

# **National Diploma in Technology**

## Curriculum

### Chemical Engineering Technology

Institute of Technology  
University of Moratuwa

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## 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.)
	<b>Engineering Mechanics</b>		
1	Introductory Topics	04	04
2	Energy	04	-
3	Friction and Friction Drives	12	06
4	Gears	02	
5	Dynamics	08	04
	<b>Strength of Materials</b>		
6	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
	<b>Total</b>	<b>30</b>	<b>30</b>

## 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 theorem

#### 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 Gear Drives (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's 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<sup>nd</sup> 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 101 Process Engineering Technology

<b>Subject Code: DCH 101</b>			<b>Division: Polymer, Textile and Chemical Engineering Technology</b>		
<b>Title : Processes Engineering Technology</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>-</b>	<b>90</b>	<b>2</b>	<b>-</b>	<b>3</b>
<b>Method of Assessment: - 3 Hour Question Paper &amp; Coursework</b>					

### General Objectives :

On completion of this module students will be able to understand the operations carried out in industrial processes, factors which govern the rate of processes, equipment used & how to represent a process on a flow diagram.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
1.	Introduction	02	-
2.	Unit Operations & Unit Processes	06	36
3.	Reaction Kinetics	06	12
4.	Reactors	04	06
5.	Distillation	16	24
6.	Extraction and Leaching	12	12
7.	Industrial Processes	06	-
8.	Flow Diagrams	08	-
	<b>Total</b>	<b>60</b>	<b>90</b>

## Summary Syllabus

- 1. Introduction (02 hours)**
  - Lab Scale Preparations
  - Industrial processes
  - Continuous and batch processes
  - Work of a chemical Engineering Technologist
- 2. Unit Operations & Unit Processes (06 hours)**
  - Concept of unit operations & unit processes
  - Brief description of unit operations, unit processes and equipment used for transportation of material in industrial processes.
- 3. Reaction Kinetics (06 hours)**
  - Determination of reaction rates
  - Order and Molecularly of reactions
  - Effect of temperature on reaction rates
- 4. Reactors (04 hours)**
  - Reactor types
  - Basic design equation
  - Steady and Unsteady state operation
  - Residence time
- 5. Distillation (16 hours)**
  - Ideal solutions, Raoult's law, Dalton's law
  - Vapour pressure vs. composition and Temperature vs. composition diagrams
  - Distillation processes: Steam distillation, Batch distillation, Flash distillation, Fractionation
  - Types of columns: Plate columns, packed columns.
  - Industrial applications.
- 6. Extraction and Leaching (12 hours)**
  - Liquid-liquid extraction.
  - Limitations in extraction.
  - Equipment used in liquid-liquid extraction.
  - Leaching.
  - Factors influencing leaching.
  - Equipment used for leaching.
  - Super critical fluid extraction.
  - Extraction of industrially important metals from their ores.
- 7. Industrial Processes (06 hours)**
  - Industrial processes for the manufacture of inorganic and organic substances. (At least two processes each year.).
- 8. Flow Diagrams (08 hours)**

**List of Practicals : (90 hours)**

1. Determination of the Avogadro Number.
2. Determination of the carbonate and bicarbonate content of a mixture.
3. Determination of the hardness of water.
4. Simple distillation.
5. Phase diagram of a two-component system.
6. Soxhlet extraction.
7. Determination of gas Flow rates.
8. Schilling Effusimeter
9. Three component system
10. Corrosion
11. Batch reactor
12. Determination of the specific rate constant for the first order hydrolysis of Ethyl Acetate
13. Determination of velocity of saponification of an ester with sodium hydroxide.

**Recommended Texts Books :**

1. Chemical Engineering Volume 2, 5<sup>th</sup> edition; J.M.Coulson and J.F.Richardson
2. Introduction to Chemical Engineering; Walter I.Badger and Julius T Banchemo
3. General Chemistry, Second edition; Ralph S Becker, Wayne E Wentworth

### 3. 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	-
	<b>Total</b>	<b>60</b>	<b>00</b>

## 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, 6<sup>th</sup> Edition; Van Vlack (Addison Wesley)
2. Introductions to Materials Science for Engineers, 4<sup>th</sup> Edition; Shackelford (Prentice Hall International)
3. The Science of Engineering materials; Smith (Prentice Hall International)
4. Materials Science and Engineering, 4<sup>th</sup> Edition; Callister (Wiley)

#### 4. DEE 101 Electro Technology

<b>Subject Code : DEE 101</b>			<b>Division : Electrical &amp; Electronic Engineering Technology</b>		
<b>Title : Electro Technology</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>30</b>	<b>30</b>	<b>2</b>	<b>1</b>	<b>2/2</b>
<b>Method of Assessment :- 3 Hour Question Paper &amp; Course Works</b>					

#### 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 2<sup>nd</sup> Year.

<u>No</u>	<b>Subject Outlines</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
	<b>Basic Electricity</b>		
01	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	-
	<b>Basic Electronics</b>		
08	Semi-Conductor Materials	04	-
09	Transistor and its Applications	08	05
10	Analogue and Digital Systems	08	-
11	Transducers	06	-
	<b>Total</b>	<b>60</b>	<b>30</b>

## 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, Hysteresis 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, Wiley 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

## 5. DIS 101 English

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

### 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.

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

\* 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.

## 6. DIS 102 Introduction to Information Technology

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

### 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.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
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	-
	<b>Total</b>	<b>15</b>	<b>15</b>

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

## 7. DIS 103 Mathematics

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

### 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

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

## 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. Laplace Transforms; Murray R Spiegel, Schaum's Outline Series
5. Probability and Statistics; Murray R Spiegel , Schaum's Outline Series
6. 1<sup>st</sup> 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

## 8. DME 101 Applied Thermodynamics & Fluid Mechanics

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

### 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.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
	<b>Applied Thermodynamics</b>		
1.	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
	<b>Fluid Mechanics</b>		
1.	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
	<b>Total</b>	<b>60</b>	<b>30</b>

## 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 perfect 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 pressure.
- 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 liquid.
  - 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 Bernauli'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  $\lambda$  value in the formula to find the head loss due to friction.
  - Formulae derived from Moody Diagram to find  $\lambda$ .
  - 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.

## 9. DME 103 Engineering Drawing

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

### 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.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical* (hr.)</b>
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, Involutés & Cycloids	02	03
11.	Helix & Mechanisms	01	03
12.	True Lengths & Inclinations	01	03
13.	Developments	02	06
14.	Interpenetration Curves	02	06
	<b>Total</b>	<b>30</b>	<b>90</b>

\* **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, Involutés & Cycloids (02 hours)**

- Involutés 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

**List of Practicals (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

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

### 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

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
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
	<b>Total</b>	<b>30</b>	<b>90</b>

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. DCH 201 Environmental Technology and Occupational Safety

<b>Subject Code: DCH 201</b>			<b>Division: Polymer, Textile and Chemical Engineering Technology</b>		
<b>Title : Environmental Technology and Occupational Safety</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>-</b>	<b>30</b>	<b>2</b>	<b>-</b>	<b>3/3</b>
<b>Method of Assessment :- 3 Hour Question Paper &amp; Course Work</b>					

### General Objectives

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

- Deal with environmental pollution problems in their work environment. They will also be able to deal with situations connected to industrial safety.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
1.	Water and Wastewater Treatment	25	30
2.	Solid Waste Management	10	-
3.	Air Pollution	15	-
4.	Occupational Safety and Health	10	-
	<b>Total</b>	<b>60</b>	<b>30</b>

## Summary Syllabus

### **1. Water and Wastewater Treatment (25 hours)**

Fundamentals of conventional water and wastewater treatment  
Physical treatment processes and operations  
Chemical treatment processes and operations  
Biological treatment processes and operations – Aerobic and Anaerobic treatments  
Sludge treatment and disposal  
Legal framework  
Boiler water treatment – chemical additions  
Water treatment for power generation through steam turbine (Ultra pure water)

### **2. Solid Waste Management (10 hours)**

Concept of integrated waste management  
Municipal solid waste management – gas generation, incineration & composting  
Hazardous waste management

### **3. Air Pollution (15 hours)**

Sources of pollution  
Health effects and global impacts  
Air quality monitoring and standards  
Air pollution control & ventilation

### **4. Occupational Safety and Health (10 hours)**

Noise & vibration  
Carcinogens  
Chemical safety  
Safety equipments & Standards  
Basics of first aid  
Basics of fire extinguishes  
Awareness of MSDS

### **List of Practicals: ( 30 hours)**

1. Alkalinity and pH test
2. Determination of total solids, total dissolved solids and volatile suspended solids
3. Determination of dissolved oxygen
4. Coagulation
5. Biological Oxygen Demand (BOD) and Chemical Oxygen Demand COD)

### **Recommended Text Books :**

1. Chemistry for Environmental Engineers; Sawyer & MacCarty, McGraw Hill
2. Air Pollution Control and Design for Industry; Marcet Dekker
3. Waste Water Engineering; Mercalf & Eddy

## 12. DCH 202 Fuels and Lubricants

Subject Code: DCH 202			Division: Polymer, Textile and Chemical Engineering Technology		
Title : Fuels and Lubricants					
Annual Workload			Weekly Workload		
Lectures	Tutorials	Practicals	Lectures	Tutorials	Practicals
60	-	45	2	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:

- deal with, processes involved in petroleum refining and laboratory testing of fuels & lubricants.

No.	Subject Outline	Lecture (hr.)	Practical (hr.)
1.	Chemical Composition of Crude Oils and of the Petroleum Fractions	04	-
2.	Physical and Chemical Characteristics of Crude Oil and Petroleum Fractions	12	15
3.	Petroleum Distillation- Atmospheric and Vacuum Distillation	04	12
4.	Solvent Refining	05	-
5.	Utilization of Petroleum Fractions as Fuels and for Other Purposes	07	03
6.	The Cracking Reaction Mechanisms	04	-
7.	Thermal Cracking & Catalytic Cracking	04	-
8.	Catalytic Reforming	04	-
9.	Isomerisation, Alkylation, Polymerisation	04	-
10.	Hydrotreating	04	-
11.	Lubricating Oil. Friction Lubrication	04	09
12.	Bitumen, Asphalt	01	-
13.	Grease from Petroleum	01	03
14.	Solid Fuels	02	03
	<b>Total</b>	<b>60</b>	<b>45</b>

## Summary Syllabus

### **1. Chemical Composition of Crude Oils and of the Petroleum Fractions (04 hours)**

Paraffinic, Aromatic, Olefinic & Napthenic hydrocarbons  
Oxygen, Sulphur, Nitrogen and other compounds  
Metallic constituents: Sodium, Vanadium

### **2. Physical and Chemical Characteristics of Crude Oil and Petroleum Fractions (12 hours)**

Molecular weight correlation with boiling point of the pure hydrocarbon  
Density of petroleum fractions, liquid and vapour phase. Variation with chemical composition. Experimental determination.  
Viscosity of petroleum fractions, liquid and vapour phase. Variation of viscosity with temperature, pressure and chemical composition. Experimental determination, analytical calculations.  
Vapour pressure of pure hydrocarbons and of petroleum fractions. Experimental determination, analytical calculations.  
Critical parameters. Critical temperature, critical pressure, critical volume for petroleum fractions. Usefulness of these values.  
Thermal characteristics of petroleum fractions. Specific heat, latent heat of vaporization, enthalpy variation with temperature, pressure and composition.  
Distillation curves. ASTM, TBP and EFV curves. Average boiling temperature, experimental determination and method of calculation.  
Burning of hydrocarbons. Calorific value. Explosion limit of a mixture, flash point, fire point.  
Electrical properties, refractive index, dielectric constant.  
Solubility. Aniline point. Correlation with chemical composition.  
Determination of chemical composition of the petroleum fractions by physical properties such as refractive index, density, molecular weight and viscosity.  
Watson's characterization factor  
Sediment, water & salt content of crude oil.

### **3. Petroleum Distillation- Atmospheric and Vacuum Distillation (04 hours)**

Material and energy balances.  
Operation of distillation plants. Operating variables.

### **4. Solvent Refining (05 hours)**

Solvent refining processes. Selection of solvents.  
Aromatic recovery  
Refining of lubricating oil stocks  
Separation of wax  
Propane deasphalting

**5. Utilization of Petroleum Fractions as Fuels and for Other Purposes (07 hours)**

The principal characteristics needed and correlation with chemical composition.

General considerations

Liquefied gas – LPG, LNG

Gasoline

Diesel fuel

Liquid fuel for gas turbines. Fuel for turbo-jets.

Kerosene

Petroleum solvents.

**6. The Cracking Reaction Mechanisms (04 hours)**

Thermodynamic and Kinetic consideration

Reactor principles

**7. Thermal Cracking & Catalytic Cracking (04 hours)**

Process principles

Operating variables

**8. Catalytic Reforming (04 hours)**

Process principles

Operating variables

**9. Isomerisation, Alkylation, Polymerisation (04 hours)**

**10. Hydrotreating (04 hours)**

Process principles

Operating variables

**11. Lubricating Oil. Friction Lubrication (04 hours)**

The principle qualities of lubricating oil in connection with chemical composition.

Motor oils and additives

Oils for turbines

Insulation oil for transformers

Hydraulic oil

Oil for low temperature machines

**12. Bitumen, Asphalt (01 hours)**

The principal qualities for bitumen

Methods of testing different types of Bitumen

**13. Grease from Petroleum (01 hours)**

Principle qualities of grease

Different types of grease obtained from petroleum fractions

**14. Solid Fuels (02hours)**

Coal, Biomass

**List of Practicals: (45 hours)**

1. Specific gravities and densities of petroleum fractions
2. Flash point
3. Engler and Saybolt universal viscosities
4. Aniline point
5. A.S.T.M. Distillation
6. Determination of water and sediment content & salt content of crude oil
7. Viscosity Index
8. Viscosity of very viscous liquids
9. Proximate analysis of coal
10. Vacuum distillation
11. True boiling point curve
12. Distillation column

**Recommended Text Books :**

Fuels and Lubricants Part I; Prof. Dr. Constantin D. Ionescu  
Fuels and Lubricants Part II; Prof. Dr. Constantin D. Ionescu

### 13. DCH 203 Heat and Mass Transfer

<b>Subject Code: DCH 203</b>			<b>Division : Polymer, Textile and Chemical Engineering Technology</b>		
<b>Title : Heat and Mass Transfer</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>30</b>	<b>30</b>	<b>2</b>	<b>1</b>	<b>3/3</b>
<b>Method of Assessment :- 3 Hour Question Paper &amp; Course Works</b>					

#### General Objectives

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

- deal with Heat and Mass transfer problems and equipment used to carry out Heat and Mass transfer operations in industry and be able to carry out material and energy balances for industrial processes.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
1.	Heat Transfer	16	12
2.	Evaporators	12	06
3.	Mass Transfer	08	-
4.	Humidity Control and Water Cooling	08	06
5.	Drying	08	06
6.	Material and Energy Balances	08	-
	<b>Total</b>	<b>60</b>	<b>30</b>

## Summary Syllabus

### 1. Heat Transfer (16 hours)

Heat transfer by conduction, convection and radiation.  
Mean temperature difference in heat exchangers.  
Heat exchange equipment

### 2. Evaporators (12 hours)

Evaporator types.  
Evaporator auxiliaries.  
Multiple effect evaporation.  
Performance of single effect evaporators.

### 3. Mass Transfer (08 hours)

Fick's Law.  
Molecular diffusion.  
Film and Penetration theory of mass transfer.  
Film and overall mass transfer coefficients.

### 4. Humidity Control and Water Cooling (08 hours)

Humidity, relative humidity, dew point and wet bulb temperature.  
Psychrometric chart.  
Water cooling – cooling water treatment & algae treatment  
Air conditioning.

### 5. Drying (08 hours)

Equilibrium moisture, Free moisture and Bound moisture.  
Drying rates.  
Drier types.

### 6. Material and Energy Balances (08 hours)

### List of Practicals: (30 hours)

1. Heat transfer teaching unit
2. Determination of heat transfer coefficient
3. Study of analogy between fluid friction and heat transfer
4. Drying.
5. Multiple effect evaporation
6. Moisture balance

### Recommended Text Books :

1. Chemical Engineering - Volume I; J M Coulson and J F Richardson, Pergamon Press
2. Mass Transfer Operations; R E Treybal, Mc Graw Hill

## 14. DCH 204 Instrumentation and Process Control

<b>Subject Code: DCH 204</b>			<b>Division: Polymer, Textile and Chemical Engineering Technology</b>		
<b>Title : Instrumentation and Process Control</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>-</b>
<b>Method of Assessment :- 3 Hour Question Paper</b>					

### General Objectives

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

- Select appropriate instruments to monitor industrial processes, operate these instruments and control such processes.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
1.	Introduction to Instrumentation	10	-
2.	Basic Process Parameters and Relevant Instrumentation	10	-
3.	Process Parameters and Relevant Instrumentation	10	-
4.	Process Control	30	-
	<b>Total</b>	<b>60</b>	<b>-</b>

## Summary Syllabus

### 1. Introduction to Instrumentation (10 hours)

The importance of Instrumentation in industry  
The integration of instrumentation into processing  
Instrumentation terminology  
Representation of instruments in flow-diagram, drawing and interpretation.  
Piping and instrumentation diagram, drawing and interpretation.

### 2. Basic Process Parameters and Relevant Instrumentation (10 hours)

Pressure and pressure measurement  
Flow and flow measurement  
Level and level measurement  
Temperature and temperature measurement

### 3. Process Parameters and Relevant Instrumentation (10 hours)

PH, chemical composition, viscosity, density, colour, hardness, elasticity, clarity & turbidity, moisture analysis  
Flue gas analysis  
Toxic gas analysis & volatile organic carbons  
Calibration of instrumentation (Metrology)

### 4. Process Control (30 hours)

Importance of process control in industry.  
Basic control systems – Feedback control, feedforward control and cascade control.  
Basic control actions – On-off control, P,I,D and PID  
Development in controls – Multivariable control systems, distributed control systems, supervising control and data acquisition.

### List of Practicals:

Nil

### Recommended Text Books :

1. Process Control; A. Pollard
2. Chemical Process Control, An Introduction to Theory and Practice; George Stephanopoulos
3. Principle and Practice of Automatic Process Control; Calos A. Smith, Armando B. Corripio

## 15. DCH 205 Separation Processes

<b>Subject Code: DCH 205</b>			<b>Division: Polymer, Textile and Chemical Engineering Technology</b>		
<b>Title : Separation Processes</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>30</b>	<b>45</b>	<b>2</b>	<b>1</b>	<b>3/2</b>
<b>Method of Assessment :- 3 Hrs Question Paper &amp; Coursework</b>					

### General Objectives

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

- select the most appropriate equipment, operate and maintain such equipment used to carry out, any physical process, chemical process or transportation of material in chemical and other industries.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
1.	Gas Absorption and Stripping	08	06
2.	Adsorption	08	06
3.	Filtration	06	06
4.	Refrigeration	04	-
5.	Sedimentation	04	-
6.	Centrifugation	04	06
7.	Fluidisation	02	03
8.	Conveying	08	06
9.	Size Reduction	04	06
10.	Crystallisation	02	06
11.	Membrane Separation	06	-
12.	Mixing	04	-
	<b>Total</b>	<b>60</b>	<b>45</b>

## Summary Syllabus

### **1. Gas Absorption and Stripping (08 hours)**

Ideal and non ideal gas liquid equilibrium data.  
Transfer unit and theoretical plate methods of evaluating mass transfer requirements.  
Column efficiency.  
Pressure drop and flooding in columns.

### **2. Adsorption (08 hours)**

Physical adsorption and chemisorption.  
Heat of adsorption.  
Adsorption coefficients.  
Surface area by Langmuir and BET isotherms.  
Importance of adsorption in catalytic reactions.

### **3. Filtration (06 hours)**

Flow through porous media and Darcy's equation.  
Filter types.

### **4. Refrigeration (04 hours)**

Vapour compression and absorption generation systems.

### **5. Sedimentation (04 hours)**

Terminal falling velocity.  
Settling rates of slurries.  
Thickeners and clarifiers.  
Coagulation.

### **6. Centrifugation (03 hours)**

General principles.  
Types of centrifuges.

### **7. Fluidisation (02 hours)**

General principles and uses – Fluidized bed driers

### **8. Conveying (08 hours)**

Types of conveyors.  
Pneumatic conveying.  
Types of pumps.

### **9. Size Reduction (03 hours)**

Size reduction and screening.  
Sieves and screens.  
Crushing and grinding equipment.

**10. Crystallisation (02 hours)**

General principles.

**11. Membrane Separation (06 hours)**

General principles.

Micro filtration.

Nano filtration.

Molecular sieves.

**12. Mixing (02 hours)**

Types of Impellers

**List of Practicals: (45 hours)**

Determination of specific surface area of a powder

Sieve analysis

Filter press

Pressure drop across a bubble cap column

Fluidized bed

Crystallisation

Screw conveyor

Centrifuge

Adsorption of acetic acid on charcoal

**Recommended Text Books :**

1. Chemical Engineering - Volume II; J.M.Coulson and J.F. Richardson
2. Equilibrium Stage Separations; P.C.Wankat, Elsevier, Science Publication
3. Unit Operations in Chemical Engineering; Mc Cabe and Smith, Mc Graw Hill
4. Mass Transfer Operations; R.E.Trebal, Mc Graw Hill

## 16. DEE 201 Applied Electricity

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

### 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.

<b>No</b>	<b>Course Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
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	-
	<b>Total</b>	<b>60</b>	<b>45</b>

## 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

## 17. DIS 202 Mathematics

<b>Subject Code: DIS 202</b>			<b>Division : Interdisciplinary Studies</b>		
<b>Title : Mathematics</b>					
<b>Annual Workload</b>			<b>Weekly Workload</b>		
<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practicals</b>
<b>60</b>	<b>30</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>-</b>
<b>Method of Assessment :- 3 Hour Question Paper</b>					

### 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

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>
1.	Fourier Series and Laplace Transformations	10
2.	Integrals	05
3.	Statistics	20
4.	Vector Calculus	10
5.	Differential Equations	14
	<b>Total</b>	<b>60</b>

## Summary Syllabus

### **1. Fourier Series and Laplace Transformations (10 hours)**

Periodic functions,  
Fourier expansion of a periodic function,  
Odd and even functions,  
Half range Fourier series,  
Complex notation for Fourier series.  
Laplace 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.  
Laplace 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. Laplace 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

## 18. DME 204 Industrial Management

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

### 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.

<b>No.</b>	<b>Subject Outline</b>	<b>Lecture (hr.)</b>	<b>Practical (hr.)</b>
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	-
	<b>Total</b>	<b>60</b>	<b>--</b>

## 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

## 19. DPT 206 Polymer Science & Technology

Subject Code: DPT 206			Division : Polymer, Textile and Chemical Engineering Technology		
Title : Polymer Science & Technology					
Annual Workload			Weekly Workload		
Lectures	Tutorials	Practicals	Lectures	Tutorials	Practicals
60	30	30	2	1	3/3
Method of Assessment :- 3 Hours Question Paper & Course Work					

### General Objectives

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

- Use their knowledge on polymer morphology to describe the thermal and physical properties and mechanical behaviour of polymers

No.	Subject Outline	Lectures (hr.)	Practical (hr.)
1.	Basic Organic Chemistry	06	-
2.	Introduction to Polymer Materials	07	05
3.	Polymerization Processes	20	-
4.	Morphology of Polymers	07	-
5.	Naturally Occurring Rubbers	08	05
6.	Introduction to Polymer Processing	07	10
7.	Analysis and Identification of Plastics & Rubber	05	10
	<b>Total</b>	<b>60</b>	<b>30</b>

## Summary Syllabus

- 1. Basic Organic Chemistry (06 hours)**  
Empirical formulae and molecular formulae of simple substances.  
Determine the molecular formula of a simple chemical substance  
Nomenclature of organic compounds.  
Isomerisms in organic substances.
- 2. Introduction to Polymer Materials (07 hours)**  
Monomers & polymers  
Sources of monomers  
Rubbers, plastics and fibres.
- 3. Polymerization Processes (20 hours)**  
Processes & mechanisms  
Chain polymerization  
Step growth polymerization  
Ring opening polymerization  
Stereo specific polymerization  
Kinetics of polymerisation  
Copolymers & types of copolymers  
Tacticity of polymers
- 4. Morphology of Polymers (07 hours)**  
Rubbers, plastics & fibres  
The rubber –glass transition  
Factors affecting T<sub>g</sub>  
Measurement of T<sub>g</sub>  
The nature of crystallinity in polymers  
Crystallisation of polymers by cooling & stretching  
Types of crystal structures
- 5. Naturally Occurring Rubbers (08 hours)**  
Production, Grades and Properties  
Derivatives of Natural Rubber
- 6. Introduction to Polymer Processing (07 hours)**  
Machines for Preliminary Processing  
Shaping & Curing
- 7. Analysis and Identification of Plastics & Rubber (05 hours)**  
Sodium fusion test  
Burning test  
Solubility behaviour

### **List of Practicals: (30 hours)**

Detection of elements in polymer materials.

Identification of common rubbers & plastics by simple tests.

Some specification tests for grading natural rubber

- Determination of dirt content.
- Determination of nitrogen content
- Determination of volatile matter

Determination of density of polymer materials

- Raw rubbers.
- Plastics- granular, powder, pellets
- Rubber mix
- Rubber vulcanisates

Extraction of acetone soluble resinous matter from raw natural rubber

Determination of plasticity of raw and masticated rubber using Wallace Rapid Plastimeter

Determination of Plasticity Retention index of RSS and Crepe rubber

### **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
5. Developments in Rubber Technology; A Whelan, K S Lee (Editor)
6. Rubber Processing – Technology, Materials, Principals; James Lindsay White
7. Rubber Technology (Third Edition); Maurice Morton (Editor)