National Diploma in Technology

Curriculum

Mechanical 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. DCH 102 Properties of Materials

Subject Code: DCH 102			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Properties of Materials					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**-**	**2**	**1**	**-**
Method of Assessment :- 3 Hour Question Paper					

General Objectives :

On the completion of this module students will be able to understand the structure, behavior and properties of materials in engineering applications.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Crystal Structure	08	-
2.	Phase Equilibria	10	-
3.	Mechanical Properties of Materials	04	-
4.	Electrical Properties of Materials	08	-
5.	Thermal Properties of Materials	03	-
6.	Polymers, Ceramics and Composites	09	-
7.	Treatment of Water	08	-
8.	Corrosion	10	-
	Total	**60**	**00**

Summary Syllabus

1. Crystal Structure (08 hours)

- Crystal systems, Crystal lattices, Unit cells.
- Lattice types of metals, their detailed study.
- Lattice transformation of Iron with temperature.

2. Phase Equilibria (10 hours)

- Definitions: Phase, Component, Degrees of freedom
- One component systems.
- Gibb's Phase rule.
- Two component systems : Alloys, solid solutions, intermetallic compounds
- Iron-Carbon phase diagram.

3. Mechanical Properties of Materials (04 hours)

- Stress Vs. strain curves.
- Creep.
- Fatigue.

4. Electrical Properties of Materials (08 hours)

- Conductivity, Resistivity.
- Conductors, Semiconductors and Insulators: Properties, structure and bonding, band structure.

5. Thermal Properties of Material (03 hours)

- Heat Capacity, Specific Heat, Thermal Conductivity.

6. Polymers, Ceramics and Composites (09 hours)

- Homopolymer, copolymer.
- Thermoplastic polymers
- Thermosetting polymers
- Elastomers
- Their structure and formation.
- Glass transition temperature.
- Degradation of polymers.
- Structure of Ceramics, bonding and related properties.
- Composites : Fibre reinforced, particle reinforced and dispersion strengthened.

7. Treatment of Water (08 hours)

- Impurities present in water.
- Removal of impurities.
- Hard water and Soft water.
- Units used to express hardness of water.
- Removal of hardness.
- Boiler types and importance of blow down.

8. Corrosion (10 hours)

- Difference between an electrolytic cell and an electrochemical cell.
- Direct corrosion
- Indirect corrosion.
- Prevention of corrosion.

List of Practicals: Nil

Recommended Text Books :

1. Elements of Materials Science, 6th Edition; Van Vlack (Addison Wesley)
2. Introductions to Materials Science for Engineers, 4th Edition; Shackleford (Prentice Hall International)
3. The Science of Engineering materials; Smith (Prentice Hall International)
4. Materials Science and Engineering, 4th Edition; Callister (Wiley)

3. DEE 101 Electro Technology

Subject Code : DEE 101			Division : Electrical & Electronic Engineering Technology		
Title : Electro Technology					
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 & Electronics
- develop a basis for specialist studies to undertaken in the 2nd Year.

No	Subject Outlines	Lecture (hr.)	Practical (hr.)
01	**Basic Electricity** Electric Circuits	04	05
02	Fundamental Laws of Electricity	06	05
03	Electric Power & Energy	06	05
04	Electrostatics	04	05
05	Electromagnetic Induction	04	-
06	Alternating Voltages and Currents	06	05
07	Electrical Installations	04	-
08	**Basic Electronics** Semi-Conductor Materials	04	-
09	Transistor and its Applications	08	05
10	Analogue and Digital Systems	08	-
11	Transducers	06	-
	Total	**60**	**30**

Summary Syllabus

Basic Electricity

1. Electric Circuits (04 hours)

- Electricity, DC and AC current
- Conductors, semi conductors and insulators
- Cells, temperature coefficient of resistance

2. Fundamental Laws of Electricity (06 hours)

- Coulomb, Ampere, Volt, Joule and watt
- Ohm's law, resistivity, conductivity and their units
- Series and parallel circuits, Kirchoff's laws
- Ideal source (voltage and current)
- DC distribution systems

3. Electric Power and Energy (06 hours)

- Energy conversion, heating effects of electricity, heat sink and fuses

4. Electrostatics (04 hours)

- Static electricity, Coulombs law, capacitor (parallel plate)
- Charge and voltage, parallel plate capacitor with composite dielectrics
- Parallel/series connected capacitance, Electric force, Electric flux density
- Potential gradient

5. Electromagnetic Induction (04 hours)

- Magnetic field, direction of the field, magnetic flux
- Right hand grip rule/cork screw rule
- Solenoid, toroid, induced emf, Flemming's right hand rule and Lenz's law
- Composite magnetic circuits, B-H curve, Hysterisis laws on magnetic circuits

6. Alternating Voltages and Currents (06 hours)

- Generation of an Alternating emf (single phase)
- Magnetic coil, frequency, speed and no. of pole pairs
- Average, peak and rms values of an ac current
- Rotating vector concept, sinusoidal AC quantities
- Single phase circuits, LRC circuits, phasor diagrams

7. Electrical Installation (04 hours)

- Wiring regulations, Domestic wiring installation ,two way switch, ring circuits, radial circuit of socket outlets

Basic Electronics

8. Semiconductor Materials (04 hours)

- Semiconductor categorization
- n-type and p-type semi conductors
- p-n junction, forward bias and reverse bias
- Diodes characteristics, half /full wave rectification
- Voltage clipping/clamping circuits
- Zener diode

9. Transistor and its Applications (08 hours)

- Transistors types, transistor characteristics
- Biasing & amplification

10. Analogue and Digital Systems (08 hours)

- Analogue circuits, digital circuits, set theory, combinational logics

11. Transducers (06 hours)

- Temperature, pressure and position transducers

List of Practicals: (30 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. Familiarisation of electronic computers
6. Diode applications
7. Transistor characteristics

Recommended Texts :

1. Electrical Fundamentals; John Ryder, Prentice Hall International
2. Electrical Measurements & Measuring Instruments; E W Golding
3. Electronic Principles; Gray & Searle, Wily International Electrical Engineering
4. Electrical Engineering; G Hughes
5. Electrical Technology; H Cotton
6. Electronic Engineering; Schelling & Belove
7. Electronic Circuits; Milman & Haukias
8. Principles of Electronics; JE Holding & MR Garvin
9. Digital Systems; RJ Tocci, Prentice Hall International
10. Pulse & Digital Circuits; Milman & Taub, Mcgraw Hill
11. 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

07. 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.

08. DME 102 Automobile Technology

Subject Code: DME 102			Division : Mech. Eng. Tech. & Maritime Studies		
Title : Automobile Engineering					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
1 x 30	**-**	**3/2 x 30**	**1**	**-**	**3/2**
Method of Assessment :- 3 Hour Question Paper & Course Works					

General Objectives

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

- understand the construction of the basic components of a motor vehicle
- describe the operation of main components and systems of a motor vehicle
- diagnose and rectify simple defects of a motor vehicle.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Introduction to Basic Components of a Motor Vehicle	02	-
2.	Construction and Operation of Engines	02	06
3.	Lubrication Systems	02	03
4.	Fuel System – Petrol Engine	02	06
5.	Fuel System – Diesel Engine	02	06
6.	Ignition System	02	03
7.	Starting System	02	-
8.	Transmission System	04	06
9.	Braking System	03	03
10.	Steering System	03	03
11.	Electrical System	03	03
12.	Cooling System	01	02
13.	Fault Findings	02	04
	Total	**30**	**45**

Summary Syllabus

1. Introduction to Basic Components of an Automobile (02 hours)

- Layout of an automobile
- Constructional features and their features

2. Construction and Operation of Engines (02 hours)

- Types of automobile engines:
  - 4-stroke petrol / diesel engines
  - 2-stroke petrol / diesel engines
- Combustion process of Engines
- Main components of an automobile engine
- Operating principles of main components

3. Lubrication Systems (02 hours)

- Lubricants and their types
- Lubricating systems, their functions and working principle
- Maintenance and common defects

4. Fuel System – Petrol Engine (02 hours)

- Main Components of the fuel system of a petrol engine; Petrol tank, Petrol filter, Fuel pump, Carburetor, Air cleaner
- Carburetion and Carburetors
- Constructional details and operation of the components
- Maintenance and common defects

5. Fuel System – Diesel Engine (02 hours)

- Main Components of the fuel system of a diesel engine; Diesel tank, Diesel filter, Fuel feed pump, Fuel injection pump, Fuel Injectors, Glow plugs (heating coils), Air cleaners
- Constructional details and operation of the components
- Emission control in Diesel Engines
- Phasing and calibration
- Superchargers and Turbochargers
- Governors
- Maintenance and common defects
- Emission control in Diesel Engines

6. Ignition System of a Petrol Engine (02 hours)

- Main Components in the ignition system of a petrol engine: Battery, Ignition coil, Distributor, Spark plug, Platinum and condenser
- Ignition Systems – Coil, Magnet and Transistorized Ignition systems
- Ignition Timing
- Constructional details and operation of the components
- Defects in the ignition system and correction of defects

7. Starting System (02 hours)

- Main Components in the starting system; Battery, Starter switch, Electro magnetic switch, Stator motor
- Operating principle of starting system
- Maintenance and common defects

8. Transmission Systems (04 hours)

- Types of transmission system; Rear wheel drive and Front wheel drive, Two wheel drive and Four wheel drive
- Components in the transmission system: Clutch, Gear box (Epicyclic and Pre selector type), Propeller shaft, Differential, Axels
- Suspension Systems – Independent front suspension systems
- Constructional details and operation of the components
- Maintenance and common defects

9. Braking System (03 hours)

- Types of braking systems: Foot brakes, Hand brakes
- Type of brakes: Drum brakes, Disk brakes
- Components in the braking system: Brake pedal, Master cylinder, Wheel cylinder, Brake shoes / pads, Brake drum / disk
- Constructional details and operation of the components
- Anti-locking braking system
- Power assisted braking system
- Maintenance and common defects

10. Steering System (03 hours)

- Types of steering system: Drop arm type, Rack and pinion type
- Components in the steering system, their constructional details and operation
- Settings made during wheel alignment and their importance
  - Toe-in-toe-out
  - Chamber and caster
  - King-pin inclination
- Adjustments of wheel alignment

11. Electrical System (03 hours)

- Function, construction and operation of the charging system
- Alternators
- Voltage and Current regulators
- Operation of the lighting system
- Maintenance and common defects

12. Cooling Systems (01 hour)

- Radiators
- Exhaust and Draught type fans
- Cleaning and Maintenance of radiators

13. Fault Findings (02 hours)

- Systematic approach to identify the source of a fault and rectifying it.

List of Practicals: (45 hours)

1. Cylinder Block and Crankcase
2. Cylinder Head
3. Lubrication System
4. Cooling System
5. Ignition System
6. Fuel System
7. Transmission System
8. Propeller Shaft, Fixed Drive and Differential
9. Brake System
10. Steering System
11. Stator Motor, Generator and Auxiliary Electric Equipment
12. Fuel Injection
13. Front Axel and Suspension Systems

Recommended Text Books:

1. Automobile Engineering; G B S Narang
2. Automobile Engineering; K Singh
3. Introduction to Motor Mechanics; L Stackpoole, M Morrison & A Gregory
4. Automobile Fault Tracing: A practical hand book for service mechanics and owner drivers; S Abbeys
5. Automobile Maintenance: 500 questions and answers; R W Bent
6. Automotive Engines; H Ellinger
7. Automotive Electrical Systems; T Mellard
8. Automotive Technology; H M Sethi
9. Vehicle Technology; M J Nunney

09. 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

10. 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

11. DEE 201 Applied Electricity

Subject Code : DEE 201		Division : Electrical & Electronics Eng. Technology			
Title : Applied Electricity					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**45**	**2**	**1**	**3/2**
Method of Assessment :- 3 Hour Question Paper & Course Works					

General Objectives

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

- possess the fundamental knowledge of Applied Electricity.
- form a basis for advanced studies to be undertaken in Applied Electricity.

No	Course Outline	Lecture (hr.)	Practical (hr.)
1.	AC Theory	08	-
2.	Three Phase Systems	06	06
3.	Cost of Electricity (Simple applications)	04	06
4.	Transformers	08	06
5.	DC Machines	08	15
6.	AC Machines	10	-
7.	Electrical Measurements	04	06
8.	Basic Electronics	04	06
9.	Model Papers and Simple Assignments	06	-
	Total	**60**	**45**

Summary Syllabus

1. AC Theory (08 hours)

Definition of frequency and period. Sine wave and other waveforms
Meaning of Instantaneous, peak, average, rms values, Phase angle and power factor
Plotting and addition of out of phase sine waves, Use of phasors for representation of sinusoidal quantities.
Inductance capacitance in AC circuits, Solution of simple network problems by phasor and complex number representation
Concept of active, reactive and apparent power and power factor, simple series and parallel circuits, Resonance

2. Three Phase Systems (06 hours)

Balance 3-Phase Systems
Analysis of three phase circuits
Simple calculations on 3-phase unbalance circuits

3. Cost of Electricity (Simple Applications) (04 hours)

Electricity Tariffs and cost of Electricity
Power factor improvements

4. Transformers (08 hours)

Construction; of equivalent circuit representation of power transformers
Determination of equivalent circuit parameters
Voltage regulation and efficiency of a transformer
Application of transformers

5. DC Machines (08 hours)

Construction details, EMF and torque equations of DC machines
DC generators & their applications
DC Motors & their applications
Starting & speed control of DC Machines

6. AC Machines (10 hours)

Construction; define slip; equivalent circuit representation of Induction motors
Torque-Speed characteristics of Induction Motors
Effect of rotor resistance, supply voltage and frequency variations on torque-speed characteristics
Starting and speed control of Induction motors
Application of induction motors
Introduction to other types of AC generators and Motors

7. Electrical Measurements (04 hours)

Operating principles of simple instruments used for measuring voltage, current and power
Potentiometer, Wheatstone-bridge, and Simple AC bridges
Measurement of Single & three Phase Power

8. Basic Electronics (04 hours)

Brief introduction to solid state devices
Rectifiers and Simple smoothing circuits
Amplifiers & Oscillators

9. Model Papers and Simple Assignments (06 hours)

Discussion on model papers & assignments
Discussion on model papers & assignments

List of Practicals : (45 hours)

1. Determination of Load Diversity Factor
2. Test on a series DC Motor
3. Measurement of power using two Wattmeter method
4. Starting and Speed control of Induction Motor
5. Study of a model Power distribution System
6. Test on a single phase transformer
7. Study on DC machines
8. Rectifiers & Inverters

Recommended Text Books :

1. Electrical Technology; H Cotton
2. Electrical Technology; E Hughes
3. Electrical Machines; Bimbhra
4. Electrical Power & Control; T Skavarenina & William

12. DIS 202 Mathematics

Subject Code: DIS 202			Division : Interdisciplinary Studies		
Title : Mathematics					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**-**	**2**	**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.)
1.	Fourier Series and Laplase Transformations	10
2.	Integrals	05
3.	Statistics	20
4.	Vector Calculus	10
5.	Differential Equations	14
	Total	**60**

Summary Syllabus

1. Fourier Series and Laplase Transformations (10 hours)

Periodic functions,
Fourier expansion of a periodic function,
Odd and even functions,
Half range Fourier series,
Complex notation for Fourier series.
Laplase transform of elementary functions and basic theorems

2. Integrals (05 hours)

Brief introduction to improper integral,
Differential of integral,
Functions of two or three variables,
Multiple integrals,
Constraint maxima and minima,
Langrange multipliers,
Introduction to Fourier series.

3. Statistics (20 hours)

Techniques and methods of statistics with practical applications,
Description and handling of numerical data,
Sampling theory
Estimation theory
Hypothesis testing,
Correlation and regression,
Non-parametric methods.

4. Vector Calculus (10 hours)

Vector differentiation and differential operators,
Space curves and line integral,
Surface and surface integrals,
Divergence theorem, Stroke's theorem, Green's theorem in a plane and their basic applications.

5. Differential Equations (15 hours)

Ordinary linear differential equations with variable coefficients,
Bessel, Legendre special functions, singular points, existence and uniqueness of the solution.
Laplase transform of elementary functions and basic theorems,
Application to solution of differential equations and their systems,
Transfer functions, convolution theorem, concepts of stability and controllability.

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. Probality and Statistics; Murray R Spiegel, Schaum's Outline Series
6. !st 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

13. DME 201 Applied Thermodynamics II

Title : Applied Thermodynamics II					
Subject Code : DME 201		Division : Mech. Eng. Tech. & Maritime Studies			
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 Works					

General Objectives

On completion of this subject the students will be able to gain knowledge of practical applications of thermodynamic systems.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Steam Power Plant	10	09
2.	Refrigeration	06	06
3.	Air Compressors	06	06
4.	Internal Combustion Engines	06	09
5.	Gas Turbine	06	-
6.	Air Conditioning	06	-
7.	Heat Transfer	06	-
8.	Heat Exchangers	06	-
9.	Steam Turbine	08	-
	Total	**60**	**30**

Summary Syllabus

1. Steam Power Plant (10 hours)

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

2. Refrigeration (06 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
Properties of Refrigerants
Chillers
Screw Type Compressors

3. Air Compressors (06 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

Energy Balance of Two-Stage Air Compressors
Introduction to Rotary Air Compressors
Compressed Air Distribution Systems

4. Internal Combustion Engines (06 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

5. Gas Turbine (06 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

6. Air Conditioning (06 hours)

Mixture of Gases, Gas & Vapour Mixtures
Psychrometric Mixtures
Specific Humidity, Relative Humidity and Percentage Saturation
Air Conditioning
Cooling Towers

7. Heat Transfer (06 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

8. Heat Exchangers (06 hours)

Main Types of Heat Exchanges
Parallel-flow and Counter-flow Recuperators
Logarithmic Mean Temperature Difference (LMTD)
Cross-flow Recuperators and Arithmetic Mean Temperature Difference (AMTD)
Multi-pass & Mixed flow Recuperators
Effectiveness –NTU Method of Analysis of Heat Exchangers

9. Steam Turbine (08 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 : (30 hours)

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

Recommended Text Books :

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

14. DME 202 Engineering Drawing & CAD

Title :- Engineering Drawing & CAD					
Subject Code : DME 202			Division : Mech. Eng. Tech. & Maritime Studies		
Annual Workload			Weekly Workload		
Lectures	Tutorials	Practicals	Lectures	Tutorials	Practicals
30	-	90	1	-	3
Method of Assessment: - 4 Hour Question Paper & Course Works					

General Objectives

On completion of this module 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.
- construct a set of working drawing in AutoCAD

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Assembly Drawings	08	24
2.	Cams	01	03
3.	Welding	02	06
4.	Computer Aided Draughting – 2D	12	36
5.	3D Modelling using AutoCAD	07	21
	Total	**30**	**90**

Summary Syllabus

1. Assembly Drawings (08 hours)

Screws, Studs, Keys, Keyways, Pins, Circlips & locking devices
Collar, Snug, Pulleys, Spacers, Revolved Section
Gland, Springs, Gland Nut, Spindle, Spindle Guide, Valve, Valve Seat, Packing & Undercut
Conventional Representation of Gear Wheels
Assembly drawings of Control Valve, Relief Valves, Gears etc.

2. Cams (01 hour)

Functions of various Cam mechanisms
Discs and Cylindrical type Cams
Knife edge, roller and flat followers
Different types of Cam motions
Cam profiles for different follower and motions

3. Welding (02 hours)

Basic Welding symbols, size of Weld, Length of weld, Placement of weld and dimension of weld
Application of Standard Welding symbols to a working drawings

4. Computer Aided Draughting – 2D (12 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

5. 3D Modelling using AutoCAD (07 hours)

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

List of Practicals: (90 hours)

A minimum of twenty drawings relevant to mechnical engineering technology should be produced.

Recommended Text Books :

1. Technical Drawing & Design - Goetsch / Nelson
2. Engineering Drawing; A W Boundy
3. Engineering Drawing with CAD Applications; O Ostrowsky
4. Engineering Drawing with Problems & Solutions; K R Hart
5. Production Drawing; K L Narayana, P Kannaiah, V Reddy
6. Manual of Engineering Drawing; Dennis Maguire
7. Manual of Engineering Drawing to British & International Standards; Colin Simmons; Dennis Maguuire
8. AutoCAD 2000 User's Guide
9. SLS 409:1977 Engineering Drawing Practice

15. DME 203 Engineering Mechanics & Machine Design

Subject Code : DME 203		Division : Mech. Eng. Tech. & Maritime Studies			
Title : Engineering Mechanics & Machine Design					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**60**	**90**	**2**	**2**	**3**
Method of Assessment :- 4 Hour Question Paper & Course Works					

General Objectives

Section A - Engineering Mechanics

On completion of this subject the students will be able to acquire a sufficient theoretical knowledge in Mechanical Engineering components in Machinery.

Section B - Machine Design

On completion of this subject, the students should be able to design basic machine elements used in practice

No.	Subject Outline	Lecture (hr.)	Practical* (hr.)
	Engineering Mechanics		
1.	Mechanisms	05	06
2.	Turning Moment Diagrams	03	-
3.	Friction	06	06
4.	Balancing of Rotors	03	06
5.	Gear Drives	05	-
6.	Vibration	05	12
7.	Governors	02	-
8.	Cams	01	-
	Machine Design		
9.	Introduction to Machine Design	04	-
10.	Joints & Cotter Joint	01	-
11.	Riveted Joint	04	-
12.	Welded Joint	02	-
13.	Interference Fit Joint	01	-
14.	Screw Joints	04	-
15.	Keys & Splines	02	-
16.	Shaft Design	03	-
17.	Gear Design	04	-
18.	Bearings	02	-
19.	Couplings	03	-
20.	Assignments	-	60
	Total	**60**	**90**

*** Practical** – Laboratory Practicals & Assignments in Machine Design

Summary Syllabus

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 undamped 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

Machine Design

9. Introduction to Machine Design (04 hours)

General Consideration
Basic Design Criteria
Materials available in the market

10. Joints & Cotter Joint (01 hour)

General introduction of joints
General concept of cotter joint and their applications
Strength calculations of a cotter joint
Other types of cotter joint

11. Riveted Joint (04 hours)

Introduction
Advantages & disadvantages of riveted joints
Types of riveted joints & rivets
Design & strength calculation of riveted joints
Eccentrically loaded riveted joints

12. Welded Joint (02 hours)

Introduction
Types of welded joints
Strength of welds
Eccentrically loaded welded joints

13. Interference Fit Joint (01 hour)

General concept
Advantages & disadvantages of interference fit joints
Strength calculations
Interference fit joint design

14. Screw Joints (04 hours)

Introduction
- Advantages & disadvantages

Principal types of screw threads
Types of screw fastenings
Locking devices of screw joints
Strength calculations of screw joints under static loads
Screw joints under eccentric loading

15. Keys & Splines (02 hours)

Introduction to key joints
Types of key joints
Failures of key joints
Introduction to spline joints
Types of splines
Strength calculation of spline joint and selection of splines

16. Shaft Design (03 hours)

Introduction
Types of shafts
Stresses in the shafts
Design of shafts
- Based on strength: Shafts subjected to twisting moment only, Shafts subjected to bending moment only, Shafts subjected to combined twisting & bending moments, Shafts subjected to fluctuating loads, Shafts subjected to axial loads in addition to the above loads
- Based on rigidity: Torsional rigidity, Lateral rigidity

17. Gear Design (04 hours)

Classification of gears & technical terms
Condition for constant velocity ratio of gears
Forms of teeth & systems of teeth
Gear materials
Design of spur gears drives
- Design considerations
- Beam strength of gear teeth
- Permissible working stress for gear teeth
- Design procedure for spur gears

Design of helical gear drives

18. Bearings (02 hours)

General classification
Bearing types
Rolling element bearings
- Basic conditions for bearing choice
- Bearing selection procedure
- Application & mountings

19. Couplings (03 hours)

Introduction to Couplings
Types of couplings
Design of couplings

- Rigid couplings: Sleeve, muff, & flange couplings
- Flexible couplings: Pin type couplings -Applications

List of Practicals: (90 hours)

Engineering Mechanics (30 hours)

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

Machine Designs (60 hours)

1. Three assignments relevant to the syllabus

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; WG 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 CStephen
10. Solution of Problems in Theory of Machines; S Anvoner

Machine Design

11. Machine Design; G R Nagpal, Khanna Publishers, Delhi
12. Text Book of Machine Design, R S Khurmi, J K Guptha, Eurasia Publishing House, ISBN No. : 81 219 0501 4

16. DME 204 Industrial Management

Subject Code: DME 204			Division : Mech. Eng. Tech. & Maritime Studies		
Title : Industrial Management					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**-**	**-**	**2**	**-**	**-**
Method of Assessment :- 3 Hour Question Paper					

General Objectives

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

- understand and appreciate management theory and develop management skills.
- develop decision making skills.
- handle resources in a most appropriate manner.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Principles of Economics	06	-
2.	Principles of Management	08	-
3.	Financial Accounting	08	-
4.	Cost Accounting	08	-
5.	Materials Management	04	-
6.	Planning of Projects	09	-
7.	Work Improvement and Work Measurement	08	-
8.	Introduction to Maintenance Management	02	-
9.	Organisational Behaviour	06	-
10.	Law of Contract	08	-
11.	Management Case Study Discussions	02	-
	Total	**60**	**--**

Summary Syllabus

1. Principles of Economics (06 hours)

Basic elements.
Demand and supply.
Market competition.
Economy of Sri Lanka.

2. Principles of Management (08 hours)

Organisational Chart.
Design of an organization.
Scientific management thought.
Line and staff organization.
Span of control, authority, responsibility, power and accountability.

3. Financial Accounting (08 hours)

Business transactions.
Book-keeping procedures.
Balance sheet.
Final accounts.
Financial statements
Manufacturing accounts.

4. Cost Accounting (08 hours)

Cost components.
Application of costing procedures, depreciation.
Break-even analysis and its application.

5. Materials Management (04 hours)

Organisation of stores.
Economic order quantity.
Quality control.

6. Planning of Projects (09 hours)

Network diagrams.
Critical path analysis.
Gantt charts.
Resource allocation.

7. Work Improvement and Work Measurement (08 hours)

Job analysis.
Job evaluation.
Work study.
Performance standards, incentive scheme.
Labour regulations.
Industrial safety.

8. Introduction to Maintenance Management (02 hours)

Preventive and break-down maintenance.
Replacement policies.

9. Organisational Behaviour (06 hours)

Formation of groups in organizations.
Group behaviour and group dynamics.
Basic concepts in 'motivation'.
Organisational politics.
Introduction to leadership concept.

10. Law of Contract (08 hours)

How a contract is formed. 'offer' and 'acceptance'.
Conditions affect a contract.
Termination of a contract.

11. Management Case Study Discussions (02 hours)

List of Practicals:

Nil

Recommended Text Books :

1. Management – Don Hellriegel & John W Slocum
2. Advanced Accountancy – RL Gupta & M Radhaswamy
3. Organisational Behaviour and Human Behaviour at Work – John W Newstrone & Keith Davis
4. Introduction to Economics – Carin Cross & Sinclair
5. Production Planning Control and Industrial Management – K C Jain

17. DME 205 Manufacturing Technology

Subject Code : DME 205		Division : Mech. Eng. Tech. & Maritime Studies			
Title : Manufacturing Technology					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**-**	**210**	**2**	**-**	**3/3 + 6**
Method of Assessment :- 3 Hour Question Paper, Coursework & Project Report					

General Objectives

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

- understand the Manufacturing System.
- gain the practical experience on machines such as Lathe Machine, Milling Machine, Shaping Machine, etc. and experience on metrological background.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Limits and Fits	04	-
2.	Metrology	10	-
3.	Processes of Metal Cutting	10	-
4.	Machinability	10	-
5.	Casting	04	-
6.	Metal Forming Processes	10	-
7.	Testing and Maintenance of Machine Tools	02	-
8.	Welding and Weldability	04	-
9.	Spinning	02	-
10.	Die Sinking	02	-
11.	Plastics and Composite Materials	02	-
	Practicals in Metrology Laboratory	-	30
	Projects in the Workshop	-	180
	Total	**60**	**210**

Note: Engineering Safety should be covered in relevant practical classes of the section II of the practical list.

Summary Syllabus

1. Limits and Fits (4 hours)

I.S.O. Systems of limits and fits.

2. Metrology (10 hours)

Techniques of measurement.
Units and measuring instruments for the following are dealt with in relation to production quality.

- Length, concept of tolerance
- Angle, concept of tolerance
- Shape, flatness, square-ness, roundness, parallelism surface finish.

3. Process of Metal Cutting (10 hours)

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

4. Machinability (10 hours)

Machine parameters.
Rotary primary cutting.
Reciprocating primary cutting.
Grinding.
Capstan, turret and auto lathes.
C.N.C. Machines.

5. Casting (04 hours)

Process.
Sand, die, investment, centrifugal casting.
Casting defects.

6. Metal Forming Processes (10 hours)

Rolling
Drawing
Extrusion
Forging

7. Testing and Maintenance of Machine Tools (02 hours)

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

8. Welding and Weldability (04 hours)

Gas welding.
Electric arc welding.
Tig Mig Welding.
Plasma Cutting.
Defects and testing.

9. Spinning (02 hours)

Description of the process, product shapes, tools used.

10. Die Sinking (02 hours)

Description of the process.
Use of conventional machines.

11. Plastics and Composite Materials (02 hours)

Classification of plastic materials.
Compression, injection, blow and transfer moulding.
Laminated plastics.

List of Practicals : (210 hours)

Section 1 – (30 hours in Metrology Laboratory)

1. Pneumatic Comparator
2. Introduction to basic measuring instruments
3. Production and measurement of a screw thread
4. Assessment of surface texture
5. Measurement of bores, angles and tapers
6. To determine the accuracy of roundness of a cylindrical specimen
7. To check concentricity of a stepped cylindrical specimen
8. Statistical quality control by measurements
9. Gear measurement on Goulder – Mikron Involute Tester

Section 2 – (180 hours) Six mini projects & one main project

Mini projects
(a) Fitting
(b) Machining
(c) Melding
(d) Casting
(e) Forging
(f) Woodwork

Main Project: After acquiring the required skill after completing mini projects (6 hrs), assign to the project, annually changing.

Recommended Text Books :

1. A Test Book of Production Engineering; Sharma
2. Handbook of Industrial Engineering; Salvendy, Gavriel
3. Production Technology, Processes, Materials & Planning; W Bolton
4. Mechanics of Machines: Elementary Theory and Examples; J Hannah and R C Stephens
5. Mechanical Science for Higher Technicians; D H Bacoon and Stephens
6. Workshop Technology Part I; W A Chapman
7. Workshop Technology Part II; W A Chapman
8. Workshop Technology Part III; W A Chapman
9. Manufacturing Technology; M Haslehurst
10. Manufacturing Processes; Beyeman, L Myron

18. DME 207 Pneumatic Control Systems and Instrumentation

Subject Code : DME 207		Division : MET & Maritime Studies			
Title : Pneumatic Control Systems and Instrumentation					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
30	**-**	**15**	**1**	**-**	**3/6**
Method of Assessment :- 3 Hour Question Paper & Course Work					

General Objective:

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

- identify the main elements of basic pneumatic control systems
- describe, in general, how the elements work together to maintain a process variable at or near set point.
- demonstrate application of basics in order to understand more elaborate control systems.

No	Course Outline	Lecture (hr.)	Practical (hr.)
01	Introduction.	02	-
02	Measurements of Temperature	02	-
03	Measurements of Pressure	02	-
04	Measurements – Level	02	-
05	Measurements – Flow.	02	-
06	General Measurement Processes	04	-
07	Control Systems Theory	06	-
08	Pneumatic Control Components	04	-
09	Pneumatic Control Systems	04	-
10	Air Supply	02	-
	Laboratory Practicals		15
	Total	**30**	**15**

Summary Syllabus

1. Introduction (02 hours)

Instrumentation – elements of an instrument system, transducers, selection of an instrument, accuracy and error

Control systems in industry – types, functions, advantages

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 Level (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 (04 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. Control Systems Theory (06 hours)

Open loop and closed loop systems,
Proportional, integration and derivative including their combinations.
Transfer function, system response

8. Pneumatic Control Components (06 hours)

Pneumatic cylinders
Valves
Air motors
Accessories

9. Pneumatic Control Systems (04 hours)

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

Applications of pneumatic control systems

10. Air Supply (02 hours)

Arrangement of the air supply circuit and its components
Purity of the air - Filtering, Water removal and drying
Maintenance of the system

List of Practicals : (15 hours)

Four Practicals relevant to the subject matter

Recommended Text Books :

1. Industrial Instrumentation and control; Singh
2. Instrumentation and control systems; Jackson L
3. Instrumentation & control applications; Edgar TF
4. Automatic control systems; Kuo BO
5. Pneumatic control; Deppert W & Stoll K
6. Basic control system technology; Chesmond CJ
7. Fundamentals of pneumatic control engineering; Hasebrink JP & Kobler R
8. Maintenance of pneumatic equipment and systems; Meixner H & Kobler R

19. DME 208 Power Hydraulics & Fluid Machinery

Subject Code : DME 208		Division : Mech. Eng. Tech. & Maritime Studies			
Subject : Power Hydraulics & Fluid Machinery					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**-**	**15**	**2**	**-**	**3/6**
Method of Assessment :- 03 Hour Question Paper & Course Works					

General Objectives

On completion of this module students will be able to:

- posses fundamental understanding of the basics and principles of hydraulic power engineering
- posses fundamental understanding the function of various components within a hydraulic system, basic system design, schematic symbols and troubleshooting sequences.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Advantage of Hydraulics	02	-
2.	Pumps, Actuators, Motors and Directional Valves	08	-
3.	Pressure and Flow Control Valves	08	-
4.	Hydraulic Auxiliaries	06	-
5.	Hydraulic System Designs	12	-
6.	Closed Loop Electro-hydraulic Control	06	-
7.	Hydraulic Machines	08	-
8.	Fluid Machinery	10	-
9.	Laboratory Practicals		15
	Total	**60**	**15**

Summary Syllabus

1. **Advantage of Hydraulics (02 hours)**

   Basic physics and principles of hydraulic fluids

2. **Pumps, Actuators, Motors and Directional Valves (08 hours)**

   Types of Pumps
   Single and double acting cylinders
   Hydraulic motors
   Directional valves
   Introduction to proportional and servo valves
   Relief valve and pressure regulating valves
   Pilot operated valve

3. **Pressure and Flow Control Valves (08 hours)**

   Types of valves
   Meter (in, out and bypass)

4. **Hydraulic Auxiliaries (06 hours)**

   Reservoirs, filters, accumulators, strainers, pipe/tube and hoses etc.,

5. **Hydraulic System Designs (12 hours)**

   Schematic symbols
   Blueprint reading
   Hydraulic circuit design and analysis
   Troubleshooting sequences
   Safety

6. **Closed Loop Electro-hydraulic Control (06 hours)**

   Introduction to control theory
   Electronic regulators
   Electro-hydraulic control systems

7. **Hydraulic Machines (08 hours)**

   Log Splitters
   Large Hydraulic Machines
   Skid/Loaders
   Dump Trucks
   Putting gears to work
   Gear ratio
   Gear trains

8. **Fluid Machinery (10 hours)**

   Centrifugal pumps
   Reciprocating pumps and their operation
   Turbines; Axial and radial

List of Practicals : (15 hours)

Four practicals relevant to the syllabus

Recommended Text Books :
List to be added