National Diploma in Technology

Curriculum

Polymer 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

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. DPT 101 Polymer Science & Technology

Subject Code: DPT 101		Division: Polymer, Textile & Chemical Engineering Technology			
Title :- Polymer Science & Technology					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**45**	**2**	**1**	**3/2**
Method of Assessments: - 3 Hours Question Paper & Course Works					

General Objectives:

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

- apply their background knowledge of science to understand the nature of polymeric materials.
- understand the concept of high relative molecular mass of polymeric materials, and the methods available for the synthesis of such materials
- acquire some knowledge on the relationships between polymer structure and polymer physical properties.
- gain a basic knowledge on the theoretical aspects underlying the physical properties of polymers.
- acquire some information on the processing techniques and machineries used in the production of polymer based articles.
- develop skills of investigation through practical experiences in the characterisation of polymers.

No.	Subject Outline	Lecture (hr.)	Laboratory (hr.)
1.	Basic Organic Chemistry	08	09
2.	Polymer Materials	10	-
3.	Analysis and Identification of Plastics & Rubbers	08	09
4.	Introduction to Some Physical Properties of Polymers	12	-
5.	Natural Rubber	12	18
6.	Introduction to Polymer Processing	10	09
	Total	**60**	**45**

Summary Syllabus

1. **Basic Organic Chemistry (08 hours)**
   - Empirical formula and molecular formula
   - Nomenclature of organic compounds
   - Isomerism
   - Normal alkene type reactions.
2. **Polymer Materials (10 hours)**
   - Molecular differences between simple chemical substances and polymeric substances
   - General methods of obtaining polymeric materials from the monomers
   - Influence of molecular structures of polymers on their properties
3. **Analysis and Identification of Plastics & Rubber (08 hours)**
   - Simple analytical and identification tests of plastics and rubber materials
   - Solubility behaviour of polymers
4. **Introduction to Some Physical Properties of Polymers (12 hours)**
   - Mechanical properties of polymers
   - Thermal properties of polymers
   - Viscoelastic properties of polymers
5. **Natural Rubber (12 hours)**
   - Methods of production, properties and applications of dry natural rubber and latex
   - Chemical & physical properties of natural rubber
6. **Introduction to Polymer Processing (10 hours)**
   - Mastication and compounding of natural rubber
   - Processing techniques of rubber and plastics

List of Practicals: (45 hours)

1. Determination of Avogadro's number.
2. Determination of carbonate & bicarbonate content in a mixture.
3. Determination of hardness of water.
4. Phase diagram of a two component system.
5. Simple distillation.
6. Determination of chloride content.
7. Determination of elements in organic compounds – Sodium Lassargne's fusion tests.
8. Detection of elements in polymer materials.
9. Identification of common rubbers & plastics by simple tests.
10. Some specification tests for grading natural rubber.
    a. Determination of dirt content.
    b. Determination of nitrogen content.
    c. Determination of volatile matter.
11. Determination of density of polymer materials.
    a. Raw rubbers.
    b. Plastics – granular, powder, pellets
    c. Rubber mix.
    d. Rubber vulcanisates.
12. Extraction of acetone soluble resinous matter from raw natural rubber
13. Determination of plasticity of raw and masticated rubber using Wallace Rapid Plastimeter.
14. Determination of Plasticity Retention Index of RSS and Crepe rubber.

Recommended Text Books

1. Polymer Processing Fundamentals; Tim A Osswald
2. Developments in Rubber Technology; A Whelan, K S. Lee (Editior)
3. Rubber Processing: Technology, Materials, Principles; James Lindsay White
4. Rubber Technology – Third Edition; Maurice Morton (Editor)
5. Rubber Technology and Manufacture; C M Blow
6. Polymer Latices: Science and Technology: Fundamental Principles; D C Blackley
7. Polymer Latices: Science and Technology: Types of latices; D C Blackley
8. Polymer Latices: Science and Technology: Applications of latices; D C Blackley
9. Introduction to Extrusion; Paul N Richardson
10. Injection and Compression Molding Fundamentals; Avraam I Isayev
11. Injection Molding : An Introduction; Gerd Potsch, Walter Michael

11. 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

12. 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

13. DPT 201 Latex Technology

Subject Code: DPT201			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Latex Technology					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**90**	**2**	**1**	**3**
Method of Assessment :- 3 Hour Question Paper & Course Work					

General Objectives

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

- understand the importance of preservation, stabilisation and concentration of natural rubber latex, characterise natural rubber latex concentrates, design latex compound formulations and manufacture latex based products

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Introduction to Latex	08	-
2.	Natural Rubber Latex	15	30
3.	Latex Compounding Ingredients	12	20
4.	Manufacture of Latex Based Products	15	20
5.	Testing of Latex Based Products	10	20
	Total	**60**	**90**

Summary Syllabus

1. Introduction to Latex (08 hours)

Colloidal nature of latex
Natural and synthetic lattices
Sources of natural lattices
Techniques for manufacturing synthetic lattices

2. Natural Rubber Latex (15 hours)

Composition and constitution
Stability and spontaneous coagulation
Preservation
Concentration
Characterisation
Destabilisation - Coacervation, coagulation, gelation & flocculation.

3. Latex Compounding Ingredients (12 hours)

Emulsions, Dispersions & Solutions
Prevulcanisation of latex
General principals of compound design

4. Manufacture of Latex Based Products (15 hours)

Manufacturing methods- Dipping, casting, foaming, spreading, carpet backing, extrusion, rubberised coir
Manufacture of gloves, balloons, latex foam, latex thread, toys etc., surface coatings, adhesives, rubberised coir

5. Testing of Latex Based Products (10 hours)

Testing of dipped products
Testing of foam products
Testing of rubberized coir
Testing of latex thread
Testing of adhesives

List of Practicals: (90 hours)

1. Determination of Total Solids Content (TSC) of natural rubber latex
2. Determination of Dry Rubber Content (DRC) of natural rubber latex
3. Determination of Alkalinity of natural rubber latex
4. Determination of Volatile Fatty Acid Number (VFA NO) of natural rubber latex
5. Determination of KOH number of natural rubber latex
6. Determination of Mechanical Stability Time (MST) of natural rubber latex
7. Determination of Viscosity of natural rubber latex
8. Determination of Mg content of NR latex
9. Preparation & Testing of Dispersions of latex compounding ingredients
10. Preparation & Testing of emulsions of latex compounding ingredients
11. Pre-vulcanisation of natural rubber latex
12. Dipping with natural rubber latex
13. Castings with natural rubber latex
14. Latex foam manufacture
15. Synthesis of synthetic latex by Emulsion Polymerisation

Recommended Text Books :

1. Polymer Latices : Science & Technology : Fundamental Principles; D C Blackley
2. Polymer Latices : Science & Technology : Types of Latices; D C Blackley
3. Polymer Latices : Science & Technology :Applications of Latices; D C Blackley
4. Polymer Latices and Their Applications; K O Calvert
5. Chemistry and Physics of Rubber Like Substances; L Bateman

14. DPT 202 Manufacturing Technology of Polymer Products

Subject Code: DPT 202			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Manufacturing Technology of Polymer Products					
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 completion of this module the students will be able to:

- Design and formulate suitable compounds of rubber and plastics mixes for various types of articles and manufacture various polymer products by using appropriate manufacturing technologies.
- Choose suitable textile materials for making rubber-textile composite products

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Compounding Ingredients for Rubbers	10	-
2.	Additives to Plastics	10	-
3.	Manufacturing Methods of Rubber Products	20	15
4.	Manufacturing Methods of Plastics Products	15	15
5.	Recycling of Rubber & Plastics	05	-
	Total	**60**	**30**

Summary Syllabus

1. Compounding Ingredients for Rubbers (10 hours)

Peptizers, vulcanizing systems, fillers, softeners, processing aids, extenders, antidegradants

Auxillary ingredients- blowing agents, flame retardants, colourants, rubber reinforcing textiles

2. Additives to Plastics (10 hours)

Instruments, methods of measurements; on level ground, on slope and across obstacles
Setting out parallels and perpendiculars
Errors and mistakes
Corrections to linear measurements.

3. Manufacturing Methods of Rubber Products (20 hours)

Mix design, general compounding principles used with the commercially important rubbers in terms of service requirements and cost

Manufacturing methods of – carpets, tyres, tubes, cables, belting(conveyor, transmission), hoses, bonded products(rubber to metal), chemical plant linings, cellular rubber goods, foot wear components, ebonite, rubber covering, rubber thread, adhesives etc.

4. Manufacturing Methods of Plastics Products (15 hours)

Extruded plastics products -tubes, pipes, sheets, films, cable sheathing,

Moulded plastics products - cups, gear wheels etc., bottles and containers, tanks, drums, blocks, boat hulls, fiber glass laminates

5. Recycling of Rubber & Plastics (05 hours)

Recycling of rubbers
Recycling of plastics

List of Practicals: (30 hours)

1. Production of NR based Ebonite sheets
2. Production of Cellular and Blown Rubber products
   a. Micro Cellular Sheet
   b. Sponge Rubber
   c. Play Ball
3. Production of hand made rubber hose use in Automobiles to discharge exhaust fumes
4. Production of water delivery rubber hoses
5. Production of rubber-metal bonded units: Methods of In-vulcanisation bonding and post vulcanization bonding
6. Extrusion of plastics: solid rod, tube, flat sheet
7. Film blowing of plastics and production of thin plastics sheets
8. Blow moulding of plastics
9. Injection moulding of plastics
10. Thermoforming of plastics
11. Compression moulding of thermosets
12. Production of fibre glass laminates

Recommended Text Books :

1. Developments in Injection Moulding; Whelan
2. Injection and Compression Moulding Techniques; Avraam I Isayev
3. Injection Moulding – An Introduction; Gerd Potsch, Walter Michael
4. Extrusion : Processes, Machinery, Tooling; Kurt Laue
5. Polymer Extrusion; Chris Rauwendaal
6. Film Extrusion Manual ; Process, Materials, Properties; Thomas I Butler
7. Introduction to Extrusion; Paul N Richardson
8. Rubber Products Manufacturing Technology; Anil K Bhowmick, Malcolm. M Hall, Henry A Benarey (Editor)

15. DPT 203 Polymer Engineering & Process Control

Subject Code: DPT 203			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Polymer Engineering & Process Control					
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:

- design plastics and rubbers for various engineering applications, and design and make various types of moulds and dies required in plastics and rubber processing machinery
- perform unit operations in industries producing polymers and polymer products
- apply the principles of instrumentation and control, practically in industrial measurement and control systems

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Principles of Design with Plastics for Engineering Applications	10	-
2.	Principles of Design with Rubbers for Engineering Applications	10	-
3.	Designing Moulds and Dies for Compression, Transfer & Injection Moulding Processes	10	-
4.	Design of Extrusion Dies for Rubbers and Plastics	05	-
5.	Unit Operations	10	-
6.	Process Control	15	-
	Total	**60**	**00**

Summary Syllabus

1. Principles of Design with Plastics for Engineering Applications (10 hours)

Stress/strain behaviour of plastics
Creep criterion of design
Use of isochronous plots for design

2. Principles of Design with Rubbers for Engineering Applications (10 hours)

Stress/strain behaviour of rubbers
Rubber to metal bonded units; bridge bearings, dock fenders, Building mounts etc.
Designing theory and illustrations.

3. Designing Moulds and Dies for Compression, Transfer & Injection Moulding Processes (10 hours)

Theory and techniques of mould making
Materials for construction
Standard mould parts
Mould design requirements
Theory of die design

4. Design of Extrusion Dies for Rubbers and Plastics (05 hours)

Annulus dies
Slit dies
Circular dies

5. Unit Operations (10 hours)

Materials and energy balances
Heat and mass Transfer
Drying rates and drying equipments
Solvent Extraction, sedimentation, separation by centrifuging processes and equipments
Conveying - types of conveyers and types of pumps

6. Process Control (15 hours)

Elements of process control
Common transducers
Operational features of selected systems
On-off control, Proportional, Integral & PID control systems
Selected examples
Control systems

Recommended Text Books :

1. Rubber Engineering; Indian Rubber Institute (Editor)
2. Principles of Polymer Engineering; C P Buckley, C B Bucknall, N G McCrum
3. Fundamentals of Polymer Engineering; Arie Ram
4. Polymer Engineering Principles: Propeerties, processes, and Tests for Design; R . Progelhof, James L Throne
5. Engineering Instrumentation and Control; J A Hasam. G R Summers and D Williams
6. Process Control; A Pollard
7. Instrumentation for Process flow Engineering; P Nicolas and Paul N Cheremisinoff

16. DPT 204 Polymer Processing

Subject Code: DPT 204			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Polymer Processing					
Annual Workload			**Weekly Workload**		
Lectures	**Tutorials**	**Practicals**	**Lectures**	**Tutorials**	**Practicals**
60	**30**	**30**	**2**	**1**	**3/3**
Method of Assessment :- 3 Hrs Question Paper & Course Work					

General Objectives

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

- Process rubber and plastics into useful products by operating various processing machineries with safety procedures, maintain various types of polymer processing machineries and handle raw materials with safety precautions

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Rubber Processing	20	12
2.	Plastics Processing	20	12
3.	Other Moulding Processes	10	06
4.	Storage and Maintenance	10	-
	Total	**60**	**30**

Summary Syllabus

1. Rubber Processing (20 hours)

Mixing
- Standard mixer characteristics, continuous mixing, control of mixing, automation controls
- Dispersion - requirements for & characterization
- Safety - human aspects & machine aspects

Shaping
- Extrusion
- Calendaring
- Moulding - compression & transfer moulding, injection moulding

Curing; Batchwise & Continuous vulcanisation

2. Plastics Processing (20 hours)

Polymer blending, mixing (melt), equipment used
Extrusion
Blow moulding
Calendering
Thermoforming

3. Other Moulding Processes (10 hours)

Rotational moulding
Reaction injection moulding

4. Storage and Maintenance (10 hours)

Material handling
House keeping and safety
Waste management

List of Practicals: (30 hours)

1. (a) Mastication of Natural Rubber
   (b) Measurement of plasticity of rubber by means of Wallace Rapid Plastimeter
   (c) Effects of peptizers on mastication of Natural Rubber
   (a) Natural & Synthetic rubber and blends of NR/Synthetic rubber gum compound preparation and testing of processing properties by means of Mooney Viscometer and Shearing Disc Rheometer
   (a) Moulding of test pieces of gum rubber for physical testing
3. (a) Preparation of Carbon black filled natural and synthetic rubber compounds
   (b) Testing of processing properties of the mix by means of Shearing Disc Rheometer
   (c) Moulding of test pieces of Carbon Black filled rubber compounds for physical testing
4. Preparation of NBR-based rubber compound for petroleum oil storage tank sealings
5. Investigation of extrusion variables in NR compounds
6. Determination of vicat softening point of plastics
7. Determination of melt Flow Index of plastics
8. Processability testings of plastics

Recommended Text Books :

1. Developments in Rubber Technology; A Whelan, K S Lee (Editor)
2. Rubber Processing – Technology, Materials, Principals; James Lindsay White
3. Rubber Technology – Third Edition; Maurice Morton (editor)
4. Rubber Technology and Manufacture; C M Blow
5. Fundamentals of Rubber Technology; K Subramanium
6. Polymer Extrusion; Chris Rauwendaal
7. Introduction to Extrusion; Paul N Richardson
8. Polymer Processing Fundamentals; T A Osswald
9. Polymer Processing: Principles and design; D G. Baird, Dimitris G Collias
10. Science and Technology of Polymer Processing; Nam P Sue (Editor)

17. DPT 205 Polymer Science

Subject Code: DPT 205			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Polymer Science					
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:

- use their knowledge on polymer morphology in describing the thermal and physical properties and mechanical behaviour of polymers.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Raw Materials	05	-
2.	Polymerization Processes	20	-
3.	Morphology of Polymers	10	-
4.	Chemical Behaviour of Polymers	05	-
5.	Mechanical Behaviour of Polymers	10	-
6.	Physical Properties of Polymers	10	-
	Total	**60**	**00**

Summary Syllabus

1. Raw Materials (05 hours)

Monomer types & sources of monomers
Natural polymers & derivatives

2. Polymerization Processes (20 hours)

Processes & mechanisms

- Chain polymerization
- Step growth polymerization
- Ring opening polymerization
- Stereo specific polymerization

Kinetics of polymerization
Coplymerisation & types of copolymers
Average molar masses of polymers such as Mn, Mw and Mv

3. Morphology of Polymers (10 hours)

Rubbers, plastics & fibres
The rubber –glass transition
Factors affecting Tg & Tm
Measurement of Tg & Tm
The nature of crystallinity in polymers
Crystallisation of polymers by cooling & stretching
Types of crystal structures
Tacticity

4. Chemical Behaviour of Polymers (05 hours)

Chemical resistance
Flame resistance

5. Mechanical Behaviour of Polymers (10 hours)

Rubber elasticity
Viscoelasticity
Rheology
Swelling effects of solvents
Stress/strain characteristics in different modes of deformation

6. Physical Properties of Polymers (10 hours)

Electrical properties
Optical properties
Diffusion & solution properties

Recommended Text Books :

1 Chemistry and Physics of Modern Materials; J M G Cowie
2 Physical Testing of Rubbers; R P Brown
3 Text book of Polymer Science; Billmeyer
4 Principles of Polymerisations; Odeon

18. DPT 207 Polymeric Materials

Subject Code: DPT 207			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Polymeric 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 completion of this module the students will be able to:

- select suitable types of general purpose rubbers, modified general purpose rubbers, synthetic rubbers and plastics for products, to suit widely differing service characteristics and process them based on the knowledge they gain on structure property relationships and the essential principals of compound formulation & processing of a wide range of polymers.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Introduction to Polymeric Materials	05	-
2.	Natural Rubber	06	-
3.	Modified Forms of Natural Rubbers	09	-
4.	General Purpose Synthetic Rubbers	05	-
5.	Special Purpose Synthetic Rubbers	10	-
6.	Thermoplastics	12	-
7.	Thermosets	05	-
8.	Degradation & Stabilisation of Polymers	05	-
9.	Blooming	03	-
	Total	**60**	**00**

Summary Syllabus

1. Introduction to Polymeric Materials (05 hours)

General review of polymeric materials
Classification systems
Polymer morphology
Thermal properties of polymers
Rubbers, Plastics & Fibres

2. Natural Rubber (06 hours)

Composition, effects of non rubbers, storage hardening, crystallization
Principles of compound design and applications

3. Modified Forms of Natural Rubbers (09 hours)

Manufacture and essential characteristics of modified forms of NR- CV rubbers, LV rubbers, ENR, Cyclised NR, MMA grafted NR, Chlorinated NR, Deproteinised NR, Depolymerised NR etc.
Principles of compound design and applications

4. General Purpose Synthetic Rubbers (05 hours)

Manufacture, structure and essential characteristics of Styrene Butadiene rubbers, Butadiene rubbers, Isoprene rubbers
Applications

5. Special Purpose Synthetic Rubbers (10 hours)

Manufacture, structure and essential characteristics of special purpose elastomers - NBR, CR, EPR, EPDM, fluorocarbon rubbers, acrylates, polyurethanes, epichlorohydrins, chlorosulphonated polyethylenes, polysulphides, thermoplastic elastomers
Applications

6. Thermoplastics (12 hours)

Structure-property relationships, processing behavior and typical applications of thermoplastics such as polyethylene, polypropylenes, polyvinyl chlorides, polystyrenes, polyamides, polyacrylates, polyesters, polycarbonates, polyoxymethylenes.
Modified forms of thermoplastics such as high impact polystyrenes, ABS block copolymers, SAN
Expanded thermoplastics such as cellular forms of PVC, expanded polystyrene, polyurethanefoams and expanded polyethylene

7. Thermosets (05 hours)

Processing behaviour
Applications of thermosets such as phenol formaldehyde, urea formaldehyde, melamine formaldehyde resins

8. Degradation & Stabilisation of Polymers (05 hours)

Effects of various influences such as thermal, photo-oxidative, biological, chemical and mechanical etc. upon the degradation of polymers
Methods for limiting degradation in practical circumstances using stabilizers

9. Blooming (03 hours)

Types of blooms
Identification of blooms

Recommended Text Books :

1. Synthetic Rubbers – Their Chemistry and Technology; D C Blackley
2. Rubber Technology – Third Edition; Maurice Morton
3. Rubbery Materials; J A Brydson
4. Rubber Compounding; F W Barlow
5. Plastics Materials; J A Brydson
6. Developments with Thermosetting Plastics; A Whelan and J A Brydson
7. Engineering Thermoplastics – Properties and Applications; M James

19. DPT 208 Quality Control and Testing of Polymers and Polymer Products

Subject Code: DPT 208			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Quality Control and Testing of Polymers and Polymer Products					
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 completion of this module the students will be able to:

- test polymers and polymer products according to the standard test procedures to evaluate processability of polymers and service characteristics of polymer products.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Definition of Terms	05	-
2.	Introduction to Quality Standards	05	-
3.	Tools in Solving Quality Related Problems	10	-
4.	Planning for Quality	10	-
5.	Basic Methods of Improving Quality	10	-
6.	Testing of Polymers	10	10
7.	Testing of Polymer Products	10	20
	Total	**60**	**30**

Summary Syllabus

1. Definition of Terms (05 hours)

Inspection, quality control, quality assurance
Total quality management
Quality of design, quality of manufacture

2. Introduction to Quality Standards (05 hours)

ISO 9000 series
EN 46000
ISO 14000

3. Tools in Solving Quality Related Problems (10 hours)

Paseto diagram
Fish bone diagram
Flow charts
Histograms
Cause and effect diagrams
Use of quality specifications and specification limits

4. Planning for Quality (10 hours)

Market research
Product development etc.

5. Basic Methods of Improving Quality (10 hours)

Systems of designating bearings
Compass and its parts
Open and closed traverses
Compass traverse: field work and office work
Accuracy of compass traversing

6. Testing of Polymers (10 hours)

Outline of simple identification and analysis procedures for plastics and rubbers eg. Elemental analysis, burning, behavior towards solvents
Specification tests for polymers and raw materials used in compounding

7. Testing of Polymer Products (10 hours)

Principles of compounding tests for rubber and plastics compounds viscosity, melt flow index, cure characteristics as applicable
Principles of testing physical and chemical properties plastics and rubber products
Standard test methods used for processabilty tests and testings of plastics and rubber vulcanisates & polymer films

List of Practicals: (30 hours)

1. Physical Testing of rubber vulcanisates of NR-Gum rubber compound and NR- Carbon black filled compound
2. Comparison of Conventional and Efficient vulcanizing systems in NR compounds with respect to processing and physical properties
3. Comparison of Silica filled NR- compound with HAF black filled NR compound with respect to processing and physical properties
4. Comparison of SBR, BR, CR, EPDM based rubber compounds with NR based rubber compounds with respect to processing and vulcanizing properties
5. Physical testing of plastics products
   (a) Strength properties
      - Tensile strength
      - Tensile stress/strain
      - Impact strength
   (b) Heat Deflection temperatures
   (c) Moisture absorption
   (d) Pressure testing of plastic pipes
   (e) Impact resistance of plastic pipes
   (f) Heat reversion test

Recommended Text Books :

1. Rubber Technology: Compounding and Testing for Performance; John S Dick
2. ISO – Standard Testing Methods for latex, rubber and plastics materials
3. ASTM - Standard Testing Methods for latex, rubber and plastics materials
4. BS - Standard Testing Methods for latex, rubber and plastics materials
5. Plastics Materials; J A Brydson
6. Physical Testing of Rubbers; P Brown