- Velocity diagram
- Stage Efficiency

Losses in Steam Turbines
- Friction losses
- Leakage losses

List of Practicals; (45 hours)

Engineering Mechanics

1. Hook'S Joint
2. Static and Dynamic Balancing
3. Linear Vibration
4. Damped Oscillations of a Liquid column
5. Equivalent Moment of Inertia

Thermodynamics

1. Load Test on Perkins Diesel Engine
2. Trial on Steam Turbine
3. Trial on Coheran Boiler
4. Valve Timing
5. Calibration of Indicator Spring Mechanism
6. Refrigeration Apparatus

Recommended Text Books :

Engineering Mechanics

1. Mechanics of Machines - Elementary Theory and Examples; J Hannah & R C Stephen
2. Mechanics of Machines - Advanced Theory and Examples; J Hannah & R C Stephen
3. Theory of Machines; W.G. Green
4. Theory of Machines; P L Ballaney
5. A Text Book of Applied Mechanics; R S Khurmi
6. Theory of Machines; R.S. Khurmi & Gupta
7. Applied Mechanics; J.Hannah & M. J Miller
8. Mechanics of Machines; G H Ryder & M D Bennett
9. Mechanical Technology; D H Bacon & R C Stephen
10. Solution of Problems in Theory of Machines – S Anvoner

Thermodynamics

1. Applied Thermodynamics for Engineering Technologists - S.I.Units; T P Eastop A. McConkey, Longman, ISBN No.:0 582 44197-8
2. Engineering Thermodynamics – Work and Heat Transfer; G F C Rogers, Y R Mathew, ELBS, ISBN No.:0 582 05376 5

12. DME 209 Workshop Technology II

Subject Code : DME 209		Division : Mechanical Engineering Technology & Maritime Studies			
Title :- Workshop Technology II					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**-**	**120**	**2**	**-**	**4**
Method of Assessment :- 3 Hour Question Paper & Course Work					

General Objectives

On the completion of this module the student will be able to:

- understand the fundamentals of workshop theory and practice.
- describe and adopt the methods of production and properties of engineering materials.
- gain skills and experience in handling machine tools and carrying out metal cutting and welding operations.

No	Subject Outline	Lecture (hr.)	Practical (hr.)
01	Process of Metal Cutting	06	32
02	Machinability	04	40
03	Process Capability of Machine Tools	10	
04	Testing and Maintenance of Machine Tools	04	
05	Welding and Weldability	06	16
06	Cold and Hot Working of Metals	10	12
07	Moulding and Casting	06	08
08	Heat Treatment of Metals	04	04
09	Corrosion Preventive Methods	02	-
10	Measurements	02	04
11	Limits, Fits, Tolerances and Gauges	06	04
	Total	**60**	**120**

Summary Syllabus

1. Process of Metal Cutting (06 hours)

Chip removal processes and principals of cutting metal.
Metal cutting machines.
Machine diagrams (vector).
Cutting tools
Introduction to mechanics of metal cutting.

2. Machinability (04 hours)

Machining parameters.
Rotary primary cutting.
Reciprocating primary cutting.
Grinding.

3. Process Capability of Machine Tools (10 hours)

Capstan, Turret and Auto lathe.
C.N.C. machines.

4. Testing and Maintenance of Machine Tools (04 hours)

Lubrication and lubricants.
Cutting fluids.
Preventive and corrective maintenance.

5. Welding and Weldability (06 hours)

Metallurgical problems of welding ferrous and non ferrous metals.
Destructive and non destructive tests of welding

6. Cold and Hot Working of Metals (10 hours)

Cold working and its effects on the structure of mechanical properties of metal.
Hot working and its effects on the structure of mechanical properties of metal.

7. Moulding and Casting (06 hours)

Pattern making.
Mould making.
Casting

8. Heat Treatment of Metal (04 hours)

Hardening, tempering, annealing and normalizing.
Surface treatment.
Treatment of non ferrous metals.

9. Corrosion Preventive Methods (02 hours)

Galvanizing.
Tinning etc.

10. Measurements (02 hours)

Introduction.
Linear
Slip gauges.

11. Limits, Fits, Tolerances and Gauges (06 hours)

Limits, fits and tolerances.
Gauges.

List of Practicals: (120 hours)

Hands-on training relevant to the topics

Recommended Text Books:

List to be added

13. DMR 201 Engineering Knowledge (General)

Subject Code : DMR 201		Division : Mech. Eng. Tech. & Maritime Studies			
Title : Engineering Knowledge (General)					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
90	**-**	**15**	**3**	**-**	**3/3**
Method of Assessment :- 03 HourQuestion Paper & Course Work					

General Objective

On completion of this module the students will be able to gather awareness of the construction, operation and maintenance of auxiliary machines used in ships.

No.	Subject Outline	Lectures (hr.)	Practical (hr.)
1.	Introduction to Auxiliary Machinery	01	-
2.	Pumps and Pumping Systems	09	-
3.	Evaporators and Distillers	06	-
4.	Oily Water Separators	06	-
5.	Heat Exchangers	04	-
6.	Steering Gears	09	-
7.	Fuels, Lubricants and Fuel Treatment	09	-
8.	Refrigeration and Air-conditioning	12	-
9.	Steam Boilers, Fuel Atomization and Combustion	04	-
10.	Deck Machinery	09	-
11.	Boiler Water Testing and Treatment	06	-
12.	Fire Fighting & Safety	09	-
13.	Propellers & Shafting	06	-
	Laboratory Practicals		30
	Total	**90**	**30**

Summary Syllabus

1. **Introduction to Auxiliary Machinery (01 hours)**
2. **Pumps and Pumping systems (09 hours)**

   Principles
   Types of pumps, Pump operation
   Maintenance and troubleshooting of pumps.

3. **Evaporators and Distillers (06 hours)**

   Boiling evaporators
   Flash Evaporators,
   Heat recovery evaporator
   Multiple effect evaporation
   Distillation
   Drinking water
   Control of water density and scale
   RO Plants

4. **Oily Water Separators (06 hours)**

   Principles.
   Oily water separators with automatic system
   Safety
   Defection systems

5. **Heat Exchangers (04 hours)**

   Shell and tube type
   Plate type Heat exchanger
   Repair & Maintenance

6. **Steering Gears (09 hours)**

   IMO Requirements
   Steering gear principles
   Steering gear hydraulic control system
   Steering gear electric control
   Hydraulic power operated rudder systems
   Hydraulic power rotary pumps
   Electric steering systems
   Emergency steering

7. **Fuels, Lubricants and Fuel Treatment (09 hours)**

   Friction
   Introduction to fuel and lubricants
   Refining process
   Properties of fuels
   Type of fuels
   Combustion of fuels
   Purifiers and clarifiers
   Types of lubricants
   Handling of fuels and lubricants
   Type of filters
   Additives, coagulants and sludge conditioners

8. Refrigeration and Air-conditioning (12 hours)

Principles of refrigeration.
Refrigerating compressors.
Refrigerating system components
Refrigerating system operation
Brine cooling system
Cold storage spaces.
Air Conditioning
Air Conditioning Systems for Accommodation,
General Operation and Maintenance

9. Steam Boilers, Fuel atomization and Combustion (04 hours)

Pressure jet burner
Atomization of fuel
Combustion air registers
Fuel oil supply system

10. Deck Machinery (09 hours)

Anchor Handling Equipment
Cargo Handling Equipment
Hand and Hydraulically Operated Watertight Doors
Life boats and davits

11. Boiler Water Testing and Treatment (06 hours)

Acidity / Alkalinity / Chlorinity
Corrosion
Water testing and treatment

12. Fire Fighting and Safety (09 hours)

Portable Extinguishers
Extinguishing agents and Fire fighting methods
Fixed Installations
Application
Emergency Procedures
Safety Equipment

13. Propellers and Shafting (06 hrs)

- Types of Propellers
- Controllable pitch propellers
- Stern tubes; Water lubricated, Oil lubricated
- Shafting systems
- Defects of propellers
- Repair and maintenance of propellers

List of Practicals: (30 hours)

1. Introduction to Tools and Equipment
2. Pumps
3. Purifiers
4. Telescopic Gland and Heat Exchangers
5. Thrust Block
6. Calibration to the Temperature Transducer
7. Inclining Experiment and Stability
8. Calibration of Three Term Pneumatic Controller

Recommended Text Books :

1. Marine Auxiliaries; Professor Daas Gupta
2. Marine Auxiliaries; Butterworth

14. DMR 202 Engineering Knowledge (Motor)

Subject Code : DMR 202		Division : Mechanical Engineering Technology & Maritime Studies			
Engineering Knowledge (Motor)					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**30**	**2**	**1**	**3/3**
Method of Assessment :- 3 Hour Question Paper & Course Work					

General Objectives

On the completion of this module students will be able to possess the knowledge with regard to the running and operation of Marine Diesel Engines.

No	Subject Outline	Lecture (hr.)	Practical (hr.)
01.	Engine Types	02	-
02.	Large Bore Two Stroke Cycle Engines	10	-
03.	Diesel Fuel Atomization	03	09
04.	Medium and High Speed Engines (four stroke) Diesel Engines	10	06
05.	Engine Systems	12	09
06.	Operation and Maintenance of Engines	12	-
07.	Auxiliary Boiler	03	-
08.	Constructional Details of Reciprocating Compressors	03	-
09.	Compressor Operation and Maintenance	03	-
10.	Air Distribution	02	06
	Total	**60**	**30**

Summary Syllabus

1. Engine Types (02 hours)

Engines categorized by bore and rotational speed
Large bore slow speed engines with cross head connected to propeller
Smaller bore medium and high speed engines depending on their use directly coupled to generator or indirectly coupled via gearbox to propeller.

2. Large Bore (Two Stroke) Engine Details (10 hours)

Construction and principal components of an engine
Piston cooling arrangement
Engine bedplate, main-bearing and tie bolt housing
Valves, their principle parts, materials and methods of operation
Work clearance of bearings and sliding surfaces, and interference fits, where applicable.
Distribution of oil to the guides , top end, bottom end, and main bearings when pistons are cooled by oil and when they are cooled by water.

3. Diesel Fuel Atomization (03 hours)

Injector Nozzle Assembly and its function
Atomization, turbulence and penetration (Impingement)
Care necessary for injector nozzle holes

4. Medium and High Speed Engines (four stroke) Diesel Engines (10 hours)

Services for which auxiliary diesel engines are used
Constructional details and materials used in the manufacture of engine components
Principal features of a typical " v " type medium speed diesel engine.
Purpose of guards over moving machinery
Importance of maintaining above items in good condition

5. Engine Systems (12 hours)

Filters, heaters, coolers, pumps, valves, drains, air bleeds etc. and arrows to indicate flow.
Typical systems of the following - diesel and heavy fuel, Lubricating oil, piston cooling water and oil, Jacket cooling water, fuel valve cooling, starting air, scavenge combustion air and exhaust passage.
Normal operating limits
Air reservoir and connections, typical pressures and safety devices incorporated and safe guards against explosions in starting air lines.
Sheathing fuel injection lines
Importance of lagging and /or sheathing hot surfaces

6. Operation and Maintenance of Engines (12 hours)

Turning gear usage and interlock, safety checks necessary before using turning gear
How an engine is: prepared for starting, started and stopped
Reversing when maneuvering and at full speed.
How output speed and power are controlled for normal requirements
How engine over speed is prevented
How dangerous mist occurs in the crankcase, detection equipment and action to be taken when alarm sounds, maintenance of the equipment to ensure good working order.

Normal exhaust temperatures at cylinder outlet,
Typical temperatures of exhaust gas at inlet and outlet of turbocharger
Importance of keeping scavenge air spaces or supercharged are spaces drained and cleaned.
Scavenge fire, how to detect it and what action to take in case of a fire in the scavenge space.
Turbocharger surge, what causes it and what action to be taken
Importance of keeping Exhaust trunk cleaned when waste gas heater is being used and dangers that may arise if neglected.
Maintenance

7. Auxiliary Boiler (03 hours)

Automatic operation
Preparing the boiler for survey
Setting of safety valve after the survey

8. Constructional Details of Reciprocating Compressors (03 hours)

Two-stage reciprocating air compressor, main components and the materials used

9. Compressor Operation (03 hours)

- Cylinder lubrication, cylinder lubricating oil
- Correct and safe operation
- Attention required to keep the intake air filter working effectively
- Reason for fitting drain valves after air coolers
- Starting up and stopping procedures
- Principles upon which air compressors are run automatically
- Quality required for compressed air to be used in control systems
- How the required quality in the above objective is achieved
- Purpose of relief valves, fusible plugs, water–space pressure relief facility

10. Storage of Compressed Air (03 hrs)

Air storage tanks or reservoirs and rules relating to the construction of such vessels
Steel from which air storage tanks are made
Form of construction of an air reservoir
Important mountings on the shell of an air storage tank
Use of the drain valves
Regularly inspect/examine the interior surface for indications of corrosion or other deterioration
Examination of all internal surfaces
How excessive internal pressure is avoided, i.e. by fitting to the shell spring loaded relief valves, bursting discs, fusible plugs

11. Air Distribution (02 hours)

Pressure reducing valve
Relief valve
How moisture is removed from the filters in a distribution system

List of Practicals: (30 hours)

1. Fuel Injectors
2. Fuel Pumps
3. Engine Test Bed
4. Overhaul and Inspection of Trunk Piston Engine
5. Cylinder Head and Valve Timing
6. Overhaul of Valves and Fittings
7. Air Starting Valve

Recommended Text Books:

List to be added

15. DMR 203 Instrumentation and Control Systems

Subject Code : DMR 203		Division : MET & Maritime Studies			
Title :- Instrumentation and Control Systems					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**-**	**-**	**2**	**-**	**-**
Method of Assessment :- 3 Hour Question Paper					

General Objectives

On the completion of this module the student will be able to possess a knowledge of Instrumentation and Controls for use on board ships and in industry.

No	Subject Outline	Lecture (hr.)	Practicals (hr.)
01	Introduction	02	-
02	Measurement of Temperature	02	-
03	Measurement of Pressure	02	-
04	Measurement of Level	02	-
05	Measurement of Flow.	02	-
06	General Measurement of Processes	08	-
07	Transmission of Signals - Transmitters	06	-
08	Transmission of Signals - Receivers	06	-
09	Control Theory	10	-
10	Control Circuits- examples	08	-
11	Monitoring Systems	02	-
12	Remote Control of Diesel Engines	08	-
13	Air Supply	02	-
	Total	**60**	**00**

Summary Syllabus

1. Introduction (02 hours)

Role and importance of instrumentation and control systems in modern ships

2. Measurements of Temperature (02 hours)

Mechanical
- thermometers, pyrometers
- temperature range, fluids used
- features of mercury in steel, vapour-pressure, gas filled thermometers
- principal features of a bimetallic thermometer

Electrical
- range and accuracy variation according to the material used in the detecting element
- resistance type measuring instrument based on the Wheatstone bridge
- characteristics of a thermistor and the conditions for which it is suitable
- thermocouples
- optical pyrometers

3. Measurement of Pressure (02 hours)

Principle features of;
- manometers (simple water, wide cistern or well, inclined tube and mercury type)
- pressure gauges (Bourdon, diaphragm sealed gauge and Schaffer)
- twin bellows differential pressure cell
- strain gauge

Testing of pressure gauges on board ship, test pressure pump

Calibration curve for a bourdon pressure gauge
- zero adjustment
- multiplication adjustment
- angularity adjustment

4. Measurement of Levels (02 hours)

Direct Methods
- principle of a float operated level measuring device
- principle of a probe element
- displacement gauge

Inferential methods
- principle of inferential methods
- level sensor based on immersed resistors
- level indicator based on a bubbler system
- pneumercator gauge

5. Measurement of Flow (02 hours)

Quantity meter and rate of flow meter
- function of the two elements of a flow meter

Relationship between velocity of a fluid and its pressure difference

Principal feature of
- rotormeter
- electrical flow meter
- rotameter

Orifice and a venturi, the direction of flow and the pressure measuring points

Manometer as a square root extractor when measuring the pressure difference in an orifice or Venturi

Extraction of a square root accomplished pneumatically and electrically

6. General Measurement of Processes (08 hours)

Principle of a tachometer
Principle of a.c. and d.c. electric tachometer
Principle of a torque meter based on the effect of stress in a magnetic field
Principal feature of a viscometer
Application of a photoelectric cell to oil in water, a smoke density detector, an oil mist detector, a flame detector
Common type of fire detector
Principal features of explosive gas detector, vibration monitor, oxygen analyzer, CO2 analyser, relative humidity meter, salinity measurement, dissolved oxygen meter, PH meter
setting up, testing and maintenance of the measuring devices

7. Transmission of Signals - Transmitters (06 hours)

Function of a transducer
Pneumatic controlling elements
- nozzle and flapper arrangement
- negative feedback and positive feed back
- nozzle flapper arrangement with negative feedback
- function of a force balance transducer
- principal feature of a electro pneumatic transducer

Electrical controlling elements
- Wheatstone bridge as a transducer
- variable inductance transducer
- variable capacitance transducer
- electronic force balance system
- voltage current transducer

8. Transmission of Signals - Receivers (06 hours)

Principle features of pneumatic receiver integrator, potentiometric pen recorder
Function of the X- Y recorder
Principle of ac and dc position motors
Pneumatic controlling elements
- **f**inal controlling element operated pneumatically, hydraulically, electrically
- diaphragm operated control valve
- characteristics of a motor element and the correcting element
- flow characteristics and applications of mitre valve, vee ported valves
- turn down ratio
- positioner, piston actuators, butterfly valves
- wax element temperature control valve and its temperature range.

Electrical Servo Motor
- dc servo motor
- problem of using three phase ac machine as a servo motor
- applications of a two phase ac servo motor and how its characteristic can be varied

Hydraulic Servo Motor
- swash plate pump
- hydraulic ram servomotor

9. Control Theory (10 hours)

Simple control loops, system response, phase lag.
Proportional, integration and derivative including their combinations.
Cascade and split control
Operational amplifier and its uses

10. Control Circuits - Examples (08 hours)

Jacket Cooling, Lube oil , Nozzle Cooling, Fuel Viscosity, Boiler Operation. Purification etc.

11. Remote Control of Diesel Engines (08 hours)

Alarm systems, Routine checks
Principles of alarm scanner and data logger.

12. Air Supply (02 hours)

Arrangement of the air supply circuit and its operation
Purity of the air - Filtering, Water removal and drying

13. Monitoring Systems (02 hours)

Control systems and functions
Communication with bridge and safety aspects
UMS and Bridge control

List of Practicals:

Nil

Recommended Text Books

List to be added

16. DMR 204 Marine Engineering Drawing

Subject Code : DMR 204			Division : Mech. Eng. Tech. & Maritime Studies		
Title :- Marine Engineering Drawing					
Annual Workload			**Weekly Workload**		
Lecture	**Tutorial**	**Practicals**	**Lecture**	**Tutorial**	**Practicals**
30	**-**	**60**	**1**	**-**	**2**
Method of Assessment: - 3 Hour Question Paper & Course Work					

General Objectives

On completion of this module the students will be able to;

- read and understand Engineering Drawings.
- produce Engineering Drawings conforming to Engineering Drawing Standards.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Revision	03	06
2.	Engineering Drawing Practice - Assembly Drawings	13	26
3.	Computer Aided Draughting – 2D	10	20
4.	3D Modelling using AutoCAD	04	08
	Total	**30**	**60**

Summary Syllabus

1. Revision (03 hours)

Engineering Drawing Standards and Symbols
Standards used – SLS 409:1977 – Engineering Drawing Practice and ISO Standards
Types of Line, Lettering , Drawing Standards, Symbols and abbreviations used
Mechanical Devices
Screw threads and fasteners
Locking and retaining devices
Bearings
Seals
Materials
Orthographic Projection
First Angle Projection, Third Angle Projection, labeling of views and standard symbols of projection, dimensioning, sectional views and sectioning, part sectioning, half sections, thin sections, revolved sections, hidden detail.
Representation of specific components / features such as external and internal threads, squares on shafts, serrated and splined shafts, holes on a linear and on a circular pitch, bearings, gears, springs, interrupted views

2. Assembly Drawings (13 hours)

Practice drawing marine engine and machinery components and assemblies
Prepare parts and materials lists

3. Computer Aided Draughting – 2D (10 hours)

Introduction to AutoCAD and drawing setup
Draw and Edit commands
CAD construction techniques – OSNAP, Layers, Grips, Block, Wblock etc.
Orthographic views using AutoCAD
Sectional Views using AutoCAD
Dimensioning an AutoCAD Drawing
Lettering an AutoCAD Drawing
Threads and fasteners on AutoCAD drawing
Adding Tolerances to AutoCAD Drawing
Constructing a set of Working Drawings in AutoCAD
Gears, Bearings and Cams in AutoCAD
Model Space / Paper Space in Printing & Plotting

4. 3D Modelling using AutoCAD (04 hours)

Wireframe, Surface & Solid Modelling Concepts
Surface Modelling tools available in AutoCAD
Solid Modelling tools available in AutoCad
Simple Surface & Solid Models

List of Practicals:

Components and equipments related to Marine machinery & mechanisms should be selected for exercises

Recommended Text Books :

1. Reed's Engineering Drawing for Marine Engineers; H G Beck
2. Engineering Drawing with worked examples 1 and 2; M A Parker
3. Engineering Drawing – pt. 1; S C Sharma
4. Engineering Drawing; A W Boundy
5. Basic Engineering Drawing; R S Rhodes
6. Engineering Drawing with CAD applications; O Ostrowsky

17. DMR 205 Maritime Safety and Law

Subject Code : DMR 205			Division: Mech. Eng. Tech. & Maritime Studies		
Title : Maritime Safety and Law					
Annual Workload			**Weekly Workload**		
Lecture	**Tutorial**	**Practicals**	**Lecture**	**Tutorials**	**Practicals**
30	**-**	**-**	**1**	**-**	**-**
Method of Assessment :- 3 Hrs Question Paper					

General Objectives

On completion of this module the students will be able to demonstrate level of knowledge related to IMO conventions concerning safety of life and property at sea and protection of the marine environment.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1	Introduction to Maritime Law	01	-
2	Role of the National Maritime Administration	02	-
3	Law of the Sea	03	-
4	Main Maritime Conventions	16	-
5	Role of Classification Societies	04	-
6	Types of Surveys and Certifications	04	-
	Total	**30**	**00**

Summary Syllabus

1. Introduction to Maritime Law (01 hour)

Sources of Maritime Law
Organisations concerned with Maritime Law
International Maritime Organisation
- Role of IMO
- Convention ratification

2. Role of the National Maritime Administration (02 hours)

Certification of seafarers
Surveys
Port state control etc

3. Law of the Sea (03 hours)

Conventions on the law of the sea
Territorial sea and the contiguous zone
International straights
Exclusive economic zone and continental shelf
High seas
Protection and preservation of marine environment

4. Main Maritime Conventions (16 hours)

International Convention on Load Lines (LL 1966)
International Convention on Safety of Life at Sea (SOLAS)
- general provisions
- subdivision and stability, machinery and electrical installation
- fire protection, fire detection and fire extinction
- life-saving appliances and arrangements
- radiotelegraphy and radiotelephony
- radiocommunications
- carriage of grain
- carriage of dangerous goods
- International safety management (ISM) code

MARPOL
- oil
- noxious liquid substances in bulk
- harmful substances carried by sea in packaged form
- sewage
- garbage

London Dumping Convention (LDC)

5. Role of Classification Societies (04 hours)

6. Types of Surveys and Certifications (04 hours)

List of Practicals:
Nil

Recommended Text Books:
List to be added

18. DMR 206 Naval Architecture & Ship Construction

Subject Code : DMR 206		Division: Mech. Eng. Tech. & Maritime Studies			
Title : Naval Architecture & Ship Construction					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
120	**-**	**-**	**4**	**-**	**-**
Method of Assessment :- 3 Hour Question Paper					

General Objectives

Naval Architecture

On completion of this module the students will be able to demonstrate level of knowledge related to;

- ship configuration and representation of a ship hull
- calculation of ship particulars and assessment of complete stability of ships at a given loading condition.

Ship Construction

On completion of this module the students will be able to demonstrate level of knowledge related to;

- the constructional details of different types of ship.
- purpose, function and details of major and minor structural items.
- procedures, rules and regulations governing construction and maintenance of ships.

	Subject Outline	Lecture (hr.)	Practical (hr.)
	Naval Archtecture		
2	Coefficient of Forms	03	-
3	Hydrostatics Particulars	09	-
4	Estimation of hydrostatic particulars and Capacities	07	-
5	Initial Stability of Ships	08	-
6	Stability of ships at large angles of heel	08	-
7	Effect of Slack Tanks and Free surface Correction	04	-
8	Trim and Longitudinal Stability	08	-
9	Resistance and Propulsion	06	-
	Total	**60**	**00**

Subject Outline Continues to page 229

	Subject Outline	Lecture (hr.)	Practical (hr.)
	Ship Construction		
2	Ship Stresses	04	-
3	Ship Building Materials	02	-
4	Welding and Cutting Processes	04	-
5	Hull Structure	08	-
6	Bow and Stern	06	-
7	Minor Structural Items	04	-
8	Fittings	04	-
9	Ships Carrying Special Cargoes	04	-
10	Rudder and Propeller	04	-
11	Corrosion and its Prevention	06	-
12	Organisations and Regulations	04	-
13	Load Lines and Draught Marks	04	-
14	Surveys and Maintenance	04	-
	Total	**60**	**00**

Summary Syllabus

1. Hullform and Representation (07 hours)

Lines Plan of a ship -Stations, Waterlines, Profile Plan, Offsets, Body Plan, Waterline Plan, Buttock Planes, Parallel Middle body.

2. Coefficient of Forms (03 hours)

Definitions of block coefficient, Waterplane area coefficient, Midship area coefficient, Prismatic coefficient with appropriate sketches

Estimations of above coefficients for given dimensions

3. Hydrostatics Particulars (09 hours)

Definitions of vertical and longitudinal center of buoyancy (KB and LCB), Centre of floatation (LCF), Tonnes Per Centimeter immersion (TPC) , Metacenter and metacentric height (BM and KM)

Derive expression for KB, BM, and KM of a rectangular barge, Variation between draft and metacentre, minimum metacentric height.

4. Estimation of hydrostatic Particulars and Capacities (07 hours)

Method of integration of ships lines- Trapezoidal rule, Simpson's First, Second and Third rules

Use of Simpson's rules to estimate

- Waterplane area, centre of flotation
- Displacement and KB using waterplane areas
- Displacement and LCB using cross-sectional areas

5. Initial Stability of Ships (08 hours)

Initial metacentre,
Stable, Neutral and Unstable Equilibrium Condition
Minimum Metacentric height according to IMO criterion.
Effect of movement of ship centre of gravity on stability and heel
Effect of suspended mass
Angle of loll and list
Correction of angle of loll and list
$GZ = GM \sin \theta$ for a small angle of heel

6. Stability of Ships at Large Angles of Heel (08 hours)

Definition of righting moment and righting lever.
Cross curves of stability and estimation of GZ from Cross curves
$GZ = KN - KG \sin \theta$
Particulars of GZ curve, maximum GZ, Range and angle at stability vanishes
Effect of movement of centre of gravity on GZ curve
Estimation of GZ curve for different heights of centre of gravity.

7. Effect of Slack Tanks and Free surface Correction (04 hours)

Centre of gravity of a liquid in fully fill tank and partially filled tank.
Movement of centre of gravity of a partially filled tank
Effect upon GM due to change oscillation of centre of gravity of liquid
Free surface correction and estimation of free surface correction
Effect of longitudinal subdivision to reduce the free surface correction.

8. Trim and Longitudinal Stability (08 hours)

Movement of centre of gravity of a ship on longitudinal plane and trimming effect.
Longitudinal Metacentric height and it definition
Moment to Change trim by 1cm (MCTC) and its definition
Trimming Moment and estimation of Trim due to mass movement on longitudinal plane
Trim due mass loading
Trimming moment based on LCG and LCB
Estimation fwd and aft draft at trim condition
Estimation of a loading condition of a ship

9. Resistance and Propulsion (06 hours)

Friction Resistance
Residuary Resistance
Effect of Hullform on resistance
Geometry of a propeller and terminology
Estimation of propeller torque, power and efficiency

Ship Construction

1. Shipyard Practice (02 hours)

Drawing office
Lines drawing
Fabrication
Assembly
Launching

2. Ship Stresses (08 hours)

Forces and moments acting
Sagging and hogging effects
Racking
Panting and pounding
Localized loading
Measurement and analysis of stresses

3. Ship Building Materials (02 hours)

Materials used in ship construction
Standard rolled steel sections

4. Welding and Cutting Processes (04 hours)

Welding processes
Testing of welds
Cutting processes

5. Hull structure (08 hours)

Keel and bottom construction
Framing systems
Shell and deck plating
Bulkheads
Bilge keels

6. Bow and Stern (06 hours)

Constructional details of forward end and after end structure
Functions of various items

7. Minor Structural Items (04 hours)

Shaft tunnel
Deep tanks
Watertight doors

8. Ships carrying special cargoes (04 hours)

Oil tankers
Bulk carriers
Liquefied gas carriers
Container ships

9. Fittings (06 hours)

Hatches and hatch covers
Mooring and anchoring arrangements
Masts, derricks and deck cranes
Sounding pipes, air pipes
Carriage of containers on deck

10. Rudder and propeller (04 hours)

Action of rudder
Rudder types
Constructional details of rudders
Principle of propulsion
Propeller types
Constructional details of propellers
Stern tube and tail shafts

11. Corrosion and its prevention (06 hours)

Corrosion
Corrosion control
Paint systems

12. Organisations and Regulations (04 hours)

Classification societies
IMO
Other organizations and authorities involved in shipping

13. Load Lines and Draught Marks (04 hours)

Freeboard, load line marks
Draughts
Tonnage

14. Surveys and Maintenance (04 hours)

Surveys
Examinations in dry dock

Recommended Text Books :

Naval Architecture

1. Ship Stability for Masters and Mates, Derrett, 4th ed. London Stanford Maritime, 1984.
2. Naval Architecture for Marine Engineers, Stokoe EA, Vol. 4, Reed Publication Ltd.
3. Merchant Ship Stability, Butterworth.

Ship Construction

1. Merchant Ship Construction by DA Taylor
2. Ship Construction by DJ Eyres
3. Ship Construction Sketches and notes by JF Kemp and P Young
4. Reed's Ship Construction for Marine Students by Stokoe and Embleton
5. Ship Design and Construction by AM D'Arcangelo
6. Merchant Ship Construction by HJ Pursey

19. DMR 207 Shipboard Electrical Systems

Subject Code : DMR 207		Division : Mech. Eng. Tech. & Maritime Studies			
Title :- Shipboard Electrical Systems					
Annual Workload			Weekly Workload		
Lectures	Tutorials	Practicals	Lectures	Tutorials	Practicals
30	-	-	1	-	-
Method of Assessment :- 3 Hour Question Paper					

General Objective:

On the completion of this module students will possess the knowledge with regard to the operation and maintenance of Ship Board Electrical Systems commonly found on board merchant ships.

No	Course Outline	Lecture (hr.)	Practical (hr.)
01	Introduction to Shipboard Electrical Systems	08	-
02	Electrical Distribution	06	-
03	Alternators and Main Circuit Breakers	07	-
04	Motors and Starters	04	-
05	Ancillary Electrical Services	03	-
06	Electrical Survey Requirement	01	-
07	Safety and Emergency Procedures	01	-
	Total	**30**	**00**

Summary Syllabus

1. Introduction to Shipboard Electrical Systems (08 hours)

Electrical power supply, range of voltage and frequency
Electrical diagrams, block diagram, system diagram, circuit diagram, wiring diagram
Electrical Safety

2. Electrical Distribution (06 hours)

Distribution scheme – from main switch board to the items of load
Essential and non-essential service
Emergency Power supply
Earth Faults
Transformers
Shore Supply Connection
Fault Protection
Over current, under voltage (for ex. Generator Breakers),
Preference tripping and Reverse power
Fuse Protection
Protection discrimination
Circuit Breakers (CB) Miniature Circuit Breaker (MCB) Fused Isolators
Electric Cables and Cable Glands and Cable Testing

3. Alternators and Main Circuit Breakers (07 hours)

Ac generators
Construction of, rotor field connections, generator cooling and excitation methods
Automatic voltage regulation and parallel running of generators
Emergency generators
Generator maintenance
Main circuit breaker and description

4. Motors and Starters (04 hours)

Electric Motors , Its Construction, Motor Enclosures
The Effect of shaft Load and Motor Rating
Induction Motor, Starting Methods DOL and Star Delta sequence Control
Auto Transformer Starting
Motor Protection
Motor speed control

5. Ancillary Electrical Services (03 hours)

Ship's lighting including navigational and emergency lighting and maintenance,
Galley equipment
Air-conditioning and Refrigeration
Laundry services
Hull protection by impressed current cathodic protection
Battery supplies

6. Electrical Survey Requirement (01 hour)

Main Electrical Survey items
Generators and Governors
Circuit Breakers
Switch Board and Fittings
Cables
Insulation Resistance
Motors and Starters
Emergency power associated equipment
Part of Steering Gear
Navigational Light Indicators
UMS Operation
Tankers

7. Safety and Emergency Procedures (01 hour)

Safety Precaution necessary before repair work commences
Isolation procedure for electrical equipment
Safety and Isolation precautions necessary before commencing work
Purpose of interlocks fitted to circuit breakers
Danger associated with spaces in the vicinity of bus bars
Potential danger of instrument voltage/ current transformer circuits and the safe procedure for working on such circuits
Procedure if fault develops with a miniature circuit breaker
Protection normally provided on the doors of switchboard cubicles.
Safety and emergency procedures documented in the ship's safety management system

Recommended Text Books:

List to be added