 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 : ME																	
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2009-10							
SEMESTER : FIFTH										DURATION: 16 WEEKS							
PATTERN : FULL TIME - SEMESTER										SCHEME : E							
SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										
				TH	TU	PR	PAPER HRS	TH (01)		PR (04)		OR (08)		TW (09)		SW (16005)	
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Advanced Manufacturing Processes \$	AMP	12154	03	--	02	03	100	40	--	--	--	--	25@	10	50	
2	Power Engineering	PEN	12155	04	--	02	03	100	40	50#	20	--	--	25@	10		
3	Measurements & Control \$	MCO	12156	03	--	02	03	100	40	--	--	--	--	25@	10		
4	Metrology & Quality Control \$	MQC	12157	04	--	02	03	100	40	50#	20	--	--	25@	10		
5	ELECTIVE – I (Any One)																
	Tool Engineering	TEN	12158	03	--	02	03	100	40	--	--	--	--	25@	10		
	Automobile Engineering	AEN	12159	03	--	02	03	100	40	--	--	--	--	25@	10		
	Power Plant Engineering	PPE	12160	03	--	02	03	100	40	--	--	--	--	25@	10		
	Mechatronics Ø	MEC	12161	03	--	02	03	100	40	--	--	--	--	25@	10		
6	Industrial Project & Entrepreneurship Development Ø	IPE	12162	01	01	02	--	--	--	--	--	--	--	25@	10		
7	Professional Practices-V	PPR	12163	--	--	04	--	--	--	--	--	--	--	50@	20		
TOTAL				18	01	16	--	500	--	100	--	--	--	200	--		50

Student Contact Hours Per Week: **35 Hrs.**
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.
Total Marks : **850**
@ Internal Assessment, # External Assessment, No Theory Examination, \$- Common to ME/PG/PT/MH/FE, Ø - Common to ME/PT/AE/MH/FE

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, 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 : Mechanical and Production Engineering / Production Technology

COURSE CODE : ME/PG/PT/MH/MI/FE

SEMESTER : FIFTH FOR ME/PG/PT AND SIXTH FOR MH/MI/FE

SUBJECT TITLE : ADVANCED MANUFACTURING PROCESSES

SUBJECT CODE : 12154

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 Technology subject which has relevance with the subjects taught earlier namely- manufacturing processes, manufacturing technology and production 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 environment.

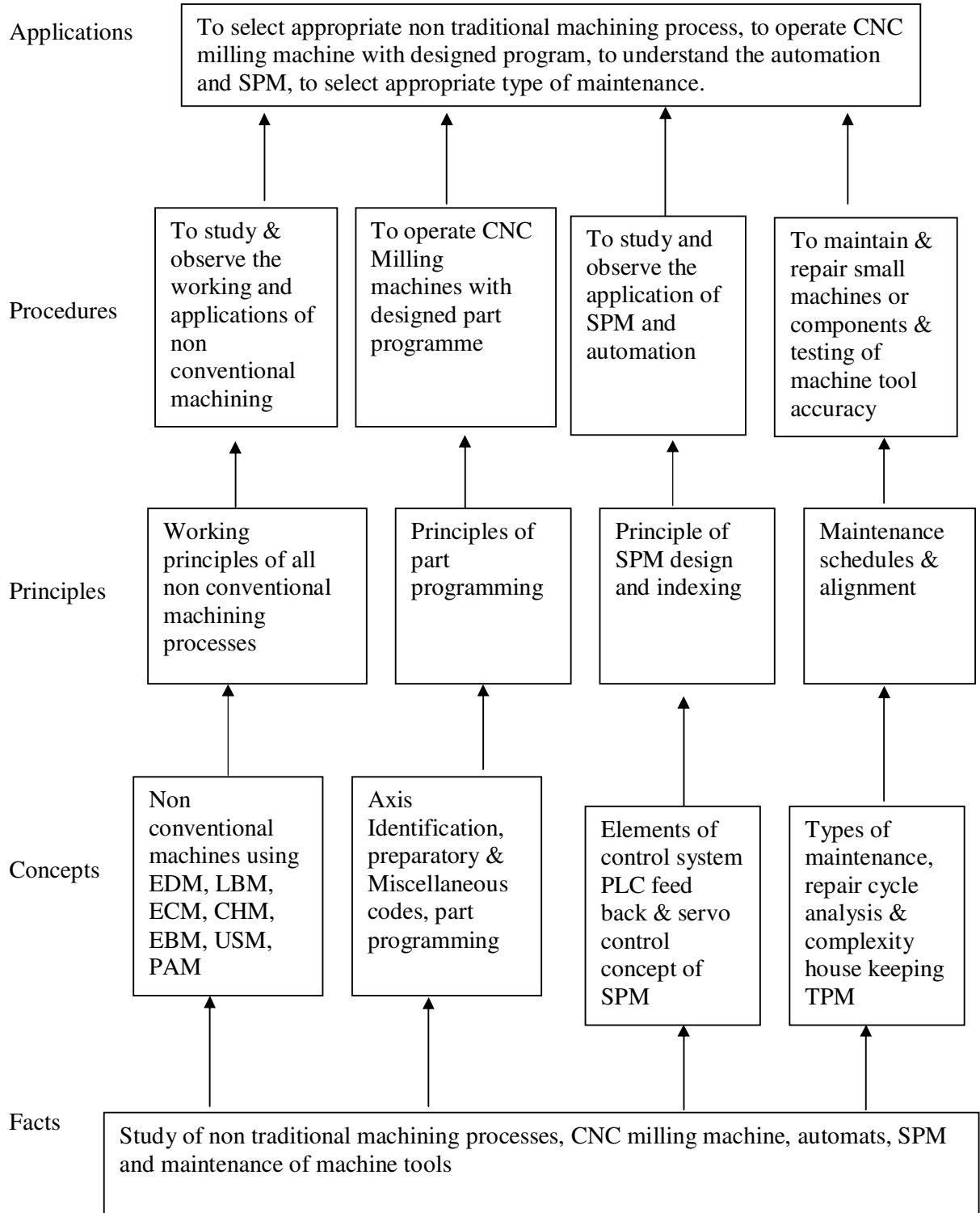
This subject will help the student to get familiarized with working principles and operations performed on non traditional machines, machining center, SPM, automated machines and maintenance of machine tools.

Objectives:

The student will be able to

- Know different non traditional machining processes, CNC milling machines,
- Understand the working of Special Purpose Machines.
- Work as maintenance engineer.
- Know the Operation and control of different advanced machine tools and equipments.
- Produce jobs as per specified requirements by selecting the specific machining process.
- Adopt safety practices while working on various machines.
- Develop the mindset for modern trends in manufacturing and automation.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks	
01	Non traditional machining processes			
	1.1 ----- 16 Marks			
	<ul style="list-style-type: none"> • Need and importance of nontraditional machining processes, its classifications • Electrical discharge Machining. Principle of working, Setup of EDM, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, Applications e.g. micro hole drilling, curve hole drilling. • Wire cut EDM - Principle of working, Setup of WEDM, controlling Parameters, Applications. 	02	30	
	1.2 ----- 14 Marks			
<ul style="list-style-type: none"> • Laser Beam Machining. Physical principle of Laser, Laser action in ruby rod, Types of Lasers. Set-up for LBM. Characteristics, controlling Parameters, Applications, Application Of Laser Beam for Welding (LBW) • Other non traditional machines such as ECM, AJM, USM, LBM, PAM etc. Principle of working, Applications. 	04			
	03			
02	CNC milling machines			
	2.1 ----- 10 Marks			
	<ul style="list-style-type: none"> • Concept of CNC milling machine • Vertical and horizontal machining center: Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine. 	01	26	
	2.2 ----- 12 Marks			
	<ul style="list-style-type: none"> • CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Part programming including subroutines and canned cycles. • Specific programming examples like simple curvilinear milling, use of sub-routine, use of canned cycle 	03		
2.3 ----- 04 Marks				
<ul style="list-style-type: none"> • Principles of computer aided part programming. 	04	02		
03	Machine Tool Automation:			
	3.1 Introduction and Need. ----- 04 Marks			
	3.2 ----- 08 Marks			
	<ul style="list-style-type: none"> • Single spindle automates, transfer lines. • Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system, 	01	18	
	3.3 ----- 06 Marks			
<ul style="list-style-type: none"> • Introduction to PLC, Block diagram of PLC. 	02	04		
	02			
	02			

04	Special Purpose Machines (SPM) Concept, General elements of SPM, elementary SPM machines like Turret and Capstan lathe Principles of SPM design, Productivity improvement by using SPM	03	08
05	Maintenance of Machine Tools: <ul style="list-style-type: none"> • Need and importance of maintenance activity • Types of maintenance. • Basic maintenance practices for simple machine element, viz Bearing, Coupling, Shaft and pulley etc. • Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. • Introduction to Total Productive Maintenance (TPM). 	08	18
Total		48	100

Practical:

Skills to be developed:

Intellectual skills:

- 1) To select an appropriate non conventional machining process for required component.
- 2) To write programs for CNC milling machine.
- 3) To specify the requirement for special purpose machines and automation.
- 4) To select the maintenance procedure for given machine tool.

Motor Skills:

- 1) To execute part programs on CNC milling machine / machining center.
- 2) To repair and maintain machine tools and sub systems.
- 3) To use and operate different hand tools required for repair and maintenance.
- 4) To identify and rectify the faults in the given sub assembly.

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

List of Practical:

- 1) Two jobs on CNC milling having following operations – face milling, slotting, Contour machining. (Group of two students , each group must use different program for different job dimensions)
- 2) One assignment on part programming on machining center.
- 3) One assignment on machine tool installation procedure.
- 4) Industrial visit to observe automats and report on the tools, fixtures and cams used on automats.
- 5) Industrial visit to observe at least one non traditional machining process and report on visit.
- 6) Dismantling and Assembly of any one – a) Tailstock on lathe b) Apron Mechanism. c) Tapping attachment on drilling machine. d) Lathe Chuck
- 7) Report on mounting and dismounting procedure of following (any two) – a) Milling machine arbor. b) Vertical milling head. c) Tool post
- 8) One assignment on USM, CHM, EBM, AJM, WJM, PAM.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	Amitabh Ghosh , Mallik	Manufacturing Science	East-West Press Pvt. Ltd.
02	HMT, Bangalore	Production Technology	Tata Mc-Graw Hill
03	Pabla B. S. M. Adithan	CNC machines	New Age international limited.
04	H.P.Garg	Industrial maintenance	S. Chand & Co. Ltd.
05	P. K. Mistra	Non conventional Machining	Narvasa Publishining House
06	Lindley R. Higgins	Maintenance Engg. Handbook	Mc-Graw Hill
07	Begman, Amsted	Manufacturing Processes	John Willey and Sons.
08	B. L. Juneja	Fundamental of metal cutting and machine tools	New age international limited.
09	Steve Krar, Albert Check	Technology of Machine Tools.	Mc-Graw-Hill International.
10	P. N. Rao	CAD/CAM Principals and Applications	Tata McGrow-Hill
11	P. N. Rao	Manufacruting Technology Metal Cutting & Machne tools	Tata McGrow-Hill

COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING
COURSE CODE : ME / MH / MI
SEMESTER : FIFTH FOR ME AND SIXTH FOR MH/MI
SUBJECT TITLE : POWER ENGINEERING
SUBJECT CODE : 12155

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	50#	--	25@	175

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:

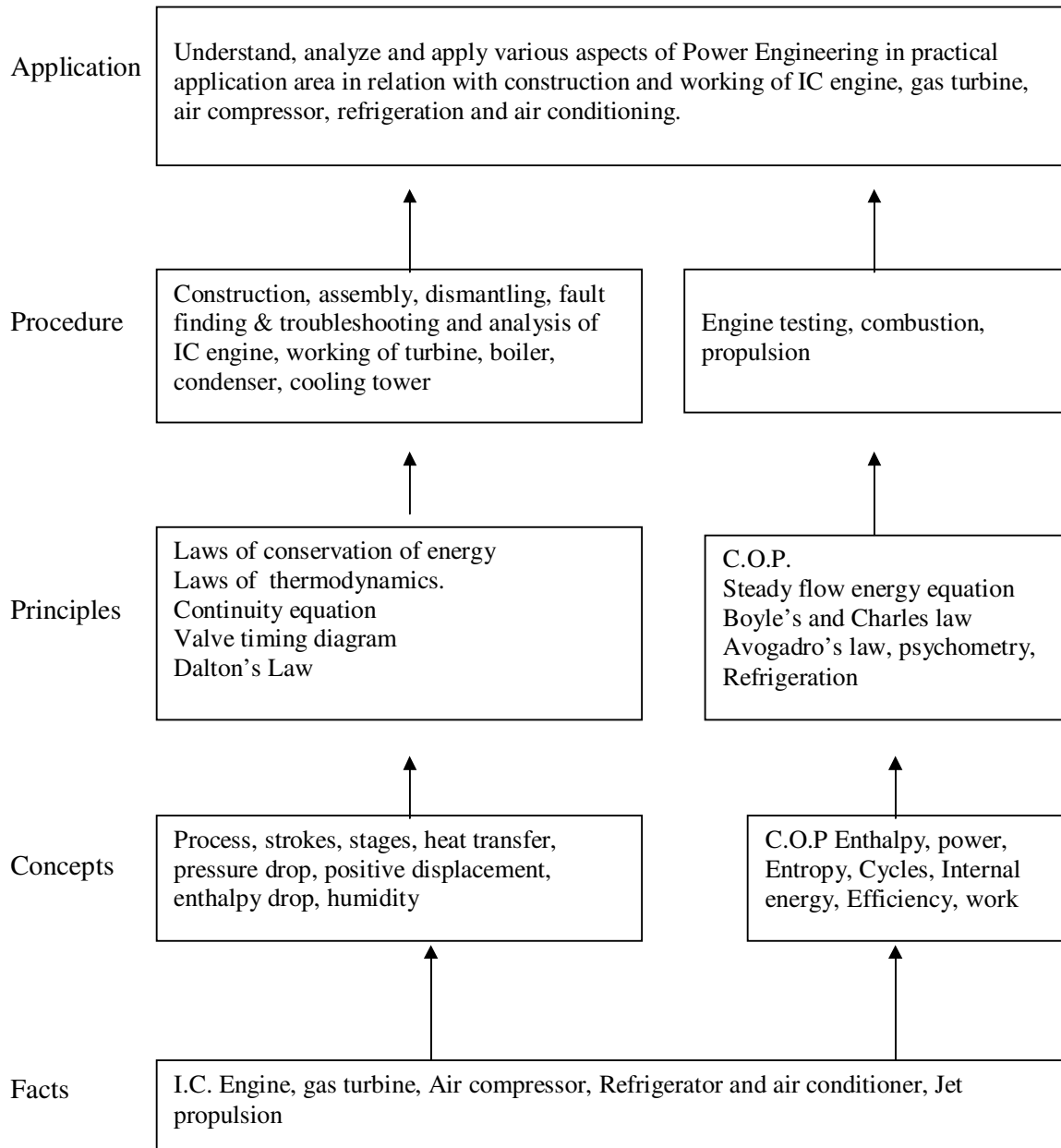
I.C. Engines find applications in almost all sectors of industry and in automobiles. Diploma technicians deal with working, testing and maintenance of I.C. Engines. I.C. Engines are one of the major contributors of air pollution. Hence I.C. Engine pollution control plays a vital role in protecting the environment. Use of air compressors is increasing. There is large scope for energy saving in air compressors. Hence it is necessary to understand thermodynamic aspect of air compressor. Gas turbine is used for power generation and for jet propulsion. Diploma engineer should understand the fundamentals of refrigeration and air-conditioning as there is scope for entrepreneurship in this field.

Objectives:

The Students should be able to:

1. Understand Power cycles & Represent on P-V & T_S diagram.
2. Describe internal combustion engine.
3. Calculate various performance characteristics of IC Engines by conducting trial.
4. Understand working of gas turbines and its application.
5. Select appropriate type of compressor to suit the requirements.
6. Calculate performance parameters of Air compressor.
7. Understand Refrigeration & Air-conditioning processes and their application

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	I.C. Engine 1.1 Power Cycles - Carnot, Otto, Diesel, Dual, Brayton Cycle, representation on P-V, T-S diagram and Simple numerical on Otto cycle & diesel cycle. 1.2 Classification of I.C. Engines 1.3 Two stroke and four stroke Engines Construction and working, comparison, valve timing Diagram, Turning moment diagram 1.4 Brief description of I.C. Engine combustion (SI & CI), scavenging, preignition, detonation, supercharging, turbo charging, simple Carburetor, M.P.F.I., fuel injection pump 1.5 List of fuel, lubricant additives and their advantages.	12	20
02	I.C. Engine Testing and Pollution Control 2.1 Engine terminology: Stroke, bore, piston speed, mep, compression & cut-off ratio etc. Engine Testing - I.P., B.P. Mechanical, Thermal relative and volumetric efficiency, BSFC, Heat Balance sheet. Morse Test, Motoring test 2.2 List of fuel, lubricant additives and their advantages. Pollution Control - Pollutants in exhaust gases of petrol and diesel engines, their effects on environment, exhaust gas analysis for petrol and diesel engine, Catalytic Converter, Bharat stage I, II, III norms.	14	24
03	AIR COMPRESSER 3.1 - Introduction - Classification of air compressors - Definition: - Pressure ratio - Compressor capacity - Free Air Delivered - Swept volume - Uses of compressed air - Single stage, multi stage, single acting, double acting 3.2 Reciprocating air compressor - Construction and working of single stage and two stage compressor - Efficiency: - Volumetric, Isothermal & Mechanical (Only simple numerical) - Advantages of multi staging. 3.3 Rotary Compressor - Construction and working of screw, lobe, vane, centrifugal compressors & Axial flow compressor (No numerical) - Comparison and applications of reciprocating and rotary compressors - Purification of air to remove oil, moisture and dust 3.4 Methods of energy saving in air compressors.	12	20

04	<p>Gas Turbine And Jet Propulsion</p> <p>4.1 Classification and applications of gas turbine.</p> <p>4.2 Constant volume and constant pressure gas turbines. - Closed cycle and open cycle gas turbines and their comparison.</p> <p>4.3 Methods to improve thermal efficiency of gas turbine- Regeneration, inter- cooling, reheating using T- ϕ diagram (no analytical treatment)</p> <p>4.4 Jet Propulsion - Principles of turbojet, turbo propeller, Ram jet.</p> <p>4.5 Rocket propulsion - Solid propellants, solid propellant rocket and liquid propellants, components of liquid propellants, liquid propellant rocket.</p>	12	16
05	<p>Refrigeration and Air- Conditioning</p> <p>5.1 Introduction - reversed carnot cycle, Bell coleman cycle - COP of Heat Pump and refrigerator, Tonnes of Refrigeration.</p> <p>5.2 Vapour compression system - Vapour compression refrigeration cycle(Simple numerical) Basic components of Vapour Compression Cycle, their function and location. Simple vapour absorption refrigeration system. Applications- Water cooler Domestic refrigerator, Ice plant & cold storage.</p> <p>5.3 Psychrometry - Psychrometric Properties of air, Dalton's law of partial pressure psychrometric chart & processes (No simple numerical)</p> <p>5.4 Air conditioning systems - Definition of Air conditioning and classification of Air conditioning Systems.(Elementry treatment) Application- Window air conditioner.</p>	14	20
Total		64	100

Practical:**Intellectual Skills:**

1. Identify components of IC Engines.
2. Understand working principals of IC Engines, Compressors and refrigeration systems.
3. Analyse exhaust gases and interpret the results.
4. Use internet for information search.
5. Interpret the test results.
6. Select tools and gauges for inspection and maintenance.

Motor skills:

Assemble and dismantle engine according to given procedure.

1. Follow the procedure to start an engine.

2. Operate IC Engine test rig, refrigeration test rig for measuring various parameters and plotting them.
3. Operate exhaust gas analyzer for measuring pollutants.

List of Practical:

1. Dismantling assembly of petrol/diesel engine
2. Trial on single/multicylinder petrol or diesel engine with heat balance sheet
3. Morse Test on Multicylinder Diesel/Petrol engine
4. Measurement of I.C. pollutants with the help of Exhaust gas Analyzer for petrol / diesel engine with the help of Exhaust gas
5. Trial on two-stage Reciprocating compressor
6. Collection and analysis of manufacturer's catalogue for Reciprocating/Screw compressor
7. Visit website- <http://library.think.quest.org>
<http://www.grc.nasa.gov>
and prepare a brief report on gas turbine and jet propulsion.
8. Trial on Refrigeration Test Rig for calculation of C.O.P, power required, refrigerating effect.
9. Identify the components and trace the flow of refrigerant through various components in window air conditioner.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	V. M. Domkundwar	Course in Thermal Engineering.	Dhanpat Rai & Co
02	P.L.Ballaney	Thermal Engineering.	Khanna Publishers
03	R.S.Khurmi	Text Book of Thermal Engineering.	S.Chand & Co. Ltd
04	Patel. Karamchandani	Heat Engine Vol.-I ,II,III.	Acharya Publication
05	R. k. Jain	Automobile Engineering.	Tata McGraw Hill
06	V.Ganeshan	I.C Engines..	Tata Mc-Grawhill

COURSE NAME : Mechanical and Production Engineering / Production Technology
COURSE CODE : ME/PT/PG/MH/MI
SEMESTER : FIFTH FOR ME/PG/PT AND SIXTH FOR MH/MI
SUBJECT TITLE : MEASUREMENTS AND CONTROL
SUBJECT CODE : 12156

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 marksheet under the head Sessional Work. (SW)

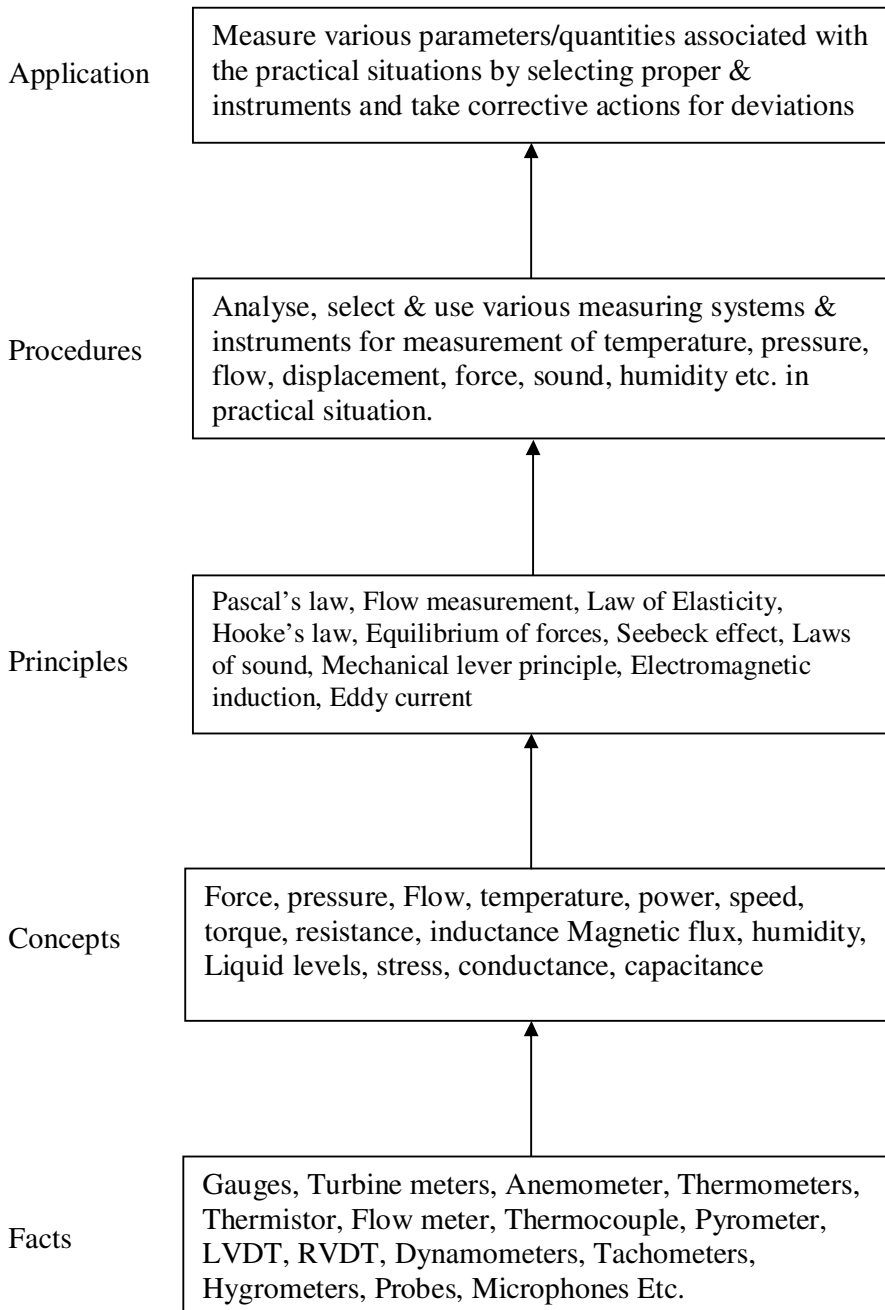
Rationale:

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.

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. Distinguish between various types of errors.

Learning Structure:

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<ul style="list-style-type: none"> • Significance of measurement, types of measurement, classification of instruments • Static terms and characteristics- Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. • Dynamic characteristics- Speed of response, Fidelity and Dynamic errors, Overshoot. • Measurement of error- Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors. • Transducers : Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive <p>Note: Simple numericals on above topics</p>	10	22
02	<p>Control systems:</p> <ul style="list-style-type: none"> • Block diagram of automatic control system, closed loop system, open loop system, feed back control system, feed forward control system, servomotor mechanism, • Comparison of hydraulic, pneumatic, electronic control systems, • Proportional control action, integral control action, derivative control action, PID control action. • Applications of measurements and control for setup for boilers, air conditioners, motorspeed control <p>Note: No numericals on above topics.</p>	08	18
03	<p>Displacement measurement: Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, selection & application of displacement transducer.</p> <p>Note: No numericals on above topics.</p>	04	04
04	<p>Temperature measurements:</p> <ul style="list-style-type: none"> • Non-electrical methods- bimetal and liquid in glass thermometer, pressure thermometer • Electrical methods- RTD, platinum resistance thermometer, thermistor, Thermoelectric methods - elements of thermocouple, law of intermediate temperature, law of intermediate metals, thermo emf measurement. • Quartz thermometer, • Pyrometers- radiation and optical <p>Note: No numericals on above topics.</p>	06	14

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. Measurement of strain by using a basic strain gauge and hence verify the stress induced.
2. Speed Measurement by using Stroboscope / Magnetic / Inductive Pick Up.
3. Measurement of flow by using rotameter.
4. Displacement measurement by inductive transducer.
5. Temperature control using Thermal Reed switch & Bimetal switch.
6. Temperature calibration by using Thermocouple.
7. Determination of negative temperature coefficient and calibration of a thermister.
8. Measurement of force & weight by using a load cell.
9. Liquid Level Measurement by using Capacitive Transducer system.
10. Verify characteristics of photo transducer & photo diode.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publication
01	A.K.Sawhney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi.
02	R. V. Jalgaonkar	Mechanical Measurement & Control	Everest Publishing House, Pune
03	D.S.Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi
04	C.S. Narang	Instrumentation Devices & Systems	Tata McGraw Hill Publications
05	R.K.Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi
06	B.C.Nakra and K.K.Chaudhry	Instrumentation, Measurement and Analysis	Tata Mc Graw Hill Publication

COURSE NAME : MECHANICAL AND PRODUCTION ENGINEERING / PRODUCTION TECHNOLOGY

COURSE CODE : ME/PT/PG/MH/MI

SEMESTER : FIFTH FOR ME / PG / PT AND SIXTH FOR MH/MI

SUBJECT TITLE : METROLOGY & QUALITY CONTROL

SUBJECT CODE : 12157

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	50#	--	25@	175

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 mechanical Engineering technician often come across measuring different parameters of machined components and the appropriate fittment of interchangeable components in the assemblies. For the above purpose he/she is also required to analyze the quantitative determination of physical magnitude and ensure the control of quality.

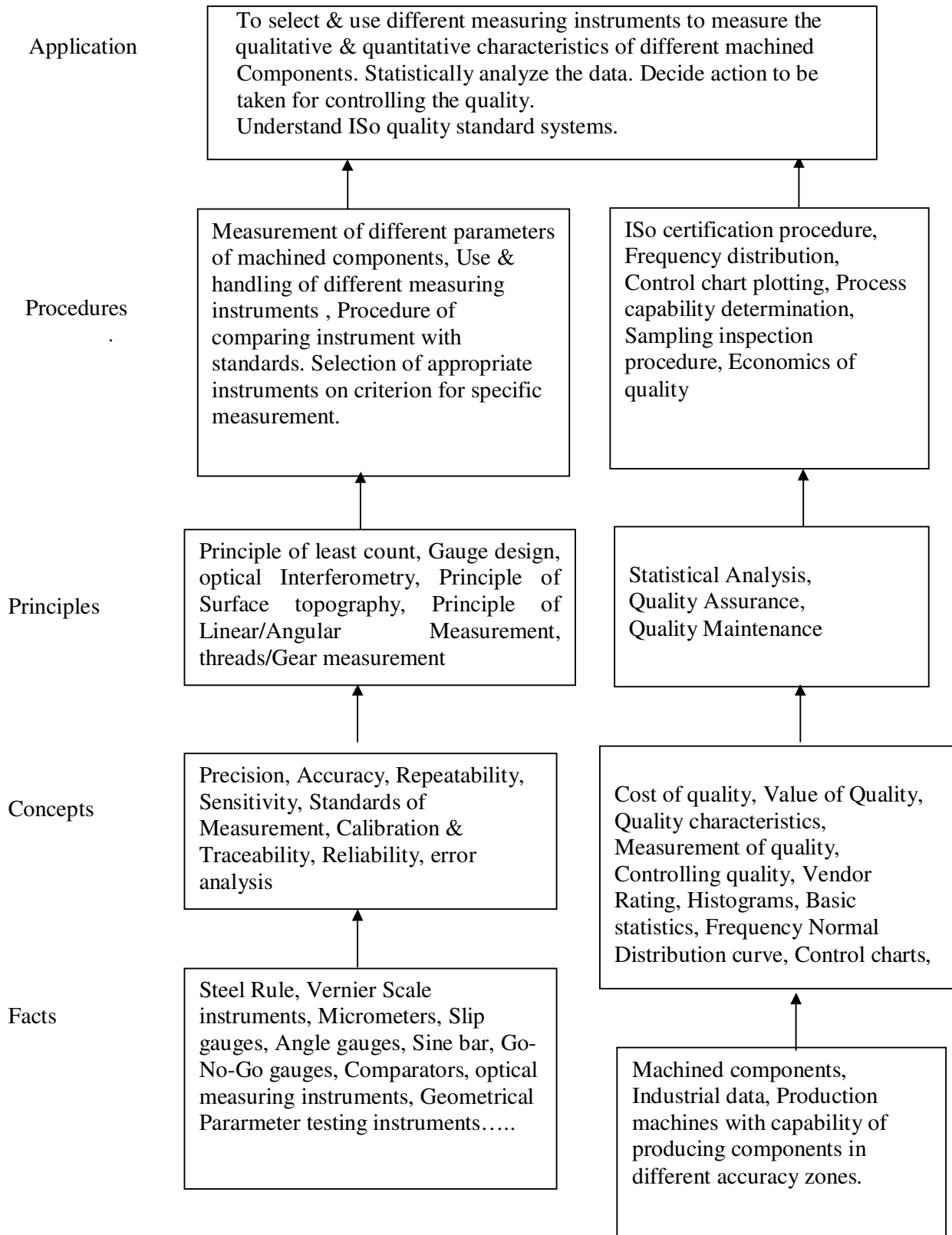
During previous semesters different systems of measurement and their units etc have been introduced in the subject, basic physics. The different methods and instruments which can be used for linear and angular measurements, geometrical parameters (like surface finish, Squareness, Parallelism, Roundness etc ..) and the use of gauges and system of limits, Fits, Tolerances etc. are often required to be dealt in detail by diploma technician on the shop floor. He/she is also required to analyze, Interpret and present the data collected, graphically & statistically for ensuring the quality.

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

Objectives: Students will be able to:

1. Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
2. Select appropriate instrument/s for specific measurement.
3. Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.
4. Construct and draw the control charts.
5. Understand ISO certification procedure and quality system.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Introduction to metrology		
	1.1 Metrology Basics Definition of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology, Need of inspection, Revision of (no questions be set) - 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. [06 M]	03	30
	1.2 Standards and Comparators Definition and introduction to line standard, end standard, Wavelength standard, Slip gauge and its accessories, Length bars. Definition, Requirement of good comparator, Classification, use of comparators, Working principle of comparators, Dial indicator, Sigma comparator, Pneumatic comparator, Electrical, Electronic, Relative advantages and disadvantages. [08 M]	06	
	1.3 Limits, Fits ,Tolerances and Gauges 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, concept of multi gauging and inspection. [08 M]	05	
1.4 Angular Measurement 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). [08 M]	03		
02	Threads and Gear Metrology		
	2.1 Screw thread Measurements ISO grade and fits of thread, Errors in threads, Pitch errors, Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch , Two wire method, Thread gauge micrometer, Working principle of floating carriage dial micrometer. [06 M]	03	10
2.2 Gear Measurement and Testing Analytical and functional inspection, Rolling test, Measurement of tooth thickness (constant chord method), gear tooth vernier, Errors in gears such as backlash, runout, composite. [04 M]	03		

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

1. To understand principle, working of various measuring instruments.
2. Selection of proper instruments for measurement.
3. Calculation of least count of instrument.
4. Take reading using the instrument
5. Interpret the observation and results
6. Collection and recording of data
7. Analysis of data.

Motor Skills:

1. Setting the instruments for zero error adjustment.
2. Proper alignment of the instrument with work piece
3. Handling of instruments
4. Care and maintenance of instruments.
5. Measure the dimensions form the instruments.
6. Calibration and traceability of the instruments
7. Graphical representation of data.

Notes:

1. The practical shall be conducted by the subject teacher, by taking actual measurements of different parameters on the jobs prepared by earlier batches in workshop practice or actual measurement of component dimension.
2. The data collected from the practical of basic measuring instruments may be used for experiments of SQC.
3. During practical examination student should measure at least five parameters by using two to three different measuring instruments and evaluation of practical be done considering
 - (a) Selection of appropriate measuring instrument by the examinee.
 - (b) Computation of Least count of instrument used.
 - (c) Correctness of measurements of the measurand.

List of Practical:

1. Standard use of basic measuring instruments. Surface plate, v-block, spirit level, combination set, filler gauge, screw pitch gauge, radius gauge, vernier caliper, micrometer and slip gauges to measure dimension of given jobs.
2. To find unknown angle of component using sine bar and slip gauges.
3. Study and use of optical flat for flatness testing.
4. Measurement of screw thread elements by using screw thread micrometer, screw pitch gauge.
5. Study and use of dial indicator as a mechanical comparator for run out measurement, roundness comparison.
6. Measurement of gear tooth elements by using gear tooth vernier caliper and verification of gear tooth profile using profile projector,.
7. Testing of machine / machine tool for flatness, parallelism, perpendicularity by **Dial indicator**.
8. Draw the frequency histogram, frequency polygon for given samples (min 50 readings) and find mean, mode, median.
9. To draw the normal distribution curve and find standard deviation, variance, range.
10. To draw and interpret the control limit for variable measurement (X – bar and R - chart).

Learning Resources:**1. Books :**

Sr. No.	Author	Title	Publisher and Address
1	R. K. Jain	Engineering metrology	Khanna Publisher, Delhi.
2	J.F.W. Galyer and C. R. Shotbolt	Metrology for Engineers	ELBS
3	K. J. Hume	Engineering Metrology	Kalyani publishers
4	I.C. Gupta	A text book of Engineering metrology	Dhanpat Rai and Sons,
5	M. Adithan and R. Bahn	Metrology Lab. Manual	T.T.T.I. Chandigarh.
6	M. Mahajan	Statistical Quality Control	Dhanpat Rai and Sons ,
7	T.T.T.I. Chennai	Quality control	Tata McGraw Hill,
8	Juran U.M. and Gryna	Quality planning and analysis	Tata McGraw Hill,
9	National productivity council	Inspection and quality control	N.P.C., New Delhi.
10	N. Logothetis	Managing for Total Quality	Prentice – Hall, Delhi.
11	Lauth Alwan	Statistical Process analysis	Tata McGraw Hill.

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
- IS 5939 – 1970 Sine angles, sine tables.

COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING
COURSE CODE : ME/MH/MI
SEMESTER : FIFTH FOR ME AND SIXTH FOR MH/MI
SUBJECT TITLE : TOOL ENGINEERING (ELECTIVE-I)
SUBJECT CODE : 12158

Teaching & 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:

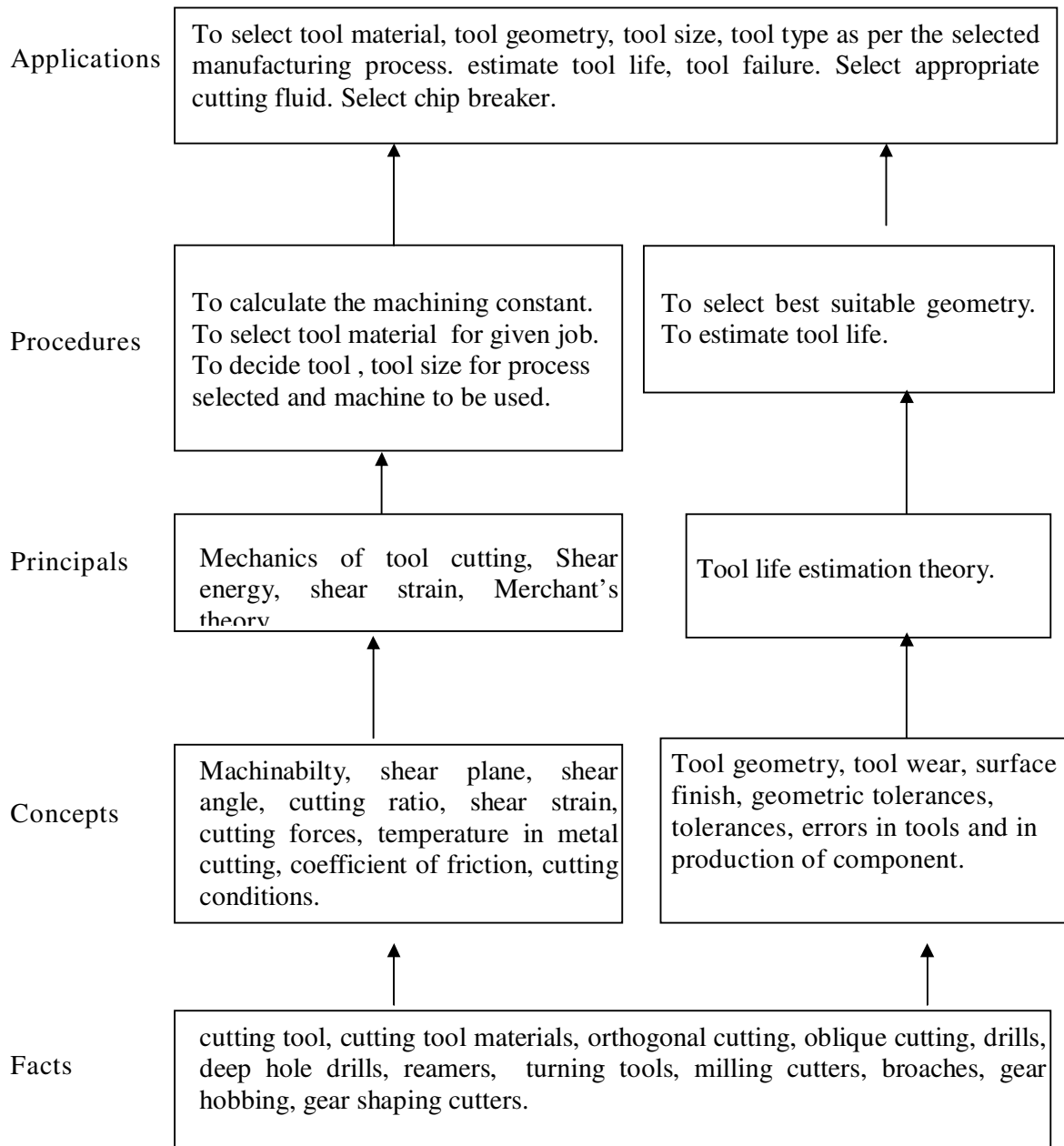
This subject is classified as technology subject offered as elective subject. It is intended to impart, concepts, principles & procedures of tool engineering to the students so that they can understand the procedure of tool design to achieve highest productivity and perform duties as a technician in tool room, shop floor, quality control & assist tool Engineer in design of tools and production processes. They can also work as supervisor in plastic molding shop & as a sales engineer in tooling industry.

Objective:

The students will be able to:

- 1) Select cutting tools and its material using data book and manufacturer's catalogue.
- 2) Estimate tool wear and tool life.
- 3) Use press tools and dies effectively.
- 4) Design strip layout for given component.
- 5) Decide appropriate cutting fluid for machining process improvement.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Metal Cutting</p> <p>1.1 Mechanics of Metal cutting: requirements of tools, cutting forces – types of chips, chip thickness ratio, shear angle – simple numericals only, types of metal cutting process – orthogonal, oblique and form cutting. Cutting fluids – types, characteristics and applications. Tool wear, Types of wear, Tool life - Tool life equations. Machinability – definition, factors affecting machinability, machinability index. [Hours: 12, marks :18]</p> <p>1.2 Tool materials: Types, characteristics, applications. Heat treatment of tool steels, Specification of carbide tips, Types of ceramic coatings. [Hours: 05, marks :12]</p> <p>1.3 Cutting Tool Geometry: Single point cutting tool, drills, reamers, milling cutters. [Hours:03 , marks :08]</p>	20	38
02	<p>Press Tools</p> <p>2.1 Presses: Types, Specification, Press operations, Types of dies and construction: Simple Die, Compound Die, Progressive Die, Combination Die. Punch & die mountings, pilots, strippers, misfeed detectors, Pressure Pads, Knock outs, stock guide, Feed-Stop, guide bush, guide pins. [Hours:08, marks :18]</p> <p>2.2 Die Design Fundamentals: Die Operations- blanking, piercing, shearing, cropping, notching, lancing, coining, embossing, stamping, curling, drawing, bending, forming. Die set, Die shoe, Die area, Calculation of clearances on die and punch for blanking and piercing dies, Strip layout, Calculation of material utilization factor. [Hours: 08, marks :18]</p> <p>2.3 Forming Dies: Bending: methods, Bending Dies, bend allowance, spring back, spanning, bending pressure, pressure pads, development of blank length. Drawing: operations, Metal flow during drawing. Calculation of Drawing blank size, variables affecting metal flow during drawing, single action and double action dies, combination dies. [Hours: 08, marks :18]</p>	24	54
03	<p>Fundamentals of Other Tools</p> <p>Constructional features of - Pressure Die casting dies, metal extrusion dies, injection moulding dies, forging dies, plastic extrusion dies.</p>	04	08
Total		48	100

Practical:

Intellectual skills:

- To understand & differentiate types of presses & press operation.
- To understand types of dies & their working principles.
- To select suitable strip layout for a given work piece.
- To calculate blank length & blank diameter of a given work piece.
- To understand tool angles of various cutting tools & their importance.
- To select suitable punch, pilot & stripper for a given application
- To calculate cutting force & shear angle.

Motor Skills:

- To draw strip layout & other figures
- To draw different types of dies.
- To draw types of cutting tools showing various angles.
- To design & draw drawing die for a given component.

List of Practical:

1. Report on Visit to press shop for study of presses.
2. Sketches of Combination Die, Progressive Die, Compound die, Inverted Die, Drawing Die, Bending Die.
3. Drawing of strip layout of simple component (Different component for every student), and calculation of material utilization factor.
4. Sketches of Injection Moulding die, Pressure die-casting die, forging die.
5. Two assignments on calculation of Cutting forces and shear angle based on Merchant's circle.
6. One assignment each on development of blank length for bending operation and single stroke drawing operation.
7. One assignment on designation of carbide tools.
8. Sketches of different types of cutting tools showing details of tool angles.
9. One assignment on types of Punches and pilots, strippers
10. Design of blanking die – Drawing sheets showing assembly & details.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	Donaldson Anglin	Tool Design	Tata Mc Graw Hill
02	P. C. Sharma	A Text Book OF Production Engineering	S Chand & Co.
03	H. M. T.	Production Technology	Tata Mc Graw Hill
04	R. K. Jain	Production Technology	Khanna Publishers
05	A.S.T.M.E.	Fundamental of tool design.	Prentice-Hall of India.
06	M.H.A. Kempster	Introduction to Jig and Tool Design	Viva publ.
07	P. H. Joshi	Jigs and Fixtures	Tata Mc Graw Hill
08	P. H. Joshi	Press Tools	Tata Mc Graw Hill

COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING
COURSE CODE : ME/MH/MI
SEMESTER : FIFTH FOR ME AND SIXTH FOR MH/MI
SUBJECT TITLE : AUTOMOBILE ENGINEERING (ELECTIVE – I)
SUBJECT CODE : 12159

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)**

Notes: No numerical should be asked in exams.

Rationale:

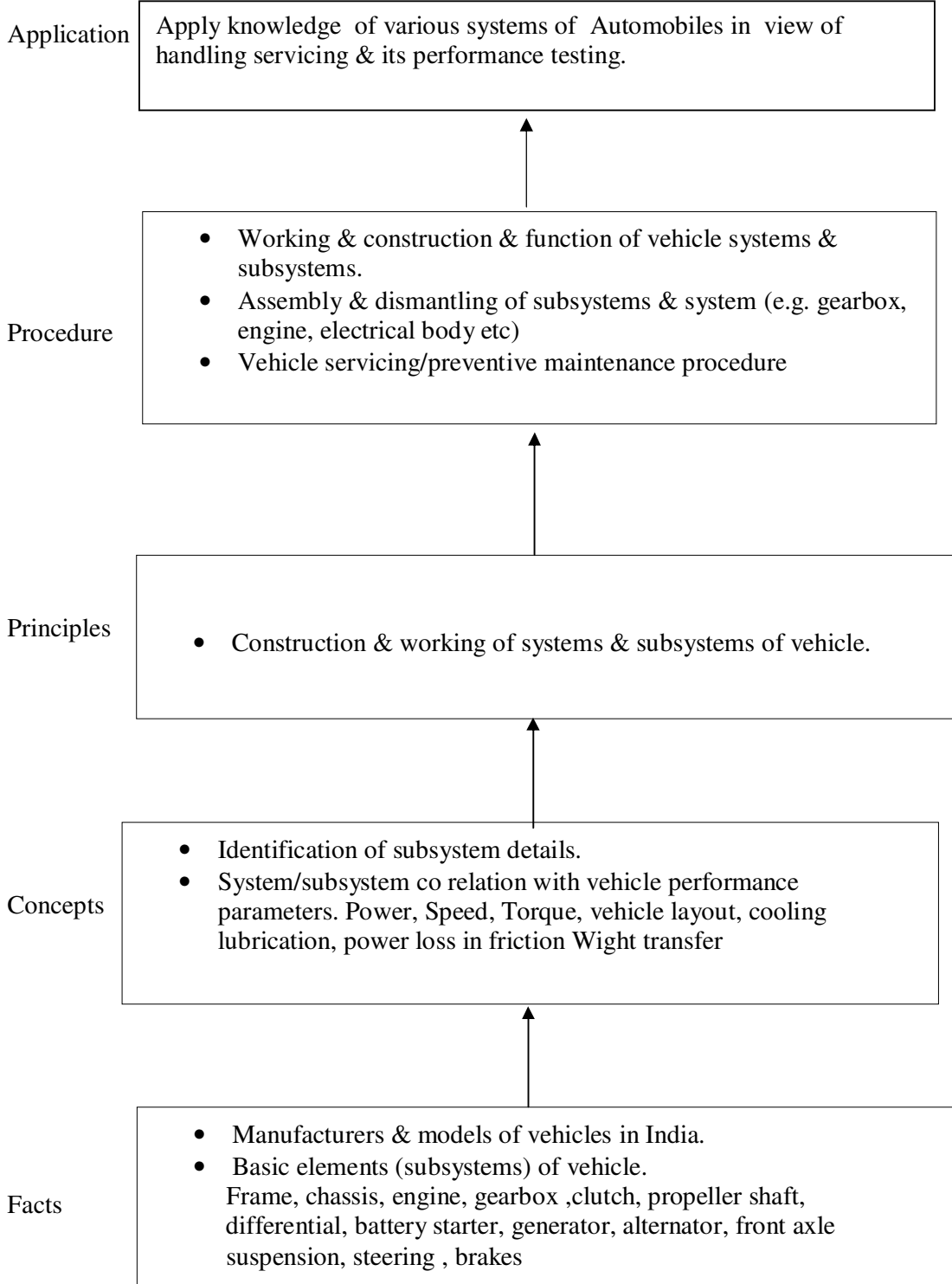
Automobile engineering, a technology subject, has applications of various subjects taught earlier. All the major global players in Automobile sector have launched their product in India. Automotive sector has major employment potential for diploma holders. Automobile servicing in particular offers good job opportunities at village, town & city level.

This course in Automobile Engineering will make student understand & apply the knowledge about various system, subsystems & their inter-relationships.

Objective:

The student will be able to:

1. Know automotive market in India.
2. Identify various automotive systems & subsystems.
3. Explain working & construction of various automotive systems & subsystems.
4. Carry out preventive maintenance & performance testing of vehicle.

Learning Structure:

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Introduction of Automobile <ul style="list-style-type: none"> • Classification of automobiles • Vehicle layout & types • Body construction - Types & Nomenclature of car body. Introduction to aerodynamic body shapes • Automobile market in India of “on road vehicles”, major manufacturers, their products & their collaborations. 	06	12
02	Automobile Transmission <ul style="list-style-type: none"> • Clutch- necessity, construction & working of coil spring & diaphragm spring type clutch. • Gear Box- tractive effort and tractive resistance, types of G.B construction & working of constant mesh G.B., & synchromesh G.B., Epicyclic G.B., Torque converter, Overdrive, Transfer case • Final drive- necessity, construction & working of propeller shaft & differential. • Axle- Type of rear axles, & their applications. 	12	24
03	Control Systems <ul style="list-style-type: none"> • Steering system- Requirement of steering system. Types of front axles. Construction and working of steering linkage. Steering gear box- construction & working of rack and pinion & re-circulating ball type gearbox. Introduction to Power steering, Steering geometry- camber, caster, toe-in, toe-out, Kingpin inclination & their effects. • Brake system- construction & working of mechanical, hydraulic & Pneumatic brakes. Comparison of disc & drum brake. 	08	18
04	Suspension systems, wheels & Tyres <ul style="list-style-type: none"> • Necessity & classification of suspension system. • Working & construction of Leaf spring, rigid axle suspension. • Introduction to air suspension • Construction & working of McPherson & wishbone, trailing link suspensions. • Construction & working of telescopic shock absorbers. • Construction & working of spoked wheel, disc wheel & light alloy cast wheel. • Types of rims, their construction & working. • Construction, working & comparison of radial, cross-ply and tubed, tubeless tyre & tyre specifications • Factors affecting tyre life • Wheel Alignment and Balancing 	08	16

05	Automobile Electrical Systems & Body 5.1 <ul style="list-style-type: none"> • Battery- working, construction & rating of battery. • Ignition system- construction & working of battery, magneto, electronic and CDI ignition system. • Starting system- construction & working of starting motor, Starter drives- bendix and overrunning clutch. • Charging system- construction & working of alternator (16)	14	30
	5.2 <ul style="list-style-type: none"> • Wiring system-harnessing & colour codes. • Lighting system-head light, tail light, indicator light & their circuits. • Gauges- construction & working of Fuel level gauge, oil gauge and water temperature gauge. • Use of microprocessor in automobile control systems (14)		
Total		48	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Select tools and equipments
2. Find fault of battery and charging system
3. Identify component and system
4. Use service manual for information search
5. Compare conventional fuels with LPG and CNG fuels for automobiles
6. Observe various components and systems like transmission, braking and charging

Motor Skills:

1. Understand proper handling of tools, equipments
2. Adopt the recommended procedures of maintenance, testing – as mentioned in service manual
3. Handle components of CNG and LPG kit

List of Practical:

1	Carrying out preventative maintenance of four wheeler as per manufacturers specifications.
2	Carrying out preventative maintenance of two wheeler as per manufacturers specifications.
3	Demonstration of single plate coil spring & diaphragm spring type clutch.
4	Demonstration of synchromesh gearbox.
5	Demonstration of differential.
6	Demonstration of rack & pinion steering gearbox.
7	Demonstration of rigid axle suspension.

8	Demonstration of hydraulic brake system
9	Testing of battery and charging system.
10	Study of LPG / CNG kit retrofitting.
11	Visit to four- wheeler service station & any automobile manufacturing unit.
12	<p>Mini project :- Student will prepare a project report & present a seminar Title:- Automotive market In India. Collect following information.</p> <p>a) Top 10 Car/MUV/2W/Heavy vehicle Manufacturers in India & their sale in last 2 Years.</p> <p>b) Top 5 models of Car/MUV/2W/Heavy vehicle Manufacturers in India.</p> <p>c) New models launched in last 3 years of Car/MUV/2W/Heavy vehicle. Survey modern features in these vehicle.</p> <p>d) Proposed launches in next two years in Car/MUV/2W/Heavy vehicle. Survey modern features in these vehicle .</p>

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	K. K. Jain and R.B. Asthana	Automobile Engineering	Tata Mcgraw hill
02	William Crouse	Automobile Mechanics	Tata Mcgraw hill
03	SRINIVASAN	Automobile Mechanics	Tata Mcgraw hill
04	H.M.Sethi	Automotive Technology	Tata Mcgraw hill
05	G.B.S. Narang	Automobile Engineering	Khanna Publication
06	Harold T. Glenn	Auto Mechanics	Bennett & Mckknight
07	Kirpal Singh	Automobile Engineering Vol. I and Vol. II	Standard Publication
08	Joseph Hitner	Automotive Mechanics	--

Website: www.auto.howstuffworks.com

C. D.

- C. D. Prepared By MSBTE under its CAI Package Program.
- C. D. on various Topics of Automobile Engineering By SAE.

COURSE NAME : DIPLOMA IN MECHANICAL ENGINEERING
COURSE CODE : ME/MH/MI
SEMESTER : FIFTH FOR ME AND SIXTH FOR MH/MI
SUBJECT TITLE : POWER PLANT ENGINEERING (ELECTIVE-I)
SUBJECT CODE : 12160

Teaching & 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:

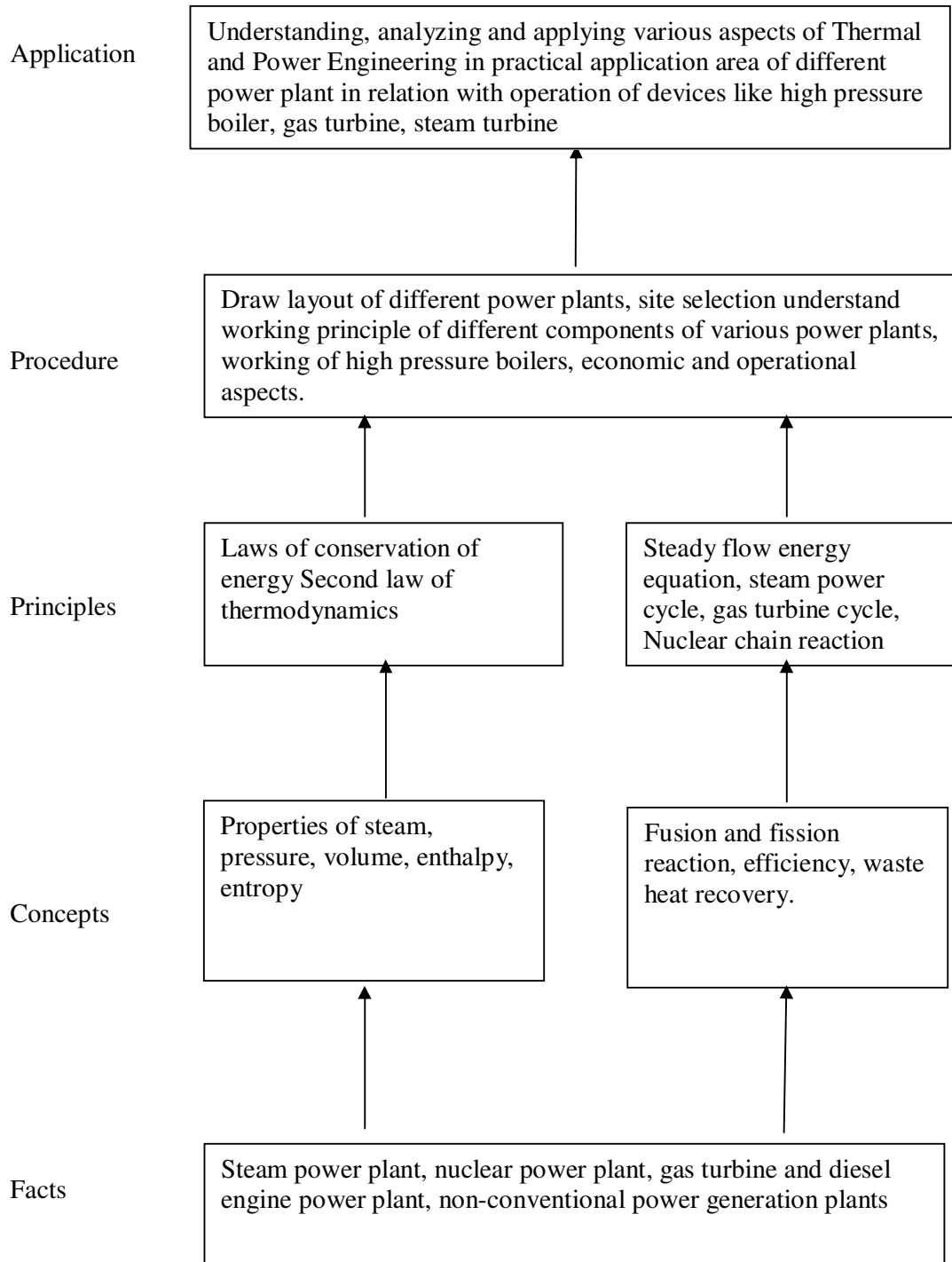
The consumption of electrical energy per capita is universally accepted as a scale for measuring the living standard of a country. The demand for energy is increasing day by day and existing power generation capacity is inadequate to meet this increasing demand. Industries are expected to generate their own power and supply the excess power to national grid. Alternate energy sources are also harnessed to meet the increasing demand. Diploma engineers should know the layout, components of different power plants and economic aspects of power plants.

Objectives:

Students should be able to:

1. Get familiar with present and future power scenario of India.
2. Calculate efficiency of power generation cycles.
3. Understand working of high pressure boilers, coal and ash handling systems of power plant.
4. Draw layout, understand the working and compare different power plants.
5. Enlist sources of waste heat and explain method of heat recovery.
6. Explain constructional features of non conventional energy source devices.
7. Appreciate economical and operational aspects of power plants.

Learning Structure:



Content: -Theory

Chapter	Name of the Topic	Hours	Marks
01	Introduction to power plant <ul style="list-style-type: none"> • Power scenario in India • Types of power plants – Hydro, Nuclear, Thermal, Future trends in power sector. • Analysis of steam cycles- Carnot, Rankine, Reheat cycle, Regenerative cycle, Methods of reheating, Advantages and disadvantages of reheat cycle, • Gas turbine cycle 	05	12
02	Steam power plant <ul style="list-style-type: none"> • Layout of steam power plant, general features of selection of site • High pressure boilers – Construction and working of Sub-critical and Super-critical boilers. • Coal and ash handling system- equipments for in plant handling of coal such as belt conveyor, screw conveyor, bucket elevator, Coal crushing, Pulverized fuel handling system, Ball mill, Pulverized fuel and their advantages, Multi retort stoker, Pulverized fuel burner, Hydraulic and pneumatic ash handling, Electrostatic precipitator. • Boiler Feed water treatment • Environmental aspects of steam power plant - water pollution, air pollution, emission standard and its control 	10	20
03	Nuclear power plant <ul style="list-style-type: none"> • Elements of nuclear power station, layout, general criteria for selection of site. • Fusion and fission reaction, types of nuclear reactors, Nuclear fuels, coolant & moderators. • Working of PWR, BWR, CANDU, BREEDER type reactor. • Safety precautions and waste disposals. 	09	20
04	Gas turbine power plant <ul style="list-style-type: none"> • General Layout, selection of site, Gas turbine power plants in India. • Components of gas turbine plants, gas turbine Fuels. • Comparison of Gas turbine plant with diesel and Steam power plant. • Environmental impact of gas turbine power plant. 	06	14
05	Waste Heat recovery <ul style="list-style-type: none"> • Sources of waste heat • Heat recovery forms & methods – Sensible and latent Heat recovery. • Use of waste heat- Agricultural, green house, Animal shelter, Aqua cultural uses, process heating. • Waste Heat recovery boilers 	05	10

06	Non conventional power generation plants <ul style="list-style-type: none"> • Tidal power plant- factors affecting suitability of site, working of different tidal power plants, advantages and disadvantages. • Wind power plant- different types, advantages and Disadvantages. • Solar power plant, Geothermal power plant, Magneto Hydro dynamics power plant, Small hydro power plant, Introduction to Plasma technology. 	05	12
07	Economics and operational aspects <ul style="list-style-type: none"> • Prediction of load, selection of types of generation, number of generating units. • Load duration curves, cost analysis, elements, controlling the cost of power plant (simple numerical) • Major electrical equipments in power station- generator, step-up transformer, switch gear, electrical motors (types, purpose & importance). 	08	12
Total		48	100

Practical:

Skills to be developed:

Intellectual skills:

1. Understand working of various power plants
2. Understand constructional features and working of devices used in non conventional energy sources
3. Understand economical and operational aspects of power plants
4. Calculate the efficiency of power generation cycles

Motor skills:

1. List technical details of components and subsystems of power plants
2. Draw layouts of different power plants
3. Operate devices using solar energy inputs

Assignments:

- Visit to steam power plants/nuclear power plants/wind power plants/ Hydro power plants and prepare a report.
- Collect information & Technical details of nuclear power plants.
- Collect information & Technical details of Steam power plants.
- Collect information & Technical details of Solar & Wind power plants.
- Study of economic and operational aspects of power plants (simple numerical).
- Assignment on Coal & Ash Handling system.
- Assignment on Waste Heat recovery systems.

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
01	P. K. Nag	Power plant engineering	Tata McGraw Hill
02	Fredrick T. Mosse	Power plant engineering	East-West press
03	A. Chkrabarti and M. L. Soni	A text book of Power System Engineering	Dhanpat Rai and Co
04	Arora and Domkundwar	A course in power plant engineering	Dhanpat Rai and Co

2. Computer Based Training Packages/Computer Aided Instructions Packages/CDs:

1. Power Plant Familiarization Vol-I to IV.
 - Ash Handling System.
 - Gas Turbine and combined cycle power plant.
 - Power Station Safety.
 - Environmental pollution & pollution control.
 - Pulverizers and feeders.
 - Renewable energy sources,

(Developed by National Power Training Institute , South Ambazari Road, Nagpur)

COURSE NAME : MECHANICAL ENGINEERING GROUP
COURSE CODE : ME/PT/AE/PG/MH/MI
SEMESTER : FIFTH FOR ME / PT / AE / PG AND SIXTH FOR MH/MI
SUBJECT TITLE : MECHATRONICS (ELECTIVE-I)
SUBJECT CODE : 12161

Teaching and Examination Scheme:

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

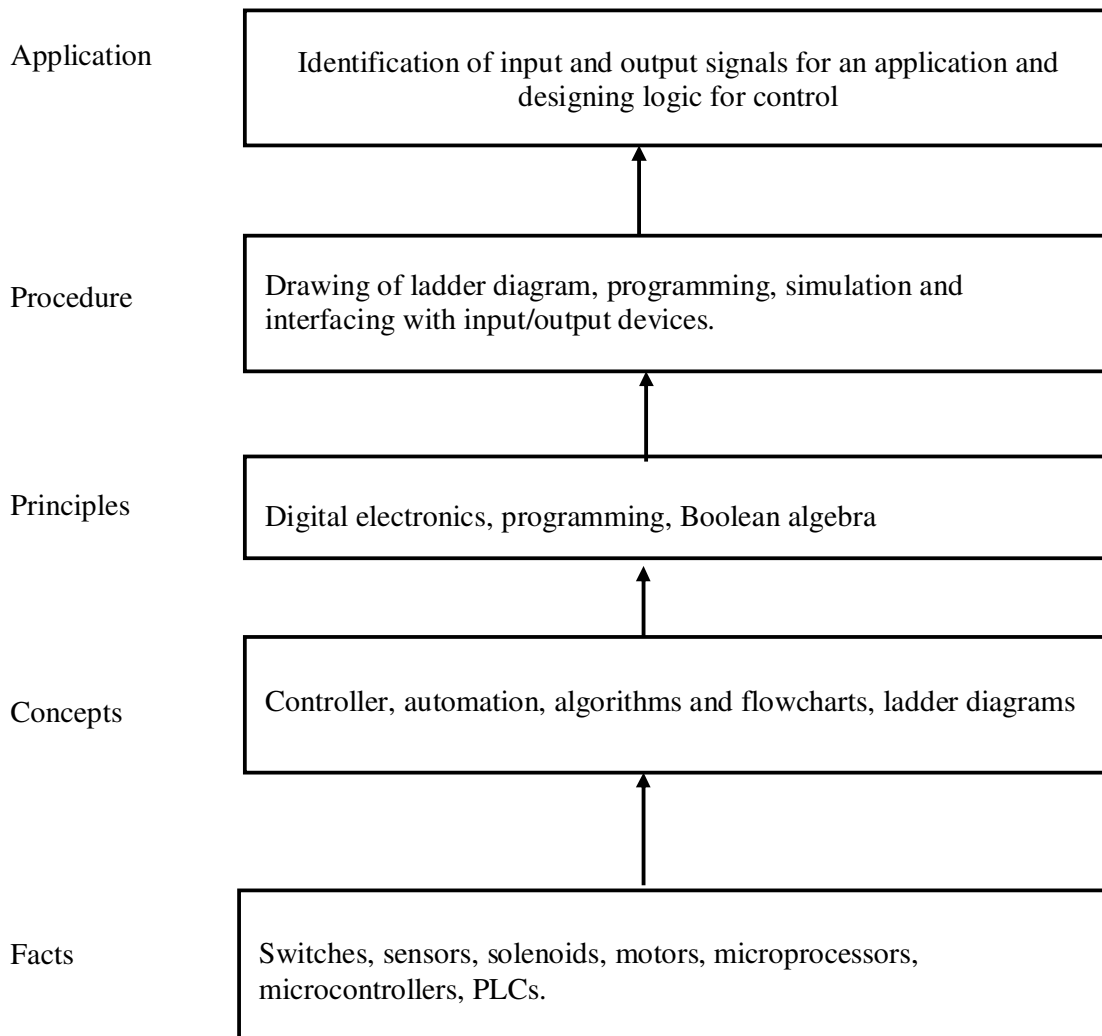
RATIONALE:

The integration of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering is increasingly forming a crucial part in the design, manufacture and maintenance of wide range of engineering products and processes. As a consequence there is a need for a diploma engineers to understand systems used in automation

OBJECTIVES:

Students should be able to:

1. Identify various input and output devices in an automated system.
2. Understand and draw ladder diagrams.
3. Write simple programs for PLCs.
4. Interpret and use operations manual of a PLC manufacturer.
5. Use simulation software provided with the PLC.
6. Understand interfacing of input and output devices.

Learning Structure:

CONTENTS: Theory

Chapter	Name of the Topic	Hours	Marks
1	Introduction to Sensors, Transducers and Actuators Principle, working and applications of-Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type), Thumb wheel switches, magnetic reed switches, Optical encoders-displacement measurement, rotary, incremental, opto-couplers. Actuator – solenoids – on-off applications, latching, triggering Types of relays- solid state Types of motors – DC motors, DC brushless motors, AC motors, stepper motors, servo motors.	06	12
2	8085 Microprocessor Architecture, Pin configuration, working of microprocessor, and applications. Introduction to ICs used for interfacing such as–Programmable peripheral devices, USART, memory, keyboard, display – LCD,LED,I/O device, ADC, DAC etc 8051 Microcontroller Architecture, Pin configuration, working of microcontroller, Applications.Comparison of microprocessor and microcontroller, advantages and disadvantages	08	18
3	Programmable Logic Controller (PLC) Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, ,power supply, input/output modules (analog, digital) concepts of sink/source, set/reset, latch/unlatch, advantages and disadvantages, installation , troubleshooting and maintenance	08	18
4	Selection of a PLC Programming equipment, Programming formats Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions, Register basics, timer functions, counter functions, Intermediate functions – Arithmetic functions, number comparison and number conversion functions. Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function	16	26
5	ONS and CLR functions and their applications PLC digital bit functions and applications Sequencer functions and cascading of sequencers PLC matrix functions Discrete and analog operation of PLC, Networking of PLCs. PLC auxiliary commands and functions,	06	12
6	Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS	04	14
Total		48	100

Practical**Intellectual Skills:**

1. Identification of various sensors and transducers used in automated systems
2. Interpretation of circuits in automation
3. Interpretation and use

Motor Skills:

1. Use of simulation software for PLCs
2. Preparation of ladder diagrams
3. Testing of interfacing ICs

List of Practical:

Term work shall consist of detailed report on the following experiments:

1. Identification and demonstration of different sensors and actuators.
2. Demonstration of the working of various digital to analog and analog to digital converters.
3. Development of ladder diagram, programming using PLC for
 - a) Measurement of speed of a motor
 - b) Motor start and stop by using two different sensors
 - c) Simulation of a pedestrian traffic controller
 - d) Simulation of four road junction traffic controller
 - e) Lift / elevator control
 - f) Washing machine control
 - g) Tank level control
 - h) Soft drink vending machine control
4. Trace, interpret and demonstrate working of at least two electro pneumatic systems.
5. Trace, interpret and demonstrate working of at least two electro hydraulic systems.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publication
1	Bolton W.	Mechatronics- Electronic control systems in Mechanical and Electrical Engineering	Pearson Education Ltd.
2	Histand B.H. and Alciatore D.G.	Introduction to Mechatronics and Measurement systems	Tata McGraw Hill Publishing
3	John W. Webb and Ronald Reis	Programmable Logic Controllers	Prentice Hall of India
4	NIIT	Programmable Logic Control – Principles and Applications	Prentice Hall of India
5	Kolk R.A. and Shetty D.	Mechatronics systems design	Vikas Publishing, New Delhi
6	Mahalik N.P.	Mechatronics principles, concepts and applications	Tata McGraw Hill Publishing

COURSE NAME : MECHANICAL ENGINEERING GROUP
COURSE CODE : ME/PT/AE/PG/MH/MI
SEMESTER : FIFTH
**SUBJECT TITLE : INDUSTRIAL PROJECT AND ENTREPRENEURSHIP
 DEVELOPMENT**
SUBJECT CODE : 12162

Teaching and Examination Scheme:

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

- Notes:**
- Two practical hours are for industrial project
 - One theory and one tutorial hours are for Entrepreneurship Development (EDP).
Twenty five marks for term work are for report prepared under EDP

Content:

PART A) Industrial Project

Following activities related to project are required to be dealt with, during this semester

- Form project batches & allot project guide to each batch. (Max. 4 students per batch)
- Each project batch should select topic / problem / work by consulting the guide & / or industry. Topic / Problem / work should be approved by Head of department.
- Each project batch should prepare action plan of project activities & submit the same to respective guide.
- At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.
- Action Plan should be part of the project report.

Part B: Entrepreneurship Development**RATIONALE:**

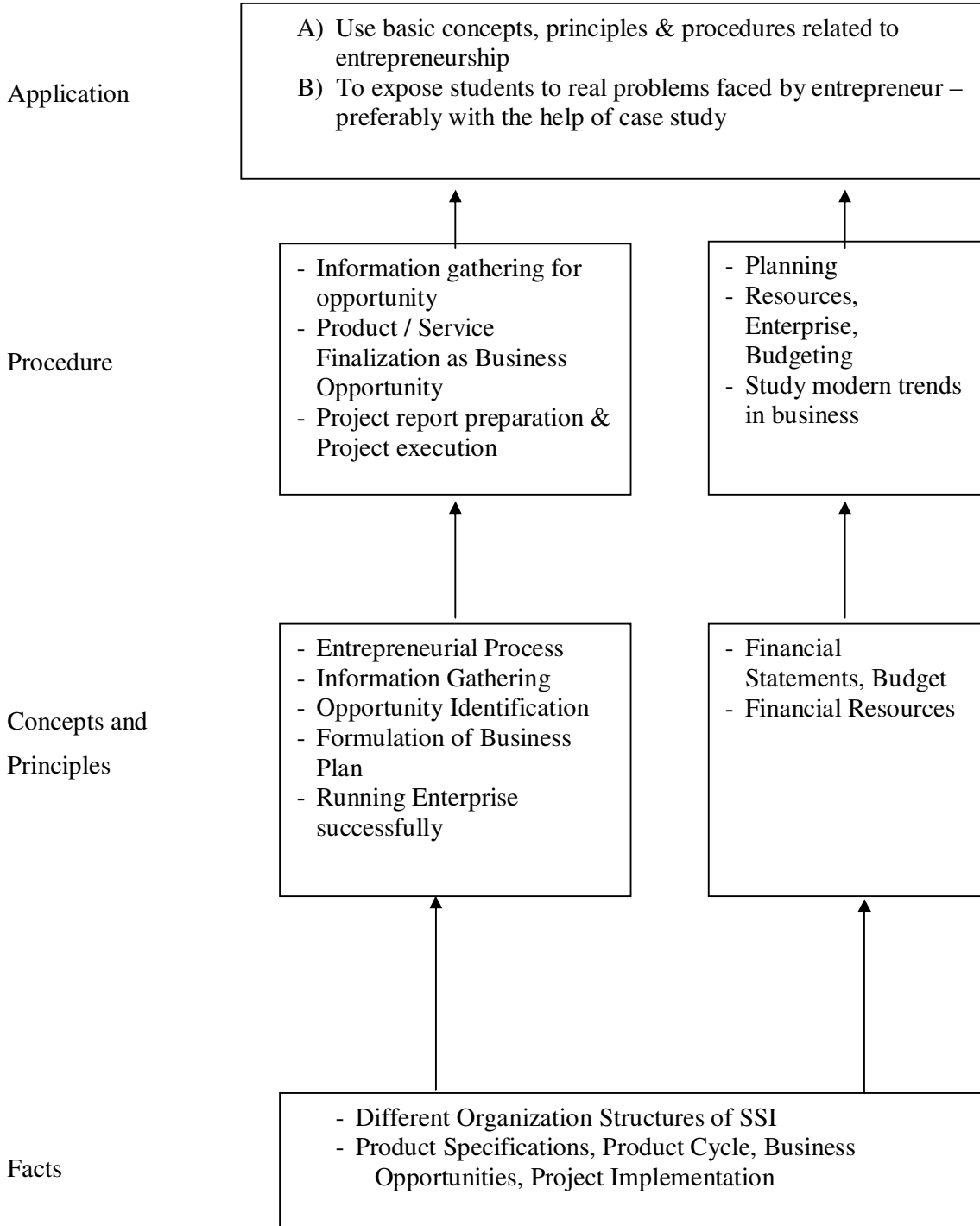
Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white-collar jobs. The educational institutions should also demonstrate their uniqueness in the creation of enterprising personalities in their colleges. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

OBJECTIVES:

Students will be able to

- 1) Identify entrepreneurship opportunity.
- 2) Acquire entrepreneurial values and attitude.
- 3) Use the information to prepare project report for business venture.
- 4) Develop awareness about enterprise management.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours
01	Entrepreneurship, Creativity & Opportunities 1.1) Concept, Classification & Characteristics of Entrepreneur 1.2) Creativity and Risk taking. 1.2.1) Concept of Creativity & Qualities of Creative person. 1.2.2) Risk Situation, Types of risk & risk takers. 1.3) Business Reforms. 1.3.1) Process of Liberalization. 1.3.2) Reform Policies. 1.3.3) Impact of Liberalization. 1.3.4) Emerging high growth areas. 1.4) Business Idea Methods and techniques to generate business idea. 1.5) Transforming Ideas in to opportunities transformation involves Assessment of idea & Feasibility of opportunity 1.6) SWOT Analysis	03
02	Information and Support Systems 2.1) Information Needed and Their Sources. Information related to project, Information related to support system, Information related to procedures and formalities 2.2) Support Systems 1) Small Scale Business Planning, Requirements. 2) Govt. & Institutional Agencies, Formalities 3) Statutory Requirements and Agencies.	03
03	Market Assessment 3.1) Marketing -Concept and Importance 3.2) Market Identification, Survey Key components 3.3) Market Assessment	02
04	Business Finance & Accounts Business Finance 4.1) Cost of Project 1) Sources of Finance 2) Assessment of working capital 3) Product costing 4) Profitability 5) Break Even Analysis 6) Financial Ratios and Significance Business Account 4.2) Accounting Principles, Methodology 1) Book Keeping 2) Financial Statements 3) Concept of Audit,	03

05	Business Plan & Project Report 5.1) Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost 5.2) Project Report 1) Meaning and Importance 2) Components of project report/profile (Give list) 5.3) Project Appraisal 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis	03
06	Enterprise Management And Modern Trends 6.1) Enterprise Management: - 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept And Importance 3) Probable Causes Of Sickness 4) Quality Assurance Importance of Quality, Importance of testing 6.2) E-Commerce Concept and process 6.3) Global Entrepreneur	02
Total		16

Sr. No	Assignments
1	Assess yourself-are you an entrepreneur?
2	Prepare a project report and study its feasibility.

Learning Resources:**1) Reference Books:**

Sr.No.	Name of Book	Author	Publisher
1	Entrepreneurship Development	E. Gorden K.Natrajan	Himalaya Publishing. Mumbai
2	Entrepreneurship Development	Preferred by Colombo plan staff college for Technical education.	Tata Mc Graw Hill Publishing co. ltd. New Delhi.
3	A Manual on How to Prepare a Project Report	J.B.Patel D.G.Allampally	EDI STUDY MATERIAL Ahmadabad (Near Villaget ,

4	A Manual on Business Opportunity Identification & Selection	J.B.Patel S.S.Modi	Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India
5	National Directory of Entrepreneur Motivator & Resource Persons.	S.B.Sareen H. Anil Kumar	P.H. (079) 3969163, 3969153 E-mail :
6	New Initiatives in Entrepreneurship Education & Training	Gautam Jain Debmuni Gupta	ediindia@sancharnet.in/olpe@ediindia.org
7	A Handbook of New Entrepreneurs	P.C.Jain	Website :
8	Evaluation of Entrepreneurship Development Programmes	D.N.Awasthi , Jose Sebastian	http://www.ediindia.org
9	The Seven Business Crisis & How to Beat Them.	V.G.Patel	
10	Poornima M. Charantimath	Entrepreneurship Development of Small Business Enterprises	Pearson Education, New Delhi
11	Special Edition for MSBTE	Entrepreneurship Development	McGraw Hill Publication
12	Entrepreneurship Theory and Practice	J.S. Saini B.S.Rathore	Wheeler Publisher New Delhi
13	Entrepreneurship Development	--	TTTI, Bhopal / Chandigadh

2) VIDEO CASSETTES

NO	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmedabad (Near Village Bhat , Via
2	Assessing Entrepreneurial Competencies	Ahmadabad Airport & Indira Bridge), P.O.
3	Business Opportunity Selection and Guidance	Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153
4	Planning for completion & Growth	E-mail :
5	Problem solving-An Entrepreneur skill	ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org

GLOSSARY:

INDUSTRIAL TERMS

Terms related to finance, materials, purchase, sales and taxes.

Components of Project Report:

1. Project Summary (One page summary of entire project)
2. Introduction (Promoters, Market Scope/ requirement)
3. Project Concept & Product (Details of product)
4. Promoters (Details of all Promoters- Qualifications, Experience, Financial strength)
5. Manufacturing Process & Technology
6. Plant & Machinery Required
7. Location & Infrastructure required
8. Manpower (Skilled, unskilled)
9. Raw materials, Consumables & Utilities
10. Working Capital Requirement (Assumptions, requirements)
11. Market (Survey, Demand & Supply)
12. Cost of Project, Source of Finance
13. Projected Profitability & Break Even Analysis
14. Conclusion.

COURSE NAME : MECHANICAL AND PRODUCTION ENGINEERING / PRODUCTION TECHNOLOGY

COURSE CODE : ME/PG/PT/MH/MI

SEMESTER : FIFTH FOR ME/PG/PT AND SIXTH FOR MH/MI

SUBJECT TITLE: PROFESSIONAL PRACTICES - V

SUBJECT CODE : 12163

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	04	--	--	--	--	50@	50

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.

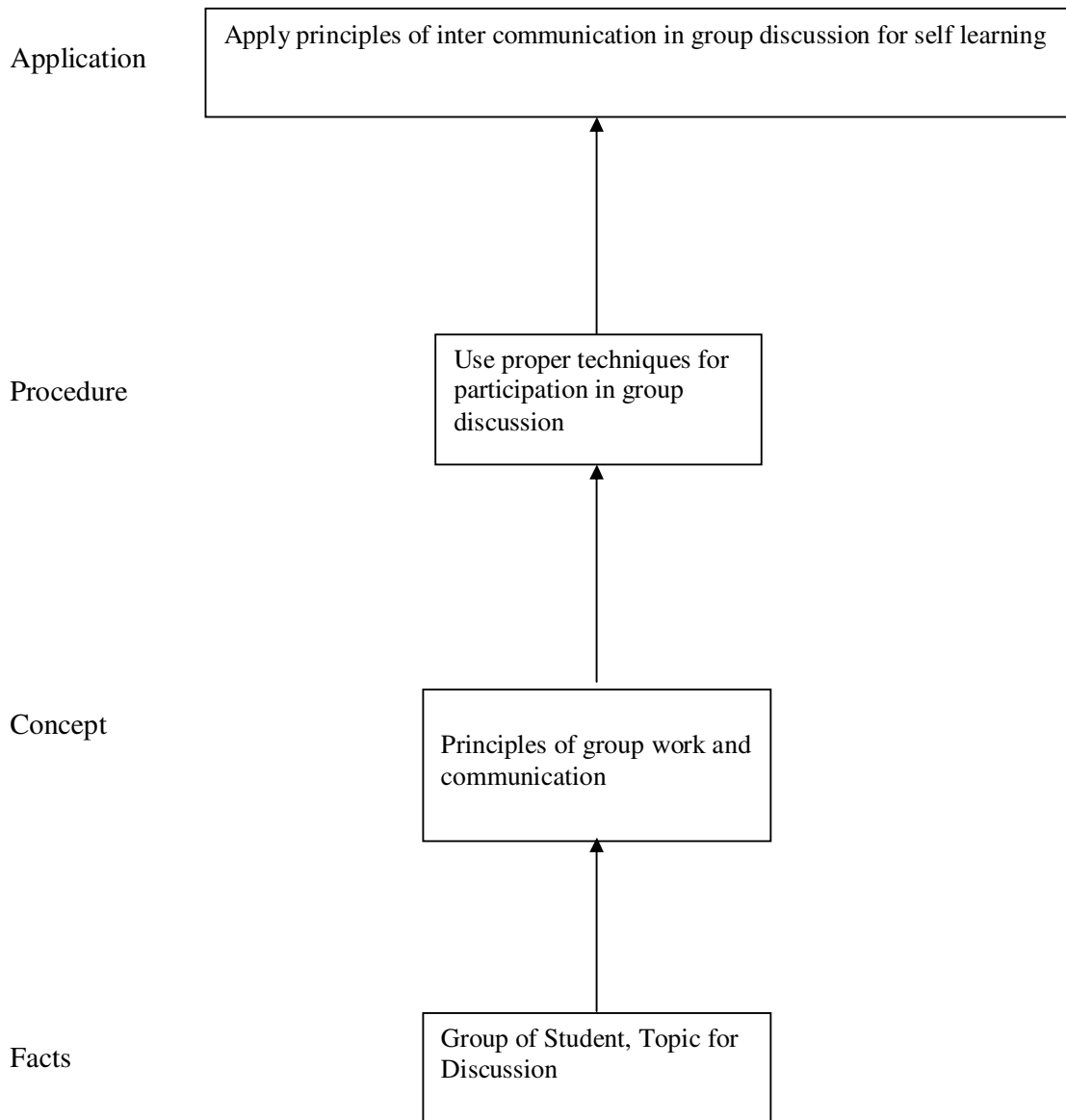
The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

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

Learning Structure:



Serial No.	Activities	Practical Hours
01	<p>Industrial Visits</p> <p>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.(2 visits)</p> <p>Following are the suggested types of Industries/ Fields -</p> <ol style="list-style-type: none"> i) Automobile manufacturing / auto component manufacturing units to observe the working of SPM ii) Refrigeration and air conditioning manufacturing / servicing units / industries / workshops iii) Automobile service stations for four wheelers iv) Co-ordinate measuring machine to observe its construction working specifications and applications. v) Auto Engine Testing unit to gather details regarding the testing procedures/parameters etc. vi) Wheel Balancing unit for light and/or heavy motor vehicles. vii) Food processing unit. viii) Textile industry machinery manufacturing / servicing units. ix) Hydro electric and Thermal power plants. x) Automotive Research Association of India, Pune, Central Institute of Road Transport, Pune, Vehicle Research and Development establishment , Ahmednagar. xi) Engine testing, exhaust gas analysis and vehicle testing xii) PWD workshop. xiii) Safety museum at Central Labour Institute, Sion, Mumbai 	12
02	<p>The Guest Lecture/s</p> <p>From field/industry experts, professionals to be arranged (2 Hrs duration), minimum 4 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work</p> <ol style="list-style-type: none"> a) Electronic fuel injection systems b) Exhaust gas analysis. c) Vehicle testing. d) Transducer application in automobiles. e) Environmental pollution & control. f) Vehicle aerodynamics & design. g) Earth moving machines. h) Automobile pollution, norms of pollution control. i) Biotechnology j) Nanotechnology k) Rapid prototyping l) Programmable logic controllers m) TQM n) MPFI o) Hybrid motor vehicles p) Packaging technology q) Appropriate technology r) Six sigma systems s) LPG / CNG conversion kit. 	10

03	<p>Group Discussion:</p> <p>The students should discuss in group of six to eight students and write a brief report on the same, as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are (any one)-</p> <ol style="list-style-type: none"> i) CNG versus LPG as a fuel. ii) Petrol versus Diesel as a fuel for cars. iii) Trends in automobile market. iv) Load shading and remedial measures. v) Rain water harvesting. vi) Trends in refrigeration Technology. vii) Disaster management. viii) Safety in day to day life. ix) Energy Saving in Institute. x) Nano technology. 	12
04	<p>Seminar : (any 2 topics)</p> <p>Seminar topic should be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes for a group of 2 students)</p>	16
05	<p>Mini Projects : (in a group of 4-5 students)</p> <ol style="list-style-type: none"> 1) Design / drawing of simple jigs, fixtures 2) Thermocouple based temperature controller. 3) Pump on / off timer 4) Models of jigs / fixtures 5) Layout design of SSI units / factory / workshop of the institute <p>Models of material handling route systems</p> <p style="text-align: center;">OR</p> <p>Modular Course on any one of the suggested or alike relevant topic be undertaken by a group of students (Min 10) :</p> <ol style="list-style-type: none"> a) LPG/CNG conversion of vehicles b) Advance features in CAD – CAM c) basics of PLC programming d) die design e) JIT techniques f) Non traditional manufacturing methods g) jigs and fixture design h) 3D Modeling I) finite element method j) Mechatronics k) Advanced computer programming l) maintenance of home appliances m) value stream mapping n) piping technology 	06
6	<p>Student Activities – Students in a group of 3 to 4 shall perform ANY TWO of the following activities (Other similar activities may be considered) and write a report as a part of term work.</p> <p>Activities :-</p> <ol style="list-style-type: none"> 1. Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs 2. Survey and interviews of successful entrepreneurs in near by areas 3. Survey of opportunities available in thrust areas identified by 	08

	Government or DIC. 4. Measuring Screw thread parameters on floating carriage dial micrometer and select the optimum diameter of wire. 5. Survey of data regarding different types of pumps with specifications from manufacturers catalogue, local markets, end users (any other engineering products may be considered for survey) 6. Survey of farm implements used by farmers	
Total		64

References:**Books:**

Sr. No.	Author	Title	Publisher
01	Mark Ratner and Daniel Ratner	Nanotechnology	Pearson Education, New Delhi
02	Yoram Korem	Computer Control of Manufacturing System	Mcgraw Hill Publication
03	Sunil Chopra, Peter Meindl	Supply Chain Management	Pearson Education, New Delhi