


<div> MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI</div>																	
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : DIPLOMA IN PRODUCTION ENGINEERING / PRODUCTION TECHNOLOGY																	
COURSE CODE : PG / PT																	
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2012-13							
SEMESTER : FIFTH										DURATION : 16 WEEKS							
PATTERN : FULL TIME - SEMESTER										SCHEME : G							
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17500)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Plant Engineering	PEN	17531	03	--	02	03	100	40	--	--	--	--	25@	10	50	
2	Advanced Manufacturing Processes β	AMP	17527	03	--	02	03	100	40	--	--	--	--	25@	10		
3	Measurement & Control β	MAC	17528	03	--	02	03	100	40	--	--	--	--	25@	10		
4	Machine Tool Design	MTD	17532	03	--	02	03	100	40	--	--	25#	10	25@	10		
5	Metrology and Quality Control β	MQC	17530	03	--	02	03	100	40	25#	10	--	--	25@	10		
6	Behavioural Science \$	BSC	17075	01	-	02	--	--	--	--	--	25#	10	25@	10		
7	CNC Machines β	CNC	17064	01	--	02	--	--	--	50#	20	--	--	25@	10		
8	Professional Practices-III β	PPT	17065	--	--	03	--	--	--	--	--	--	--	50@	20		
TOTAL				17	--	17	--	500	--	75	--	50	--	225	--	50	
Student Contact Hours Per Week: 34 Hrs.																	
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.																	
Total Marks : 900																	
@ - Internal Assessment, # - External Assessment, <div></div> No Theory Examination, \$ - Common to all branches, #* - Online Examination, β - Common to ME, MH, MI, FE, FG																	
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 Production Technology / Diploma in Production Engineering**

**Course code : PG / PT**

**Semester : Fifth**

**Subject Title : Plant Engineering**

**Subject Code : 17531**

**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).

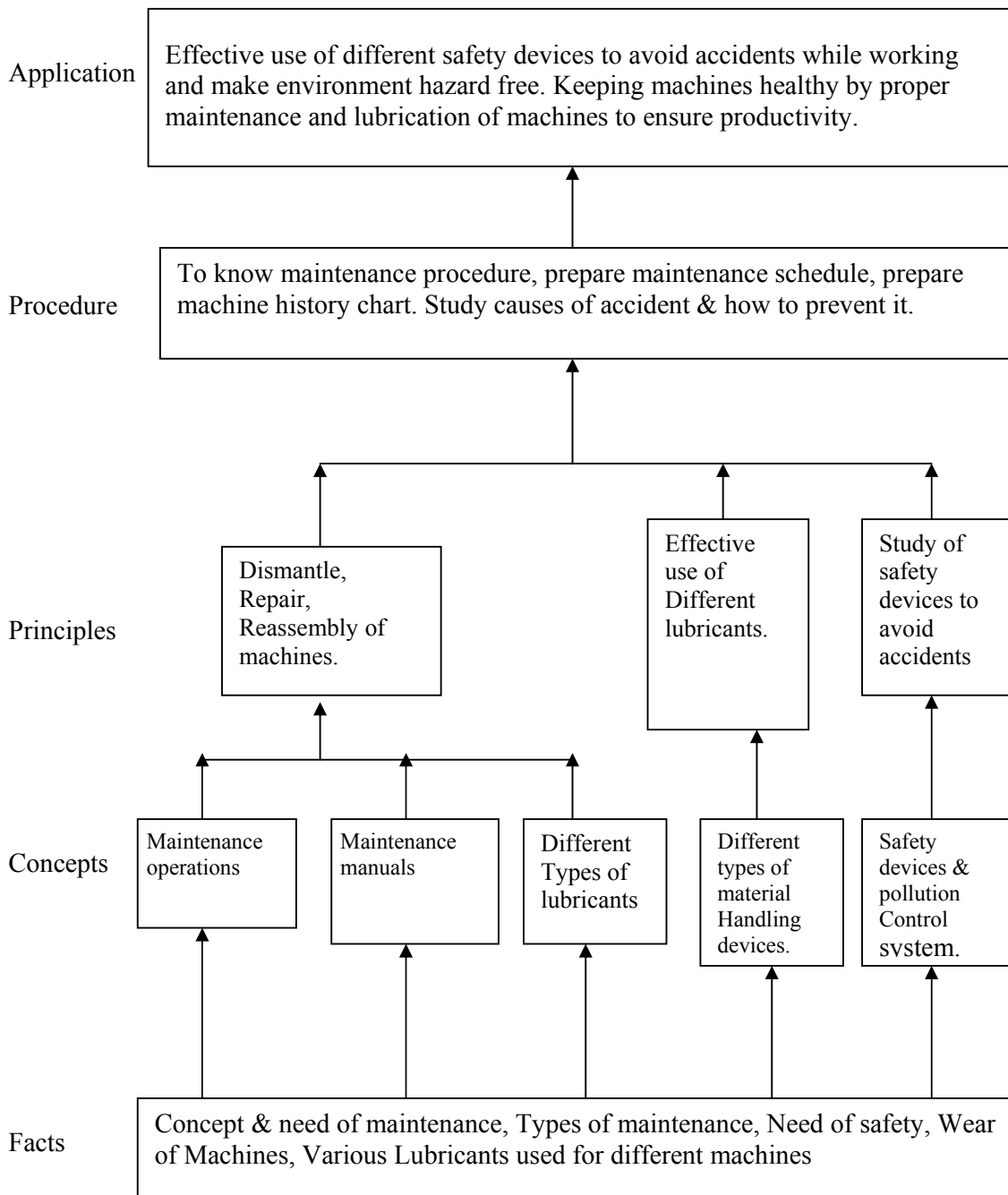
**Rationale:**

This is a technology subject and offered as an elective subject. The main intention to study this subject is to know concepts, principles, & procedure of different types of maintenance, maintenance tools, safety devices to avoid accidents. The subject also provides the knowledge about wear and lubrication of machines.

**Objectives:**

Students will be able to:

1. Appreciate the need and use of utilities like water, steam, electricity and air.
2. Understand use of proper lubricants.
3. Understand the procedure of maintenance.
4. Know different safety devices in machine to avoid accidents.

**Learning Structure:**

**Theory:**

Topic and Content	Hours	Marks
<b>1. Basic Plant Facilities:</b> <b>Specific Objectives :</b> <ul style="list-style-type: none"> <li>➤ State basic facilities in the plant.</li> </ul> <b>Content:</b> <p>1.1 Industrial Ventilation, Purification of water, Water Distribution System, <b>08 Marks</b></p> <p>1.2 Electric Power Distribution System, Electric Supply system, Stand by and Emergency Power, Lighting, <b>08 Marks</b></p>	08	16
<b>2. Mechanical Maintenance:</b> <b>Specific Objectives :</b> <ul style="list-style-type: none"> <li>➤ Describe preventive maintenance.</li> </ul> <b>Content:</b> <p>2.1 Importance and Types <b>04 Marks</b></p> <p>2.2 Breakdown, Preventive, Scheduled, Procedure of Preventive Maintenance, Accessibility for Maintenance. <b>08 Marks</b></p> <p>2.3 Planning and Scheduling of Maintenance work, Repair Cycle, Maintenance Stages, <b>08 Marks</b></p> <p>2.4 Maintenance Manuals and Reports, Machine History Chart, Maintenance Tools. <b>04 Marks</b></p>	12	24
<b>3. Total Productive Maintenance (TPM):</b> <b>Specific Objectives:</b> <ul style="list-style-type: none"> <li>➤ State concept of TPM</li> <li>➤ Describe the benefits of TPM</li> </ul> <b>Content:</b> <p>3.1 Introduction, Benefits and Features of TPM, Basic systems of TPM <b>06 Marks</b></p> <p>3.2 Pillars of TPM, Maintenance job responsibility allocation in TPM <b>06 Marks</b></p>	06	12
<b>4: Wear And Lubrication:</b> <b>Specific Objectives :</b> <ul style="list-style-type: none"> <li>➤ State the wear and wear process</li> <li>➤ State the importance of lubrication</li> </ul> <b>Content:</b> <p>4.1 Definition of wear, Primary wear processes - Adhesive, abrasive, corrosive reaction, plastic flow, pitting. <b>08 Marks</b></p> <p>4.2 Observed wear behavior due to primary wear processes. <b>04 Marks</b></p> <p>4.3 Lubricants - Importance, Properties, Types, Selection of lubricants, Lubrication systems - wick, pad, bottle, bath or sump, splash, centralized. <b>06 Marks</b></p>	08	18
<b>5. Electrical Maintenance:</b> <b>Specific Objectives :</b> <ul style="list-style-type: none"> <li>➤ State instruments for maintenance</li> </ul> <b>Content:</b> <p>5.1 Equipment needed for electrical maintenance - Ammeter, Voltmeter, Multimeter, fuses, overload relays, circuit breakers. <b>06 Marks</b></p> <p>5.2 Safety measures - Earthing, Precautions against electric shock, Prevention of fire due to electricity. <b>08 Marks</b></p>	06	14
<b>6. Accidents and Safety:</b> <b>Specific Objectives :</b>	08	16

<ul style="list-style-type: none"> <li>➤ State the causes of accidents</li> <li>➤ State safety precautions</li> </ul> <p><b>Content:</b></p> <p>6.1 Accidents: Definition, Causes, types, effects. <b>04 Marks</b></p> <p>6.2 First aid, Personal Protective Equipments, Safety Policies, House Keeping. <b>04 Marks</b></p> <p>6.3 Mechanical Controls – Control and Trip Mechanism, lever Controlled Reversal Mechanism, Travel Control by Limit Switches. <b>04 Marks</b></p> <p>6.4 Safety Controls – Fool proofing devices for interlocking a) Parallel Shafts b) Shafts at right angle. <b>04 Marks</b></p>		
<b>Total</b>	<b>48</b>	<b>100</b>

**Practical:**

Skills to be developed:

**Intellectual Skills:**

- 1) Search information from different sources.
- 2) Interpret the instructions in the manual.

**Motor Skills:**

- 1) Handle instruments for dismantling and assembly.

**Note:** The report on industrial visit will form important part of term work of the student. The teacher is expected to provide questionnaire / specific guideline for the industrial visit.

**List of Practical:**

- 1) Prepare a report on facilities provided in the institute workshop.
- 2) Report on industrial visit to observe various facilities such as compressed air, water, steam, electric supply, high voltage electric supply, air conditioning, waste disposal and treatment. (Report on different facilities to be prepared by different groups and compiled under the guidance of teacher).
- 3) Dismantling and assembly of a) air compressor, b) vane pump / motor / centrifugal pump, c) valves d) electric motors and report on maintenance procedure.
- 4) Replacing fuses / fuse wires of electrical installation in workshop.
- 5) Market Survey of lubricants for specifications and applications.
- 6) Prepare a preventive maintenance schedule of any machine in your college machine shop / lab. and prepare a report.
- 7) Report on Industrial visit to observe maintenance activities.
- 8) Removal and replacement of bearings for any machine / equipment in the lab.

**Note:** For above experiments prepare report and submit as a term work.

**Learning Resources:**

**Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title of Book</b>	<b>Edition</b>	<b>Publisher</b>
01	H.P. Garg	Industrial Maintenance	Revised Edition 2009	S. Chand
02	C.R. Dragon	Electrical Technology	First	Dhanpat Rai and Sons
03	G.C. Sen. & A. Bhattacharya	Principles of Machine tools	First	New Central Book Agency
04	P. GopalKrishnan & A.F. Banerji	Maintenance & spare part maintenance	First	Prentice –Hall of India Ltd
05	R.C. Mishra and K. Pathak	Maintenance Engg. And Management	--	Prentice –Hall of India Ltd
06	Sushil Kumar Shrivastava	Maintenance Engg. And Management	Revised Edition 2009	S. Chand
07	Lindecy R. Higgins	Maintenance Engineering Handbook	Fifth	McGraw Hill Publication

**Course Name : Mechanical Engineering Group****Course Code : ME/MH/MI/PG/PT/FE/FG****Semester : Fifth for ME/PG/PT/FG and Sixth for MH/MI/FE****Subject Title : Advanced Manufacturing Processes****Subject Code : 17527****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:**

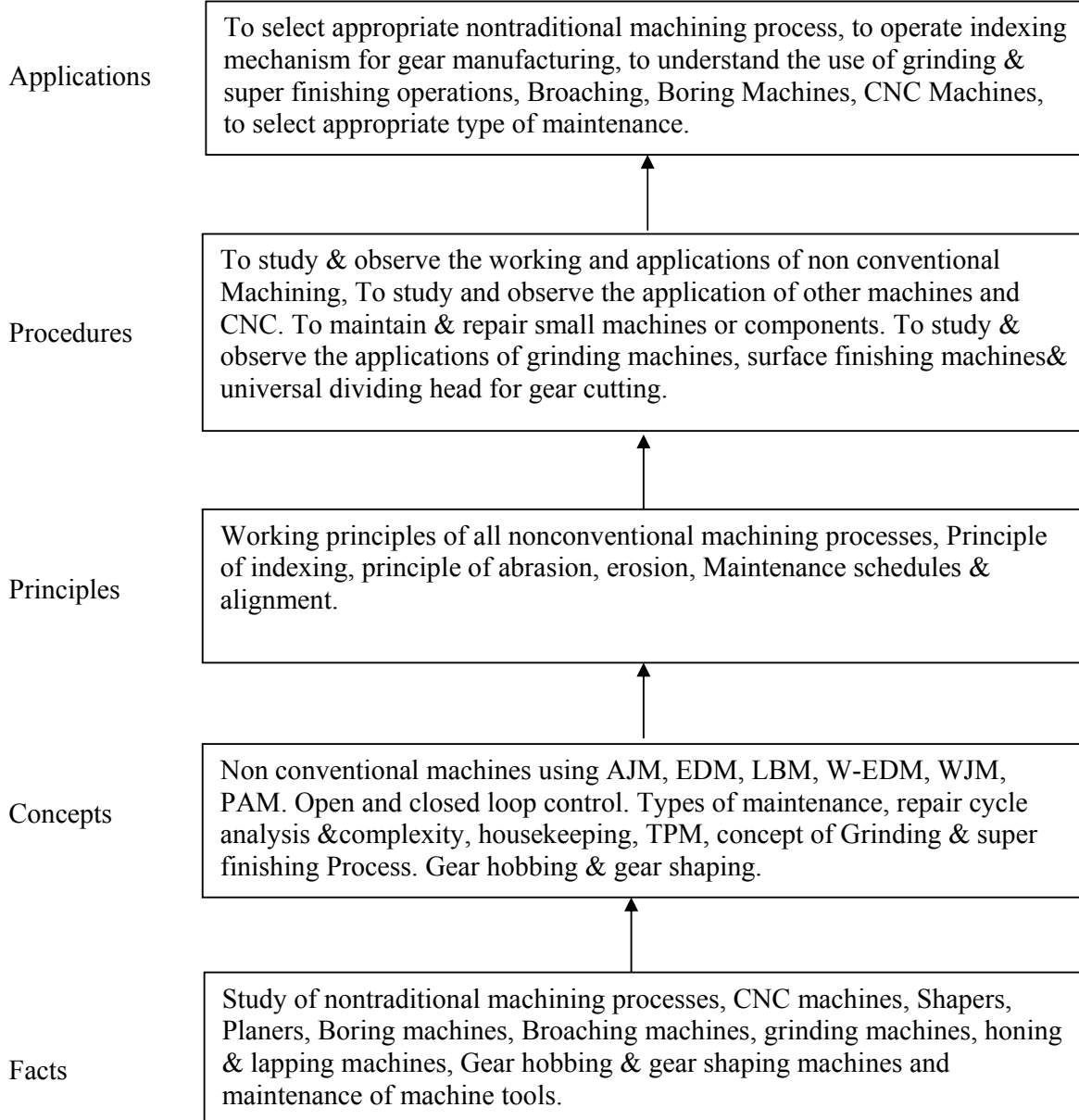
- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

**Rationale:**

This is a advanced technology subject which is to be taught, after getting conversant with the basic manufacturing processes. It is necessary for a diploma engineer to know about the advancements in the area of manufacturing processes. This subject will impart knowledge & skills necessary for working in modern manufacturing environment. This subject will help the student to get familiarize with working principles and operations performed on non conventional machines, CNC Machines, milling machines, grinding machines, surface finishing machines and maintenance of machine tools.

**Objectives:****The student will be able to:**

- 1) Know different Nontraditional machining processes.
- 2) Understand the working of Broaching Machine, Milling Machine, Gear Cutting machines, Grinding Machines, Surface finishing machines.
- 3) Work as a maintenance engineer.
- 4) Know the Operation and control of different CNC machine tools.
- 5) Produce jobs as per specified requirements by selecting the specific machining process.
- 6) Adopt safety practices while working on various machines.
- 7) Develop the mindset for modern trends in manufacturing and automation.

**Learning Structure:**



**Theory:**

Topic & Content	Hours	Marks
<b>1. Non Traditional Machining</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>➤ Understand different Nontraditional machining processes.</li> </ul> <b>Content</b> <p><b>1.1</b> Need and importance, classification 04 Marks</p> <p><b>1.2</b> AJM, WJM, EDM, W-EDM - setup, working, process parameters, advantages, disadvantages and applications. 08 Marks</p> <p><b>1.3</b> PAM, LBM - setup, working, process parameters, advantages, disadvantages and applications. 08 Marks</p>	10	20
<b>2: Introduction to CNC</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>➤ Know the Operation and control of CNC machine tools.</li> </ul> <b>Content</b> <p><b>2.1</b> Introduction, advantages of CNC, open loop and closed loop control, axis identification, absolute &amp; incremental coordinate system- G codes and M codes 08 Marks</p> <p><b>2.2</b> Fundamental part programming - simple lathe and milling programmes. Dry run, Jog Mode, Block by Block execution, Safety Procedures, Adaptive controls, Displays and indicators. 08 Marks</p>	08	16
<b>3: Other Machining Methods</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>➤ Understand the working of different Machines.</li> </ul> <b>Content</b> <p><b>3.1</b> Introduction, classification of Broaching machines, basic parts of horizontal broaching machine &amp; their functions, applications, advantages and limitations of Broaching machine. 08 Marks</p> <p><b>3.2</b> Capstan, turret lathe &amp; automats, Planer and planomiller function of parts &amp; operations. 04 Marks</p> <p><b>3.3</b> Boring Machines – types, tools and operations. 04Marks</p>	08	16
<b>4: Milling &amp; Gear Cutting</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>➤ Understand the working of Milling &amp; Gear Cutting machines.</li> </ul> <b>Content</b> <p><b>4.1 Milling:</b> 10 Marks Introduction, classification ,basic parts of column &amp; knee type milling machine &amp; their functions, standard milling cutters, milling operations like plain milling, side milling, straddle milling, gang milling, face milling - slot milling, slitting. Up milling &amp; down milling, cutting parameters.</p> <p><b>4.2 Gear Cutting:</b> 12 Marks Introduction, gear manufacturing methods, universal dividing head &amp; indexing methods, gear shaping &amp; gear hobbing - setup, working, advantages, disadvantages, applications, gear finishing methods-grinding, shaving, burnishing.</p>	10	22
<b>5. Surface Finishing</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>➤ Understand the working of Grinding Machines &amp; Surface finishing machines.</li> </ul>	06	14

<b>Content</b> <b>5.1 Grinding Machines</b> 08 Marks Classification and working of grinding machine - surface, cylindrical, centreless, grinding wheel specifications, grinding wheel dressing & truing. Selection criteria for grinding wheel. Balancing of grinding wheels, safety precautions. <b>5.2 Super Finishing</b> 06 Marks Methods of surface finishing like honing, lapping, burnishing, polishing and buffing - setup, working, advantages, limitations and applications.		
<b>6. Maintenance of Machine Tools:</b> <b>Specific Objectives</b> ➤ Know the maintenance methods and procedures. <b>Content</b> Need and importance of maintenance activity, Types of maintenance, Basic maintenance practices for simple machine elements, viz Bearing, Coupling, Shaft and pulley, gears, chains, machine belts. Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records.	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

**Practical:**

Skills to be developed:

**Intellectual Skills:**

- 1) Compare an appropriate non conventional machining process for required component.
- 2) Write part programming for a component.
- 3) Know the significance of various super finishing methods.
- 4) Calculations for indexing for a spur gear cutting, helical gear cutting.
- 5) Select the grinding machine parameters.
- 6) Identify the maintenance procedure for a machine.

**Motor Skills:**

- 1) Use the indexing mechanism.
- 2) Operate CNC Lathe & CNC milling machine.
- 3) Operate grinding machine
- 4) Carry out maintenance of machines.
- 5) Use and operate different hand tools required for repair and maintenance.
- 6) Identify and rectify the faults in the given sub assembly.

**List of Practical:**

- 1) Industrial visit to observe at least one nontraditional machining process and write a report individually on visit.
- 2) One simple Job on CNC Lathe Machine and Verification on simulation software (One job /max. four students).
- 3) One simple Job on CNC Milling Machine and Verification on simulation software (One job /max. four students)
- 4) Industrial visit to observe Broaching machine, Boring machine, Planer machine and report on the same.
- 5) One job of gear cutting (spur gear /helical gear) by using simple indexing method (max. four students per job).
- 6) One job containing surface grinding / cylindrical grinding operation. (max. four students per job).

- 7) Industrial visit to observe at least one super finishing process.
- 8) Maintenance procedure for any two machines/machine elements with reference to type of faults, causes & remedies. (In a group of 4-5 students)
- 9) Teacher can suggest topics (ind. visit/non conv. man. process etc.) for ppt files and students (4 students) should present in practical batch.

**Notes:**

1. The workshop instructor should prepare the specimen job in each shop as demonstration/ before the students (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

Sr. No.	Equipment /Software	Group Size	Remark
1	Simulation software for Turning on 20 PCs	One student	Institute can establish a separate simulation, CAD, CAM, CAE, computational facility lab. Internet facility is must. Teacher can download good videos and help students to understand the principles. Students can observe various videos on machining, calibration, maintenance of machine tools.
2	Simulation software for Milling on 20 PCs		
3	Videos demonstrating Non Conventional machining and other machines on 20 PCs		
4	Simulation software for Grinding on 20 PCs		
5	Videos on maintenance of machine tools		

**Learning Resources:****Books:**

Sr.No.	Author	Title	Publisher
01	S. K. Hajra Chaudary, Bose, Roy	Elements of workshop Technology-Volume II	Media Promoters and Publishers Limited
02	O. P. Khanna & Lal	Production Technology Volume- II	Dhanpat Rai Publications.
03	P.K.Mishra	Nonconventional Machining	Narosa Publishing Houswe
04	H.P.Garg	Industrial Maintenance	S.Chand& Co.
05	L.R.Higgins	Maintenance Engg. Handbook	McGraw Hill
06	B. L. Juneja, G.S.Sekhon, Nitin Seth	Fundamental of metal cutting and machine tools	New age international ltd.
07	P.C.Sharma	Production Engg.	Dhanpat Rai Publications.
08	S.F.Krar,A.R.Gill,P.Smid	Technology of Machine Tools	Tata-McGraw Hill
09	HMT	Production Technology	Tata-McGraw Hill
10	B.S.Pabla &M.Adithan	CNC Machines	New Age International Ltd.

**Course Name : Mechanical Engineering Group****Course code : ME/MH/MI/PG/PT****Semester : Fifth for ME/PG/PT and Sixth for MH/MI****Subject Title : Measurements and Control****Subject Code : 17528****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).

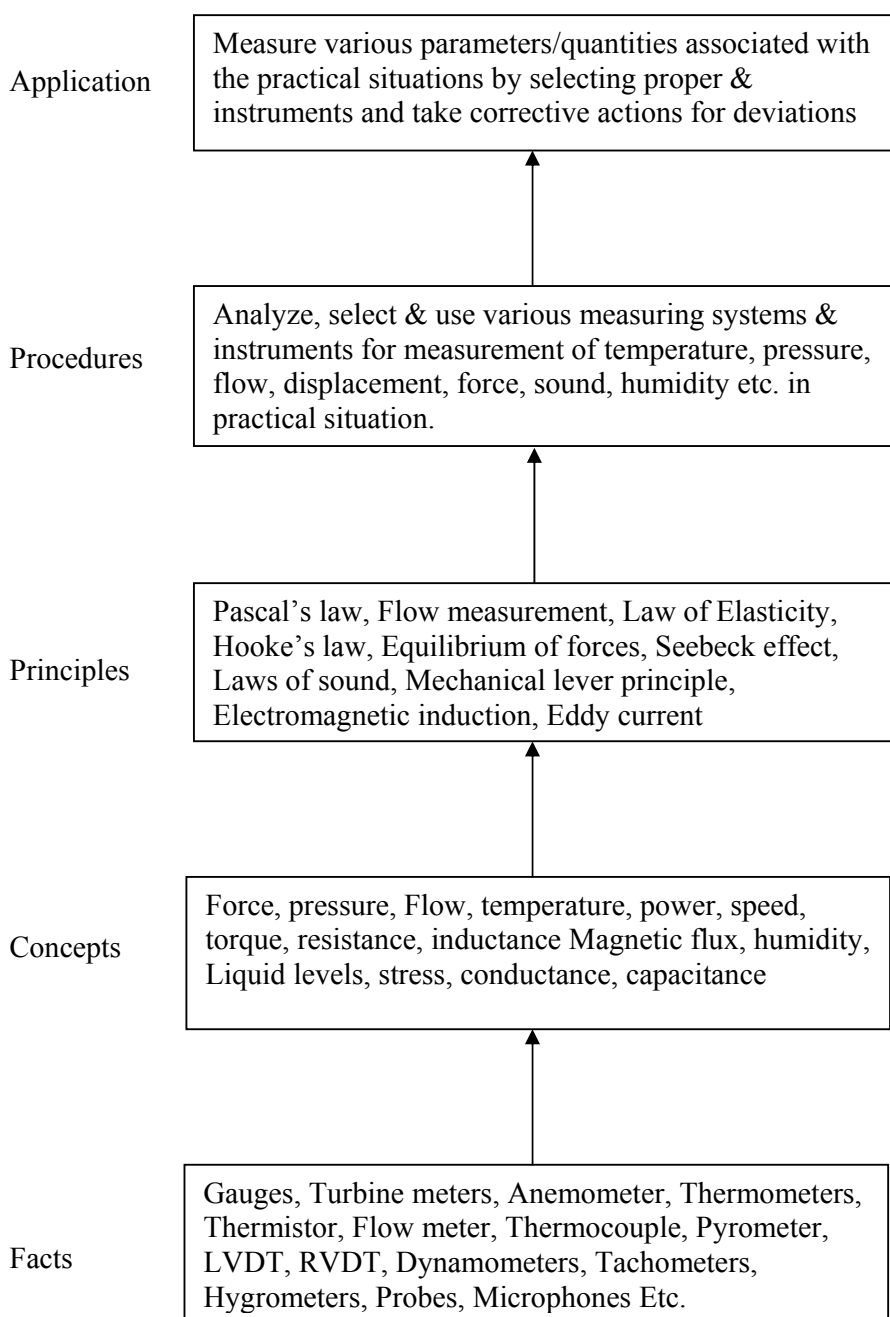
**Rationale:**

The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid strides, with many types of instrumentation devices, innovations, refinements. The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress and methods of control systems for engineering applications.

**Objectives:**

Student will be able to:

1. Understand the principle of operation of an instrument.
2. Appreciate the concept of calibration of an instrument.
3. Select Suitable measuring device for a particular application.
4. Identify different types of errors.

**Learning Structure:**

**Contents: Theory**

Topic and content	Hours	Marks
<b>1: Introduction and significance of Measurement</b> <b>Specific objectives-</b> The students will be able to understand <ul style="list-style-type: none"> <li>➤ Terminology related to measurement</li> <li>➤ Various types of errors</li> <li>➤ Concept of transducers</li> </ul> <b>Contents:</b> <b>1.1 Types of measurement, classification of instruments</b> <b>Static terms and characteristics-</b> Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. <b>Dynamic characteristics-</b> Speed of response, Fidelity and Dynamic errors, Overshoot. <b>06 Marks</b> <b>1.2 Measurement of error-</b> Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors. <b>04 Marks</b> <b>1.3 Transducers :</b> Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive <b>08 Marks</b>	08	18
<b>2: Displacement and Pressure Measurement</b> <b>Specific objectives-</b> The students will be able to <ul style="list-style-type: none"> <li>➤ Explain working of displacement transducers</li> <li>➤ Explain construction and working of low pressure and high pressure measuring instruments.</li> </ul> <b>Contents:</b> <b>2.1 Displacement Measurement</b> Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, selection & application of displacement transducer. Optical measurement scale and encoders <b>08 Marks</b> <b>2.2 Pressure Measurement</b> Low pressure gauges- McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge. High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type <b>10 Marks</b>	10	18
<b>3: Temperature Measurement</b> <b>Specific objectives</b> The students will be able to <ul style="list-style-type: none"> <li>➤ Explain electrical and non electrical methods of temperature measurements</li> <li>➤ Describe high temperature measuring instruments such as pyrometers</li> </ul> <b>Content:</b> <b>3.1 Non-electrical methods-</b> Bimetal, Liquid in glass thermometer and Pressure thermometer <b>04 Marks</b> <b>3.2 Electrical methods-</b> RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebeck series, law of intermediate temperature, law of intermediate metals, thermo emf	06	16

measurement.	08 Marks		
3.3 Pyrometers- radiation and optical	04 Marks		
<b>4: Flow Measurements</b> <b>Specific objectives-</b> The students will be able to <ul style="list-style-type: none"> <li>➤ Describe variable area, variable velocity flow meters</li> <li>➤ Special flow meters-electro-magnetic and ultrasonic flow meter</li> </ul> <b>Content :</b> 4.1 <b>Variable area meter</b> -Rota meter, Variable velocity meter-Anemometer <b>06 Marks</b> 4.2 <b>Special flow meter</b> - Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter ,Turbine meter ,Vortex shedding flow meter <b>06 Marks</b>	06	12	
<b>5: Miscellaneous Measurement</b> <b>Specific objectives-</b> <b>The students will be able to</b> <ul style="list-style-type: none"> <li>➤ Explain characteristic of sound and Measurement of sound intensity</li> <li>➤ Measure shaft power</li> <li>➤ Describe contact and non contact type of speed measuring instruments</li> <li>➤ Explain working of strain gauges</li> </ul> <b>Content :</b> 5.1 Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone. 5.2 <b>Humidity measurement</b> –Hair hygrometer, Sling psychrometer, 5.3 <b>Liquid level measurement</b> – direct and indirect methods. 5.4 <b>Force &amp; Shaft power measurement</b> -Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. 5.5 <b>Speed measurement</b> -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope 5.6 <b>Strain Measurement</b> -Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types(foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.	08	16	

<b>6 : Control Systems</b> <b>Specific objectives-</b> The students will be able to <ul style="list-style-type: none"> <li>➤ Know various types of control systems and their comparison</li> <li>➤ State field applications of control systems</li> </ul> <b>Contents:</b> 6.1 Block diagram of automatic control system, closed loop system, open loop system, feed back control system, feed forward control system, servomotor mechanism, 06 Marks 6.2 Comparison of hydraulic, pneumatic, electronic control systems, 06 Marks 6.3 Control action: Proportional, Integral, derivative, PI, PD, PID 04 Marks 6.4 Applications of measurements and control for setup for boilers, air conditioners, motor speed control 04 Marks	10	20
<b>Total</b>	<b>48</b>	<b>100</b>

Note- Numerical based on chapter 1,4,5 only

**Practical:**

Skills to be developed:

**Intellectual Skills:**

1. Analyze the result of calibration of thermister
2. Interpret calibration curve of a rotameter
3. Evaluate the stress induced in a strain gauge
4. Verify the characteristics of photo transistor and photo diode

**Motor Skills:**

1. Test and calibration of a thermocouple
2. Handle various instruments
3. Draw the calibration curves of rotameter and thermister
4. Measure various parameters using instruments

**List of Practical:**

- 1 Understand the methods of measurements and instrument characteristics with demonstration of any one measuring device.
- 2 Displacement measurement by inductive transducer ( LVDT)
- 3 Measurement of negative pressure using McLeod gauge / Bourdon tube pressure gauge. Conversion of pressure in different units.
- 4 Measurement of temperature by using Thermocouple.
- 5 Measurement of flow by using rotameter.
- 6 Measurement of strain by using a basic strain gauge and verify the stress induced.
- 7 Speed Measurement by using Stroboscope / Magnetic / Inductive Pick Up.
- 8 Measurement of force & weight by using a load cell.
- 9 Liquid Level Measurement by using Capacitive Transducer system.
- 10 Study of control system with one suitable application (boiler) arranging industrial visit at sugar factory / paper mill / textiles / food processing industry.
- 11 Mini project-A group of 4 students shall take a mini project of searching information about advanced instrumentation / control system using internet and submit its report. Use of this knowledge in project (6<sup>th</sup> Sem) is highly appreciable.



- 12 Visit various departments/laboratories in own institute and understand how the measurement devices are fitted on machines/equipments, the procedure of measurement and calibration. (viz. Applied mechanics/ Electronics/ Instrumentation dept.)

### Learning Resources:

#### Books:

Sr. No.	Author	Title	Publication
01	D.S.Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi
02	R.K.Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi
03	A.K.Sawhney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi.
04	E. O. Doebelin	Measurement Systems	Tata McGraw Hill Publications
05	R.V. Jalgaonkar	Mechanical Measurement & Control	Everest Publishing House, Pune
06	C.S. Narang	Instrumentation Devices & Systems	Tata McGraw Hill Publications
07	B. C. Nakra and K.K.Chaudhary	Instrumentation, Measurement and Analysis	Tata McGraw Hill Publication
08	Thomas Beckwith	Mechanical Measurement	Pearson Education
09	James W Dally	Instrumentation for Engg. Measurement	Wiley India

**Course Name : Diploma in Production Technology / Diploma in Production Engineering**

**Course code : PG / PT**

**Semester : Fifth**

**Subject Title : Machine Tool Design**

**Subject Code : 17532**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

**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).

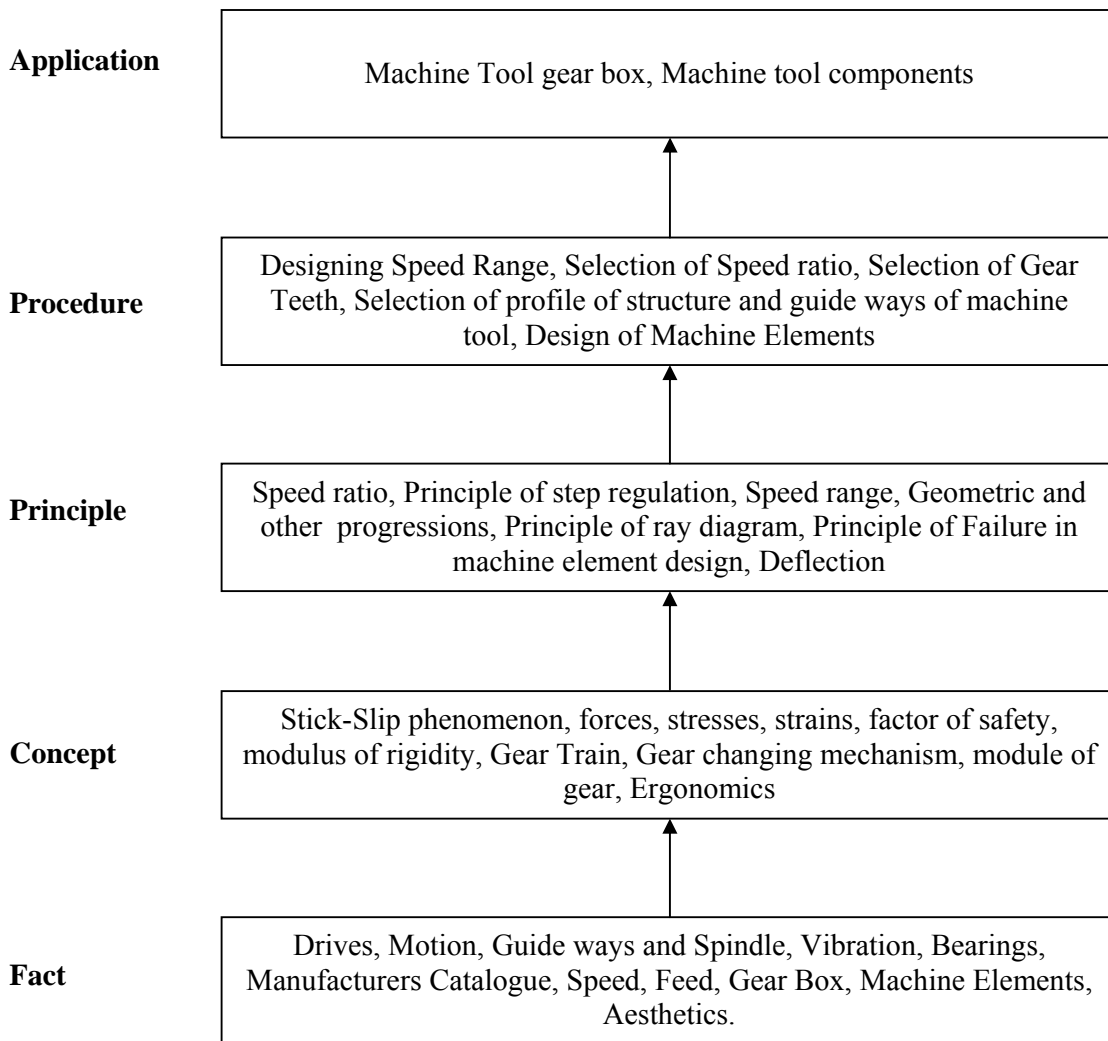
**Rationale:**

This subject is classified as a core technology subject. It is intended to learn facts, concepts, principles and procedures of Machine Tool & Design, So that the student can perform his duties as maintenance supervisor, shop floor supervisor in manufacturing industry. Also he can become an entrepreneur. To learn this subject it requires knowledge of Theory of Machines, Strength of Materials and Mechanical Engineering Materials.

**Objectives:**

The students will be able to:

1. Know the general requirements of machine tool design & processes.
2. Understand various constraints on spindle speed.
3. Apply design procedure of various machine elements.

**Learning Structure:**

**Theory:**

<b>Topic and Content</b>	<b>Hrs.</b>	<b>Marks</b>
<b>1. Introduction to machine tool design.</b> <b>Specific objectives</b> <ul style="list-style-type: none"> <li>➤ State the general requirement of machine tool design and general design procedure.</li> </ul> <b>Content:</b> <p><b>1.1</b> Introduction to machine tool.</p> <p><b>1.2</b> Basic Design Requirements, General Design Procedure.</p> <p><b>1.3</b> Design factors - factor of safety, stress concentration factor and service factor.</p> <p><b>1.4</b> Classification, General requirements of machine tool design, Engineering Design process applied to machine tools.</p>	06	16
<b>2. Machine Tool Construction</b> <b>Specific objectives:</b> <ul style="list-style-type: none"> <li>➤ Describe the various profiles of structures for machine tool.</li> </ul> <b>Content:</b> <p><b>2.1</b> Machine Tool Structures: Functions, requirements, types, profiles, Selection of Material, Factors affecting stiffness of machine tool structure and methods of improving it.</p> <p><b>2.2</b> Applications of different types of materials and profiles.</p>	08	18
<b>3. Machine Tool Spindles and Guide Ways</b> <b>Specific objectives:</b> <ul style="list-style-type: none"> <li>➤ To know the various types of guide ways and their properties.</li> <li>➤ State various types of spindle and their requirements.</li> </ul> <p><b>3.1</b> Guide ways: <b>12 Marks</b>  Functions, Classification, Shapes, and Materials. Types: Hydrostatic / hydrodynamic / aerostatic slide ways, Antifriction ways, stick-slip phenomenon.</p> <p><b>3.2</b> Spindle units: <b>10 Marks</b>  Functions, Requirements, Materials, Spindle Supports –Types, Types of Bearings used for spindle units.</p>	12	22
<b>4. Spindle Speeds</b> <b>Specific objectives:</b> <ul style="list-style-type: none"> <li>➤ Estimate various constraints on spindle speeds.</li> <li>➤ Draw layout of spindle speeds</li> </ul> <b>Content:</b> <p><b>4.1</b> Constraints, Requirement for layout of a stepped drive, Selection of range of spindle speeds <b>04 Marks</b></p> <p><b>4.2</b> Layout of speed steps: Advantages of G. P. series, Selection of value of common ratio, Number of steps in a speed range, Number of practical subdivisions, Representation of speeds on structure diagram, Structural formulae, Feasibility of structural formula. <b>12 Marks</b></p> <p><b>4.3</b> Ray diagram, Decision making for best ray diagram, Speed chart <b>08 Marks</b></p>	12	24
<b>5. Machine Tool Vibrations</b> <b>Specific objectives:</b> <ul style="list-style-type: none"> <li>➤ State sources of vibration, methods of reducing effects of vibrations</li> </ul> <b>Content:</b> <p><b>5.1</b> Introduction to machine tool vibrations and their sources, Types of vibrations and their effects, Concept of Natural frequency of Vibration.</p>	04	08

5.2 Methods of reducing vibrations.		
<b>6. Ergonomic and Aesthetic Considerations in Machine Tools 08Marks</b> <b>Specific objectives:</b> ➤ Understand ergonomic and aesthetic considerations in machine tool <b>6.1 Ergonomic considerations</b> - man-machine relationship, anthropometric and functional anatomy data, ergonomic in design of control members – push button, knobs, levers, cranks, hand wheel. <b>6.2</b> Ergonomic considerations applied to types and location of display. <b>6.3</b> Compatibility in the design of control members. <b>6.4 Aesthetics</b> – aesthetic characteristics – shape, line, form, surface finish, colour and tone.	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

**Practical:**

Skills to be developed

**Intellectual skills-**

- To search information from different sources
- To design a simple component
- To select speed ratio and speed steps
- To select gearing diagram

**Motor Skills:**

- To draw a cotter joint and rigid coupling
- To draw ray diagram and speed chart for gear box

**List of Practicals:**

1	Draw sketch with dimensions of machine tool structure used for Lathe machine, mention material used, Compare different types of shape used.
2	Draw sketch with dimensions of machine tool structure used for Milling machine, mention material used, Compare different types of shape used.
3	Draw sketch with dimensions of guide ways used for Lathe machine, mention material used, Compare different types of shape used.
4	Draw sketch with dimensions of guide ways used for Table of Universal Milling machine and Arm of Radial Drilling machine.
5	Draw the ray diagram for the speeds available on lathe machine (machine available in machine shop).
6	Two assignments on Calculation of speed steps for given conditions of machine tool, draw structural, ray diagram and speed chart for the same.
7	Design Cotter Joint for a given load and draw the dimensioned drawing of details and assembly.
8	Design of rigid coupling for joining two co axial shafts.
9	Information search on different types of bearings and sketches of bearings used on any one machine in the Institute workshop.
10	Identify and write report on ergonomic and aesthetic features of Lathe, Milling and Drilling equipments in your workshop.

**Learning Resources:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
01	C. Sen., A. Bhattacharya	Principles of Machine Tool Design	New Center Book Agency (P) Ltd. Calcutta, 2 <sup>nd</sup> edition
02	N. K. Mehta	Machine Tool Design	Tata McGraw Hill Publishing Co. Ltd 2 <sup>nd</sup> edition
03	V. B. Bhandari	Design of Machine Elements	Tata McGraw Hill Publishing Co. Ltd. 20 <sup>th</sup> edition
04	R. S. Khurmi- Gupta	Machine Design	Eurasia publishing House Pvt. Ltd 13 <sup>th</sup> edition
05	Nagpal	Machine Tool Design.	Khanna Publications

**Course Name : Mechanical Engineering Group**

**Course Code : ME/PG/PT/MH/MI**

**Semester : Fifth for ME/PG/PT and Sixth for MH/MI**

**Subject Title : Metrology and Quality Control**

**Subject Code : 17530**

### Teaching and Examination Scheme

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	25#	--	25@	150

### Rationale:

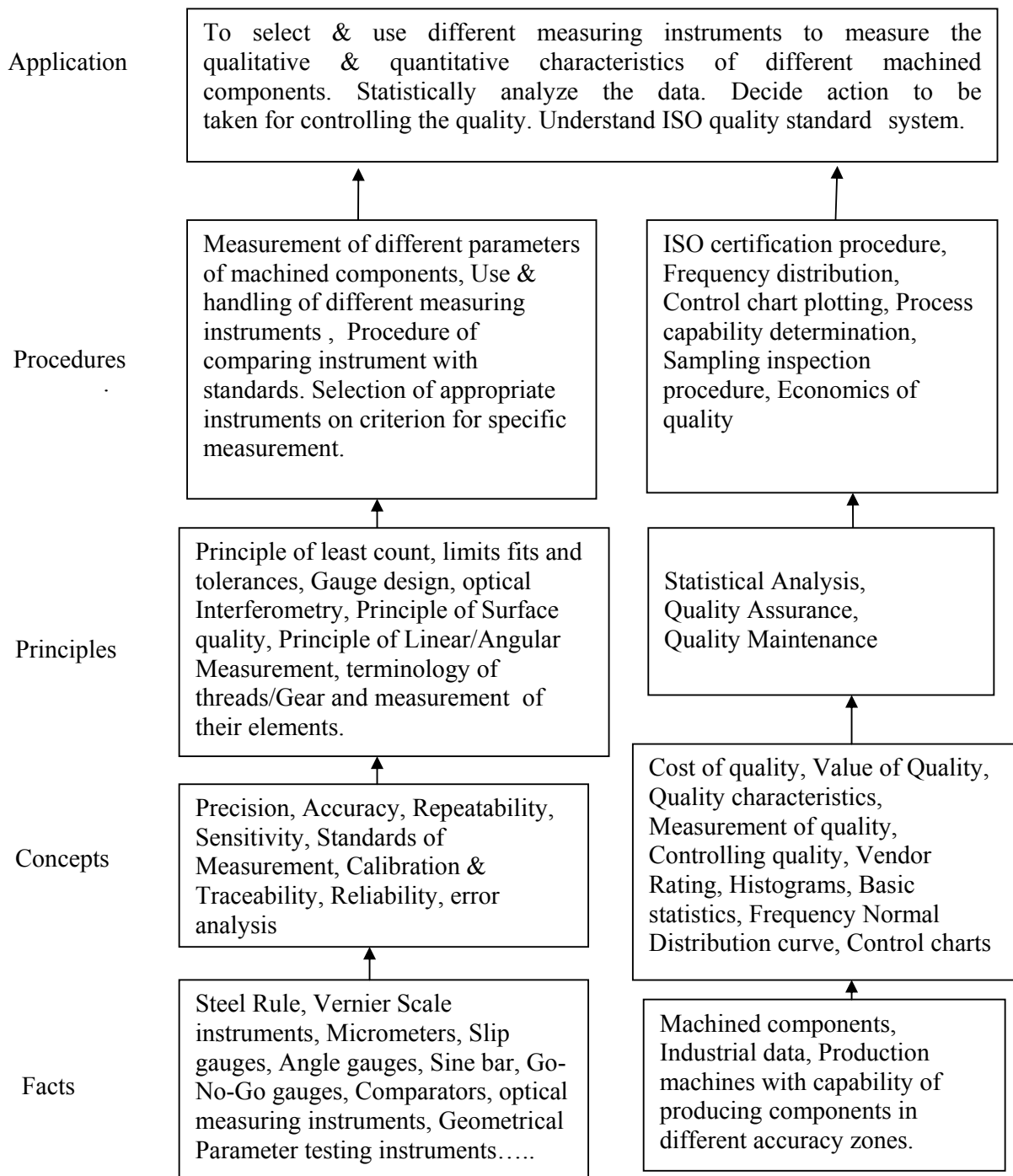
The Diploma mechanical Engineer should understand, select and use various measuring instruments as he often comes across measuring different parameters of machined components and the appropriate fitment of interchangeable components in the assemblies.

The knowledge of the subject also forms the basis for the design of mechanical measurement systems, design & drawing of mechanical components.

### Objectives:

#### Students will be able to:

1. Understand and calculate the least count of all basic measuring instruments.
2. Select and use appropriate instrument/s for specific measurement.
3. Understand the systems of limits, fits and tolerances and correlate with machine drawing and manufacturing processes.
4. Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form for understanding the concepts of SQC.
5. Construct, draw and interpret the control charts.

**Learning Structure:**



**Theory:**

Topic & Content	Hours	Marks
<b>1. Introduction to Metrology</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>To understand the basics of Metrology &amp; calculate the least count of measuring instruments.</li> <li>To understand various standards, comparators, gauge selection and limit system.</li> </ul> <b>1.1 Metrology Basics</b> 06 Marks Definition of metrology, objectives of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology, Need of inspection, <b>Revision of --Precision, Accuracy, Sensitivity, Readability, Calibration, Traceability, Reproducibility, Sources of errors, Factors affecting accuracy, Selection of instrument, Precautions while using an instruments for getting higher precision and accuracy. Concept of least count of measuring instruments (No questions to be set on revision).</b>	09	18
<b>1.2 Standards and Comparators</b> 12 Marks Definition and introduction to line standard end standard, Wavelength standard and their comparison, Slip gauge and its accessories. Definition, Requirement of good comparator, Classification, use of comparators, Working principle of comparators, Dial indicator, Sigma comparator, Pneumatic comparator- high pressure differential type, Electrical (LVDT), Relative advantages and disadvantages.		
<b>2. Limits, Fits, Tolerances and Gauges</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>To understand the basics of limits, fits &amp; tolerances</li> <li>To calculate the basic and gauge tolerances.</li> <li>To understand various types of gauges and their applicability.</li> </ul> <b>2.1</b> Concept of Limits, Fits, And Tolerances, Selective Assembly, Interchangeability, Hole And Shaft Basis System, Taylor's Principle, Design of Plug, Ring Gauges, IS919-1993 (Limits, Fits & Tolerances, Gauges IS 3477-1973), Study of relation gauges, concept of multi gauging and inspection.	06	08
<b>3. Angular Measurement</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>To understand the basics of angular measurement and measure angles using different instruments.</li> </ul> <b>3.1</b> Concept, Instruments For Angular, Measurements, Working And Use of Universal Bevel Protractor, Sine Bar, Spirit Level, Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges). Angle dekkor as an angular comparator.	04	08
<b>4. Threads and Gear Metrology</b> <b>Specific Objectives</b> <ul style="list-style-type: none"> <li>To Understand &amp; use various methods of calculating thread elements and elements of gear tooth</li> </ul> <b>4.1 Screw thread Measurements</b> 08 Marks ISO grade and fits of thread, Errors in threads, Pitch errors,	06	16

<p>Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch for internal and external threads , Three wire method, Thread gauge, screw thread micrometer, Working principle of floating carriage micrometer.</p> <p><b>4.2 Gear Measurement &amp; Testing</b> 08 Marks</p> <p>Analytical and functional inspection, Measurement of tooth thickness by constant chord method, base tangent method, gear tooth vernier, Errors in gears such as backlash, run out, composite, concentricity. Parkinson gear tester.</p>		
<p><b>5. Testing Techniques</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>To know terminology of surface finish &amp; measure the surface finish of various components.</li> </ul> <p><b>5.1 Measurement of Surface Finish</b> 06 Marks</p> <p>Primary and secondary texture, Sampling length, Lay, terminology as per IS 3073- 1967, direction of lay, Sources of lay and its significance, CLA, Ra, RMS values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis</p> <p><b>5.2 Machine Tool Testing</b> 04 Marks</p> <p>Parallelism, Straightness, Squareness, Coaxiality, roundness, run out, alignment testing of machine tools such as lathe, milling machine and drilling machine as per IS standard procedure. Study of optical flat for flatness testing.</p>	06	10
<p><b>6. Quality Control</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>To understand the concept of Quality, cost of quality.</li> <li>To understand the concept and principles of TQM.</li> </ul> <p><b>6.1 Quality :</b> 06 Marks</p> <p>Definitions, meaning of quality of produce &amp; services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost, Quality assurance, Cost of rework &amp; repair, Quality &amp; Inspection, Inspection stages.</p> <p><b>6.2 Total Quality Management :</b> 06 Marks</p> <p>Principles and concept of total quantity management.</p> <p>a) Quality Audit: Concept of audit practices, lead assessor certification.</p> <p>b) Six sigma: Statistical meaning, methodology of system Improvement.</p> <p>c) Introduction of ISO 9001-2008. ISO-14000 and TS 16949.</p>	07	12
<p><b>7. Statistical Quality Control</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>To know the basics of statistics.</li> <li>To understand different data types and analyze &amp; interpret the data</li> </ul> <p><b>7.1 Statistical Quality Control</b> 20 Marks</p> <p>Basics of Statistical concepts, Meaning and importance of SQC, Variable and attribute Measurement. control charts – inherent and assignable sources of variation, control charts for variables – X &amp; R charts, control charts for attributes p, np, C charts, process capability</p>	10	28

of machine, $C_p$ and $C_{pk}$ calculations, determination of statistical limits, different possibilities, Rejection area, Statistically capable and incapable processes <b>7.2 Acceptance Sampling</b> 08 Marks Concept, Comparison with 100% inspection, Different types of sampling plans, sampling methods, merits and demerits of acceptance sampling. OC Curve.		
<b>Total</b>	<b>48</b>	<b>100</b>

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

1. To select basic measuring instruments.
2. To calculate least count of various measuring instruments.
3. To collect, record and analyze the data.
4. To interpret the results of data analysis.

**Motor Skills:**

1. Measure the dimensions of component using various instruments.
2. To take care of instruments.
3. To draw various charts and curves related to data.
4. To handle various instruments.

**List of Practical:**

1. Measurement of various dimensions & dimensional parameters using instruments such as radius gauge, pitch screw gauge, filler gauge, vernier caliper, vernier height gauge, vernier depth gauge, dial type vernier caliper, micrometer, inside micrometer, tube micrometer.

**Note:-** \* The student should measure at least 3 dimensions of given job and take 5 readings per dimension.

\* Individual performing the measurement with one setup on one surface plate and simultaneous 4 to 5 setup should be kept ready for measurement. (At least 10 Vernier calipers, Micrometers with different range i.e. 0-25mm two nos., 25- 50 two nos. Inside micrometer, tube micrometer, V anvil micrometer at least one.)

1. To set the Adjustable snap gauge GO end and NOGO end for a given dimensions using slip gauges.
2. Inspection of given components using Dial Indicator as a mechanical comparator.
3. To check the given component using high pressure Dial type pneumatic comparator.
4. To find unknown angle of component using bevel protractor and verify the same using sine bar/ sine center and slip gauges.
5. To measure the angle of component with the Angle Dekkor / Autocollimator using angle gauge.
6. Measurement of screw thread elements by using screw thread micrometer, screw pitch gauge & their verification with the help of profile projector/tool maker's microscope.
7. Measurement of gear tooth elements by using gear tooth vernier caliper and verification of gear tooth profile using profile projector.
8. To measure surface roughness using surface roughness measuring instrument. Measure surface roughness of turning, milling, shaping, grinding and lapping surfaces.
9. Testing of lathe machine/drill machine for parallelism, squareness, trueness by Test Dial indicator.
10. Draw the frequency histogram, frequency polygon for given samples (min 50 readings) and find mean, mode, median.

11. To draw the normal distribution curve and find standard deviation, variance, range and determine process capability.
12. To draw and interpret the control Charts (X – bar and R – chart, P chart, C chart) for given data.

a. **Batch size of students for experiment 2 to 13 shall be 4 to 5.**

b. **4 to 5 experimental setups should be arranged simultaneously.**

**Assignment:**

1. Visit the industries to collect the data for p and c chart, study the coordinate measuring machine and study the quality management systems.
2. Selection of comparators for the given dimensional data

**Learning Resources:**

Sr. No.	Author	Title of Book	Edition	Publisher
01	R. K. Jain	Engineering Metrology	2010	Khanna Publisher, Delhi.
02	M. Mahajan	Text Book of Metrology	Second Reprint-2010	Dhanpat Rai & Co.
03	I.C. Gupta	A text book of Engineering Metrology	--	Dhanpat Rai and Sons
04	M. Mahajan	Statistical Quality Control	2010	Dhanpat Rai and Sons
05	Douglas C. Montgomery	Statistical Quality Control	Sixth reprint 2011	Wiley India Pvt. Ltd.
06	Dale H. Besterfield and others	Total Quality Management	Third Reprint 2012	Pearson

**2. IS/ International Codes:**

- IS 919 - 1993 Recommendation for limits, fits and tolerances
- IS 2029 - 1962 Dial gauges.
- IS 2103 - 1972 Engineering Square
- IS 2909 - 1964 Guide for selection of fits.
- IS 2921 - 1964 Vernier height gauges
- IS 2949 - 1964 V Block.
- IS 2984 - 1966 Slip gauges.
- IS 3139 - 1966 Dimensions for screw threads.
- IS 3179 - 1965 Feeler gauges.
- IS 3455 - 1966 Tolerances for plain limit gauges.
- IS 3477 - 1973 Snap gauges.
- IS 6137 - 1971 Plain plug gauges.
- IS 3651 - 1976 Vernier Caliper
- IS 4218 - Isometric screw threads
- IS 4440 - 1967 Slip gauges accessories
- IS 5359 - 1969 Sine bars
- IS 5402 - 1970 Principle and applications of sine bars

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/EE/EP/CH/PS/CD/ED/EI/CV/FE/FG/IU/MH/MI/TX/TC/DC/AU**

**Semester : Fifth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/EE/EP/CH/PS/AU and Sixth for CD/MH/IU/CV/FE/FG/MI/ED/EI/DC/TC/TX**

**Subject Title : Behavioural Science**

**Subject Code : 17075**

**Teaching and Examination Scheme:**

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

#### **Rationale:**

With increased globalization and rapid changing business expectations, employers are looking for wide cluster of skills to cater to the changing demand. Personality traits and soft skills are playing a key role in a student's career in this changing scenario. Corporate houses look for soft skills that supplement hard skills.

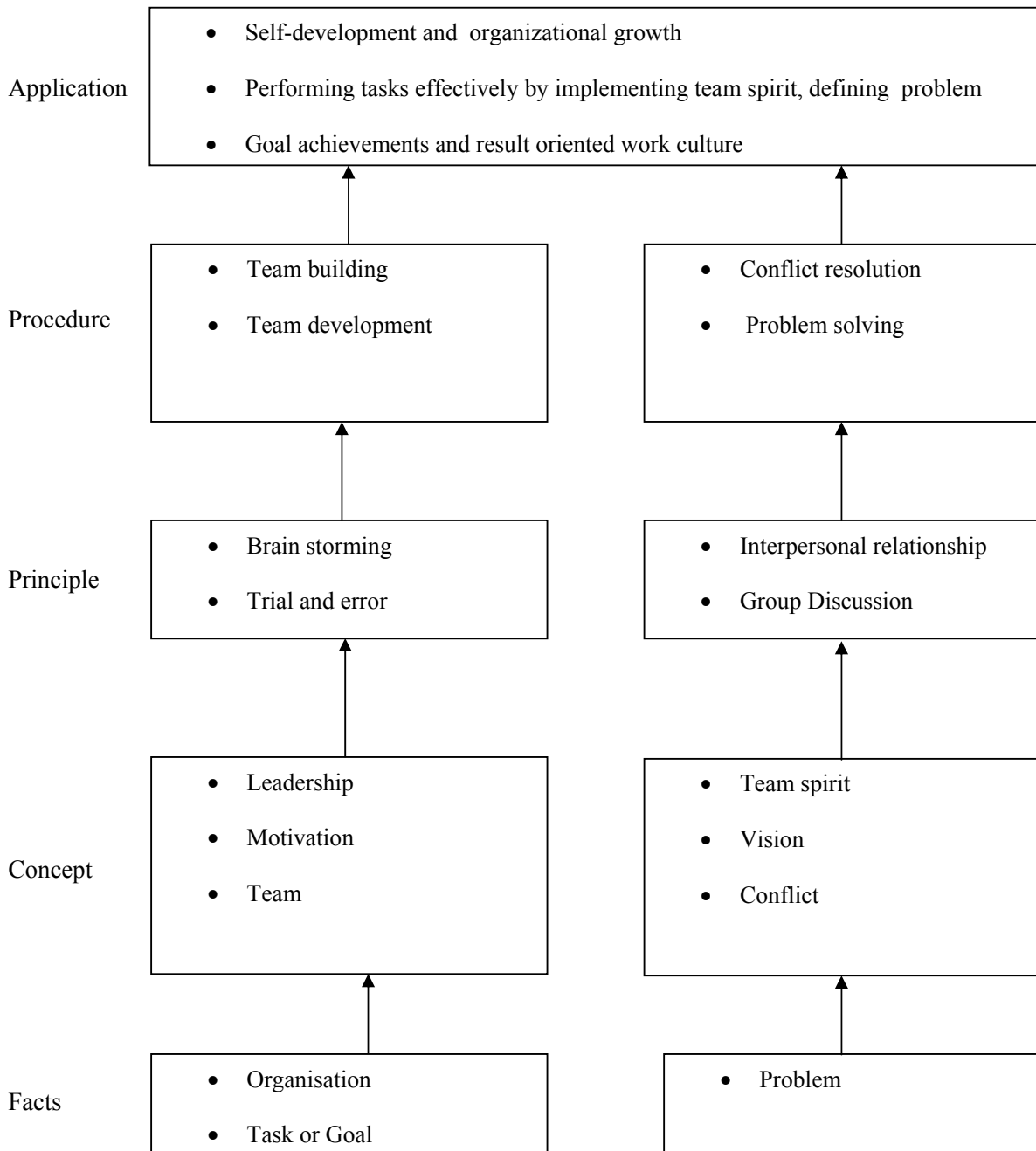
Addition of behavioural science in curriculum is intended to enhance the efficiency of a person so that he can contribute to overall growth of organisation. It aims at developing insight into leadership, team building, motivation, interpersonal relationship, problem solving, decision making and aspects of personality in a technician's profile. Addition of the topic of organizational culture will further mould him/ her in the organisational role.

This subject of 'Behavioural Science' provides a broad base in which a technician can develop a successful career in the world of work.

#### **General Objectives:**

After studying this subject, the students will be able to:

1. Develop him/her as Team leader.
2. Use self-motivation and motivate others.
3. Build a team and develop team spirit among the team members.
4. Improve the interpersonal relationship skills.
5. Learn Problem solving and decision making skills.
6. Discuss a particular topic in a group and face the interview.

**Learning Structure:**

**Theory:**

Topic and Contents	Hours
<b>TOPIC 1: LEADERSHIP</b> Contents: 1.1 Introduction – Importance, examples of different types of leaders. 1.2 Meaning and Definition of Leadership. 1.3 Leadership qualities – Confidence, Vision, Communication Skills, influencing people etc. 1.4 Types of Leadership styles, their advantages and disadvantages – Autocratic, Democratic, Delegative, Bureaucratic and Laissez Fairie.	02
<b>TOPIC 2: MOTIVATION</b> Contents: 2.1 Meaning and Definition of motivation. 2.2 Types of motivation. 2.3 Maslow’s Motivation theory. 2.4 Job characteristic model to enhance motivation.	03
<b>TOPIC 3: TEAM BUILDING</b> Contents: 3.1 Definition of Team. 3.2 Difference between Group and Team. 3.3 Need for formation of good team (vision, trust, cooperation, initiative, etc.) 3.4 Approach to Team building (Personality based, activity based, skill based, problem solving based, etc.)	02
<b>TOPIC 4: CONFLICT RESOLUTION</b> Contents: 4.1 Definition of Conflict. 4.2 Types of Conflict – Functional and Dysfunctional 4.3 Sources of Conflict – Ego, Authority, Frustration etc. 4.4 Positive and Negative effects of conflicts. 4.5 Methods of Conflict resolution – Compromising, withdrawal, forcing.	04
<b>TOPIC 5: PROBLEM SOLVING AND DECISION MAKING</b> Contents: 5.1 Steps in Problem Solving. 5.2 Methods used for solving problems – trial and error method, brain storming, lateral thinking method. 5.3 Techniques used for Decision making- Decision tree, Decision Matrix, Mind Mapping etc.	03
<b>TOPIC 6: GROUP DISCUSSION AND INTERVIEW TECHNIQUES</b> Contents: 6.1 GROUP DISCUSSION <ul style="list-style-type: none"> <li>Objectives of Group Discussion (ability to work in team, speaking and listening skills, leadership, creativity)</li> <li>Does and Don’ts of Group Discussion.</li> <li>How to conclude Group Discussion.</li> </ul>	02

6.2 INTERVIEW TECHNIQUES	
<ul style="list-style-type: none"> <li>Types of Interviews. (patterned, stress, behavioural)</li> <li>Dress Code, Body Language and Communication Skill.</li> <li>Probable questions for Interview.</li> <li>Telephonic or Video Interview.</li> </ul>	
<b>Total</b>	<b>16</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Develop ability to find his strengths.
2. Select proper source of information.
3. Follow the technique of time and stress management.
4. Set the goal.

**Motor Skills:**

1. Follow the presentation of body language.
2. Work on internet and search for information.
3. Prepare slides / transparencies for presentation.

**List of Practicals / activities:**

1. Form a group of 4 or 5 students and discuss the topic 'Qualities of an effective leader'. Each group will prepare its list with justification to the entire class and write an assignment under the guidance of subject teacher.
2. Form a pair of student and each one from pair will ask each other questionnaire on motivation, self-motivation, experiences that motivated him or other which him for success in the past and write an assignment under the guidance of subject teacher based on discussion.
3. Form a group of 4 or 5 students and assign them a group activity such as 'making a shape from match stick (50 to 100 match sticks) without guidance and without group discussion.
4. The group as in activity 3 will now perform the same activity. After group discussion and under guidance of subject teacher, each student from a group will write an assignment for both the activities and write their inferences with reference to group discussion, team development, team building, etc.
5. Form a group of 8 to 10 student and arrange a group activity such as;
  - Industrial visit.
  - Visit to any historical place/fort/museum, etc
  - Housekeeping and cleaning of any laboratory/seminar hall for any function.
 After the execution of activity student will write an assignment under guidance of teacher keeping in mind individual role, purpose of activity, inter dependency of work or task, coordination of person and task involved and final performance.
6. Write an assignment on interpersonal relationship and conflict management with student's personal experience of solving conflicts.
7. Form a group of 20 students and ask them to prepare a list of 8 to 10 problems affecting the institute. Subject teacher should analyze one such problem on black board using 'Fish bone technique' with the participation of students. Students will write an assignment consisting;
  - Apparent problem statement.
  - Analysis of the causes.



- Definition of real problem.
8. The subject teacher starts the session with 'Statement of the problem' written on the black board. After ensuring that all the participants are at the same level of understanding the statement of problem, he initiates NGT (Normal Group Technique) to arrive at maximum possible number of creative solutions.  
Based on ranking matrix the group will arrive at feasible solutions and students will write an assignment consisting of;
    - Problem Statement.
    - Model of problem solving.
    - List of creative solution suggested by participants.
    - Write the most feasible solution based on given criteria.
  9. Form a group of 4 to 5 students and give them a topic for GD for 10 to 15 minutes. Teacher should analyse GD on certain parameters and students will write an assignment on aspects of GD and prepare a format (suggested or designed by teacher) which gives details of GD carried out.
  10. Arrange a guest lecture of H.R. Person from industry/expert in interview technique and conduct mock interview of each student. Student should write a report on this activity.
  11. Arrange a visit to industry and gather information about organisation, product, turnover, work culture, vision/mission statement, quality policy, Corporate social responsibility etc and write a report on it.

**Note - Subject teacher shall guide the students in completing the assignments based on above practicals.**

#### **Learning Resources:**

##### **Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Name of Book</b>	<b>Publication</b>
1	Subject Experts-MSBTE	Handbook and assignment book on Development of Life Skills-II	MSBTE
2	Dr. Kumkum Mukherjee	Principles of management and organizational behaviour	Tata McGraw Hill Education Pvt Ltd.
3	Dr.T.Kalyana Chakravarti Dr.T.Latha Chakravarti	Soft Skills for Managers	Biztantra
4	Barun K Mitra	Personality Development and soft skills	Oxford University Press
5	Priyadarshini Patnaik	Group discussion and interview skills	Foundation Books

**Course Name : Mechanical Engineering Group****Course Code : ME/PG/PT/MH/MI/FG/FE****Semester : Fifth for ME/PG/PT/FG and Sixth for MH/MI/FE****Subject Title : CNC Machines****Subject Code : 17064****Teaching and Examination Scheme:**

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

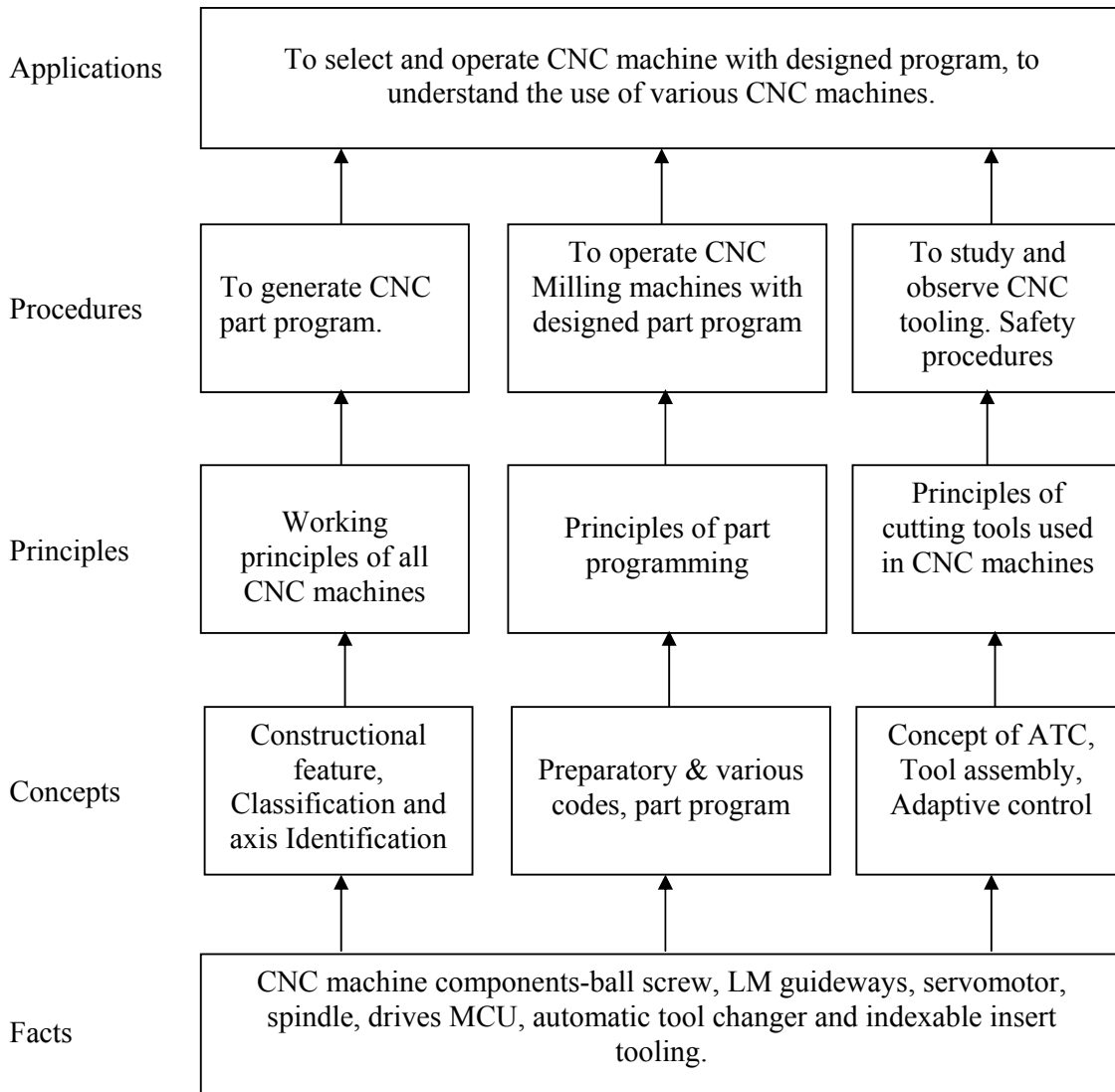
**Rationale:**

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

4.9 Fixtures used in CNC machines.	
<b>Total</b>	<b>16</b>

**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 (6<sup>th</sup> 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**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
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

**Course Name : Mechanical Engineering Group****Course Code : AE/ME/PG/PT/MH/MI****Semester : Fifth for AE/ME/PG/PT/FG and Sixth for MH/MI/FE****Subject Title : Professional Practices-III****Subject Code : 17065****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	50@	50

**Rational:**

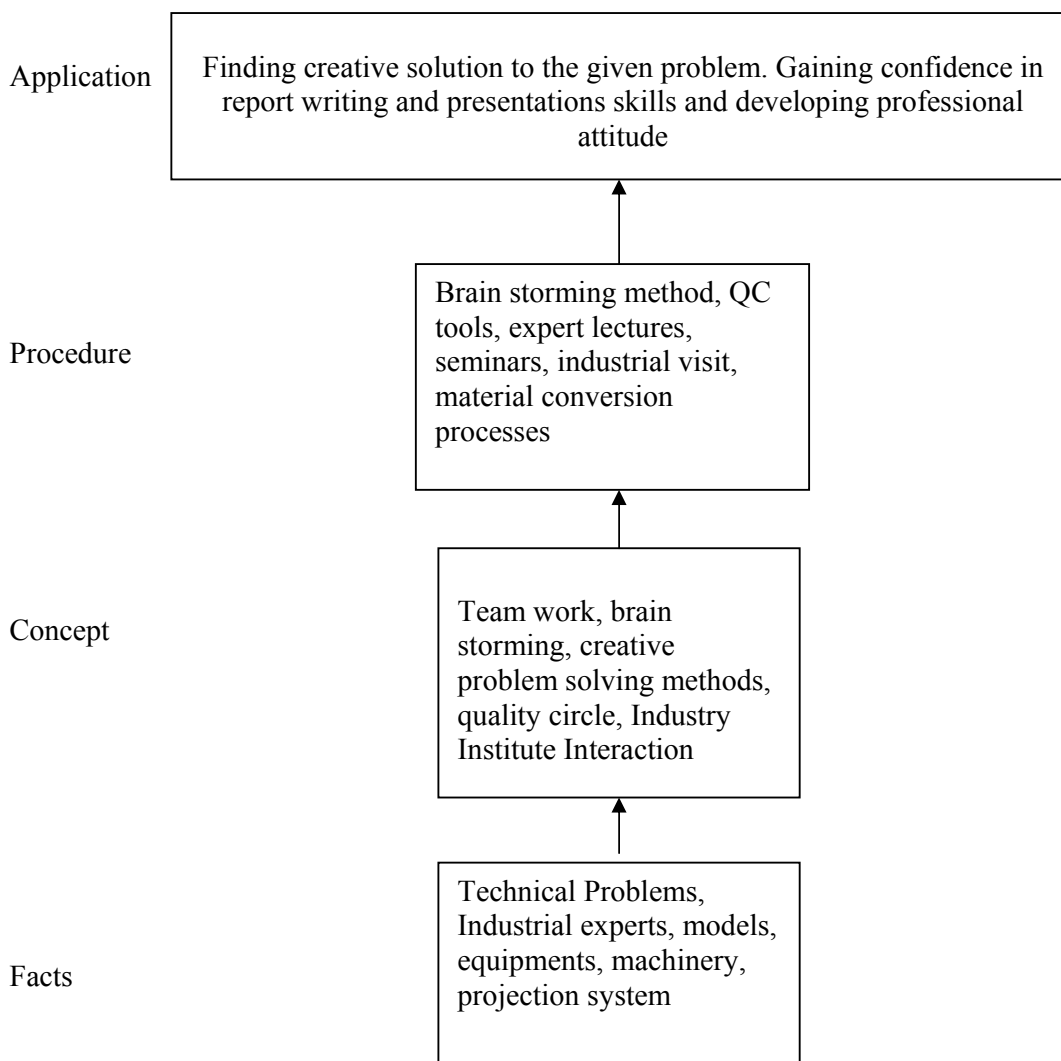
Overall professional development of diploma mechanical engineers is the need of the day for enabling them to sustain in competitive global environment.

Professional development of Diploma engineering students is to be done by exposing them to various simulative situations in the industries. This can be achieved by inculcating attitude to face the problems, get alternative solutions and validation of the selected alternatives. This is achieved by involving students in activities such as inviting experts from various industries for sharing their experiences, arranging industrial visits, quality circles, seminars and mini projects activities etc.

**General Objectives:**

Student will be able to:

1. Identify, select and solve the problems.
2. Acquire information from different sources.
3. Prepare technical report and present seminar using power projection system.
4. Interact with peers to share thoughts.
5. Make them work with their own hands.
6. Work in a team and develop team spirit.

**Learning Structure**



**Contents:**

Activity	Practical Hours
<p><b>1. Idea Generation for final semester Project selection:</b></p> <p>The student should use innovation principles for Idea generation .These ideas should lead to selection of Project. Head of Department should allot the project guides for the activity and form groups of four students per project.</p> <p>Following are some of the guidelines for projects selection.</p> <ul style="list-style-type: none"> <li>• Development of working models.</li> <li>• Development of attachments to machine tools.</li> <li>• Reconditioning of existing equipments, machines in the Institute.</li> <li>• Industrial Problem Solving.</li> <li>• Interdisciplinary Projects.</li> <li>• Use of Non conventional Energy sources.</li> <li>• Use of appropriate technology.</li> <li>• Agro based projects to reduce drudgery of farmers.</li> <li>• Ergonomic equipments</li> <li>• Jig, fixtures, dies, special purpose tools</li> <li>• Any project on Low Cost Automation</li> <li>• Automation Problems in industries</li> <li>• Experimental setups required in laboratories for measurement of parameters and component performance.</li> <li>• Any other project suitable for Industry and Institute.</li> </ul> <p><b>Note:-</b> The project group should submit their progress report, activity planning, any preliminary calculations to evaluate the project to be submitted at the end of the semester.</p> <p>The student should submit a report for the project which will have proportional weightage in the term work</p>	06

**2. Industrial Visits**

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

Following are the suggested types of Industries/ Fields. The subject teacher(s) have liberty to select nearby organization/industry

- Automobile manufacturing / press component / auto component manufacturing units to observe the working of SPM / Non Conventional Manf process / CNC / FMS / Robots
- Refrigeration and air conditioning manufacturing / servicing units / industries / workshops
- Automobile service stations for four wheelers/Wheel Balancing unit for light and/or heavy motor vehicles/exhaust gas analysis and vehicle testing / PWD / ST workshop.
- Co-ordinate measuring machine to observe its construction working specifications and applications.
- Engine Testing unit to gather details regarding the testing procedures/parameters etc.
- Food processing/ Dal mill/ Oil Mill/ Automated bakery unit.
- Textile industry / Textile machinery manufacturing / garment manufacturing / embroidery / textile printing and dyeing units.
- Hydro electric and Thermal power plants.
- Automotive Research Association of India, Pune, Central Institute of Road Transport, Pune, Vehicle Research and Development establishment, Ahmednagar.
- Safety museum at Central Labour Institute, Sion, Mumbai
- Common Facility Center by MSME, GOI.
- Auto Cluster projects of MSME, GOI.
- CIPET and IGTR Aurangabad
- Tyre retreading, paint manufacturing, foundries, forging unit, heavy fabrication unit, steel and wooden furniture manufacturing
- Agricultural equipments manufacturing units.
- Hardware and Machinery stores selling agro equipments
- Plastic injection molding, extrusion, blow molding.
- Stone crushers / hot mix plant/ service stations of JCBs and other earthmoving equipments
- Note:- One Industrial visits be arranged per practical batch of students.

06

<p><b>3. The Professionals/ Industrial Expert Lecture/s</b></p> <p>Experts / Professionals from different field/industries are invited to deliver lectures of 2 Hrs. duration at least TWO occasions. The topics may be selected by the teacher / industry expert to develop required skills .The following topics may serve guidelines.</p> <ul style="list-style-type: none"> <li>• Vehicle testing. Vehicle aerodynamics &amp; design.</li> <li>• Modern automobiles systems, Hybrid motor vehicles, electric vehicles, MPFI, ABS etc.</li> <li>• Environmental pollution &amp; control, Automobile pollution, norms, act.</li> <li>• Earth moving machines.</li> <li>• Biotechnology</li> <li>• Nanotechnology</li> <li>• CAD, CAM, Computer Integrated Manufacturing, Material resources planning, Enterprise resources planning</li> <li>• Product design and modeling, Rapid prototyping</li> <li>• Programmable logic controllers, Automation, Robotics, Automated Guided Vehicles, Non industrial robots,</li> <li>• TQM, 5S, JIT, KAIZEN, Lean Manufacturing., World class Manufacturing, Pokayoke, Total Productive Maintenance, Six Sigma.</li> <li>• Packaging technology</li> <li>• Appropriate technology</li> <li>• LPG / CNG conversion kit.</li> <li>• Current HR Policies, Labor Act.</li> <li>• ISO implementation,</li> <li>• Import – Export policies and procedures, Taxation.</li> <li>• IPO, Mutual Fund, FPO, Share- Commodity trading and Investment.</li> <li>• Role of Insurance, Value Assessors in industry and society, Vehicle valuers,</li> <li>• Trends in modern agriculture engineering</li> <li>• Sustainable development, Green Environment, Solar and alternative fuels, Rain water harvesting, Disaster management.</li> <li>• Innovation Principles.</li> <li>• Opportunities in software industries.</li> <li>• Supply chain management. E-commerce.</li> <li>• Energy Audit.</li> <li>• Road Safety, Road Signs, Prevention of accidents on Roads, First aid.</li> </ul> <p><b>Note:</b> The brief report to be submitted on these lectures by each student as a part of Term work</p>	06
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<p><b>4. Students Quality Circles:</b> The students should form Quality Circles consisting of group of six to eight students and brain storm on various problems faced by students, use QC tools to find root causes and alternative solutions.</p> <p>Following are some of the problems undertaken by students Quality Circle - Poor vocabulary of Diploma Engineering students Poor practical skills of Diploma Engineering students Poor Journal preparation of Diploma Engineering students Poor Entrepreneurial abilities of Diploma Engineering students Students and teacher can select different problems according to their priorities. The students should prepare QC register and Case Study presentation. Present this case study in the class.</p> <p>Such Quality Circles can participate in State level and National Level Conventions organized by Quality Circle Forum of India. For additional information visit website <a href="http://www.qcfihq.com">www.qcfihq.com</a></p>	12
<p><b>5. Seminar :</b> Seminar topic may be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 5 typed pages (font size 12 all Margins 1" A4 size) (Presentation time – 10 minutes per student)</p>	06
<p><b>6. Mini Projects : (in a group of 4-5 students)</b></p> <p>Students can choose any mini project of their interest. Mini Projects means a short term project which may be completed in 2 to 3 months and with a limited scope. Suggestive topics for guidance are as follows : CNC Programming and manufacturing, Advanced mechanism, Model making--conveyors, agro equipments, wax/ thermocol prototypes, factory layouts, string diagrams,. Standard Operating Procedures for various machines Students and teachers are free to select any techno-viable mini project.</p> <p>Students shall arrange exhibition of all mini projects in the class/hall and present the task to the audience/ experts/examiners. The student shall submit a brief report (Max. 5 pages) of the mini project.</p>	12
<b>Total</b>	<b>48</b>

### Note for Industrial In-plant Training

### PART A - Term Work / Assignments mentioned in the curriculum of Professional Practices-III

### PART B - In plant Training (Minimum Two Weeks)

The students who are willing to undergo In Plant Training should complete minimum two weeks training in summer vacation at the end of IV<sup>th</sup> Semester examination in following types of organizations

1. Small scale industry
2. Private Ltd organization / industry
3. Public Ltd organization
4. Machine shop / Work shop
5. Tool room

6. Press shop
7. Die manufacturing unit
8. CNC shop/Center
9. Fabrication shop
10. Foundry
11. Heat treatment shop
12. Surface plating shop
13. Rubber components manufacturing unit
14. Plastic manufacturing unit
15. Tyre retreading shop
16. Four wheeler/two wheeler service station
17. Earth moving machinery
18. Rice mill / Sugar mill / Food industry
19. Farm equipment manufacturing unit
20. CAD / CAM design unit
21. Any other relevant industry/shop in the field of Mechanical / Automobile / Production Engineering

Student should complete his report (Duly typed and bound) and submit along with Term Work in **PART - A**

**Note – Student should attach the certificate along with training report duly certified by the competent authority (Ex. Engineer/Manager/Director/Owner etc.) from the concerned industry for the validity of in plant training**

**Guidelines for contents in the report**

- Name and type of industry
- Plant layout (Actual)
- No of departments / employees
- Nature of product / manufacturing process/service etc.
- Types of machines / equipments used and their maintenance.
- Machine specifications/make/capacity/efficiency etc.
- Measuring instruments used, their types and applications.
- Name of components/items/subcomponents/assemblies/subassemblies produced.
- Raw materials used / inventory control.
- Quality systems employed - TQM/Kaizen / 5S / Quality circle.
- Information about customer and competitor
- Conclusion - knowledge gained by the student, skills developed / learned / enhanced.
- Opinion / view of student about in plant training.
- Any other relevant information.

Guidelines for assessment of Term Work and in plant training report

The assessment of Term Work and in plant training report shall be done on following basis

Assignments completed as per PART A (converted from D4 format)	In plant training	Total Term Work Marks
40	10	50

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
01	NRDC, Publication Bi Monthly Journal	Invention Intelligence Journal	National Research Development Corporation, GOI.
02	DK Publishing	How things works encyclopedia	DK Publishing
03	QCFI Publication, Secunderabad	Quality Circle Concepts and Implementation, 5S, KAIZEN 6 SIGMA TRIZ TQM SPC TPM SMED ERP	QCFI Publication, Secunderabad Visit website <a href="http://www.qcfihq.com">www.qcfihq.com</a> for details
04	Paul Trott	Innovation Management and New Product Development 4 <sup>th</sup> Ed.(2008)	Pearson Education
05	Joe Tidd	Managing Innovation,3rd Ed.	Wiley India

**2. CD-ROM:**

Federation of Indian Chambers of Commerce and Industries (FICCI) has developed 7 internationally acclaimed CD-ROM titles on various aspects of Quality Management & Business Excellence, which enable the organizations in achieving their ‘mission critical objectives’ in a cost-effective manner.

- Developing continuous improvement as an organizational strategy.
- Strategies for becoming a customer driven organization.
- Six Sigma - A breakthrough strategy.
- Seven steps to World Class Manufacturing.
- Maximizing business results and competitive advantages.
- Concise Encyclopedia of Business Excellence.
- Developing a passion to excel.

For more details log on to: [www.ficci.com/fqf03/index.htm](http://www.ficci.com/fqf03/index.htm)

**3. Web Sites:**

[www.start2think.com](http://www.start2think.com)  
[www.Innovationgoldmine.com](http://www.Innovationgoldmine.com)  
[www.engineeringforchange.org](http://www.engineeringforchange.org)  
[www.qcfihq.com](http://www.qcfihq.com)  
[www.wikipedia.com](http://www.wikipedia.com)  
[www.slideshare.com](http://www.slideshare.com)  
[www.teachertube.com](http://www.teachertube.com)

**Industrial Training (Optional)**

- Students who have completed industrial training in summer vacation after 4<sup>th</sup> Semester will be granted exemption for activities related to topic 1 to 4.
- These students shall submit report of Industrial training signed and certified by authorities from Industry. Student will give seminar on industry training attended by him.
- Evaluation will be done on seminar and report submitted by student.