

PART- II
(5th & 6th Sem.)

**CURRICULUM OF DIPLOMA
PROGRAMME
ON
MECHANICAL ENGINEERING (ME)
IN
MULTI POINT ENTRY & CREDIT SYSTEM**

For the State of Nagaland



Path Finder for Excellence in Technical Education

**National Institute of Technical Teachers' Training &
Research, Kolkata**

Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

<http://www.nittrkol.ac.in>

2018

SAMPLE PATH: TERM - V

Sl. No	Code	Course	Study Scheme			Evaluation Scheme							Total Marks	Credit	
			Pre-requisite	Contact Hours / Week			Theory			Practical					
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional			Viva
1	ME408	Hydraulic Machines	ME406	3	0	3	75	10	10	5	25	25	-	150	5
2	ME501	Metrology & Mechanical Measurements	G-106A & G-107	3	0	3	75	10	10	5	50	25	-	175	5
3	ME503	Machine Design	ME403	3	0	3	75	10	10	5	50	25	-	175	5
4	ME506	Mechatronics	G-207	3	0	3	75	10	10	5	50	25	-	175	5
5	ME507	Automobile Engineering	ME405 & ME505	3	0	3	75	10	10	5	50	25	-	175	5
6	ME512	Professional Practice – IV	ME409	-	-	2	-	-	-	-	-	50	-	50	1
Total				15	0	17	375	50	50	25	225	175	-	900	26

SAMPLE PATH: TERM - VI

Sl. No	Code	Course	Study Scheme			Evaluation Scheme								Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory			Practical					
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G-303 to G-307	Soft core course-II		3	0	0	75	15	5	5	-	-	-	100	3
2	ME513	Professional Practice – V		-	-	4	-	-	-	-	-	50	-	50	2
3	ME502	Production Management		3	1	0	75	15	5	5	-	-	-	100	4
4	ME601to ME605	Elective-1		3	0	3	75	15	5	5	25	25	-	150	5
5	ME601to ME605	Elective-2		3	0	3	75	15	5	5	25	25	-	150	5
6	ME508	Project		-	-	10	-	-	-	-	-	50	50	100	5
Total				13	1	10	300	60	20	20	50	100	50	650	24
1	ME-09	Industrial training	-	-	-	-	-	-	-	-	100	100	-	200	10

Scheme of Studies and Evaluation (MPECS) for Mechanical Engineering

6. ELECTIVE COURSES (Any TWO to be taken)

Sl. No	Code	Course	Study Scheme			Evaluation Scheme							Total Marks	Credit	
			Pre-requisite	Contact Hour/Week			Theory			Practical					
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment				
								Class Test	Assignment		Attendance	Sessional			Viva
25 & 26	ME601	Welding & Fabrication		3	0	3	75	10	10	5	25	25	-	150	5
	ME602	Refrigeration & Air Conditioning		3	0	3	75	25	10	5	25	25	-	150	5
	ME603	Computer Aided Design & Drawing (CADD)		3	0	3	50	25	10	5	25	50	-	150	5
	ME604	Jig and Tool Design		3	0	3	75	25	10	5	25	25	-	150	5
	ME605	Renewable Energy Sources		3	0	3	75	25	10	5	25	25	-	150	5
Total				6	0	6	150/125	50	20	10	50	50/75	-	300	10

TERM - V

COURSE TITLE : METROLOGY AND MECHANICAL MEASUREMENTS

L T P
3 0 3

Total Contact hrs: **90**

Lecture: 45

Tutorial: 0

Practical: 45

Pre-requisite:

Credit: **5**

Total Marks: **175**

Curri. Ref. No. : ME-501

Theory: **100**

End Term Exam: 75

P.A: 25

Practical: 75

End Term Exam: 50

P.A: 25

Rationale

The practice of mechanical measurement involves practice measurements requiring the instruments and equipment with required degree of accuracy. The subject involves dimensional measurements and measurements of different physical quantities in mechanical systems. The course Metrology and mechanical measurement makes the students to understand the process of measurement and concept of instrumentation needed in any industry. Also the student should be able to use various measuring instruments, select the appropriate instrumentation for a particular application..

DETAILED COURSE CONTENTS

PART-I METROLOGY

1.0 Fundamentals of Metrology

4

- 1.1. Definition of Metrology common terminology used such as Accuracy, Precision, Sensitivity, Magnification, Errors, Sources of errors ;
- 1.2. Standards of Measurement

2.0 Basic precise & non precise measuring instruments

5

- 2.1 Surface plate, angle plate, V Block, Spirit level, straight edge, Radius gauge, Pitch screw gauge, feeler gauge,
- 2.2 Vernier calliper, Vernier height gauge, Vernier depth gauge, Outside micrometer, inside micrometer, slip gauge.
- 2.3 Concept of calibration.

3.0 Limits, Fits & gauges	5
3.1 Definitions -Tolerance, Allowance,	
3.2 Types of fits, Hole basic system & shaft basic system of fits.	
3.3 Types of gauges ,Plug gauges, snap gauges, Ring gauges and relation gauges. Taylor's Principle of gauge design. Problems of Tolerance calculations & gauge design.	
4.0 Angular measurements	4
4.1 Concept of Angular measurement.	
4.2 Construction & working of bevel protractor, sine bar, angle gauges, clinometer, autocollimator, angle dekkor.	
5.0 Screw thread measurement	3
5.1 Terminology of screw thread.	
5.2 Measurement of various parameters of screw thread such as major diameter, minor diameter, effective diameter, pitch using instruments – bench micrometer, screw thread micrometer, floating carriage micrometer, tool makers microscope, optical profile projector.	
6.0 Gear measurement	3
6.1 Terminology of gear.	
6.2 Measurements of chordal thickness, addendum using gear tooth vernier.	
6.3 Parkinsons gear tester.	
6.4 Optical profile projector for profile terting.	
7.0 Testing Techniques -	4
7.1 Straightness testing by straight edge & autocollimator.	
7.2 Flatness testing by optical flats.	
7.3 Squareness testing by dial indicators.	
7.4 Parallelism testing by dial indicator and various cases of parallelism & squareness testing.	
7.5 Circularity testing (Roundness testing) using dial indicator.	

PART-II MECHANICAL MEASUREMENT

8.0 Force measurement 5

8.1 Spring balance , analytical balance multiple level system, load cell, electronic weight measurement system.

9.0 Pressure measurement 4

9.1 **Definitions** : Absolute pressure, gauge pressure, differential pressure, pressure measurement by gauges, Bourdon type , Bellows gauges, Diaphragm type gauge, Dead weight pressure, Measurement of vacuum by Mc Lead gauge, Pirani or thermal conductivity gauge , measurement of high pressure .

10.0 Temperature measurement 4

10.1 Thermometers , thermistors , pyrometers : radiation and optical pyrometers , thermocouples , Laws of thermocouples .

11.0 Speed measurement 4

11.1 Tachometers , mechanical , eddy current type , mechanical counter stroboscope, non-contacting type counters using photosensitivity and reluctance type pick-ups.

Suggested Implementation Strategies

Following implementation strategies are to be adopted while teaching this course .

- Use of charts transparencies for the visualisation of the concept.
- Industrial visits are to be arrange to see various measuring instruments and instrumentation in actual work.
- Emphasis is given on practical oriented approach while conducting the practical.

REFERENCE BOOKS :

1. R. K. Jain : *Engineering Metrology* – Khanna Publishers
2. D. S. Kumar: *Mechanical Measurements and Control Engineering* - Metropolitan Book Co. Pvt. Ltd.
3. I.C. Gupta: *Engineering Metrology* - Dhanpat Rai & Sons, New Delhi
4. Greeve J. and Wilson F.: *Handbook of Industrial Metrology* - Prentice Hall Publishers, New Delhi
5. Manish J.Kadam: *Metrology and Quality Control* - Everest Publishing House
6. N. V. Raghavendra and L. Krishna murthy: *Engineering Metrology and Measurements* – Oxford University Press.
7. K. L. Narayana: *Engineering Metrology* – Scitech Publications (India) Pvt. Ltd.

12. METROLOGY AND MECHANICAL MEASUREMENT LABORATORY

1.1.

- Use of basic precision measuring instruments such as Vernier calliper, Vernier height gauge, Vernier depth gauge, outside micrometer, inside micrometer for measurement of actual jobs from industry such as-Bearings, Cylinder block of scooter, Connecting rod, Crank shaft, Cam shaft, Crankcase of scooter etc.
- Use of slip guage to find unknown gap
- Use of sine centre to measure taper angle
- Use of angle dekkor (autocollimator) for angular measurement
- Use of dial indicator as a mechanical comparator. 50 jobs manufactured on any machine by single operator for a particular dimension are checked as per the job drawing with tolerances e.g. any shaft with outside diameter within 10 microns manufactured on our CNC lathe.
- Use of pneumatic comparator
- Use of screw thread micrometer to measure effective diameter of screw thread & demonstration of bench micrometer and floating carriage micrometer for two wire method.
- Use of gear tooth Vernier for chordal thickness & addendum measurement. Demonstration of Parkinson's gear tester.
- Use of optical flat for flatness testing.
- Use of tool makers microscope for screw thread measurement.
- Use of optical profile projector for screw thread & gear tooth measurement.
- Pressure measurement by U tube manometer, Bourdon tube, dead weight pressure gauge tester.
- Force measurement by analytical balance, spring balance, load cell, proving ring.
- Speed measurement by mechanical counter, stroboscope, eddy current tachometer.
- Temperature measurement by mercury thermometer, thermocouples, pyrometers

COURSE TITLE : MACHINE DESIGN

L T P
3 0 3

Curri. Ref. No. : ME-503

Total Contact hrs: **90**

Total Marks: **175**

Theory: **100**

Lecture: 45

End Term Exam: 75

Tutorial: 0

P.A: 25

Practical: 45

Practical: 75

Pre-requisite:

End Term Exam: 50

Credit: **5**

P.A: 25

Rationale

Mechanical engineer/ technicians should possess the knowledge of production design & maintenance. In order to perform the jobs in this area he should have the thorough understanding of the working principles of the machine parts. The machine elements are subjected to forces and stresses, therefore machine parts should be designed to function for a long period of time without wear and tear. Through this course the students are introduced to simple design of the machine elements like the joints, couplings, levers, springs, etc. While designing data book, design handbook, etc. are to be referred so that the design is economical.

DETAILED COURSE CONTENTS

1.0 Fundamentals

6

- 1.1 Introduction to machine design
- 1.2 Basic design requirements for machine parts
- 1.3 General design procedure
- 1.4 Design considerations for selection of material, manufacturing process, heat treatment, factor of safety.
- 1.5 Stress, strain, elastic limit, ultimate strength, stress strain diagram, thermal stress, creep
- 1.6 Endurance limit, fatigue, s-n curve,
- 1.7 Commercial designation of materials
- 1.8 IS specifications
- 1.9 Use of design data books, standards and standardization.

2.0 Design of machine parts-Subjected to combined loading.	8
2.1 Parts subjected to direct bending, direct twisting, bending and twisting	
2.2 Maximum Principal stress theories and its applications	
2.3 Design of following machine parts, levers , hand lever, foot lever, ball crank, rocker arm, safety valve levers, arm of pulley, bearing cap, c- clamp, off set links.	
3.0 Design of shafts, keys and couplings	7
3.1 Types of keys	
• Design of sunk rectangular keys	
3.1 Types of shafts, materials, production method, specification, standard shafts available,	
3.2 Design of shafts	
• Effect of keyway, hollow and solid shaft	
• On the basis of strength and rigidity	
• Shafts with one or two pulleys supported in bearings.	
3.1 Types of couplings	
• Application of couplings	
• Selection of coupling	
• Flange coupling and bush Pin type coupling.	
4.0 Design of power screws	6
4.1 Thread profiles for power screws	
4.2 Difference between v- threads and square threads	
4.3 Self locking	
4.4 Overhauling	
4.5 Maximum power transmission	
4.6 Efficiency	
4.7 Design of screw jack , toggle jack., c- clamp.	
5.0 Design of springs	6
5.1 Classifications,	
5.2 Functions and applications of springs, material, manufacturing methods	
5.3 Terminology of springs such as spring rate, stiffness, spring index	
5.4 Design of helical compression tension	
5.5 Introduction of leaf spring and design of simple leaf spring	

- 6.0 Design of screwed and welded joints** **6**
- 6.1 Types screw fastenings, bolts, studs, machine screw ,eye bolts.
 - 6.2 Advantages and disadvantages of screwed joints
 - 6.3 Stresses in screw fastenings
 - 6.4 Bolts of uniform strength
 - 6.5 Design of bolts for cylinder cover
 - 6.6 Design of bolted joints under eccentric loading.
 - 6.7 Design of welded joints-Parallel and transverse fillet weld (no eccentric loading)

- 7.0 Drives** **6**
- 7.1 Pulleys- design of Lab,rims, arm, key and key ways
 - 7.2 Drawings of related problems on pulleys
 - 7.3 Spur gears- calculation of number teeth, gear ratio, forces actions between gear wheels, selection of gear dimensions
 - 7.4 Drawings of simple gear drives and pulley drives.

- 8.0 Computer Aided Draftings** **30**
- Use of Auto CAD or any other drafting package to make isometric and perspective and assembly drawings of any of the above components

Reference Books

Sr. No.	Title	Author/ Publisher
1	Machine design	P.L. Ballaney / Dhanpath rai & sons Delhi
2	Design of Machine element	Abdulla sheriff / Khanna
3	Machine Design	R.S.Khu / S Chand
4	Machine Design	G.R.Nagpal / Khanna
5	AutoCAD reference manual	George

(b) Other Resources

- Different types of machine parts/components .
- Wooden cut section models of machine parts/components.
- Production drawings from industries

COURSE TITLE : MECHATRONICS

L T P
3 0 3

Curri. Ref. No. : ME-506

Total Contact hrs: **90**

Total Marks: **175**

Theory: **100**

Lecture: 45

End Term Exam: 75

Tutorial: 0

P.A: 25

Practical: 45

Practical: 75

Pre-requisite:

End Term Exam: 50

Credit: 5

P.A: 25

Rationale

Rapid development in Technology & competitive economy has led us to develop of new manufacturing system such as CNC Machines, Automation ,FMS etc. which consists of combination of mechanical ,electrical & electronic systems which is referred as Mechatronics. Diploma engineer in professional life has to operate & maintain systems being developed in the area of Mechatronics. In view of this , it is important for them to understand fundamental facts, concepts , principles & application of Mechatronics systems which enables them to work as technician and to adopt an interdisciplinary approach of engineering while working on shop floor.

DETAILED COURSE CONTENTS

- | | | |
|------------|--|----------|
| 1.0 | Introduction | 5 |
| 1.1 | Introduction, Definition , Block diagram representation of General Mechatronics system showing various components with suitable example. | |
| 1.2 | Traditional V/s Mechatronics Approach | |
| 1.3 | Need & Scope | |
| 1.4 | Elements of Measurement Systems | |
| 1.5 | Control System - Open & Closed Loop Systems, Basic Elements of closed loop system | |
| 1.6 | Building Blocks of Mechatronics - Electronics, Instrumentation, Sensor & Measuremen | |
| 1.7 | Actuators, Microprocessor techniques, Software, Mechanical Components. | |

2.0	Sensors	6
2.1	Introduction	
2.2	Need of Sensors	
2.3	Contact & Non – Contact Type of Sensors	
2.4	Classification, Working & Application of - Potentiometer Sensors, Strain Gauge Elements, Capacitive Elements, Eddy Current Proximity Sensors, Inductive Proximity Sensors, Light Sensors, Pneumatic Sensors, Pyroelectrical Sensors, Piezoelectric Sensors, Pressure Sensors	
2.5	Selection of Sensors.	
3.0	Transducers	6
3.1	Introduction	
3.2	Primary & Secondary Transducers	
3.3	Classification & Working of - Mechanical Device as Primary detectors, Electrical Transducers,	
3.4	Primary & Secondary Transducers, Active & Passive Transducers, Analog & Digital Transducers .	
4.0	Signal Conditioning	8
4.1	Signal Conditioning Process	
4.2	Operational Amplifiers - Inverting, Non – Inverting, Summing, Integrating, Differential	
4.3	Instrumentation Amplifier	
4.4	Logarithmic Amplifier	
4.5	Analog to Digital Converter	
4.6	Digital to Analog Converter	
4.7	Multiplexers - Digital Multiplexer, Time Division Multiplexer	
4.8	Data Acquisition	
4.9	Digital Signal Processing	
5.0	Actuators	7
	Part A (Instructional Type)	
5.1	Introduction & Classification of Actuators	
5.2	Need & Scope	
5.3	Hydraulic Actuation Systems	
5.4	Linear Hydraulic Actuation System - Single & Double Acting	
5.5	Rotary Hydraulic Actuation Systems - Gear Motors, Vane Motors Piston Motors	
5.6	Pneumatic Actuation System	
5.7	Linear Pneumatic Actuation Systems - Single & Double Acting	

5.8 Rotary Pneumatic Actuation Systems - Gear Motors & Vane Motors

Part B (Instructional Type)

5.9 Mechanical Actuation Systems - Cam & Followers, Gear Trains, Belt & Chain Drives, Four Bar Mechanism, Harmonic Drives

5.10 Electrical Actuation Systems - Electrical Systems Viz. Switching Devices solenoid Type Devices, Drive Systems , Mechanical Switches Viz. Debouncing, Keypads, Electro-Mechanical & Solid State Relays, D.C. Motors

6.0 Stepper Motor & Servo Motor	3
6.1 Introduction	
6.2 Classification , Working , Construction & Application of stepper motor	
6.3 Classification, Working, Construction & Application of servo motors	
6.4 Advantages & Disadvantages	
6.5 Selection Criteria of stepper motor and servo motor.	
7.0 Microprocessors (8085)	3
7.1 Introduction	
7.2 Control	
7.3 Microcomputer Structure	
7.4 Buses	
7.5 Central Processing Unit (CPU), Arithmetic Logical Unit (ALU)	
7.6 Memory	
7.7 Input/Output	
7.8 Minimum System Configuration	
7.9 Concept of Micro – Controller Applications	
7.10 Simple Programming - Assembly Language	
8.0 Input / Output Systems	2
8.1 Interfacing	
8.2 Input / Output Ports	
8.3 Brief study of Interface requirements - Electrical buffering / isolation, Timing control, Code conversion, Changing the number of lines, Serial to Parallel and vice versa, data transfer, Conversion from analog to digital and vice versa	
8.4 Definition of interface adopter	

9.0 Mechatronics Systems

5

9.1 Introduction

9.2 Study and application of Mechatronics systems in Washing Machines

Desk Jet Printer, CNC Trainers, Pick and Place Robot, Automatic cameras.

Reference Books

Sr. No.	Title	Author, Publisher, Edition
1	Mechatronics	Bolton, Addison Wesley /Longman Ltd., U.S.A.
2	Mechatronics	H.M.T./,Tata McGraw Hill
3	Mechatronics Electronics in Production and Process	D.A.Dawson, N.C.Burd, A.J.Loader /Chapman-Hall
4	Introduction to mechatronics & Measuring Systems	Michael B. Histan & David G. Alciatore/TMH 1999
5	Introduction to Mechatronics and Measuring system	Michal B. Histan and David G. Aleialover/ Tata McGraw Hill
6	Mech. Measurements.& Instrumentation	A.K.Sawhney/ Dhanpat Rai & Sons
7	Mechatronics	W. Bolton, Addison Wesley /Longman Ltd., U.S.A.

(b) Other Resources

- Software
- Resource material available on Internet
- www.engr.colostate.edu/~dga/mechatronics.html
- Video Cassettes

Total Hours: Marks: 25

Suggested List of Experiments/Practice work

- Observe & study of various types of sensors used in lab & in Industry.
- **Observe & study of various types of transducer used in lab & in Industry along with its applications.**
- **Observe & study the various types of actuators in lab & in industry.**
- Observe & study functioning of stepper & servo motor.
- Write program for simple microprocessor based application.
- **Example of interfacing problems : student should observe and study the various examples of interfacing in laboratory of the institution and the industries.**
- At least 02 Industrials Visits to demonstrate the various Mechatronics Systems used in industries & submit the detailed report of the above study and industrial visits.

COURSE TITLE : AUTOMOBILE ENGINEERING

L T P
3 0 3

Total Contact hrs: **90**

Lecture: 45

Tutorial: 0

Practical: 45

Pre-requisite:

Credit: **5**

Total Marks: **175**

Curri. Ref. No. : ME-507

Theory: **100**

End Term Exam: 75

P.A: 25

Practical: 75

End Term Exam: 50

P.A: 25

Rationale

Automobiles are the one of the necessities of modern life. Development and progress of the world majority is based upon the development of modern automobiles. Diploma Engineers should know about principles of construction, working and various systems of automobile vehicles of different types and sizes. Diploma engineer often comes across different types of automobiles when working as a Production engineer, Maintenance engineer, Service engineer in Automobile related fields. So he should be well conversant with basic automobile systems like engine, fuel feed systems, cooling systems, electrical systems, transmission system, brakes, suspension system etc., both theoretically and practically. In this course all these systems are included.

COURSE CONTENTS

- | | | |
|------------|--|-----------|
| 1.0 | Introduction | 5 |
| 1.1 | Types of Automobiles, Layout of typical Automobile Vehicle | |
| 1.1 | Layout of chassis frame & its main components, Location of different components, systems, Auto frame , types of frames , | |
| 2.0 | Automobile Engine (Power plant) | 10 |
| 2.1 | Types of Automobile power plants :-Petrol Engine, Diesel Engine , Gas Turbine, Rotary piston Engine Electric motor ,Fuel cell (Hydro/ Hydro methanol fuel cell) | |
| 2.2 | Engines locations - front, rear and transverse under floor with their advantages and disadvantages | |
| 2.3 | Constructional features of engine:-Engine block, engine heads, Crank case oil pan, cylinder liners, Gasket, Piston, piston pin, gudgeon pin, connecting rod, cranks shaft, cam shaft, valve & valve mechanism. | |

Combustion chambers with their types. Overhead, side valve mechanisms, Timing gears, Inlet & exhaust manifolds. Exhaust mufflers, vibration dampers, flywheel, inlet & exhaust ports of two stroke engine. Concept of firing order in multi cylinder engine.

2.4 Cooling system of engine – need, air and water cooling system and its components

3.0 Fuel feed systems

6

3.1 Petrol Engine systems

- Mixture requirement of petrol engine,
- simple carburetor & limitations,
- Electrical & mechanical fuel pumps.
- Concept of Petrol Injection & MPFI Petrol injection systems such as direct injection systems, port injection systems, throttle body Injection, etc, Mechanical and Electronic injection systems.
- Concept of supercharging types of superchargers.

3.2 Diesel engine systems

- Mixture requirements of diesel engine .
- Fuel injection systems such as Common rail fuel injection system, Individual pump fuel injection system. Fuel feed pump, Fuel injection pump, Fuel injector, Distributor type rotary fuel injection pump,
- Governors such as Mechanical, Hydraulic and Pneumatic, fuel injection timers. fuel filters, air cleaners,
- Cold starting devices such as Decompression devices, Heater Plugs, Inlet Manifold Heaters etc.

4.0 Auto-Electric System

4

4.1 Main Components of the Electrical System

4.2 The Starter

4.3 Generator

4.4 Alternator Type Generator

4.5 Regulation and Regulators

4.6 Ignition System

4.7 Distributor

4.8 Ignition Coil

4.9 Ignition Timing

4.10 Ignition Advance

- 4.11 Spark Plug
- 4.12 Electronic Ignition System
- 4.13 Electronic Switching Systems
- 4.14 Operation of Electronic Ignition System
- 4.15 The Automobile Battery
- 4.16 Low-maintenance and Maintenance-free Batteries

5.0 Transmission & Propeller Shaft 2

- 5.1 Need of transmission, functions of transmission system,
- 5.2 Types of transmission
- 5.3 Types of gear boxes (e.g. sliding mesh, constant mesh, synchromesh gear boxes). Epicyclic gear box, five speed gear box,
- 5.4 Gear shifting mechanisms.
- 5.5 Overdrive & automatic transmission.(Elementary Treatment)
- 5.6 Clutches such as Single Plate, Multiplate, Centrifugal clutches functions & types.
- 5.7 functions of propeller shaft, Universal joints & slip joints on propeller shaft

6.0 Final Drive & Rear Axle 2

- 6.1 Introduction, Function & need differential, types of gears used in differential, Differential trouble diagnosis, final drive,
- 6.2 Rear axle and forces acting on rear axle,
- 6.3 Types of Rear Axle (such as semi floating, fully floating, Three quarter floating), Rear axle drives such as Hotchkiss type, torque tube type etc.

7.0 Steering & Front Axle 3

- 7.1 Function of the steering system
- 7.2 Steering gears
- 7.3 Steering mechanism
- 7.4 Steering wheel & column
- 7.5 Front axle-Function & construction
- 7.6 Steering heads & steering geometry
- 7.7 Wheel alignment
- 7.8 Adjusting the steering angles
- 7.9 Ackerman linkage
- 7.10 Power steering

- 7.11 Under steering & over steering
- 7.12 Steering lock
- 7.13 Turning radius

8.0 Brakes

3

- 8.1 Need & principle of braking system., Brake efficiency and stopping distance,
- 8.2 Types of brakes as Mechanical brakes such as drum and disc brakes,
- 8.3 Hydraulic Brakes, Tandem Master cylinder, wheel cylinder,braking linkages
- 8.4 Self energized brakes, floating-caliper brakes
- 8.5 Power brakes, Air brakes, Air hydraulic brakes
- 8.6 Emergency & Parking Brakes, Brake trouble shooting.

9.0 Suspension systems

- 9.1 Need for Good Suspension System
- 9.2 Stages in Suspension System
- 9.3 Elements of a Suspension System
- 9.4 Suspension Systems
- 9.5 Inspection and Service of Suspension System (general)
- 9.6 Trouble Shooting of Suspension Systems

10.0 Wheels and Tyres

- 10.1 Types of Automobile Wheels
- 10.2 Tyres
- 10.3 Tyre Types
- 10.4 Tyre Tread
- 10.5 Tyre Selection
- 10.6 Tyre Service Parameters
- 10.7 Tyre Maintenance

11.0 Automobile Emission and its Control

- 11.1 Constituents of Exhaust Gases
- 11.2 Pollutant Formation
- 11.3 Effect of Air Fuel Ratio on Exhaust Emission
- 11.4 Effect of Driving Mode on Exhaust Emission
- 11.5 Sources of Pollutants in an Automobile
- 11.6 Control Approaches for Automobile Emission

(a) Reference Books:

Sr. No.	Title	Author, Publisher, Edition
1	Automotive Engineering Vol I	Kirpalsingh/ Standard publishers and distributors, New Delhi. 7 th
2.	Automotive Mechanics	Crouse & Anglin/ McGraw Hills International Pub. 10 th
3.	Automobile Engineering	K.K. Jain & R. B. Asthana, TMH. 1 st 2002
4.	Auto Mechanics- Understanding new technology	Don Knowles/ Reston Publishers, New Jersey. 1987
5.	Internal Combustion Engine	Mathur & Sharma/ Dhanpat Rai & Sons, New Delhi 7 th
6.	Automotive Handbook	Bosch/ SAE (distributor) 4 th
7.	Diesel Fuel Injection	Bosch/ SAE (distributor) 1 st
8.	Motor Automotive Technology	Anthony E. Schwaller/ Delmar Publishers, USA 3 rd

(b) Others Resources:

- Charts on various topics and chapters.
- Video cassettes and CD's on Work study..
- Transparencies on various topics.
CD's and Interactive learning packages on related topics

Suggested List of Experiments

- Dismantling & assembly of 4 stroke petrol engine (Maruti / Premier / Ambassador / Jeep engine.)
- Dismantling & assembly 4 stroke diesel engine.(Jeep/Car)
- Disassembly and assembly of following carburetors with their correct tuning.
(1) Solax (2) Su. Carburettor
- Disassembly and assembly of plunger type of fuel pump, rotary fuel pump & fuel injector with their correct tuning.
- Study of Air & water-cooling systems of a car engine.
- Dismantling & assembly of battery ignition system.
- Study of Alternator and dynamo, Startor Bendix drive by dismantling & assembly.
- Study of Gear box by dismantling & assembling of Sliding mesh ,constant mesh & Synchronesh gear boxes.
- Dismantling & assembling of single plate clutch, Diaphragm clutch, Centrifugal clutch.
- Dismantling assembly of steering gear of Rack and pinion type.
- Study hydraulic braking system of Car /Truck.
- Study Air Braking system of truck.
- Locate and study of front axle and steering system of a car
- Study of independent & conventional Suspension system.(Maruti/Jeep/Indica)
- Balance wheels on Dynamic wheel balancing machine.
- Conduct trial on petrol & diesel gas Analyzer & analyze results.
- Tune up petrol & diesel engine for minimum Emission level.

TERM - VI

ENGINEERING ECONOMICS AND ACCOUNTANCY

L T P
3 0 0

Curri. Ref. No.: G303

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Tutorial: 0

P.A.: 25

Practical: 0

Credit: 3

RATIONALE

The knowledge of Engineering Economics and Accountancy is needed by personnel dealing with the cost of products of any kind related to quality and standards of production including its financial control. Engineers / Technicians, in general, need to know the cost of the final products for marketing purposes. The knowledge of Economics as well as Accountancy is required by all people dealing in any business or enterprise.

This particular subjects deals in basic concepts of economics, production of commodities, different types of industries, market forms, objective of economic planning, concept of value of money, causes of unemployment, industrial policy, business transaction and accountancy, maintenance of cash and balances, receipt and expenditures and final accounts.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION	1
1.1 Introduction to Economics and its Utility of study	
1.2 Importance of the study of Economics	
2.0 BASIC CONCEPTS OF ECONOMICS	3
2.1 Definition of Utility, Consumption, Want, Value, Price, Goods, National Income.	

2.2	Classification of goods, characteristics and classification of wealth.	
2.3	Basic Laws of demand and supply.	
2.4	Concept and Measurement of Elasticity of demand	
3.0	PRODUCTION	3
3.1	Meaning and factors of production.	
3.2	Land, Labour, Capital and Organisation	
3.3	Formation of Capital, Break even chart-its uses.	
4.0	SCALE OF INDUSTRIES	2
4.1	Definition, advantages and disadvantages of small, medium and large scale production	
4.2	Internal and External Economies	
5.0	MARKET FORMS	3
5.1	Definition and types of Markets in respect of present trends.	
5.2	Features of Perfect, Imperfect and monopoly markets.	
5.3	Price determination under perfect competition and monopoly	
6.0	ECONOMIC PLANNING	3
6.1	Features of Under-developed and Developing Countries.	
6.2	Meaning, objectives and needs of planning.	
6.3	Introduction to industrial development in India during the five year plans.	

7.0	MONEY	3
7.1	Meaning and functions of Money	
7.2	Introduction to the concept of the value of money	
7.3	Meaning of Inflation, Deflation, Stagnation.	
8.0	UNEMPLOYMENT	2
8.1	Meaning, types and causes of Unemployment	
8.2	Unemployment problems in India	
9.0	INDUSTRIAL POLICY	3
9.1	Current Industrial Policy	
9.2	Industrial licensing Policy, De-licensing	
9.3	Monopolistic and Restricted Trade practices (MRTP) Foreign Exchange Regulation Act (FERA).	
10.0	BUSINESS TRANSACTIONS AND ACCOUNTANCY	5
10.1	Transactions and classifications, need and objectives of proper records including double entry system.	
10.2	Classification of Accounts and its description (in respect of real accounts, personal accounts and nominal accounts)	
10.3	Debit and credit concept; golden rules of debit and credit.	
10.4	Objectives and principles of double entry book-keeping.	

11.0	BOOKS OF ACCOUNTS	2
11.1	Journal and Ledger, their sub-divisions; posting from journals to ledger.	
11.2	Balancing of Accounts	
12.0	CASH BOOK	2
12.1	Objective of Cash Book (in respect of all kinds of Cash transactions)	
12.2	Single column, double column and triple column cash book	
12.3	Imprest system of Petty Cash Book.	
13.0	TRIAL BALANCE	2
13.1	Objective, Preparation, errors and rectification (in respect of balance of accounts for the total period).	
14.0	FINAL ACCOUNTS	5
14.1	Steps of preparing accounts; Trading Account; Profit and Loss Account	
14.2	Revenue and Depreciation adjustment	
14.2	Introduction to balance sheet	

15.0	CAPITAL AND REVENUE EXPENDITURE DISTRIBUTION	3
15.1	Receipts and payments	
15.2	Income and Expenditure differences	
16.0	MEANING AND PURPOSE OF COSTING	2
16.1	Elements of Cost-Analysis and classification of expenditure for cost accounts.	
16.2	Cost Control – Prime cost, Overhead cost, */and Indirect materials and tools.	
17.0	ELECTRONICS COMMERCE – MEANING – SCOPE	1
17.1	Accounting Software – Tally latest version	

SUGGESTED LEARNING RESOURCES:

Reference Books :

1. Agrawal, A.N., Indian Economy, New Delhi ; wish Prahashan, 2005
2. Wali, B.M., and A.B. Kalkundrikar – Managerial Economics, New Delhi : **R.Chand and Co., 1983**

ENTREPRENEURSHIP DEVELOPMENT

L T P
3 0 0

Curri. Ref. No.: G304

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Tutorial :0

P.A.: 25

Practical: 0

Credit: 3

RATIONALE

The course intends to provide the fundamental aspects of entrepreneurship as a means for self employment and culminating in economic development of the country. It deals with basic issues like entrepreneurial characteristics and quality, governmental policy support and overall scenario along with opportunities and the facilities available for entrepreneurship development.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION	10
1.1 Definition and functions of Entrepreneur, entrepreneurship quality, entrepreneurial spirit, need for entrepreneurship.	
1.2 Individual and social aspects of business – achievement motivation theory	
1.3 Social responsibilities of Entrepreneurs	
2.0 FORMS OF BUSINESS ORGANISATION	4
2.1 Types of company	
2.2 Merits and demerits of different types	
2.2 Registration of small scale industries	
2.4 Conglomeration.	

3.0	SMALL SCALE AND ANCILLARY INDUSTRIES	8
3.1	Definition – scope with special reference to self employment.	
3.2	Procedure to start small scale and Ancillary industries	
3.3	Pattern on which the Scheme/Project may be prepared	
3.4	Sources of finance - Bank, govt., and other financial institutions.	
3.5	Selection of site for factory	
3.6	Factors of selection	
3.7	N.O.C. from different authorities, e.g., Pollution Control Board, Factories Directorate etc.	
3.8	Trade License.	
4.0	SYSTEM OF DISTRIBUTION	1
4.1	Wholesale Trade	
4.2	Retail trade	
5.0	SALES ORGANISATION	3
5.1	Market survey, marketing trends, knowledge of competitors, product selection & its basis .	
5.2	Sales promotion	
5.3	Advertisement	
5.4	Public relations and selling skills	
6.0	PRICING THE PRODUCT	1
6.1	Basic guidelines	
7.0	INTRODUCTION TO IMPORT AND EXPORT	6
7.1	Procedures for export	
7.2	Procedures for import	
7.3	Technical collaboration – international trade	
7.4	Business insurance	
7.5	Rail and road transport	
7.6	Forwarding formalities, FOR, FOB, CIF, etc.	

8.0	BUSINESS ENQUIRIES	4
8.1	Enquiries: From SISI, DIC, SFC Dept. of Industrial Development Banks.	
8.2	Offers and Quotations	
8.3	Orders	
9.0	PROJECT REPORT	6
9.1	Project Report on feasibility studies for small scale industries, proposal for finances from bank and other financial institutions for establishing new industries and its extension, obtaining License enlistment as suppliers, different vetting organizations for Techno Economic feasibility report. Breakeven analysis, Breakeven point.	
10.0	ENVIRONMENT LEGISLATION	2
10.1	Air Pollution Act	
10.2	Water Pollution Act	
10.3	Smoke Nuisance Control Act	
10.4	ISO: 14000, OSHA	

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Entrepreneurship Development
Prepared by CTSC Manila Publishers by Tata Mc Graw Hill Publishing Co. Ltd.
2. Small Enterprise Management Published by ISTE, Mysore
3. Motivation Published by ISTE, Mysore
4. S.S.M. in Environmental Engineering Published by ISTE, Mysore
5. Entrepreneurship New Venture Creations, Holt, Prentice Hall, India.
6. Essence of TQM by John Bank

7. Rathore, B.S. and J.S. Saini(ed), A Handbook of Entrepreneurship – Panchkula : Aapga, 1997
8. Jose Pauletal, Entrepreneurship Development, Mumbai : Himalaya Publishing House, 1996
9. Khanka, S.S., Entrepreneurship Development, New Delhi : S. Chand and Co., 2001
10. Nagarazan, R.S. and A.A. Arivalagar, TQM New Delhi : New Age International Publishers, 2005
11. Bhatia, R.C., Marketing Communication and Advertising, New Delhi : Galgotia Publishing Co., 2003
12. Sinha, J.C., and V.N. Mugali : A Textbook of Commerce, New Delhi : R. Chand and Co., 1994

PRINCIPLES OF MANAGEMENT

L T P
3 0 0

Curri. Ref. No. G305

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Tutorial :0

P.A.: 25

Practical : 0

Credit: 3

RATIONALE

Management is the integrated component of all areas of technological courses as recognized across the world. Technicians or supervisors coming out of the system hence need to study the basics components of the management relevant to them. Principles of management will enable them to apply basic knowledge of management in their field of work. Keeping with this in mind necessary content details of the course on Principles of Management has been developed. With the assumption that, it will develop some management foundation to the diploma students.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
FRAMEWORK OF MANAGEMENT	8
1.1 Nature of management	
1.2 Development of management thoughts	
1.3 Management and process skills	
2.0 PLANNING	9
2.1 Fundamentals of planning	
2.2 Planning premises and forecasting	
2.3 Decision making	
2.4 Mission and objective	

3.0 ORGANIZING	10
3.1 Fundamentals of organizing	
3.2 Design of organization structure	
3.3 Forms of organization structure	
3.4 Power and authority	
3.5 Authority relationship	
4.0 STAFFING	8
4.1 Fundamentals of staffing	
4.2 HR planning	
4.3 Recruitment and selection	
4.4 Training and development	
4.5 Performance appraisal	
5.0 DIRECTING	6
5.1 Fundamentals of directing	
5.2 Operational control techniques	
5.3 Overall control technique	
6.0 TOTAL QUALITY MANAGEMENT	4
6.1 Concepts and definitions	
6.2 Sages of quality gurus and their contributions	
6.3 Basic tools of TQM	

SUGGESTED LEARNING RESOURCES:

Reference books:

1. Principles of management, by: T.Ramasamy (Himalya publishing house)
2. Management by: S. P. Robins
3. Management principles by: Anil Bhat and Arya Kumar
4. Principles and practice of management by LM Prasad
5. Principles of management by LM Prasad
6. Essentials of Management / Joseph L. Massie / Prentice-Hall of India

ORGANIZATIONAL BEHAVIOUR

L T P
3 0 0

Curri. Ref. No.:G306

Total Contact hrs.:

Theory: 45

Tutorial :0

Practical: 0

Credit: 3

Total marks: 100

Theory:

End Term Exam: 75

P.A.: 25

RATIONALE

Knowledge in behavioural principles in an organization is an important requirement because concepts such as work motivation, behavioural patterns of individuals as also those of group of individuals etc are intimately related to it. Organizational Behavioural principles, its scopes, applicability etc. are therefore important to know by the students irrespective of the branch of specialization. Based of the above facts following content details of the subject on Organizational Behaviour has been suggested.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 ORGANIZATION:	8
Concept and Definition	
Structures (line, staff, functional divisional, matrix)	
2.0 MOTIVATION :	10
Principles of Motivation	
Aspects of Motivation	
Job motivation	
Theories of motivation (Maslow, Herzberg, Theory of X&Y of Mc. Gregar)	

3.0 DEVELOPING GOOD WORK HABITS: 10

Principles of habit formation

Attitude and values

Personality-

- Concepts

- Theories

- Personality and Behaviour

4.0 ORGANIZATIONAL CULTURE: 8

Concepts and its importance

Determinants of organizational culture

Rules & regulations

5.0 TEAM BUILDING: 9

Concepts

Team and Group

Formation of Team building

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Organisational Behaviour — An introductory Text – Huezynski A. & Bucheman C. (Prentice Hall of India)
2. Image of Organisation — Morgan G. (Sage)
3. Understanding Management — Linstoand S. (Sage)
4. Organizational Behaviour — Robbins (Prentice Hall of India)
5. Understanding and Managing – Organizational Behavior — George & Jones
6. Organisational Behaviour, L.M. PRASAD, New Delhi, Sultan Chand & Sons
7. Essentials of Management — Koontz (Tata McGraw Hill)

ENVIRONMENTAL EDUCATION

L T P
3 0 0

Curri. Ref. No. G307

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 75

Tutorial : 0

P.A.: 25

Practical : 0

Credit: 3

RATIONALE

Management of Environmental Degradation as also its control using innovative technologies is of prime importance in the times we are living in. Since the days of the famed Rio Summit (1992) awareness about degradation of environment we live in and its management through participation of one and all has literally blossomed into a full fledged movement of universal importance. Technically qualified people, such as the Diploma Engineers, should not only be aware about new technologies to combat environmental degradation at their disposal but also various aspects of environment, ecology, bio-diversity, management, and legislation so that they can perform their jobs with a wider perspective and informed citizens. This course can be taken by all diploma students irrespective of their specializations.

DETAILED COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION	2
1.1 Introduction	
1.2 Environment and its components	
1.3 Environment in India	
1.4 Public Awareness	
2.0 ECOLOGICAL ASPECTS OF ENVIRONMENT	8
2.1 Ecology	
• Eco-system	
• Factors affecting Eco-system	

2.2 Bio-geochemical cycles

- Hydrological cycle
- Carbon cycle
- Oxygen cycle
- Nitrogen cycle
- Phosphorous cycle
- Sulphur cycle

2.3 Bio-diversity

2.4 Bio-diversity Index

3.0 NATURAL RESOURCES

5

3.1 Definition of Natural Resources

3.2 Types of Natural Resources

3.3 Quality of life

3.4 Population & Environment

3.5 Water Resources

- Sources of Water

3.6 Water Demand

3.7 Forest as Natural Resource

- Forest and Environment
- Deforestation
- Afforestation
- Forest Conservation, its methods

3.8 Land

- Uses and abuses of waste and wet land

4.0 GLOBAL ENVIRONMENTAL ISSUES

9

4.1 Introduction

4.2 Major Global Environmental Problems

4.3 Acid Rain

- Effects of Acid Rain

4.4 Depletion of Ozone Layer

- Effects of Ozone Layer Depletion

4.5 Measures against Global Warming

4.6 Green House Effect

5.0	ENVIRONMENTAL POLLUTION	9
	5.1 Introduction	
	5.2 Water Pollution	
	<ul style="list-style-type: none"> • Characteristics of domestic waste water • Principles of water treatment • Water treatment plant (for few industries only- unit operations & unit processes - names only) 	
	5.3 Air Pollution	
	<ul style="list-style-type: none"> • Types of air pollutants • Sources of Air Pollution • Effects of Air Pollutants 	
	5.4 Noise Pollution	
	<ul style="list-style-type: none"> • Places of noise pollution • Effect of noise pollution 	
6.0	CLEAN TECHNOLOGY	6
	6.1 Introduction to Clean Technologies	
	6.2 Types of Energy Sources	
	<ul style="list-style-type: none"> • Conventional Energy sources • Non-conventional sources of Energy 	
	6.3 Types of Pesticides	
	6.4 Integrated Pest Management	
7.0	ENVIRONMENTAL LEGISLATION	3
	7.1 Introduction to Environmental Legislation	
	7.2 Introduction to Environmental Laws	
8.0	ENVIRONMENTAL IMPACT ASSESSMENT	3
	8.1 Introduction to Environmental Impact Assessment	
	8.2 Environmental Management (elements of ISO 14001)	
	8.3 Environmental ethics	

SUGGESTED IMPLEMENTATION STRATEGIES:

The teachers are expected to teach the students as per the prescribed subject content. This subject does not have any practical but will have only demonstration and field visit as stated. The students will have to prepare report of the site visit.

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Environmental Engineering	Pandya & Carny, Tata McGraw Hill, New Delhi
2.	Introduction to Environmental Engineering and Science	Gilbert M. Masters Tata McGraw Hill, New Delhi
3.	Waste Water Engineering – Treatment, Disposal & Reuse	Metcalf & Eddy Tata McGraw Hill, New Delhi
4.	Environmental Engineering	Peavy, TMH International New York
5.	Study / training materials, references, reports etc. developed by Central Pollution Control Board, New Delhi as also State Pollution Control Boards	Central Pollution Control Board Postal Address: Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032, INDIA Tel.: 91-11-22307233 Fax: 91-11-22304948 e-mail: ccb.cpcb@nic.in
6.	Environmental Science	Aluwalia & Malhotra, Ane Books Pvt. Ltd, New Delhi
7.	Text Book of Environment & Ecology	Sing, Sing & Malaviya, Acme Learning, New Delhi
8.	Environmental Science & Ethics	Sing, Malaviya & Sing, Acme Learning, New Delhi
9.	Environmental Chemistry	Samir K. Banerji, Prentice Hall of India, New Delhi

(b) Others:

1. Text book mentioned in the references
2. Lab Manuals
3. OHP Transparencies
4. Video film on Environment

SUGGESTED LIST OF DEMONSTRATIONS/FIELD VISIT

- pH value of water sample.
- Hardness of water
- Calcium hardness
- Total Hardness
- Residual Chlorine to a given sample of water
- Turbidity
- B.O.D.
- C.O.D.

Visits: Following visits shall be arranged by the teachers during the semester:

- Water Treatment Plant
 - Sewage Treatment Plant
- Maintenance work of water supply mains and sewage system

PROFESSIONAL PRACTICE – V

L **T** **P**
0 **0** **4**

Curri. Ref. No: ME 410

Total Contact hrs.: 60

Total marks: 50

Practical:

Theory: 0

P .A : 50

Practical: 60

Credit: 2

Aim:-

To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.

Objective:-

Student will be able to:

- Acquire information from different sources.
- Prepare notes for given topic.
- Present given topic in a seminar.
- Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture.

Pre-Requisite:- Nil

Activities

1. INDUSTRIAL VISITS

16

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work.

Two industrial visits may be arranged in the following areas / industries to observe - Material Handling System, quality control charts / production record / layout flow systems / Facilities / Hydraulic & pneumatic systems / Working of Boilers and steam engineering applications.

- i) Auto / Electronic equipment manufacturing industry.
- ii) Cement / Sugar / Chemical / Textile / Steel rolling mills / extrusion industries.

- iii) Material handling in mines or ports.
- iv) Earth Moving Equipment Maintenance Shop.

2. THE GUEST LECTURE (S)

20

Lectures by Professional / Industrial Expert be organized from any of the following areas (four lectures of two hour duration) student shall submit the report on each lecture:

a) Battery and its charging system b) Electronic ignition system c) Micro-processor based instrumentation in Automobiles d) Earth moving machines. e) Tractors f) Excavators. g) Fork lift truck. h) Road- roller. i) Automated Guided Vehicles (AGV) j) Career opportunities in Service stations, Marketing, Surveyor, Insurance, R&D, call centers, CAD, NDT, Railways, Defense, Aeronautics, Marine, Software development, Information Technology k) Continuing education / Open university Programs, l) Air compressor technology 2) Tribological Aspects in automobiles / machine tools

3. GROUP DISCUSSION: (TWO TOPICS)

20

The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic for group discussions may be selected by the faculty members. Some of the suggested topics are:

- i. Solar Vehicles / Electric Vehicles.
- ii. Auto Vehicles - Comparison.
- iii. Two stroke versus four stroke engines
- iv. Recycling of plastics and other waste material
- v. Attributes of product design
- vi. Creativity and innovativeness
- vii. Energy conservation in institutes
- viii. Value engineering
- ix. Revolution in communication technology
- x. Pneumatic tools and equipments

4. STUDENT ACTIVITIES:

10

The students in a group of 3 to 4 will perform ANY THREE of the following activities (other similar activities to be considered), and write a report as a part of term work.

ACTIVITY:

- i. Collecting internal communication forms.
- ii. Collecting Failure data for automobile / machines / equipments.
- iii. Study of Hydraulic system for any one application like - dumpers, Earth moving equipment, Auto service station.
- iv. Survey of oils used for hydraulic circuits - specifications, properties, costs, manufacturers names etc.

- v. Study any one type of CNC machining center and prepare report on tooling and tool holding devices
- vi. Using finite element method analyse stresses in a cantilever beam. Write all the steps involved with brief description.
- vii. For a given job write a sequence of operations performed by automated manufacturing system. Draw a block diagram of control system to perform above operations
- viii. Survey of types of bearings involving information about construction working principles, mounting, lubrication, materials, advantages, limitations and cost.
- ix. Prepare a trouble shooting chart for any refrigeration system and suggest remedial measures to avoid failures
- x. For a drilling or milling operations on a simple machine component, draw a jig or fixtures showing various features like locating clamping, fool proofing etc.
- xi. Compare non-traditional methods on the basis of working principles, accuracy, MRR, Applications and limitations a) EBM b) PAM c) AJM d) WJM
- xii. For a given job involving 3 to 4 operations suggest to prepare a report

5. SEMINAR:-

24

Seminar on any advanced technical topic to be presented by individual student in a batch of 20 students. A separate topic be selected by an individual student.

COURSE TITLE : PRODUCTION MANAGEMENT

L T P
3 1 0

Curri. Ref. No. : ME-502

Total Contact hrs:**60**

Total Marks: **100**

Theory: **100**

Lecture: 45

End Term Exam: 75

Tutorial: 15

P.A: 25

Practical:0

Practical: 0

Pre-requisite:

End Term Exam: 0

Credit: **4**

P.A: 0

Rationale

Diploma engineers must have the knowledge of various management aspects of production apart from the technical knowledge engaged planning and controlling different types of production systems.

The knowledge of production engineering aspects will not only help the diploma engineers to get the idea of practical situation but also he will be able to handle the practical situation on shop floor during production, planning & controlling the production activity more effectively with the minimum production cost. He can perform the duties as a supervisor on shop floor & assist the production engineer in production planning & controlling.

COURSE CONTENTS

1.0 Production & Productivity

2

- 1.1 Types of production system.
- 1.2 Advantages , disadvantages & suitable examples of production system
- 1.3 Productivity.
- 1.4 Difference between production & productivity,Importance of productivity
- 1.5 Measurement of productivity,Scope of work study as an aid in raising productivity.

2.0 Production Design & Development	6
2.1 Introduction to production design, Effect of production design on cost,	
2.2 Requirements of good product design. Factors effecting production design. Introduction to product development, Factors / Aspects of product development	
2.3 Concepts of simplification,, Standardization, specification & interchangeability.	
3.0 Cost estimation	10
3.1 Defination , Cost accounting , Elements of cost , Components of cost ,	
3.2 Calculation of machining times for turning , drilling , milling , grinding , sharpening , estimation of total unit time .	
3.3 Depreciation , Methods of calculation of depreciation , Methods of allocation of overheads , Break even point, Break even analysis , Break even chart, Fraction of break even chart, Estimation of cost , Methods of cost estimating , Data requiredfor cost estimating , Steps in making a cost estimate , Chief factors in cost estimating , Numerical examples .	
4.0 Replacement Analysis	5
4.1 Introduction, Reasons for replacement,	
4.2 Factors for replacing equipment, Method used in selection of equipment,	
4.3 Total life average method, Annual cost method, Present worth method, Rate of return method	
5.0 Control of Production System	7
5.1 Meaning of control of production, Production control, Routing, Process control,	
5.2 Flow control of material, Components,	
5.3 Part of sub assemblies to the final product, Flow control, Line balancing, PERT / CPM method.	
6.0 Work study	15
6.1 Productivity enhancements, Techniques & procedures ,	

6.2 Human factors in the application of work study.

6.3 Method Study-Defination ,Objectives, Basic procedure, Charts, Diagrams,
Principles of motion economics , micromotion study , therblings, simo charts .
Work measurment -Technique, Purpose, Use & basic procedures, Time study equipments, Time study forms Selection of job for time study ,
Approch to the workers Performance ratings, Allowances

Reference Book

S. No.	Title	Author, Publisher
1.	Industrial Engg.& Management	O.P. Khanna, Khanna
2.	Production Engineering	P.C. Sharma Dhanpatrai
3.	Work Study	I.L.O.
4.	Production Technology	R.K.Jain Khanna

(b) Others Resources:

- Charts on various topics and chapters.
- Video cassettes and CD's on Work study..
- Transparencies on various topics.

CD's and Interactive learning packages on related topics

COURSE TITLE : REFRIGERATION AND AIRCONDITIONING

L T P
3 0 3

Total Contact hrs: **90**

Lecture: 45

Tutorial: 0

Practical: 45

Pre-requisite:

Credit: **4**

Total Marks: **150**

Curri. Ref. No. : ME-602

Theory: **100**

End Term Exam: 75

P.A: 25

Practical: 50

End Term Exam: 25

P.A: 25

Rationale

Diploma engineers often come across various systems based on the refrigeration and air conditioning applications. He/she is required to often operate and regularly maintain these systems in various application areas. To perform this, it is very essential that diploma engineer should be well conversant with fundamental principles concepts, devices and systems based on the refrigeration and air-conditioning.

COURSE CONTENTS

- 1.0 Introduction** **4**
- 1.1 Introduction to Refrigeration.
 - 1.2 Methods of refrigeration as Ice refrigeration, steam jet refrigeration,
 - 1.3 Concept of heat pump, Refrigerator,
 - 1.4** Concept of COP. Refrigerating effect, Units of refrigeration .
- 2.0 Air Refrigeration Cycles** **3**
- 2.1 Bell Coleman cycle its principle, components of system, ideal/actual cycle, minimum, and maximum. Temperatures.(Simple numericals),
 - 2.2 Practical application of the cycle such as Air – craft refrigeration.
- 3.0 Vapour Compression Cycle** **5**
- 3.1 VCC -principle, components, representation on PV, TS,& PH diagrams.
 - 3.2 Wet /Dry –compression-Reasons for not using Wet /Dry compression.
 - 3.3 Actual VCC, calculation of COP,
 - 3.4 Effect of superheating & under cooling.
 - 3.5 Multistage vapour compression cycle, need for multistage compression system, cascade refrigeration & its application.

Vapour Absorption System

2

- 4.1 Principle /components & working of Ammonia vapour absorption system, Lithium Bromide absorption system, Electrolux Refrigerators ,
- 4.2 Comparison with vapour compression system

5.0 Refrigerants

4

- 5.1 Types of refrigerants as primary / secondary.
- 5.2 Properties of the Commonly used refrigerants such as – Co₂, Ammonia So₂, Freon 11, Freon 12 , Freon 22, Freon 500 ,503 502. & Eco-friendly Refrigerants. Concept of Ozone layer and its destruction.
- 5.3 Selection of refrigerants for particular application with reasons.

6.0 Vapor Compression System Components

6

- 6.1 Construction & working of various components such as Open type Hermetically sealed, Centrifugal, Screw type compressors,
- 6.2 Evaporators—their functions & types such as Extended surface, Plate coil type, Flooded , Dry Direct & Indirect expansion types Capacity of evaporator. Frosting / Defrosting of evaporators.
- 6.3 Condensers – types of condensers such as Evaporative type, Air cooled [forced & natural convection) Water cooled [Double tube / Shell tube / Shell coil).
- 6.4 Construction & working of various types of expansion devices such as – capillary tube auto expansion & thermostatic expansion valves, solenoid control valves & Low side High side valves. Refrigeration system controls – LP /HP Controls, Thermostat, Overload protectors, bellows pressure controllers, Diaphragm controllers, & Relays.

7.0 Air Conditioning & Psychrometric Processes

8

- 7.1 Concept of body comfort. Properties of air as DBT, WBT , DPT, Air as mixture of different gases & water vapour
- 7.2 Daltons law of partial pressures
- 7.3 Concept of Humidity of air, absolute humidity, relative Humidity
- 7.4 Psychrometers and their types, Enthalpy of air, Sp. Volume of air, DPT of moist air
- 7.5 Psychrometric charts, & tables, Psychrometric processes such as sensible heating & cooling, latent heat of air, latent heating & cooling, heating &

humidification, cooling & dehumidification, evaporative cooling, sensible heat factor, By-pass factor, apparatus dew point, [representation on psychrometric charts]

8.0 Cooling Load Calculation 4

8.1 Concept of heat load, Heat sources as out door, walls, roofs in filtration & in door sources, types of cooling loads like—glass, walls, roofs, ventilation, people, electrical equipments, motors etc.

8.2 Calculations of total heating & cooling load estimation & determination of refrigeration capacity.

9.0 Air Distribution Systems 3

9.1 Elements of air distribution system such as types of Fans, Ducts,

9.2 Duct system as –graduated trunk, loop perimeter, Extended Platinium, Over head trunk, over head radial duct systems

9.3 Selection & Losses in duct systems.

9.4 Air distribution outlets supply outlets, return outlets, sealing diffusers, grills, resistors, fixed /adjustable louvers, low /high wall outlets, floor, baseboard & sealing outlets.

10.0 Air Conditioning Systems 6

10.1 Window air conditioning unit. Construction, Working, type of refrigeration system used, capacity.

10.2 Split air conditioners construction, working, Type of refrigeration system used, capacity Package / Summer / Winter & Year – round air Conditioner systems construction, working, type of refrigeration system used, capacity.

(a) Reference Books

S. No.	Title	Author, Publisher, Edition & Year
1.	Principles of Refrigeration	Roy /J. Dosat Wiley eastern
2.	Refrigaration & Airconditioning	P. N. Ananth Narayan TMH
3.	Practical Refrigeration & Air Conditioning	M.Adithon & S.C. Laroia Wiley eastern
4.	Principles of Air conditioning	V.Paull Lang. C.B.S.
5.	Basic Air conditioning vol . 1 & 2	Gerald Schweitzer & A.Ebling D.B. Taraporwal,

6.	Practical Air conditioning & Refrigeration	Audel D.B. Taraporwal
7.	Refrigeration & Airconditioning	S.Domkundwar Dhanpatrai
8.	Modern Airconditioning Practice	Harris
9.	Refrigeration & Airconditioning	C.P.Aurora TMH

(b) Other Resources

- Charts on various topics and chapters.
- Cut section models of Compressors.
- Transperancies on various topics.
- Display boards for quarter cut section valves used in Refrigeration and Air conditioning.
- CD's and Interactive learning packages.
- ASHRAY Journals.

Suggested List of Experiments

- Trial on vapour compression test rig for calculation of COP, Work done per cycle, Refrigerating effect. Representation on P-H diagram.
- Identification and location of refrigeration system and components in various application systems as Air conditioner, Household refrigerator, Water coolers Etc.
- Analysis and study of vapour absorption system in a typical application
- Physical properties of following Refrigerants
 - Freon 12
 - Freon22
 - Freon 503
 - Ammonia
 - One type of Eco friendly refrigerant
- Dismantling & assembling of open type of compressor in view of following—
 - Identification of parts & their functions & Free hand sketching of parts.
 - Writing of specification of compressors.
 - Collection of information of compressor manufactures & their models.
- Dismantling & assembling of Hermetic type of compressor in view of the above
- Analysis & study of typical Evaporator and condensers

- Study of following controls and valves used in Refrigeration systems. (i)Thermostatic switch (ii) LP & HP cut outs (iii)solenoid valve (iv)Service valves (v)Overload Protector
- Demonstration & study of various tools used in refrigeration system such as – Tube cutter , Bending tools , Flaring tool [block & yoke type] , Swaging tool , Brazing tools , Blow lamps etc.
- Disassemble visual inspection and servicing of water cooler
- Study of Air ducts & Air distribution systems in typical Air conditioned space in view of (1)Layout & type of air duct system .(2)Types of outlets (3)Identification of refrigeration equipments & cycle .(4)Type of blower , fans used & capacity of the unit .
- Study various types of insulating materials used in refrigeration and air conditioning applications with their properties.
- Study of window / split & package type of air conditioner [introduction of parts ,path of refrigerant, refrigeration cycle capacity , assembling & dismantling installation
- Assemble and dismantle of Air conditioning system of bus/car.

COURSE TITLE : COMPUTER AIDED DRAWING & DRAFTING

L T P
3 0 3

Curri. Ref. No. : ME-603

Total Contact hrs: **90**

Total Marks: **150**

Theory: **100**

Lecture: 45

End Term Exam: 75

Tutorial: 0

P.A: 25

Practical: 45

Practical: 50

Pre-requisite:

End Term Exam: 25

Credit: **5**

P.A: 25

Rationale

The market driven economy demands frequent changes in product design to suit the customer needs. With the introduction of computers, the task of incorporating frequent changes as desired is made simpler. This course has been introduced at Diploma level in order to develop the skills so that the student can generate various design and drawings as required using various CAD software.

DETAILED COURSE CONTENTS

3

1.0 Introduction

- 1.1 Computer Aided Drafting concept.
- 1.2 List of various CAD softwares available.
- 1.3 Components of AutoCAD 2000 window: Such as Title bar, standard tool bar, menu bar, object properties tool bar, draw tool bar, modify toolbar, cursor cross hair. Command window, status bar, drawing area, UCS icon.
- 1.4 AutoCAD coordinate systems: Cartesian, Polar.

2.0 Drawing using AutoCAD

8

- 2.1 Setting Drawing units, Limits, Grid, Snap, Saving the file. Opening an existing drawing file.
- 2.2 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Pline
- 2.3 Methods of Specifying points:
 - Absolute coordinates
 - Relative Cartesian coordinates
 - Relative Polar coordinates

2.4	Using Object Snap like	
	• Endpoint, Midpoint, Intersection, Center Point, Quadrant Point, Nearest Perpendicular, Apparent Intersection, from Osnap)	
2.5	Using Point Filters (Like .x, .y)	
2.6	Using 'cal expression	
3.0	Editing & viewing Drawing	4
3.1	Selecting objects: Selection set with its options like Pick box, Window, Crossing, Previous, Last drawn, Add, Remove.	
3.2	Editing commands like: Erase, Copy, Array, Mirror, Offset, Trim, Move, Rotate, Extended, Break, Chamfer, Fillet, Lengthen	
3.3	Display commands like : Zoom All, Zoom Previous, Zoom Extents, Zoom Window, Zoom Real Time, Zoom Dynamic, Zoom Pan.	
4.0	Organising Drawing	5
4.1	Concept of Layers: Creating Layers, Naming layers, Making layers ON/OFF, Freeze-Thaw layers, Lock/Unlock Layers. Setting the properties of layers like Color, Line type, Line weight	
4.2	Concept of Blocks: Local block, global block. Creating, inserting, redefining, exploding blocks.	
4.3	Concept of Hatch: Selecting Hatch pattern, Hatch styles, Hatch Orientations. Associative Hatch. Boundary Hatch, Hatching Object.	
5.0	Annotating Drawing	2
5.1	Dimensioning : Types of dimensioning: Linear- Horizontal, Vertical, Aligned, Rotated, Baseline, Continuous, Diameter, Radius, Angular Dimensions. Dim scale variable. Editing dimensions.	
5.2	Text: Single line Text, Multiline text. Text Styles: Selecting font, size, alignment etc	
6.0	Printing / Plotting Drawing	2
6.1	Selecting Various parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview	
7.0	Working in three dimensional space using AutoCAD	6

7.1	Right hand rule. Specifying coordinates using x,y,z co-ordinates, using x,y,z filters. Entering cylindrical co-ordinates. Entering spherical co-ordinates.	
7.2	Defining user co-ordinate system ,World Co-ordinate system. UCSICON command with its option. User co-ordinate system(UCS).	
7.3	Defining user co-ordinate system using UCS command with its options such as NEW- Z axis, 3 point, object, face, view, x,y,z,move, orthographic, prev, restore, save, del, apply, world,	
8.0	Solid modelling	8
8.1	Concept of solid modelling,	
8.2	Creating predefined solid primitives such as box, cone, cylinder, sphere, tours, wedge.	
8.3	Constructing a region using REGION command, Creating and extruded solid, creating a revolved solid,	
8.4	Creating composite solids using union, intersection and interfere commands.	
8.5	Creating cross-sections of solid with section command. Edit faces and edges of solid using SOLIDEDIT command with its options.	
8.6	Creating fillets and chamfers on solids.	
9.0	Viewing objects in 3D space	4
9.1	Viewing objects using V point command with its options such as specifying V point value, axes, tripod and compass, rotate, presets dialog box.	
10.0	Model space & paper space viewports layouts	3
10.1	Concept of model space and paper space.	
10.2	Creating view ports in model space and creating floating viewport in paper space using the VPORTS command with its options.	
10.3	Shifting from model space to paper space and vice versa	

(a) Reference Books

Sr. No.	Title	Author/ Publisher
1	AutoCAD14For Engineering Drawing Made Easy.	P. Nageswara rao, Tata McGraw Hill
2	Mastering AutoCAD	George Omura./,Tata McGraw Hill
3	AutoCAD Latest Version	Sham Tickoo, Galgotia Publications,New

4	AutoCAD Latest Version	Delhi Devid Frey , BPB
5	An Introduction to AutoCAD Latest Version	A. Yarwood , Long Man
6	Using AutoCAD Latest Version	Ron House, Prentice Hall

Other Resources

- Institute should have AutoCAD (preferably AutoCAD 2000) software for 10 seats licencing
- Use of LCD projector is recommended for effective teaching- learning process.

1.2.

1.3.

Suggested List of Experiments/Practice work

- **Print three sheets based on orthographic views for various Industrial components such as machines, Automobiles, Jigs & fixtures, Press tools, fasteners etc.**
- Create at least four solid models which covers all the features available in solid modeling.

COURSE TITLE : PROJECT

L T P
0 0 10
Total Contact hrs:
Lecture: 0
Tutorial: 0
Practical: 150
Pre-requisite:
Credit: 5

Total Marks: **100**

Curri. Ref. No. : ME-508

Theory: **0**
End Term Exam: 0
P.A: 0
Practical: 100
End Term Exam: 50
P.A: 50

Rationale

Every diploma engineer should work on project which will be useful for him actual to work an industrial environments. This course helps the student to study various applications of mechanical engineering such as compressors, pumps, blowers, torque wrenches, generators. Also the students should be exposed to the repair and maintenance of various types of machines and equipments encountered in practice..

DETAILED COURSE CONTENTS

The student will undertake one project which will consist of problem related to design and fabrication, repair and maintenance, fault finding of actual situations and there by plan organize and execute the project physically.

BASICS OF PROJECT

The project shall be executed in the following basic steps

- Project idea generation
- Literature survey for project.
- Design & Fabrication.
- Working & result analysis.

The student should follow the guidelines listed below for basic project idea generation

- Study & maintenance of different equipments which work on compressed air such as Pneumatic Impact wrenches, Air motors, Air blowers, Air spray gun, grease gun etc
- Study & Maintenance of various conveyors such as roller conveyors belt conveyors, over head hanger conveyors used for material handling.

- Study & maintenance of compressed air pipe lines, gas pipe lines and water pipe lines.
- Study and maintenance of fork lifts used for material handling.

Sample list of projects that can be taken by the group of 4 to 5 students

- Repair and maintenance of machines such as lathe milling m/c, drilling m/c, shaper, planer, grinder etc
- To fabricate work benches for two wheeler maintenance
- To manufacture some attachments for existing machines such as spherical turning attachment, taper turning attachment to lathe, lapping attachment to lathe etc
- To design and manufacture small material handling equipment required in the institute such as hydraulic trolleys, wheeled pallets etc
- Design & manufacturing of jigs and fixtures
- Design & manufacturing of attachment to machines
- Manufacturing of dies
- Simple automation in existing machines using hydraulic & pneumatic systems
- Quality study in the industry
- To develop simple computer programmes for various industrial applications.
- To study and manufacture innovative simple mechanisms from popular mechanics magazine or Invention intelligence magazine.

COURSE TITLE : INDUSTRIAL TRAINING

L T P
0 0 0

Curri. Ref. No. : ME-514

Total Contact hrs: **00**

Total Marks: **200**

Theory: **0**

Lecture: 0

End Term Exam: 00

Tutorial: 0

P.A: 00

Practical: 0

Practical: 200

Pre-requisite:

End Term Exam: 100

Credit: **10**

P.A: 100

Rationale

The purpose of industrial training is to offer wide range of practical exposures to latest practices, equipment, machines used in Govt. industries, Semigovt. Industries, private industry, workshops and ancillary units. Industrial training also helps the students in acquiring hands-on-experience of various practices and events required to perform in different job situations. Through the industrial training the students try to integrate all that they have learnt and put that into practice.

The duration of six weeks is kept for compulsory industrial training for all students of the programme. It has been suggested that industrial training must be offered only after acquiring 100 credits by the student. Some of the areas for industrial training is suggested below.

1. Repair & maintenance of machines, equipments and tools.
2. Welding and fabrication
3. Foundry Shop
4. Manufacturing of parts, components etc.
5. Repairing maintenance of air conditioner & refrigerator.
6. Workshop management.
7. CNC machines-operation and maintenance
8. Design and development of drawing using CAD software.
9. Inventory and store management
10. Calibration of measuring instruments.

Expected outcome

Expected outcome of industrial training is the work done by the student or a group of students during the industrial training. Proper recording of events and work done shall

be recorded and assessed in the requisite format. The student shall be assessed on the basis of work done during industrial training and report submitted and also by way of oral/ viva voce examination/presentation after completion of the training.

The Industrial Training has basically the following three components: -

1. Orientation Programme
2. Training in the Industry
3. Report Writing and
4. Evaluation

Orientation programme:

During the orientation programme complete guidelines will be provided to the students regarding planning, implementation and evaluation of industrial training.

Training in industry:

During the training student will have to maintain a daily dairy to record his observations and experiences in various department/section and on the basis of daily dairy student will prepare and submit the Industrial Training Report. Competent faculty / staff member shall follow-up the students progress regularly. The student should be encouraged to seek & collect relevant forms; brochures; & other print material from the various organization related to training/project.

Report writing:

Daily dairy will form the basis for report writing. The formats for the report preparation will vary depending upon the type of training/project and will be generated by the teacher guide.

Evaluation

The industrial training work of the student or a group of students will be evaluated jointly by faculty member and an expert from industry/field. The basis of evaluation will cover following criteria:

- Nature and extent of technical skills learnt
- Innovative skills/problem solving skills.

- Coordination and integration between theory and practice.
- Planning and decision making skills.
- Organization of work.
- Assemble the component/materials being used in given task.
- Work in group or independently and confidently.
- Submission of report.
- Skills and attitudes necessary in a technician.

Note: To assess the student performance, general guidance will be provided by the teacher.

The purpose of industrial training is to offer wide range of practical exposures to latest practices, equipment, machines used in private industry, Government workshops and authorized automobile dealers. Industrial training also helps the students in acquiring hands-on-experience of various practices and events required to perform in different job situations. Through the industrial training the students try to integrate all that they have learnt and put that into practice.

The duration of six weeks is kept for compulsory industrial training for all students of the programme. It has been suggested that industrial training must be offered only after acquiring 100 credits by the student. It is expected that the student should undergo industrial training on the following areas:

1. All kinds of automobile repair and maintenance.
2. Workshop equipment/tools maintenance.
3. Workshop management.
4. Spare parts management.
5. Engine and gearbox overhauling.
6. Auto engine reconditioning.
7. Tyre maintenance and re-treading.
8. Automobile air conditioning.
9. Auto body repair (denting and painting)
10. Two wheeler maintenance.
11. Auto electrical maintenance.
12. Fuel pump calibration, etc.

COURSE TITLE : JIG & TOOL DESIGN

• Course Code : ME604

Rationale

Diploma engineers often come across various Machine Tools with varieties of tools for different operations. He/She is required to differentiate between different tools required for varieties of application. For this purpose, it is very essential that diploma engineers should be well acquainted with the fundamental concepts and geometry of various tools.

Teaching & Examination Scheme

1 Teaching Scheme				Examination Scheme				Total Marks
L	T	P	C	Theory				
				ET	PA	ET	PA	
2	-	3	5	75	25	50	25	175

DETAILED COURSE CONTENTS

Chapter 1.0 Geometry of cutting tools

- 1.1 Classification of cutting tools – Single and multi-point cutting tool
- 1.2 Tool geometry and tool nomenclature
- 1.3 Tool angles

Chapter 2.0 Mechanism of metal machining

- 2.1 Elements of a machining process
- 2.2 Mechanism of cutting/machining
- 2.3 Metal machining processes- Orthogonal and oblique cutting
- 2.4 Chip formation and its type
- 2.5 Cutting forces
- 2.6 Measurement of cutting forces

Chapter 3.0 Machinability and tool life

- 3.1 Concept and variables affecting machinability

- 3.2 Parameters used to measure machinability
- 3.3 Machinability index
- 3.4 Tool life – Definition, factors affecting tool life
- 3.5 Tool life specification and its measurement
- Chapter 4.0 Punch & Die design**
 - 4.1 Cutting action in die and punch
 - 4.2 Die clearance
 - Necessity, purpose, amount of clearance, Angular clearance
 - 4.3 Stripping
 - 4.4 Cutting forces
 - (Simple numerical)
 - 4.5 Punch and die mountings
 - Die sets
 - Die shoe
 - Punch holder
 - Die area
 - 4.6 Types of die construction
 - Inverted dies
 - Compound dies
 - Combination dies
 - Steel rules dies
 - Rubber pad
 - Blanking
 - kirksite blanking dies
 - fine blanking
 - 4.7 Die design fundamentals
 - Construction of Blanking and piercing die construction
 - Screws and dowels
 - Plain punch
 - Pedestal punches
 - Punches mounted in punch plates
 - Punch support
 - Punch shedders (slug pulling)
 - 5.0 Bending, forming dies
 - 5.1 Bending dies
 - 5.2 Bending methods,
 - 5.3 Spring back
 - 5.4 Bend allowance,
 - 5.5 U dies and channel dies

5.6 Bending pressures (with numericals)

5.7 Forming dies

- Solid forms
- Pad type
- Curling
- Embossing
- Coining
- Pressure forming dies

6.0 Drawing dies

6.1 Drawing operation

- Metal flow during drawing
- Variables affecting metal flow in drawing operation.- radius on punch, draw radius on die, friction, material to be drawn
- Factors affecting selection of grade and quality of low carbon steel sheets for deep drawing, perfect reduction and depth of draw. drawing speed, die clearance.

6.2 Determining blank size.

6.3 Determining drawing force, draw ratio, radius on punch and die, die clearance, drawing pressure,

6.4 Single and double action draw dies.

7.0 Jigs and fixtures

7.1 Types and details of jigs and fixtures

7.2 Locating devices

7.3 Clamping devices

7.4 Mechanics of clamps

7.5 Jig bustings

7.6 Indexing fixtures

7.7 Relevant IS codes