


MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI																	
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING																	
COURSE CODE : MC																	
DURATION OF COURSE : 8 SEMESTERS										WITH EFFECT FROM 2013-14							
SEMESTER : FIFTH										DURATION : 16 WEEKS							
PATTERN : CORRESPONDANCE - SEMESTER										SCHEME : G							
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17905)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Basic Electronics & Mechatronics	BEM	17971	07	01	18	03	100	40	--	--	--	--	25@	10	50	
2	Theory of Machines	TOM	17972	08	01	20	03	100	40	--	--	--	--	25@	10		
3	Manufacturing Processes	MPR	17973	05	01	40	03	100	40	25#	10	--	--	50@	20		
4	CNC Machines	CNC	17974	03	--	16	--	--	--	50#	20	--	--	25@	10		
TOTAL				23	03	94	--	300	--	75	--	--	--	125	--	50	
TOTAL CONTACT HOURS DURING RESIDENT SESSION: 120 HRS [15 days * 8 hrs per day]																	
Total Marks : 550																	
@ - Internal Assessment, # - External Assessment, No Theory Examination, \$ - Common to all branches, Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work																	
NOTE:																	
1. HOURS MARKED BY * FOR INTERNAL PRACTICAL EXAMINATION TO BE CONDUCTED AT RESSIDENT SESSION.																	
2. ONE TEST OF 25 MARKS TO BE CONDUCTED AT RESIDENT SESSION AND MARKS TO BE SUBMITTED TO GPDL PUNE.																	
3. 240 HOURS FOR SELF STUDY AT HOME.																	
4. ALL PRACTICALS/ORAL EXAMS [EXTERNAL ASSESSMENT INDICATED BY #] TO BE CONDUCTED AT EXAM CENTRE.																	
5. ORAL EXAMINATION [INTERNAL ASSESSMENT @] TO BE CONDUCTED AT EXAM CENTRE.																	
6. INTERNAL ASSESSMENT @ OF TERM WORK WILL BE DONE AT RESIDENT SESSION.																	

 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING																	
COURSE CODE : MG																	
DURATION OF COURSE : 8 SEMESTERS										WITH EFFECT FROM 2013-14							
SEMESTER : FIFTH										DURATION : 16 WEEKS							
PATTERN : PART TIME - SEMESTER										SCHEME : G							
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17905)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Basic Electronics & Mechatronics	BEM	17971	04	--	02	03	100	40	--	--	--	--	25@	10	50	
2	Theory of Machines	TOM	17972	03	--	02	03	100	40	--	--	--	--	25@	10		
3	Manufacturing Processes	MPR	17973	03	--	04	03	100	40	25#	10	--	--	50@	20		
4	CNC Machines	CNC	17974	01	--	02	--	--	--	50#	20	--	--	25@	10		
TOTAL				10	--	08	--	300	--	75	--	--	--	125	--	50	
Student Contact Hours Per Week: 18 Hrs. THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH. Total Marks : 550 @ - Internal Assessment, # - External Assessment, No Theory Examination, \$ - Common to all branches Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work ➤ Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW). ➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms. ➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.																	

Course Name : Diploma in Mechanical Engineering

Course Code : MC / MG

Semester : Fifth

Subject Title : Basic Electronics & Mechatronics

Subject Code : 17971

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

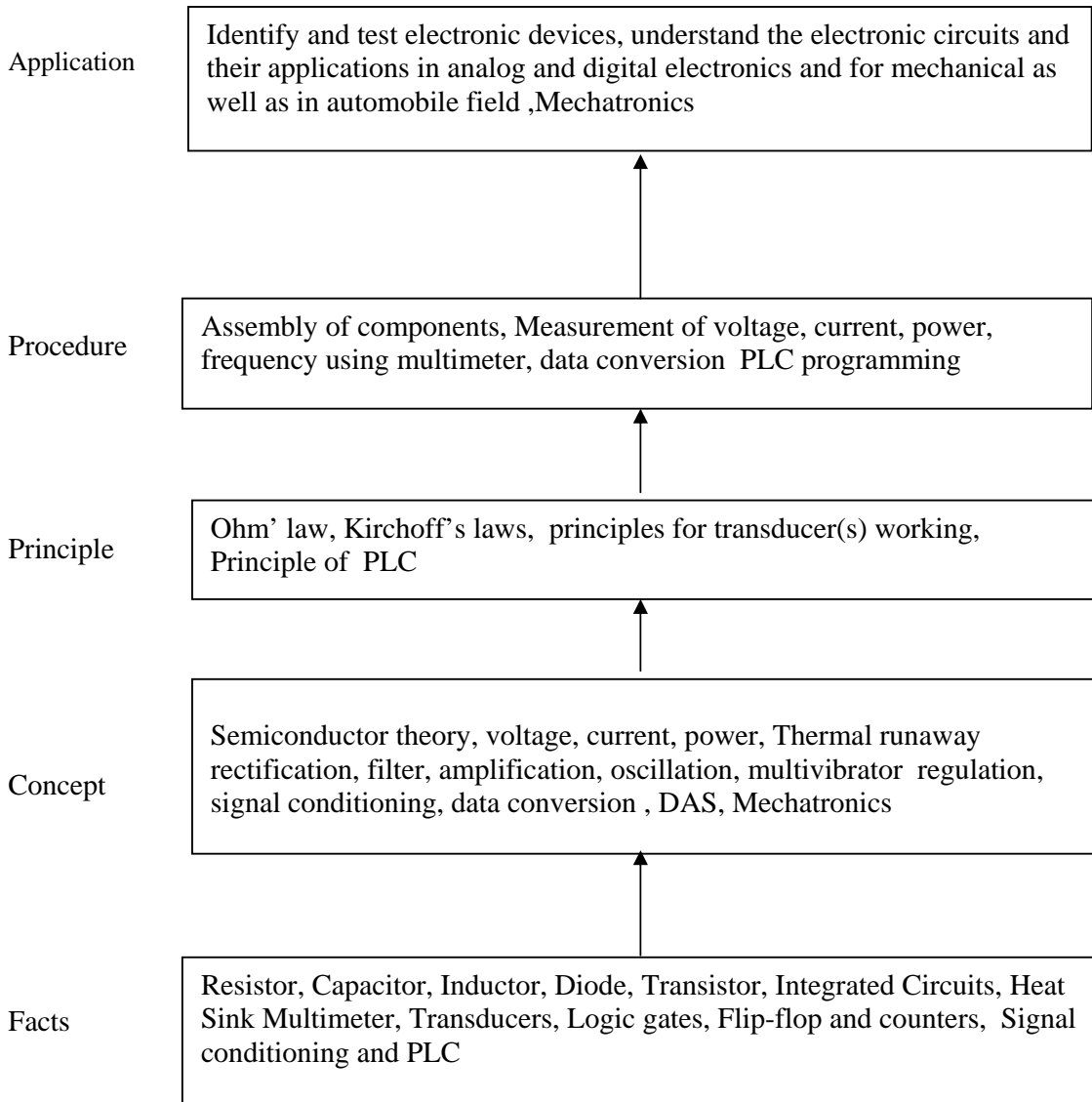
This subject is classified under core technology group and forms an important course of mechanical branch of engineering. The course envisages identification and testing of components, their principles of working and applications of various electronic devices, signal conditioning and processing. This subject introduces the concepts of mechatronics and PLC. This subject is prerequisite for the subject mechanical measurement and control as well as for mechatronics.

General Objectives:

The students will be able to: -

1. Identify and test different electronic components.
2. Use principles of circuit operations and its applications.
3. Distinguish various elements in analogue and digital electronics.
4. Understand applications of electronics in mechanical field for measurement and control.
5. Understand working of different types of transducers and their applications.
6. Understand concept of mechatronics and PLC.

Learning Structure:



Theory

Topic and Contents	Hours	Marks
<p>1: Solid-State Devices and Diode Circuits</p> <p>Specific objectives Students will be able to</p> <ul style="list-style-type: none"> ➤ Draw energy band diagram and compare various types of materials ➤ Draw symbols ,state working principle and list out ,applications of electronics devices in electronics and mechanical field ➤ Sketch circuit diagram , state working with waveform for rectifier circuits ➤ Sketch block diagram and state functions of various blocks of regulated power supply <p>Content</p> <p>1.1 Fundamentals of solid state Devices– 10 Marks Material classification conductors, semiconductors and insulators, Energy band diagram intrinsic and extrinsic semiconductors Solid state Devices -- schematic symbols, working principle and applications of Diode, Zener diode, BJT, FET,UJT, Photo-devices- LDR, Photo diode, Photo-transistor, LED, 7 segment display opto-coupler, LCD type and operation [No constructional details are expected]</p> <p>1.2 Diode Circuits : 04 Marks Rectifier circuits Circuit diagram, working principle and waveforms for Half wave, Full wave-and Bridge rectifier, comparison w. r. t efficiency, PIV , ripple factor and applications Filters circuits C, inverted L and CLC filter circuit diagram and operation of these filters.</p> <p>1.3 Regulated power supply 04Marks Concept of load regulation , line regulation , block diagram and functions of each block [Note Mathematical calculations is not expected for any subtopic]</p>	10	18
<p>2: Transistor Circuits</p> <p>Specific objectives Students will be able to</p> <ul style="list-style-type: none"> ➤ Explain working of BJT, Biasing of BJT and concept of thermal runaway ➤ Compare CB , CC and CE configuration ➤ Write operation of single stage amplifier. ➤ Draw circuits of RC, direct and transformer coupled amplifier and compare their performance <p>Content :</p> <p>2.1 Tansistor 06 Marks Working of NPN and PNP transistor, Configurations CB., CC and CE , Biasing circuits, concept of thermal runaway , construction and use of heat sink [No need of design and mathematical analysis]</p> <p>2.2 BJT Circuits 08 Marks BJT as an amplifier single stage amplifier, Multistage amplifier, RC coupled, direct coupled and transformer coupled amplifier, their frequency response and applications BJT as a switch</p>	08	14
<p>3: Analog Circuits</p> <p>Specific objectives Student will be able to</p> <ul style="list-style-type: none"> ➤ Explain and draw block diagram of IC 741, circuits of op amp as 		

<p>inverting, non-inverting, differential amplifier, adder, subtractor, integrator, differentiator, and Instrumentation amplifier</p> <ul style="list-style-type: none"> ➤ Explain and draw block diagram of IC 555, circuits of timer as BMV, AMV and MMV ➤ State Barkhausen criteria and compare oscillator circuits <p>Content:</p> <p>3.1 Operational amplifier 08 Marks IC741 Block diagram, pin diagram, specifications, and applications Op amp configurations- Inverting, Non-inverting and differential circuit diagram and operation of these circuits Op amp as adder, subtractor, integrator and differentiator Instrumentation amplifier [simple numerical are expected]</p> <p>3.2 Timers 06 Marks IC 555–Block diagram pin diagram specifications, Concept of multivibrator IC 555 as AMV, BMV, MMV.</p> <p>3.3 Oscillator Marks 04 Concept of oscillator, Barkhausen criteria Comparison of RC, LC and Crystal oscillator [no any special circuit is expected]</p>	08	18
<p>4: Digital Circuits</p> <p>Specific objectives</p> <p>Student will be able to</p> <ul style="list-style-type: none"> ➤ Draw symbol and write truth table of all logic gates, various combinational circuits, sequential circuits ➤ Compare microprocessor and microcontroller <p>Content:</p> <p>4.1 Logic gates 04 Marks Study of logic gates, symbol, truth table NOT, AND, OR, NAND, NOR, XOR, XNOR</p> <p>4.2 Combinational Circuits 04 Marks Half and Full adder, subtractor, Multiplexer, demultiplexer, decoder and encoder, applications [only block diagram, truth table and simple circuits]</p> <p>4.3 Sequential Circuits 10 Marks Flip Flops Block diagram of RS, JK, Master Slave JK, D and T, Triggering mechanism Application of flip flop Basics of counter, asynchronous counter, Decade counter, Ring counter, Shift register. [only circuit diagram and operation is expected not details of timing diagram] Concept of Microprocessor and microcontroller Features of 8085 and 8051. Comparison of microprocessor and microcontroller Applications</p>	14	18
<p>5: Transducers and Signal Conditioning</p> <p>Specific objectives</p> <p>Student will be able to</p> <ul style="list-style-type: none"> ➤ Define, state characteristics and Classify transducers ➤ Draw block diagrams and explain operation of ADC, DAC, AC and DC signal conditioning. ➤ Explain and draw block diagram of single and multi-channel DAS and data logger. <p>Content :</p> <p>5.1 Transducers 06 Marks Definition, Classification characteristics of transducer, Active and passive, primary and secondary, Electrical, mechanical optical transducer their examples, selection criteria.</p> <p>5.2 Signal conditioning Marks 08</p>	08	14

Introduction to Data converter ADC and DAC [only principle of operation and applications] Signal conditioning need and Block diagram of AC and DC signal conditioning, DAS - single channel multi-channel , applications Data loggers		
6: Mechatronics and PLC Specific objectives Student will be able to <ul style="list-style-type: none"> ➤ State meaning, need and basic concept of mechatronics. ➤ State features of real time mechatronics ➤ State applications, advantage disadvantages of mechatronics ➤ State operation with block diagram of CNC, FMS, AVCS CIM Robotics, ➤ State working of basic PLC architecture and write simple programs. Content: 6.1 Fundamentals of mechatronics 10 Marks Concept of mechatronics, basic elements of mechatronics, Overview of mechatronics design process modeling and simulation, prototyping and deployment .Introduction to real time mechatronics system, advantages and disadvantages, applications. Functional diagram, approach to CNC, flexible manufacturing system (FMS), Computer integrated machine (CIM), Robotics, Advance vehicle condition system (AVCS) [only brief information] 6.2 Programmable Logic Controller(PLC) 08 Marks Basic PLC structure, principle of PLC, architecture and components, PLC programming, selection of PLC, Concept of Nano PLC, PLC applications, Ladder diagrams, Ladder diagram circuits Simple Ladder programming examples	16	18
Total	64	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Identification and selection of components.
2. Interpretation of circuits and signals.
3. Understand working of mechatronics systems and PLC

Motor Skills:

1. Drawing of circuits.
2. Measurement of various parameters using multimeter.
3. Testing of components using IC tester.
4. Follow standard test procedure.

List of Practical-

1. Identify various passive components such as resistors, capacitors, inductors, switches, transformers, breadboard and cables and write their specifications.
2. Identify various active electronic components such as diode, BJT, FET, UJT, LED, Photodiode.
3. Use of multimeter (analogue and digital) for current, voltage and resistance measurement Testing of various electronics components.
4. Measure frequency and voltage using CRO.
5. Construct rectifier circuits on breadboard and observe waveforms on CRO
6. Measure load regulation of un-regulated power supply and regulated power supply.

7. Trace the given RC coupled amplifier and plot frequency response f and determine its bandwidth.
8. Construct Op Amp as inverting amplifier and Non Inverting amplifier on breadboard and observe the waveforms on CRO.
9. Verify truth tables for logic gates- . NOT, AND, OR, NAND, NOR, XOR, XNOR Testing of an IC using IC tester.
10. Assemble a square wave oscillator for 100 Hz using IC 555. (Use as table multivibrator).
11. Write simple PLC program and execute on PLC (2 exercises).

[Note: Expected group size for practical no. 1 and 2 is one, for practical no.3 to 10 is 2 and for practical no 11 it may be 4]

Assignments

- Assignments are part of term work.
- Assignment shall include observation of systems from mechatronics point of view. Individual shall prepare report consisting of functional block diagram of the system , specifications of major components and system operation
 - I. Observe and prepare report on mechatronics used in camera system
 - II. Observe and prepare report on mechatronics used in robotic system
 (Where ever possible arrange visit to manufacturing unit where mechatronics is used for production purpose and prepare report.)

Note

Teachers are expected to make students familiar with the Data Books and Operation Manuals and also encourage them to visit related websites.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher , Edition
01	Boylestad	Electronics devices and circuit Theory	Pearson (Tenth edition)
02	Shalivahnan	Electronics Devices and circuits	TMH
03	Baru Vijay	Basic Electronics Engg.	Wiley India Pvt.Ltd (first edition)
04	De Debasnis Ghatak Kamakhya	Basic Electronics	Pearson (First edition)
05	Bolton	Mechatronics	Pearson (Fourth edition)
06	K.P.Ramchandran, G.K.Vijayaraghavan M.S.Balsundarm	Mechatronics (intergrated mechanical electronics systems)	Wiley india pvt.ltd ,(first edition)

Journals – Manufactures catalogues

- IEEE/ASME Transactions on Mechatronics.
- Mechatronics Journal – Elsevier

1. IS, BIS and International Codes:

- NF E 01-010 2008 – AFNOR (French standard NF E 01-010)
- XP E 01-013 2009 – AFNOR (French standard NF E 01-013)

2. Websites:

<http://en.wikipedia.org/wiki/Mechatronic>

Course Name : Diploma in Mechanical Engineering

Course Code : MC / MG

Semester : Fifth

Subject Title : Theory of Machines

Subject Code : 17972

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

It is a core technology subject in Mechanical Engineering Discipline. Mechanical Engineers often come across various machines in practice. They should be able to identify and interpret various elements of machines in day to day life. In maintaining various machines, a diploma engineer should have sound knowledge of fundamentals of machine and mechanism. It will be helpful for them to understand the mechanisms from operational point of view in a better way. This subject imparts the kinematics involved in different machine elements and mechanisms like gear, cam-follower, follower, belt-pulley, flywheel, brake, dynamometer, clutch, etc.

Detailed knowledge of these aspects with deep insight into the practical applications develops a professional confidence in them to become successful Engineer.

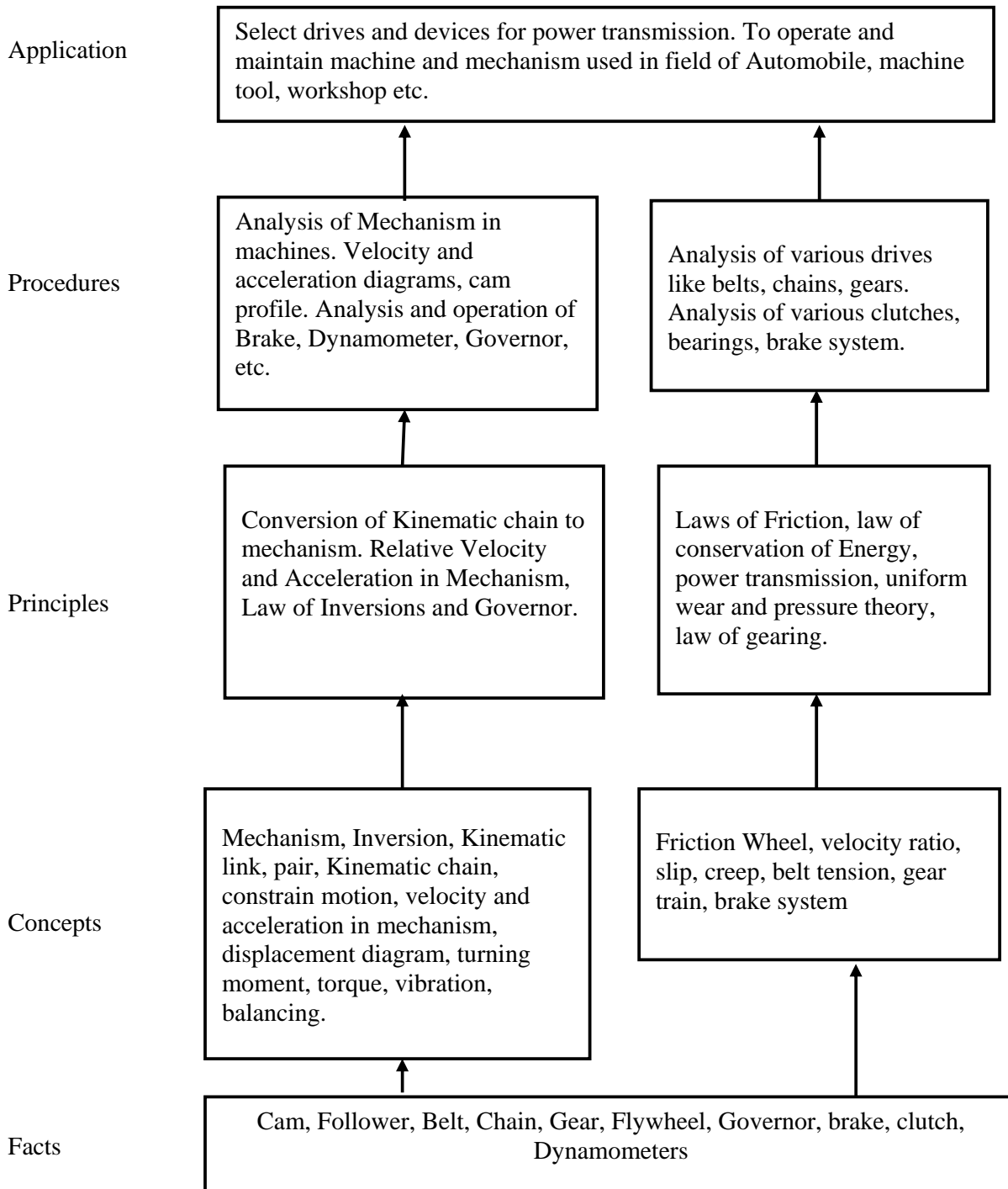
This subject serves as a prerequisite for subjects like Machine Design to be learned in higher semester.

General Objectives:

The student will be able to:

1. Understand different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Draw cam profile suitable to various displacement diagram.
4. Select Suitable Drives and Mechanisms for a particular application
5. Understand the function, operation and application of flywheel and governor.
6. Understand the function, operation and application of brake, dynamometer, clutch and bearing
7. Find magnitude and plane of unbalanced forces.

Learning Structure:



Theory:

Topic and Content	Hours	Marks
<p>1. Fundamentals and type of Mechanisms</p> <p>Specific objectives:</p> <ul style="list-style-type: none"> ➤ Define various terms related to mechanisms. ➤ Explain construction and working of various mechanisms <p>1.1 Kinematics of Machines:- Definition of Kinematics, Dynamics, statics, Kinetics, Kinematic link, Kinematic pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. ----- 8 Marks</p> <p>1.2 Inversion of Kinematic Chain</p> <ul style="list-style-type: none"> • Inversion of four bar chain, coupled wheels of Locomotive, Beam engine, Pantograph. • Inversion of single slider Crank chain –Pendulum pump, Rotary I.C. Engine mechanism, Oscillating cylinder engine, Whitworth quick return mechanism. Quick return mechanism of shaper. • Inversion of Double Slider Crank Chain- Scotch Yoke Mechanism, Elliptical trammel, Oldham's Coupling ----- 8 Marks 	07	16
<p>2. Velocity and Acceleration in Mechanisms</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Draw velocity and acceleration diagram for given mechanism <p>2.1 Concept of relative velocity and relative acceleration of a point on a link, angular acceleration, inter-relation between linear and angular velocity and acceleration.</p> <p>2.2 Analytical method (No derivation) and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism. ----- 8 Marks</p> <p>2.3 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple Mechanism. Determination of velocity and acceleration of point on link by relative velocity method(Excluding Coriollis component of acceleration) ----- 8 Mark</p>	08	16
<p>3. Cams and Followers</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Define the terms related to Cam ➤ Classify Cams and Followers ➤ Draw cam profile as per the given applications <p>3.1 Concept, definition and applications of Cams and Followers. Cam terminology</p> <p>3.2 Classification of Cams and Followers.</p> <p>3.3 Different follower motions and their displacement diagrams - Uniform velocity, Simple harmonic motion, uniform acceleration and Retardation. ---- 4 Marks</p> <p>1.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method) ---- 8 Marks</p>	06	12
<p>4. Power Transmission</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Give State broad classification of Drives. ➤ Select Suitable Drives and Mechanisms for a particular application ➤ Calculate various quantities like velocity ratio, belt tensions, slip, angle of contact, power transmitted in belt drives 	10	20

<p>4.1 Belt Drives- flat belt, V-belt & its applications, material for flat and V-belt. Selection of belts, angle of lap, length of belt, Slip and creep. Determination of velocity ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numericals) ----- 8 Marks</p> <p>4.2 Chain Drives- Types of chains and sprockets, velocity ratio. Advantages & Disadvantages of chain drive over other drives, Selection of Chain & Sprocket wheels, methods of lubrication. ----- 4 Marks</p> <p>4.3 Gear Drives – Classification of gears, Law of gearing, gear terminology. Types of gear trains, their selection for different applications. Train value & velocity ratio for simple, compound, reverted and epicyclic gear trains.8 Marks</p>		
<p>5. Flywheel and Governors ----- 8 Marks</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Differentiate between flywheel and governor ➤ Explain with neat sketch the construction and working of various governors <p>5.1 Flywheel –Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C Engine (no Numericals) Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance.</p> <p>5.2 Governors- Types, concept, function and application & Terminology of Governors.</p> <p>5.3 Comparison between Flywheel and Governor.</p>	04	08
<p>6. Brakes and Dynamometers. ----- 10Marks</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ List the differences between brakes and dynamometers ➤ Explain with neat sketch the construction and working of various brakes and dynamometers ➤ Calculate braking force, braking torque and power lost in friction in shoe and band brake <p>6.1 Function of brakes and Dynamometers, Type of brakes & Dynamometers, comparison between brakes & Dynamometer.</p> <p>6.2 Construction and working i) shoe brake, ii) Band brake iii) Internal expanding shoe brake iv) Disc Brake</p> <p>6.3 Numerical problems to find braking force and braking torque and power for shoe and band brake.</p> <p>6.4 Construction and working of i) Rope brake Dynamometer ii) Hydraulic Dynamometer iii) Eddy current Dynamometer.</p>	05	10
<p>7. Clutches and Bearings.</p> <p>Specific objectives</p> <ul style="list-style-type: none"> ➤ Explain the difference between uniform pressure and uniform wear theories ➤ Explain with neat sketch, the construction and working of various clutches ➤ Calculate torque required to overcome friction and power lost in friction in clutches and footstep bearings <p>7.1 Clutches- Uniform pressure and Uniform Wear theories. Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch v) Diaphragm clutch, (Simple numericals on single and Multiplate clutches).</p>	06	12

7.2 Bearings- i) Simple Pivot, ii) Collar Bearing iii) conical pivot. Torque and power lost in friction. (Simple numericals)		
8. Balancing Specific objectives ➤ Explain the concept of balancing ➤ Find balancing mass and position of plane, analytically and graphically.	02	06
8.1 Concept of balancing. Balancing of single rotating mass. Analytical/Graphical methods for balancing of several masses revolving in same plane.		
Total	48	100

Practicals:**Skills to be developed:****Intellectual Skills:**

1. Determine velocity and acceleration of links in a given mechanism.
2. Analyze balancing of rotating masses in a single plane.
3. Interpret interrelationship between components of various braking mechanisms.
4. Compare various power transmission devices.

Motor Skills:

1. Drawing of velocity and acceleration diagrams.
2. Dismantle and assemble given brakes and clutches.
3. Draw cam profiles for a given application
4. Draw velocity and acceleration diagram of the given mechanisms
5. Draw force polygon for unbalanced masses revolving in same plane

Note - The Term work shall consist of Journal / lab manual and A-3 size sketch book.

List of Practical:-

1. Sketch and describe working of quick return mechanism for a shaper. Find the ratio of time of cutting stroke to the return stroke to understand quick return motion in shaping operation.
2. Sketch and describe the working of the following mechanisms with its application,
 - a) Bicycle free wheel sprocket mechanism
 - b) Geneva mechanism
 - c) Ackerman's steering gear mechanism
 - d) Foot operated air pump mechanism
3. Determine velocity and acceleration of various links of the given two mechanism, by relative velocity method for analysis of motion of links.
4. Determine velocity and acceleration in an I. C. engine's slider crank mechanism by Kleins's construction.
5. Draw the profile of a radial cam for the given follower type to obtain the desired follower motion.
6. Determine slip, length of belt, angle of contact in an open belt drive to understand its performance.
7. Draw a schematic diagram of centrifugal governor and describe its working. Draw a graph between radius of rotation versus speed of governor to understand its function.
8. Dismantle and assemble mechanically operated braking mechanism of two wheelers. Sketch the two wheeler braking system and identify the functions of various components.

9. Dismantle and assemble multi-plate clutch of two wheeler. Draw neat sketch and state the functions of various components.
10. Determine graphically counterbalance mass and its direction for complete balancing of a system of several masses rotating in a single plane.

Learning Resources:**Books:**

Sr. No.	Title	Author	Edition	Publication
01	Theory of Machines	Khurmi Gupta	--	Eurasia publishing House Pvt. Ltd. 2006 edition
02	Theory of Machines	S.S. Rattan	Third	McGraw Hill companies, II Edition
03	Theory of Machines	P.L. Ballaney	--	Khanna Publication
04	Theory of Machines	Jagdishlal	--	Bombay metro-politan book limited
05	Theory of Machines	Sadhu Singh	Second	Pearson
06	Theory of Machines	Ghosh – Mallik	--	Affiliated East west press
07	Theory of Machines	Thomas Bevan	Third	Pearson
08	Theory of Machines	J.E. Shigley	Third	Oxford

Course Name : Diploma in Mechanical Engineering

Course Code : MC / MG

Semester : Fifth

Subject Title : Manufacturing Processes

Subject Code : 17973

Teaching and Examination Scheme

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	04	03	100	25#	--	50@	175

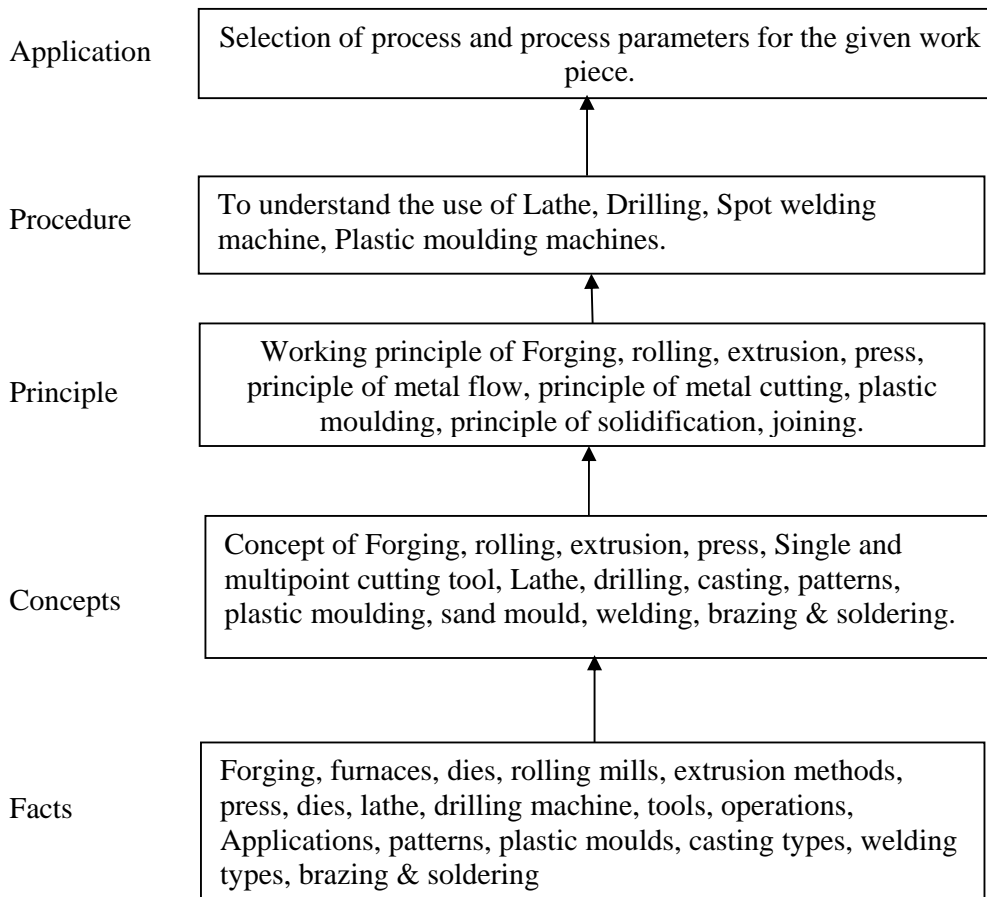
Rationale:

Diploma technician often comes across various types of basic manufacturing processes. He / she is required to select, operate and control the appropriate processes for specific applications. He / she is also required to know about various cutting tools, latest improvements in manufacturing processes. This is a core technology subject. The diploma technician should know how the raw material gets processed through various processes and ultimately results into finished goods. Hence it is essential that, he has understanding of basic manufacturing processes, machines, tools and equipments. With sound knowledge of this subject, the diploma technician will be able to handle and control practical situations more effectively and confidently.

Objectives:

The student will be able to:

- 1) Use the basic machine tools like lathe and drilling.
- 2) Produce and inspect the job as per specified dimensions.
- 3) Select the specific manufacturing processes for the desired output.
- 4) Adopt safety practices while working on various machines.
- 5) Explain the different types of plastic moulding processes.
- 6) Select the basic manufacturing process for different components to be machined.

Learning Structure:

Contents: Theory

Topic and Content	Hours	Marks
1:Forming Processes Specific Objectives: <ul style="list-style-type: none"> ➤ To list basic manufacturing processes and write working principal of different manufacturing processes like Drop forging, Rolling and Extrusion ➤ To identify and select proper manufacturing process for a specific component Content 1.1 Drop forging: 06 Marks Upset forging, press forging(die forging),open die & closed die forging, forging operations 1.2 Rolling: 06 Marks Principle of rolling, hot & cold rolling, Types of rolling mill, application of rolling 1.3 Extrusion: 06 Marks Direct & indirect extrusion, Advantages, disadvantages and Applications.	08	18
2. Press working: Specific Objectives: <ul style="list-style-type: none"> ➤ To define Press working machine principal ➤ To state various classification of press machine. ➤ To state different operations performed on press machine and their p[practical applications Content 2.1 Press classification, press operations like punching/piercing, blanking, notching, lancing 06 Marks 2.2 Die set components and types of dies 06 Marks 2.3 Forming Operations: Bending, drawing 04 Marks	08	16
3. Casting Processes: Specific Objectives: <ul style="list-style-type: none"> ➤ To state different between pattern and model ➤ To list different types of pattern and their applications ➤ To state various types of pattern allowances. ➤ To state various types of casting processes. Content 3.1 Pattern making: 06 Marks Basic steps in making casting, Pattern : types, materials and allowances, tools, color coding of patterns 3.2 Moulding: 06 Marks Types of moulding sands, properties of sand, moulding methods, cores and core prints, elements of gating system, bench moulding, floor moulding, pit moulding, machine moulding. 3.3 Casting: 06 Marks Furnaces: Construction and working of cupola furnace, electric arc furnace. - Methods & applications of - Centrifugal casting, shell moulding, investment casting, Casting defects - Causes & remedies. 3.4 Hot chamber and cold chamber die casting, Die casting defects - Causes & remedies. 04 Marks	10	22
4. Welding Specific Objectives:	07	14

<p>➤ To define Arc welding and Gas welding Principal. ➤ To state difference between soldering and brazing processes</p> <p>Content 4.1 Introduction & classification of welding processes - Gas welding, carbon arc welding, shielded metal arc welding, TIG welding, MIG welding, plasma arc welding, resistance welding types- spot, seam projection. Electron beam welding, laser beam welding, welding defects. 10 Marks</p> <p>4.2 Introduction to soldering and brazing – Process, fillers, heating methods & applications. 04 Marks</p>		
<p>5. Machining Operations Specific Objectives: ➤ To state the working principal of lathe and drilling machines. ➤ To list out various operations performed on lathe and drilling machines</p> <p>Content 5.1 Lathe Machine: 12 Marks Introduction, classification and basic parts of center lathe & their functions, Lathe operations like facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling. Cutting tool nomenclature & tool signature, cutting parameters.</p> <p>5.2 Drilling Machine: 08 Marks Introduction, classification, basic parts of radial drilling machine and their functions, twist drill nomenclature, drilling machine operations like drilling, reaming, boring, counter sinking, counter boring, spot facing. Cutting parameters.</p>	10	20
<p>6. Plastic Moulding: Specific Objectives: ➤ To state different properties of plastics ➤ To explain various plastic mauling methods like Injection, blow, compression molding</p> <p>Content Introduction, Properties of plastics, types of plastics, plastic moulding methods - compression moulding, injection moulding, blow moulding, extrusion, vacuum forming and calendaring.</p>	05	10
Total	48	100

Practical:

Skills to be developed:

Intellectual skills:

- 1) Identify basic manufacturing processes like forging, rolling and extrusion, for required component.
- 2) Specify need of pattern allowances.
- 3) Decide process parameters for different operations.
- 4) Decide tools required for a manufacturing process.
- 5) Identify a joining method for fabrication.

Motor Skills:

- 1) Operate lathe, drilling machine.

- 2) Set the tool and select the cutting parameters for machining operations.
- 3) Set the tools, job and decide cutting parameters.
- 4) Inspect various dimensions of jobs by using measuring instruments.
- 5) Make simple wooden / thermocole pattern.

List of Practical:

- 1) One turning job on lathe containing the operations like plain turning, step turning, taper turning, grooving, knurling and chamfering.
- 2) One job using Spot welding machine. (Min. 4 spots on 0.5-1mm thick metal strip.)
- 3) One simple job on TIG / MIG welding setup or visit to TIG / MIG welding shop.
- 4) Moulding practice for any one pattern.
- 5) Industrial visit to observe plastic processing shop and report on the visit.
- 6) One composite job containing the operations like lathe with axial & across drilling (like Nut- Bolt assembly or any other equivalent job).
- 7) Demonstration of eccentric turning using four jaw chuck.

Notes:

- 1] The workshop instructors should prepare specimen job in each shop as demonstration practice before the student (as per the drawing given by subject teacher/ workshop superintendent).
- 2] Theory behind practical is to be covered by the concerned subject teacher/ workshop superintendent.
- 3] Workshop diary should be maintained by each student duly signed by respective shop instructors.
- 4] Assignments are to be assessed by the concerned subject teacher/ workshop superintendent.

Guidelines for conducting Practical Examination for MANUFACTURING PROCESSES

1. The job drawing must be jointly decided by the External and Internal examiner prior to one day in advance from the commencement of practical examination. Every student should be supplied the copy of job drawing before examination.
2. Time for practical examination should be **THREE HOURS**.
3. Practical examination of the students shall consists of Turning job containing different operations like Facing, straight Turning, Taper turning, Chamfering, Knurling , Threading, Grooving. (Minimum 5 operations) Students will perform the job as per the drawing provided to them.
4. Raw material size – Bar dia. 40 to 50 mm, length 80 to 100 mm.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	S. K. Hajra Chaudhary, Bose, Roy	Elements of workshop Technology-Volume I & II	Media Promoters and Publishers Limited
02	O. P. Khanna & Lal	Production Technology	Production Technology

		Volume- I & II	Volume- I & II Dhanpat Rai Publications
03	W. A. J. Chapman, S. J. Martin	W. A. J. Chapman, S. J. Volume –I,II	Viva Books (p) Ltd.
04	O.P. Khanna	A text book of Foundry Tech.	Dhanpat Rai Publications
05	H.S. Bawa	Workshop Technology Volume- I & II	Tata McGraw-Hill
06	P.C. Sharma	Production Engineering	S. Chand Publications

Course Name : Diploma in Mechanical Engineering

Course Code : MC / MG

Semester : Fifth

Subject Title : CNC Machines

Subject Code : 17974

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	--	--	50#	--	25@	75

Rationale:

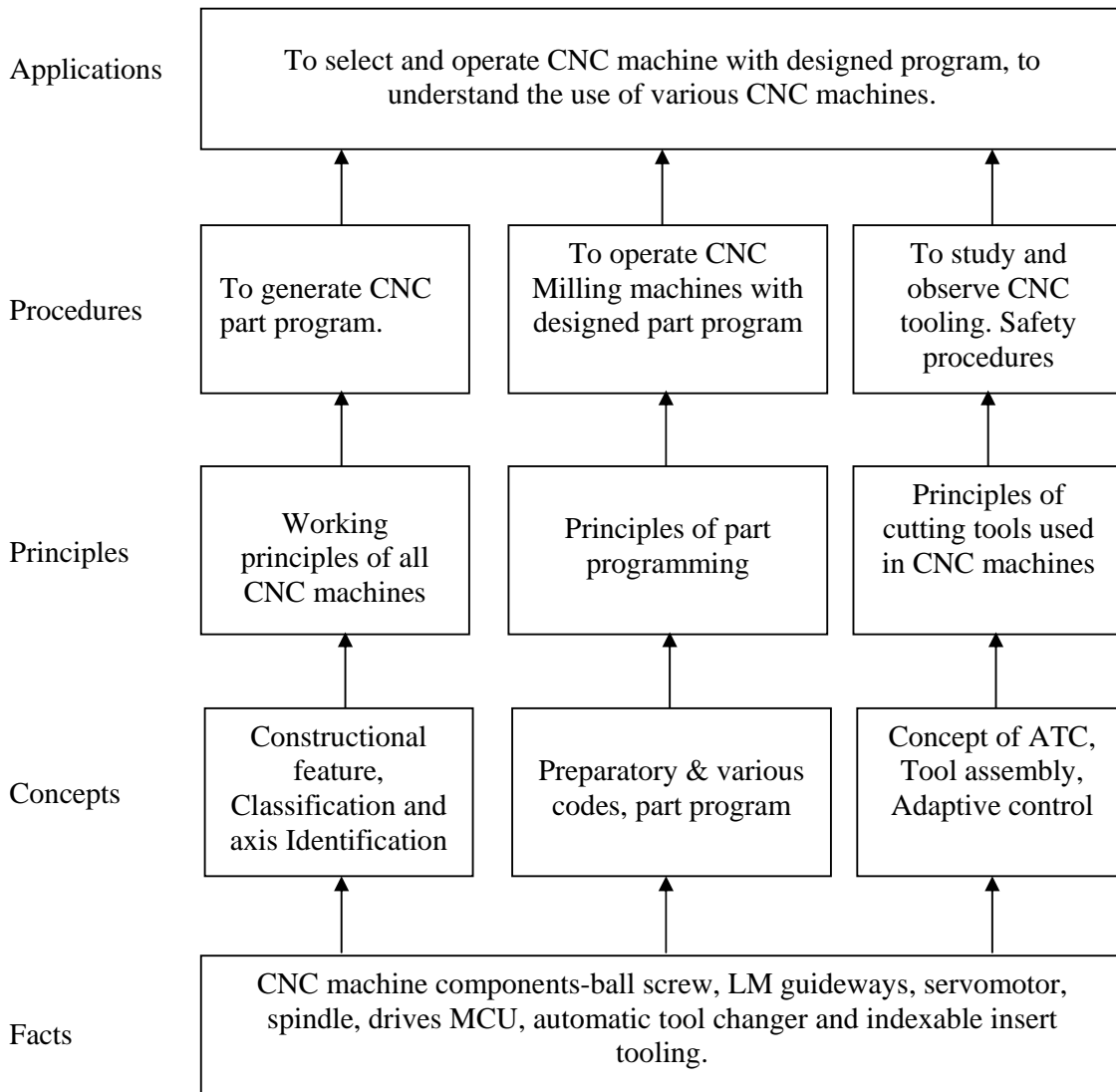
This is Technology subject which has relevance with the subjects taught earlier namely Manufacturing Processes and advanced manufacturing processes. After getting conversant with the basic manufacturing processes and production processes, it is necessary for a technician to know about the advancements in the area of manufacturing and production processes. The subject will impart knowledge & skills necessary for working in modern manufacturing demands and environment. This subject will help the student to get familiarized with working principles and operations performed on CNC machining centers, generation of part program and study tooling of CNC machine.

Objectives:

The student will be able to

- 1) Know different types of CNC machines.
- 2) Understand the different codes used in CNC programming.
- 3) Know the Operation and control of different CNC machine and equipments.
- 4) Adopt different tooling while working on various CNC machines.

Learning structure:



Theory:

Topic and Content	Hours
<p>1. Introduction to CNC machines Specific objectives:</p> <ul style="list-style-type: none"> ➤ State different types and advancements in CNC machines ➤ Describe Construction and working of CNC turn-mill center <p>Content:</p> <p>1.1 Classification of CNC machines 1.2 Axis standards and its identification. 1.3 Construction and working of CNC turning centre, VMC and HMC 1.4 Construction and working of CNC turn mill centre 1.5 Construction and working of Multi- axis CNC machines 1.6 Construction and working of Pallet type CNC machine 1.7 Construction and working of CNC based Coordinate Measuring Machine.</p>	4
<p>2. Constructional features and working of CNC machines Specific objectives:</p> <ul style="list-style-type: none"> ➤ Describe construction and working of the different components, subassemblies, assemblies and peripherals of CNC machines <p>Content:</p> <p>2.1 Bed and machine frame construction. 2.2 Spindle constructional details 2.3 Constructional details and working of ball screw and L.M. guideways. 2.4 Various Spindle drives used in CNC machines. 2.5 Working of Machine control unit. 2.6 Types of lubrication systems used for CNC machines. 2.7 Working of swarf removal arrangement. 2.8 Working of hydraulic and pneumatic systems used for chuck, tool and pallet changing in CNC machines.</p>	4
<p>3. CNC Part programming Specific objectives:</p> <ul style="list-style-type: none"> ➤ Describe CNC part programming according to the drawing of the component <p>Content:</p> <p>3.1 NC words, G codes, M codes. 3.2 Programming format, word statement, block format. 3.3 Tool offsets and tool wear compensation. 3.4 Part programming containing Subroutines, Do- loops and Canned cycles. 3.5 Introduction to Macro programming.</p>	4
<p>4. Tooling for CNC machines Specific objectives:</p> <ul style="list-style-type: none"> ➤ State types of CNC cutting tools ➤ Describe tool presetting procedure <p>Content:</p> <p>4.1 Introduction 4.2 Types of CNC Cutting tools 4.3 Types of indexable inserts with its geometry 4.4 Construction of tool holding assembly 4.5 Tool presetting procedure 4.6 Working of Automatic Tool Changing (ATC) device and types of tool magazine 4.7 Safety Procedures, alarms, fool-proof procedures. 4.8 Online measurement of dimensions, cutting forces, Adaptive controls, communication with servers.</p>	4

4.9 Fixtures used in CNC machines.	
	Total
	16

Practicals:

Skills to be developed.

Intellectual Skills:

- 1) To select the appropriate CNC machine for the given component.
- 2) To select the appropriate tools for the given component.
- 3) To generate programme for the given component.
- 4) To calculate the cycle time for the given component.

Motor Skills:

- 1) To feed the programme to CNC machine.
- 2) To conduct the programme in single block mode and dry run.
- 3) To carry out job production on CNC machine.
- 4) To carry out changes in job and carry out compensation.

Notes:

- 1) The College/Institute should purchase at least one CNC production machine.
- 2) The requisite time of practical mentioned in the scheme should be allotted to the students. A group of 4-5 students can handle machine for 30mins in 2 hrs. practical. Whenever students are free they can approach the lab in charge to work on machines.
- 3) Students can model components required for their project (6th sem) on 3D modeling software, thereafter if students manufacture these components on CNC machines, it is highly appreciable.
- 4) The Workshop Superintendent/ HOD should personally see that the CNC Practicals are conducted in his Institute.

Guidelines for Practical Examination

An examiner must prepare 6 assignments on turning and 6 assignments on milling. See that the task can be completed in 1 hr. A group of 4 students can pick up **one** assignment randomly. The group should write part programme, enter into machine, dry run and manufacture the component. Evaluation of students based on their contribution in activities shall be done by the internal as well as external examiner.

List of Practical

1. One practical on single block mode & dry run on CNC turning center for production job part programme (Batch of 4-5 students) and verification using any simulation software.
2. One practical on single block mode & dry run on CNC milling for production job part programme (Batch of 4-5 students) and verification using any simulation software.
3. One job on CNC lathe having plain turning, taper turning, step turning, threading, boring and grooving (Batch of 4-5 students).
4. One job on CNC milling having following operations – face milling, slotting, contour machining (Batch of 4-5 students)
5. One assignment on indexable inserts used in CNC tooling with its geometrical details and ISO codes, nomenclature.
6. Conduct a practical on presetting of a milling cutter or one assignment on tool presetting procedure.
7. Visit to CNC machine (Production) shop having turning and machining centre to observe construction and working of CNC turning and vertical machining centre, write visit report and draw plant layout.

8. One assignment on CNC programming containing subroutines, do-loop and canned cycle
9. Visit to industry having CNC-CMM machine and inspect various dimensions and geometry of production component.

List of Books

Sr. No.	Author	Title	Publisher
1	HMT, Bangalore	CNC Machines	New age International Limited
2	P. N. Rao	CAD/CAM Principles Applications	Tata McGraw Hill
3	Pabla B. S. & M. Adithan	CNC Machines	New age International Limited
4	Groover, Zimmers	CAD/CAM Computer Aided Design & Manufacturing	Pearson
5	HMT, Bangalore	Mechatronics	Tata McGraw Hill
6	Chougule N. K.	CAD/CAM/CAE	Scitech Publication Pvt. Ltd.
7	Binit Kumar Jha	CNC Programming Made Easy	Vikas Publishing House Pvt. Ltd. New Delhi. Revised Edition 2010.

Note: Practice of Programming is required for students using Simulation Software.