 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 / MH / MI																
DURATION OF COURSE : 6 SEMESTERS FOR ME AND 8 SEMESTERS FOR MH/MI											WITH EFFECT FROM 2009-10					
SEMESTER : FOURTH											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 (16004)
								MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
1	Theory of Machines & Mechanisms Ø	TMM	12089	04	--	02	03	100	40	--	--	--	--	25@	10	50
2	Fundamentals of Electronics \$	FEL	12090	03	--	02	03	100	40	50@	20	--	--	--	--	
3	Production Processes \$	PPO	12091	02	--	04	03	100	40	--	--	--	--	25@	10	
4	Thermal Engineering	TEG	12092	04	--	02	03	100	40	--	--	25#	10	25@	10	
5	Fluid Mechanics and Machinery \$	FMM	12093	04	--	02	03	100	40	--	--	25#	10	25@	10	
6	Computer Programming Ø	CPR	12094	01	--	02	--	--	--	50@	20	--	--	--	--	
7	Professional Practices - IV \$	PPR	12095	--	--	03	--	--	--	--	--	--	--	50@	20	
TOTAL				18	--	17	--	500	--	100	--	50	--	150	--	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/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 Engineering Group

Course Code : ME/PT/PG/AE/MH

Semester : Fourth

Subject Title : Theory of Machines and Mechanisms

Subject Code : 12089

Teaching and Examination Scheme:

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

NOTE:

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

Rationale:

It is a core Technology subject in Mechanical Engineering Discipline. Mechanical Engineering Diploma Holders often come across various mechanisms in practice. He should be able to analyze, identify and interpret various mechanisms and machines in day-to-day life. In maintaining various machines, a diploma technician should have sound knowledge of fundamentals of machine and mechanism. It will be helpful to technician to understand the mechanisms from operational point of view in better way. This subject imparts the facts, concepts, principles, procedure, kinematics and dynamics involved in different machine elements and mechanisms like lever, gear, cam, follower, belt, flywheel, brake, dynamometer, clutch, etc.

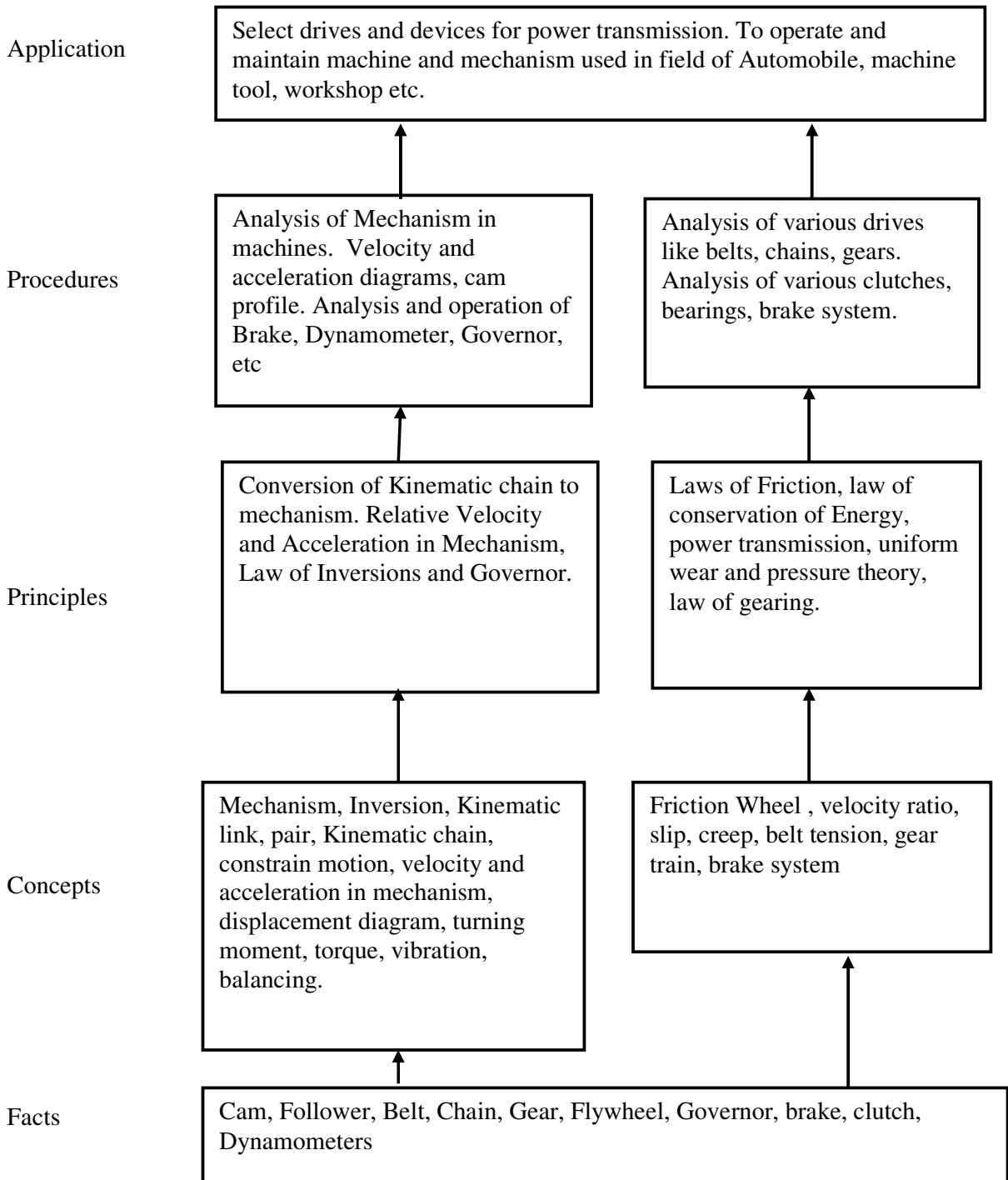
Detail knowledge of above-mentioned aspect with deep insight to the practical applications develops a professional confidence in them to become successful Engineer.

Objectives:

Student will be able to:

1. Know different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Select Suitable Drives and Mechanisms for a particular application.
4. Appreciate concept of balancing and Vibration.
5. Develop ability to come up with innovative ideas.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	<p>Fundamentals and types of Mechanisms</p> <p>Kinematics of Machines: - Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. (Marks- 6)</p> <p>Inversions of Kinematic Chain. (Marks- 8)</p> <ul style="list-style-type: none"> • Inversion of four bar chain, coupled wheels of Locomotive & Pentograph. • Inversion of Single Slider Crank chain- Rotary I.C. Engines mechanism, Whitworth quick return mechanism, Crank and Slotted lever quick return mechanism. • Inversion of Double Slider Crank Chain Scotch Yoke Mechanism & Oldham's Coupling. <p>Common Mechanisms. (Marks- 4)</p> <ul style="list-style-type: none"> • Bicycle free wheel Sprocket mechanism. • Geneva Mechanism. • Ackerman's Steering gear mechanism. • Foot operated air pump mechanism. 	12	18
2.	<p>Velocity and Acceleration in Mechanism</p> <p>Concept of relative velocity and relative acceleration of a point on link, angular velocity and angular acceleration, inter- relation between linear and angular velocity and acceleration.</p> <p>Analytical method [no derivation] and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism. (Marks- 4)</p> <p>2.2 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple mechanisms. Determination of velocity and acceleration of a point on link by relative velocity method [Excluding coriolis components of acceleration]. (Marks- 8)</p>	09	12
3.	<p>Cams and Followers</p> <p>3.1 (Marks- 4)</p> <ul style="list-style-type: none"> • Concept, definition and application of Cams and Followers. • Classification of Cams and Followers. • Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation. 	08	12

	3.2 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method). (Marks- 8)		
4.	<p>Power Transmission (Marks- 8)</p> <p>Belt Drives - flat belt, V– belt & its applications, material for flat and V-belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission(Simple numericals)</p> <p>(Marks-12)</p> <ul style="list-style-type: none"> • Chain Drives – Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods of lubrication. • Gear Drives – Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for compound, reverted and simple epicyclic gear train, methods of lubrication, Law of gearing. • Rope Drives – Types, applications, advantages & limitations of Steel ropes. 	14	20
5.	<p>Flywheel and Governors (Marks- 12)</p> <ul style="list-style-type: none"> • Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. • Governors - Types, concept, function and application & Terminology of Governors. • Comparison between Flywheel and Governor. 	06	12
6.	<p>Brakes, Dynamometers, Clutches & Bearings (Marks- 12)</p> <p>Brakes and Dyanometers</p> <ul style="list-style-type: none"> • Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer. • Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake. • Concept of Self Locking & Self energizing brakes. • Numerical problems to find braking force and braking torque for shoe & band brake. • Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometer. 	12	20

	Clutches and Bearing (Marks- 8) <ul style="list-style-type: none"> • Clutches- Uniform pressure and Uniform Wear theories. • Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch v) Diaphragm clutch. (Simple numericals on single and Multiplate clutch). • Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numericals 		
7.	Balancing & Vibrations (Marks- 6) <ul style="list-style-type: none"> • Concept of balancing. Balancing of single rotating mass. Graphical method for balancing of several masses revolving in same plane. • Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies. 	03	06
Total		64	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Understand working of free wheel mechanism of a bicycle, Geneva mechanism, steering gear mechanism etc.
2. Determine velocity and acceleration of links in a given mechanism.
3. Analyse balancing of rotating masses in a single plane.
4. Interpret interrelationship between components of various braking mechanisms.
5. Understand concepts of vibrations in various machineries, their harmful effects and remedies.
6. Compare various power transmission devices.

Motor Skills:

1. Drawing of velocity and acceleration diagrams.
2. Assembly and dismantling of brakes and clutches.
3. Drawing of cam profiles from a given data for i. C. Engine.
4. Drawing of velocity and acceleration diagram.

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

List of Practical:

- 1) Find the ratio of time of cutting stroke to the time of return stroke for quick return mechanism of a shaper machine.
- 2) Sketch & describe working of bicycle free wheel sprocket mechanism.
- 3) Determination of velocity and acceleration by relative velocity method (four problems).

- 4) Determination of velocity and acceleration of piston of an I.C. engine's Slider Crank mechanism by Klein's construction, for different position of crank in between 0^0 and 360^0 . Represent graphically velocity verses crank angle and acceleration verses crank angle.
- 5) Draw the profile of radial cam for the given motion of follower. (At least four problems)
- 6) Determine the radius of rotation of flyball for different speed of governor and draw a graph between radius of rotation versus speed.
- 7) Dismantling and assembly of mechanically operated braking mechanism for two wheelers.
- 8) Determination of power transmitted by any belt drive using any one dynamometer.
- 9) Dismantling and assembly of multiplate clutch of two-wheeler.
- 10) Determine graphically balancing of several masses rotating in a single plane.

Learning Resources:

Books:

So. No.	Author	Title	Publication
01	Khurmi Gupta	Theory of Machines	Eurasia publishing House Pvt. Ltd. 2006 edition
02	S.S.Rattan	Theory of Machine	McGraw Hill companies, II Edition
03	P.L.Ballaney	Theory of Machines	Khanna Publication
04	Timo Shenko	Theory of Machines	Wiley Eastern
05	Jagdishlal	Theory of Machines	Bombay Metro – Politan book ltd.
06	Ghosh - Mallik	Theory of Machines	Affiliated East west press
07	Beven T.	Theory of Machines	CBS Publication
08	J.E.Shigley	Theory of Machines	Mc Graw Hill

Course Name : Mechanical and Production Engineering/Production Technology

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

Semester : Fourth

Subject Title : Fundamentals of Electronics

Subject Code : 12090

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	50@	--	--	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 0 and to be entered in mark sheet under the head Sessional Work (SW)**

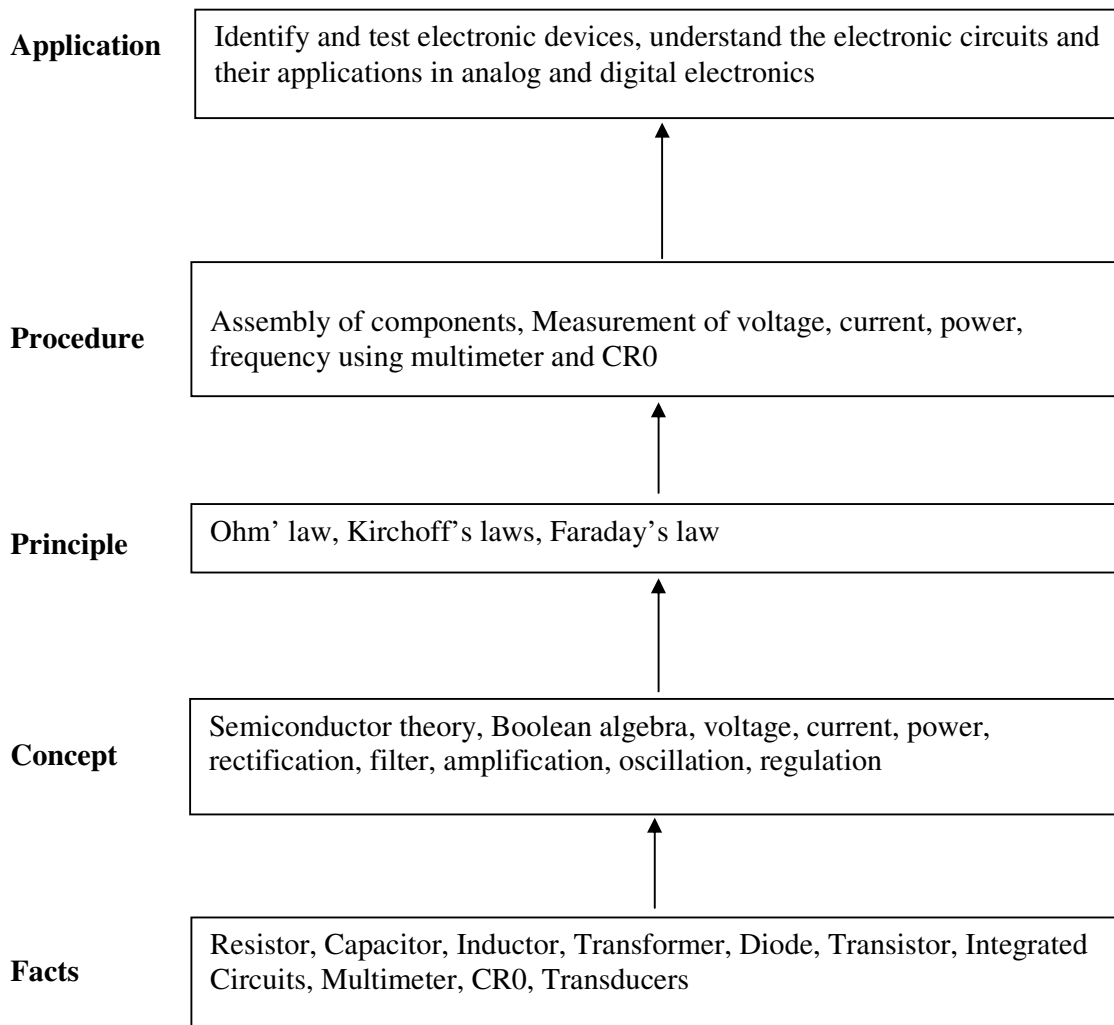
Rationale:

This subject is classified under core technology group and forms an important course of any branch of engineering. The course envisages identification and testing of components, their principles of working and applications of various electronic devices and circuits in analog and digital electronics.

Objectives:

The students will be able to: -

1. Identify and test different components.
2. Use principles of circuit operations and its applications.
3. Distinguish various elements in digital electronics.
4. Understand working of different types of power supplies.
5. Use test instruments.

Learning Structure:

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	<p>Electronic Devices Comparison of conductor and insulators Intrinsic and Extrinsic semiconductors. Introduction to electronic devices, their symbols, principle of working and testing procedure - Diode, Zener diode, Power diode, Varactor diode, Bipolar Junction Transistor (BJT), Field Effect Transistor(FET) - JFET & MOSFET, Uni-j unction Transistor(UJT), power devices — DIAC, TRIAC, SCR, Photo devices-, LDR, Photo diode, Photo transistor, LED & LED display (7 segment), Liquid crystal display(LCD), opto — coupler, therm ister- NTC, PTC</p>	10	20
2	<p>Power Supply Circuit diagram and operation- Half wave, full wave & bridge rectifier. Comparison of efficiency and ripple f of rectifiers Filters - L, C, L-C, n filter Zener diode as voltage regulator in line and load regulation. Regulator ICs 78XX series 723 Block diagram of power supply Concept of unregulated power supply, regulated power supply- line regulation & load regulation. Principle of operation, block diagram and application of shunt regulated power supply, series regulated power supply, switch mode power supply (SMPS), 3 pin 1C regulated, IC 723 adjustable power supply. Block diagram of UPS, Concept of online and off line UPS. Concept of constant current limiting and fold back current limiting, concept of constant voltage source, constant current source</p>	09	18
3	<p>Transistor Transistor as a switch and amplifier, single stage transistor amplifier CB, CE and CC configuration and their applications, RC coupled and direct coupled amplifier, their frequency response and application. Power amplifier- class A, class B, class C, class AB, their comparison on operating point, conduction cycle, efficiency, application.(No circuits expected) Oscillator - Requirement of oscillator circuit, Barkhausen's criteria of oscillator, circuit diagram and its application-. Phase shift oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillator.</p>	09	18
4	<p>OP Amp Block diagram, configurations and use of op amp as - Inverting, Non-inverting, Summing, Voltage to current converter, current to voltage converter, differentiator, Comparator, Wien bridge oscillator, Schmitt's trigger, Instrument amplifier</p>	05	12
5	Digital Electronics	09	18

	<p>Number system- Decimal, Binary, Hexadecimal, BCD, Decimal to binary conversion, Decimal — Hexadecimal conversion.</p> <p>Study of logic gates, Symbol, truth table and IC numbers - NOT, AND, OR, NAND, NOR, XOR, XNOR and NAND as universal gate.</p> <p>Flip Flops — Block diagram of flip flop, RS flip flop, D flip flop ,Toggle , JK flip flop, Master Slave JK flip flop, Clocked flip flop — level triggered and edge triggered , Application of flip flop — Frequency divider, Ring counter, Shift register. Seven segment driving circuit, Encoder, Decoder, Multiplexer, (2:1 A:_1_only)_Dc_multiplier. (1_:2,1:4_only)</p>		
6	<p>IC 555 - Block diagram, Multi vibrator circuit diagram and working for Mono stable, Bi stable and Astable Multivibrator, Analog to Digital Converters, Digital to Analog converter A..DCTypes:staircase ramp method,sucessive approximation iuethod slope m slope method. DAC Types:Binary weighted resistor method,R-2R ladder network method. Block diagram and. working of— Welding control circuits — sequential timer Temperature control circuits using SCR,FWR Speed control circuits Level control circuit using variable capacitor and potentiometer</p>	06	14
Total		48	100

Practical: Skills to be developed:

Intellectual Skills:

1. Identification and selection of components.
2. Interpretation of circuits.
3. Understand working of various types of power supplies.

Motor skills:

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

List of Practical:

1. Use of multimeter (analog and digital) for current, voltage and resistance measurement (Use of colour code for resistors).
2. Study of front panel of CR0 and measurement of frequency and voltage.
3. I) Measurement of L, C, R on LCR meter II) Testing of an IC using IC tester

4. Testing of components like diode, FET, MOSFET, LED, SCR, diac, triac, Zener diode, inductor, capacitor using a multimeter
5. Line and load regulation of un-regulated power supply and regulated power supply.
6. To plot the frequency response of single stage RC coupled amplifier and calculate band width.
7. Verification of Op-Amp as inverting and non inverting amplifier.
8. To generate a square wave by using Schmitt trigger.
9. Verify truth tables for logic gates- . NOT, AND, OR, NAND, NOR, XOR, XNOR
10. Construct a ring counter using JK flip-flop and verify count sequence.
11. Design a square wave oscillator for 100 Hz using IC 555.(Use astable multivibrator).
12. Speed control of AC/DC motor by using SCR, UJT.

Note:

- 1) Teachers are expected to make students familiar with the Data Books and Operation Manuals and also encourage them to visit related websites.
- 2) At least one practical from the above list be performed by using simulation software.

Learning Resources:**Books:**

Sr. No	Author	Title	Publisher
01	V.K. Mehta	Principles of Electronics	S. Chand & Company Ltd.
02	Paul Malvino	Electronic Principles	Tata McGraw Hill Publishers
03	A. Mottershead	Electronic Devices & Components'	Prentice Hall of India
04	R.P. Jam	Modern Digital Electronics	Tata McGraw Hill Publishers
05	Grob Bernard	Basic Electronics	Tata McGraw Hill Publishers
06	Paul B. ZBar, Albert P. Malvino, Michael A. Miller	Basic Electronics - a Text Lab Manual	Tata McGraw Hill Publishers
07	Paul B. ZBar	Industrial Electronics - a Text Lab Manual	Tata McGraw Hill Publishers

Course Name : Mechanical and Production Engineering/Production Technology

Course Code : ME/PT/PG/MH/MH/FE

Semester : Fourth

Subject Title : Production Processes

Subject Code : 12091

Teaching & Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
02	--	04	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:

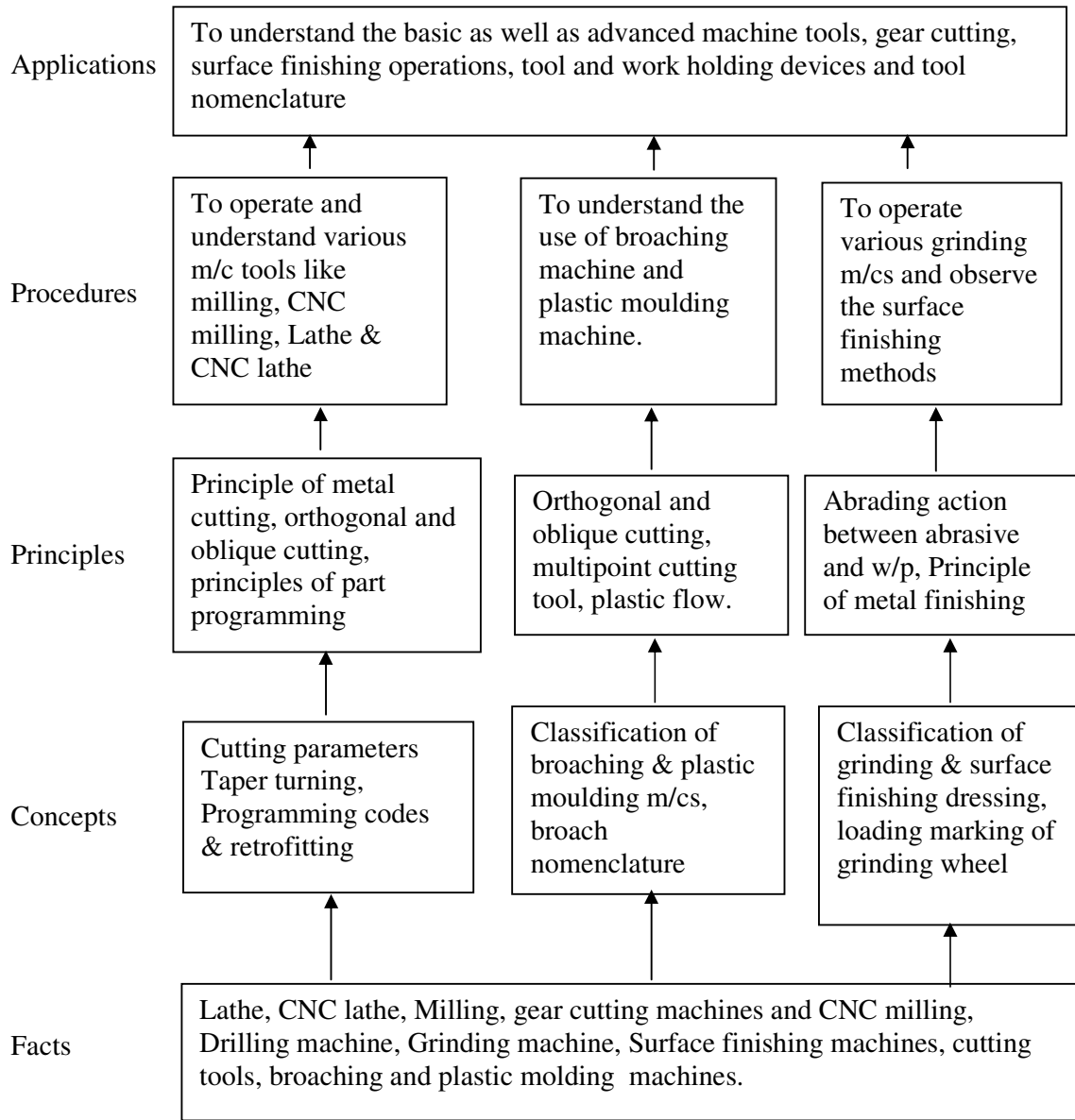
Diploma technician often comes across various types of basic production processes. He/ she is required to select, operate and control the appropriate processes for specific applications. He/ she is also required to know about various cutting tools, latest improvements in production processes, surface finishing processes and plastic processes.

Objectives:

The student will be able to:

- 1) Use the basic machine tools like lathe, drilling and milling.
- 2) Know about broaching machine and its applications.
- 3) Understand the importance of surface finish and related surface finishing methods.
- 4) Program and use basic on machines.
- 5) Understand and select the gear cutting processes.
- 6) Understand and select plastic moulding processes.

Learning Structure:



Chapter	Name of the topic	Hours	Marks
01	Turning 1.1 Lathe Angle calculations for taper turning. Cutting tool nomenclature and tool signature. Cutting parameters and machining calculation	03	08
	1.2 CNC Lathe Introduction, classification, advantages, positioning system, Constructional features. Part programming: programming format, word, statement, block, Preparatory and miscellaneous code, Fixed cycles in programming – canned cycle, do – loop, subroutine.	09	22
02	Drilling Twist drill nomenclature. Cutting parameters, machining time calculation, Deep hole drilling	02	06
03	Milling and gear cutting 3.1 Milling Cutting parameters, machining time calculations, Milling operations – plain milling, face milling, T – slot milling, slitting	03	12
	3.2 Gear cutting Gear cutting on milling machine – Dividing head and Indexing methods Gear hobbing, Principle of operation, advantages and limitations Hobbing techniques – climb and conventional, Gear shaping principle of operation, advantages, disadvantages, Gear finishing processes – Gear shaving, Gear grinding, Gear burnishing, Gear lapping	06	20
04	Grinding Classification of machines, Grinding wheel composition, types and shapes. Designation, Types of grinding operations	04	12
05	Super finishing processes 1. Honing 2. Lapping 3. Burnishing 4. Buffing and 5. Polishing	03	12
06	Plastic Moulding Types of plastic, Compression molding, Transfer molding, Injection molding, blow molding, vacuum forming, extrusion, calendaring, rotational moulding	02	08
Total		32	100

Practical:

Note: One hour of the practical per week is to be utilized for instructions by subject teacher to explain & demonstrate the accessories, tool holding & work holding devises as mentioned in practical contents. The student will write assignments based on these sessions.

Skills to be developed:**Intellectual skills:**

Understand the axis identification of CNC lathe

1. Understand the various types of preparatory and miscellaneous codes.
2. Calculate machining time for different operations.
3. Identify cutting tool nomenclature / marking systems.
4. Know the significance of various super finishing methods.
5. Understand the different processes of gear cutting.
6. Understand various plastic molding methods.
7. Write programs for CNC Lathe.

Motor Skills:

1. Operate lathe, CNC lathe, drilling and milling machines.
2. Execute part programming.
3. Operate grinding machine.
4. Use the indexing mechanism.

List of Practical:

- 1) One assignment on cutting tool nomenclature and tool signature of single point cutting tool.
- 2) Industrial visit to observe plastic processing shop and report on the visit.
- 3) One job on lathe containing the operations like plain turning, threading, boring, taper turning.
- 4) One job on CNC lathe containing the operations like plain turning, taper turning and curvature. (Group of two students , each group must use different program for different job dimensions)
- 5) One job containing drilling, milling, reaming, gear cutting (spur gear) per job max. two students.
- 6) One job containing surface grinding / cylindrical grinding for tolerances ± 30 micron, (For the job already made on milling machine /lathe).
- 7) One assignment on accessories & attachment – chucks, mandrels, carrier and catch plates rests, face plate and angle plate, grinding attachment used on lathe.
- 8) One assignment on accessories & attachment, work holding & tool holding devises used on milling machine.
- 9) One assignment each on shaper, planer, boring machine, broaching machine.
- 10) One assignment each on tool nomenclature & geometry of boring tool, broaching tool, milling cutters.
- 11) One assignment on types of grinding wheels.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	S. K. Hajra Chaudary, Bose, Roy	Elements of workshop Technology-Volume I & II	Media Promoters and Publishers Limited.
02	O. P. Khanna & Lal	Production Technology Volume- I & II	Dhanpat Rai Publications.
03	W. A. J. Chapman, S. J. Martin	Workshop Technology- Volume –I,II & III	Viva Books (p) Ltd.
04	O.P. Khanna	A text book of Foundry Tech.	Dhanpat Rai Publications.
05	R.B. Gupta	Production Technology	Satya Prakashan New Delhi
06	H.S.Bawa	Workshop Technology Volume-I& II	Tata McGraw-Hill
07	John A. Schey	Introduction to Manufacturing Processes	McGraw-Hill
08	M. Adithan A. B. Gupta	Manufacturing Technology	New age International
09	Pabla B. S. M. Adithan	CNC machines	New age international limited.
10	B. L. Juneja	Fundamental of metal cutting and machine tools	New age international limited.
11	Steve Krar, Albert Check	Technology of Machine Tools.	McGraw-Hill International.
12	P. N. Rao	CAD/CAM Principals and Applications	Tata McGraw-Hill
13	P. N. Rao	Manufacruting Technology Metal Cutting & Machne tools	Tata McGraw-Hill

Course Name : Mechanical Engineering Group

Course code : ME/MH/MI

Semester : Fourth

Subject title : Thermal Engineering

Subject code : 12092

Teaching and Examination Scheme

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	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)**

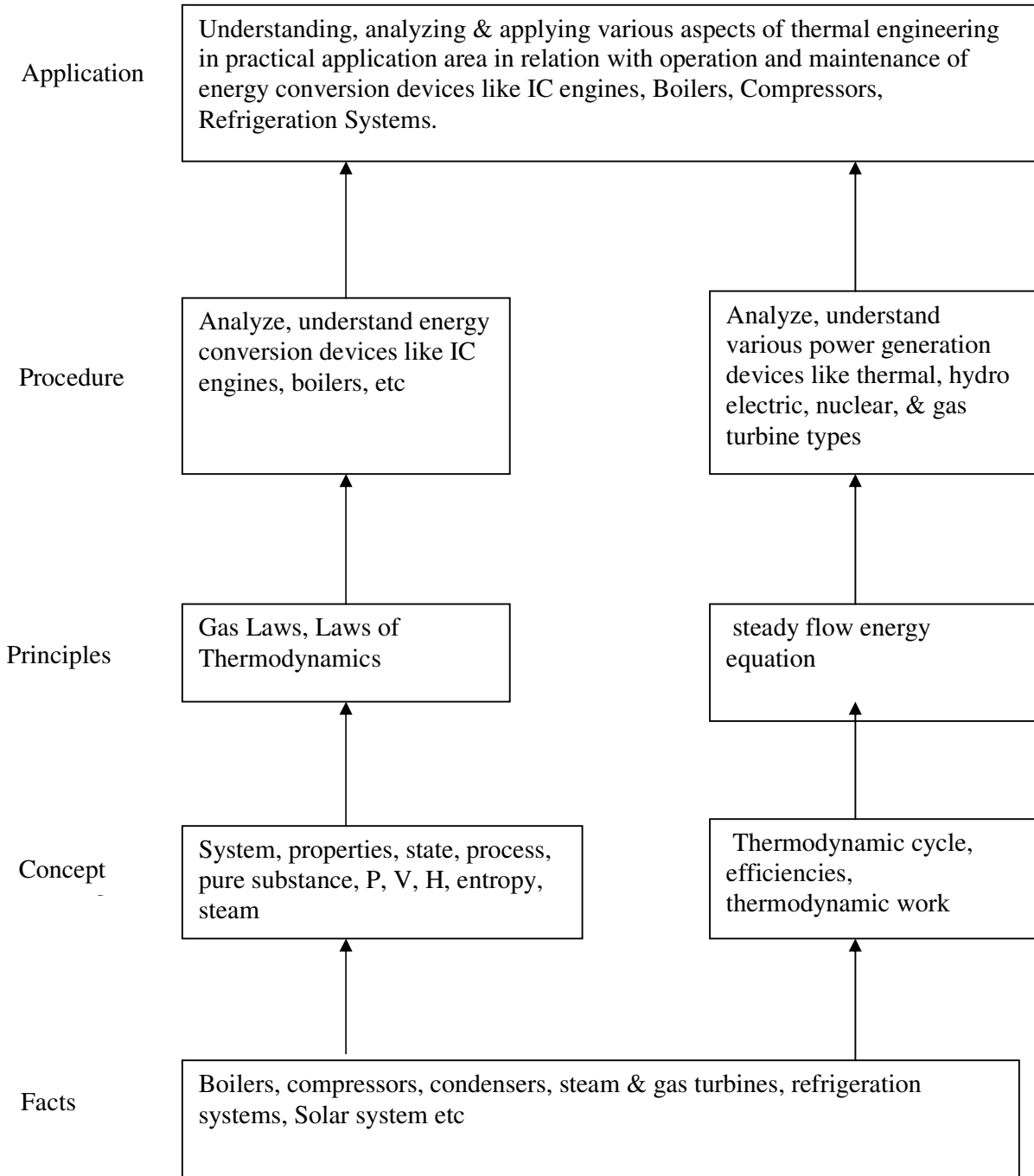
Rationale:

Mechanical engineers have to work with various power producing & power absorbing devices like boilers, turbines, compressors, pumps etc. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them. Hence it is important to study the subject of Thermal Engineering which is a core subject. It includes the study of various sources of energy, basic laws & concept of thermodynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application. Boilers find application in different process industries. Steam turbines and condensers are the major component of any steam power plant. Mechanical engineer should understand working and application of these devices.

Objectives: The Students should be able to:

1. Know various sources of energy & their applications.
2. Apply fundamental concepts of thermodynamics to thermodynamic systems.
3. Understand various laws of thermodynamics.
4. Apply various gas laws & ideal gas processes to various thermodynamic systems.
5. Calculate properties of two phase system by using steam tables/ mollier charts.
6. Explain construction & working of boilers, mountings & accessories.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	Sources of energy 1.1 Brief description of energy sources - Classification of energy sources - Renewable, Non-Renewable 1.2 Fossil fuels, including CNG, LPG. 1.3 Solar - Flat plate and concentrating collectors & its application. - Solar Water Heater - Photovoltaic Cell, Solar Distillation. 1.4 Wind, Tidal, Geothermal 1.5 Biogas, Biomass, Bio-diesel 1.6 Hydraulic, Nuclear 1.7 Fuel cell – list of fuel cells	08	10
2.	Fundamentals of Thermodynamics 2.1 Concepts of pure substance, types of systems, properties of systems, Extensive and Intensive properties with units and conversion like P, V, ρ And temperature. Point function and path function. 2.2 Work and Energy - Thermodynamic definition of work, heat, difference between heat and work, P.E., K.E, Internal Energy, Flow work, concepts of enthalpy, entropy. 2.3 Laws of Thermodynamic - Zeroth Law, Temperature measurement, principle of energy conservation, irreversibility, Second Law of Thermodynamics, Kelvin Plank, Clausius statements and their equivalence, Concept of perpetual motion machine 1 and 2. 2.4 Application of Thermodynamic laws - Steady Flow Energy equation and its application to open system like boiler, engine, nozzle, turbine, compressor & condenser. 2.5 Application of Second law to Heat Engine, Heat Pump and Refrigerator.	12	20
3.	Ideal Gases 3.1 Concept of Ideal gas, Charle's law, Boyle's law, Avogadro's law, equation of state, Characteristic gas constant and universal gas constant. 3.2 Ideal gas processes: - - Isobaric, Isochoric, Isothermal, Adiabatic, Polytropic, Isentropic with representation of the processes on P-V and T-S diagram (only simple numericals)	08	14
4.	Steam and Steam Boiler 4.1 Generation of steam at constant pressure with representation on various charts such as T-H, T-S, H-S, P-H. Properties of steam and use of steam table, Quality of	14	22

	<p>steam and its determination with Separating, throttling and combined Separating and throttling calorimeter (no numerical).</p> <p>4.2 Vapour process : - - constant pressure, constant volume, constant enthalpy, constant entropy (numericals using steam table and Mollier chart), Rankine Cycle</p> <p>4.3 Steam Boilers: - - Classification of boilers. - Construction and working of - Cochran, Babcock and Wilcox, La-mont and Loeffler boiler. Boiler draught natural and Mechanical.</p> <p>4.4 Boiler mounting and accessories [to be covered in practical].</p>		
5.	<p>Steam Turbines and Condensers</p> <p>5.1 Steam nozzle: - - Continuity equation, types of nozzles, concept of Mach number, critical pressure, application of steam nozzles.</p> <p>5.2 Steam turbine: - - Classification of turbines, Construction and working of Impulse and Reaction turbine.</p> <p>5.3 Compounding of turbines, Regenerative feed heating, bleeding of steam, nozzle control governing (no velocity diagrams and numerical).</p> <p>5.4 Steam condenser: - - Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers.</p> <p>5.5 Sources of air leakage, concept of condenser efficiency, vacuum efficiency (no numerical).</p> <p>5.6 Cooling Towers. - Force draught, natural draught and induced draught.</p>	12	22
6.	<p>Heat Transfer</p> <p>6.1 Modes of heat transfer: - - Conduction, convection and radiation.</p> <p>6.2 Conduction by heat transfer - Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, composite walls, combined conduction and convection (Simple numerical)</p> <p>6.3 Heat transfer by Radiation: - - Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Stefan-Boltzman law.</p> <p>6.4 Heat Exchangers: - - Shell and tube, plate type, multiphase heat exchangers. Materials Used and applications of heat exchangers.</p>	10	12
Total		64	100

Practical:

Skills to be Developed

Intellectual Skill:

1. Understand different sources of energy and their applications.
2. Understand various concepts and fundamentals of thermodynamics.
3. Understand concepts and laws of ideal gasses.
4. Understand vapour processes, steam boilers and different mountings and accessories.
5. Understand modes of heat transfer and concept of heat exchanges.
6. Interpret steam tables, mollier chart and relationship between different thermodynamic properties.

Motor Skills:

1. Collect and write technical specifications of photovoltaic cells and identify different components on panels of photovoltaic cells.
2. Conduct trial on the setup for calculation of thermal conductivity of metal rod
3. Trace path of flue gases and water steam circuit in a boiler.
4. Conduct trial on solar water heating system.

List of practical:

1. Collection of technical data and specification of photovoltaic cell by referring to manufacturers' catalogues.
2. Study and Trial on solar water heating system.
3. Report on visit to wind power generation plant / biogas plant / hydraulic power plant.
4. Trace the flue gas path and water-steam circuit with the help of boiler model and write a report.
5. Report on visit to sugar factory / Dairy / steam power plant with specifications of boiler and list of mountings and accessories.
6. Calculation of thermal conductivity of a solid metallic rod.
7. Verification of Stefan-Boltzman's law
8. Study and compare various heat exchangers such as radiators, evaporators, condensers, plate heat exchangers etc.
9. Numericals on vapour processes and ideal gas processes (minimum two problems on each)

Learning Resources:**Books:**

Sr. No.	Author	Title	Publication
01	Domkundwar V. M.	A Course in Thermal Engineering	Dhanpat Rai & Co.
02	P. L. Ballaney	A Course in Thermal Engineering	Khanna Publishers
03	R. S. Khurmi	A text book of Thermal Engineering.	S. Chand & co. Ltd.
04	R. K. Rajput	A Course in Thermal Engineering	Laxmi Publication, Delhi
05	Patel and Karmchandani	Heat Engine Vol. - I & II	Acharya Publication
06	P. K. Nag	Engineering Thermodynamics	Tata McGraw Hill
07	B. K. Sarkar	Thermal Engineering	Tata McGraw Hill

Course Name : Mechanical and Production Engineering/Production Technology

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

Semester : Fourth

Subject Title : Fluid Mechanics & Machinery

Subject Code : 12093

Teaching and Examination Scheme:

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

Knowledge of fluid flow & related machinery is essential in all fields of engineering.

Hydraulic machines have important role in power generation, water supply and irrigation and also in most of engineering segments.

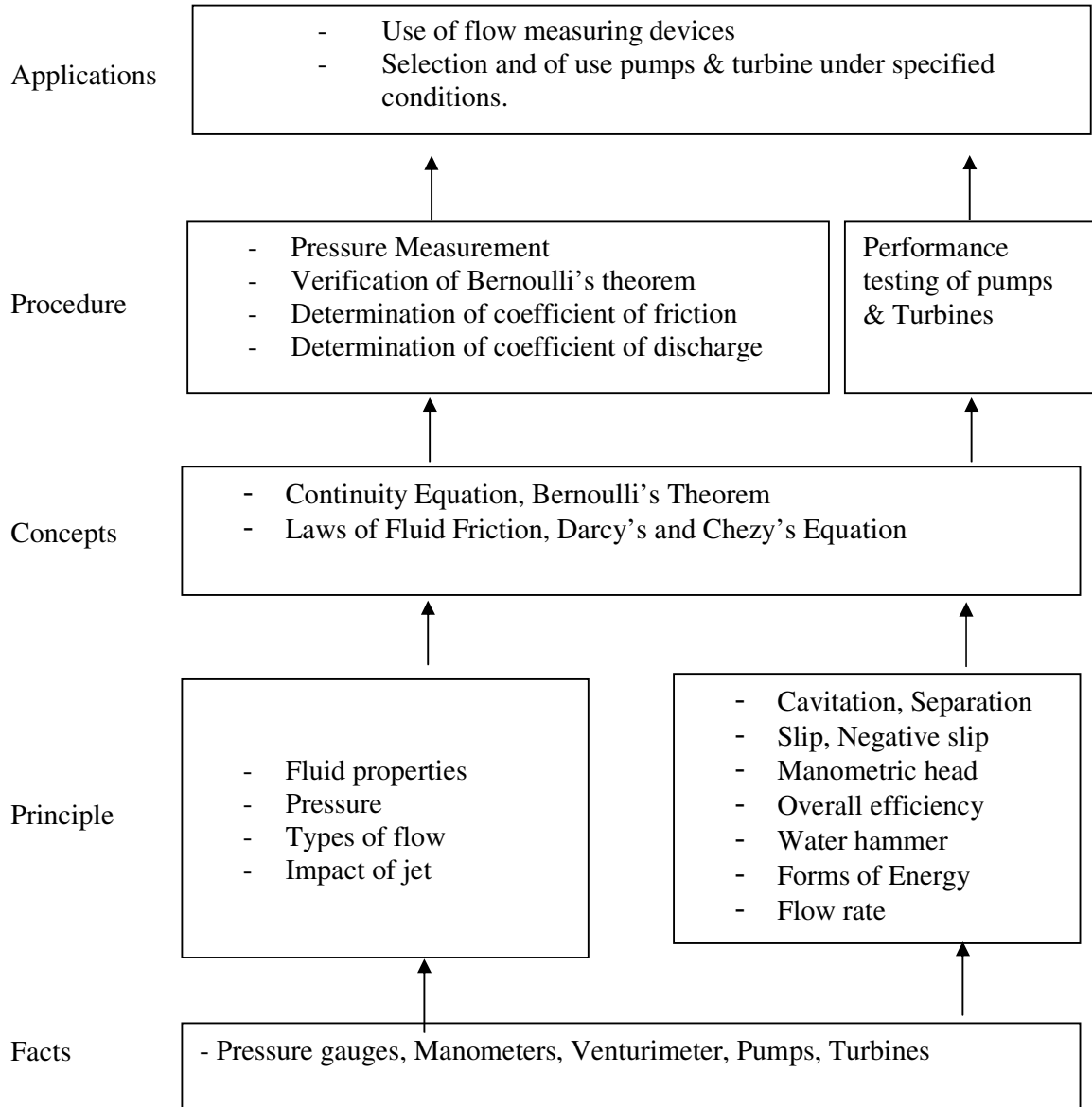
This subject requires knowledge of basic engineering sciences, applied mechanics, mathematics etc.

The fundamentals of this subject are essential for the subject "Industrial Fluid Power" in sixth semester.

Objectives: The student will be able to

1. Measure various properties such as pressure, velocity, flow rate using various instruments.
2. Calculate different parameters such as co-efficient of friction, power, efficiency etc of various systems.
3. Describe the construction and working of turbines and pumps.
4. Test the performance of turbines and pumps.
5. Plot characteristics curves of turbines and pumps.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Properties of fluid <ul style="list-style-type: none"> • Density, Specific gravity, Specific Weight, Specific Volume • Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity • Vapour Pressure, Compressibility 	04	06
02	Fluid Pressure & Pressure Measurement <ul style="list-style-type: none"> • Fluid pressure, Pressure head, Pressure intensity • Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure. • Simple and differential manometers, Bourden pressure gauge. • Total pressure, center of pressure of plane, regular surfaces immersed in liquid. Horizontally, vertically and inclined. Note: Numericals on Manometers, Total Pressure & Centre of pressure	09	14
03	Fluid Flow <ul style="list-style-type: none"> • Types of fluid flows • Continuity equation • Bernoulli's theorem • Venturimeter – Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturimeter. • Orifice meter – Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter • Pitot tube – Construction, Principle of Working Note :- Numericals on Venturimeter, orifice meter, pitot tube	09	14
04	Flow Through Pipes <ul style="list-style-type: none"> • Laws of fluid friction (Laminar and turbulent) • Darcy's equation and Chezy's equation for frictional losses. • Minor losses in pipes • Hydraulic gradient and total gradient line. • Hydraulic power transmission through pipe Note: Numericals to estimate major and minor losses	07	14
05	Impact of jet <ul style="list-style-type: none"> • Impact of jet on fixed vertical, moving vertical flat plates. • Impact of jet on curved vanes with special reference to turbines & pumps Note - Simple Numericals on work done and efficiency	09	10

06	Hydraulic Turbines <ul style="list-style-type: none"> • Layout of hydroelectric power plant. • Features of Hydroelectric power plant. • Classification of hydraulic turbines. • Selection of turbine on the basis of head and discharge available • Construction and working principle of Pelton wheel, Francis and Kaplan turbine. • Draft tubes – types and construction, Concept of cavitation in turbines • Calculation of Work done, Power, efficiency of turbine. 	09	18
07	7.1 Centrifugal Pumps <ul style="list-style-type: none"> • Construction , principle of working and applications. • Types of casings and impellers. • Concept of multistage • Priming and its methods, Cavitation • Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH. • Performance Characteristics of Centrifugal pumps. • Trouble Shooting. • Construction, working and applications of submersible, jet pump <p>Note :- Numericals on calculations of overall efficiency and power required to drive pumps.</p> 7.2 Reciprocating Pump <ul style="list-style-type: none"> • Construction, working principle and applications of single and double acting reciprocating pumps. • Concept of Slip, Negative slip, Cavitation and separation. • Use of Air Vessel. • Indicator diagram with effect of acceleration head & frictional head. <p>Note:- No Derivations and Numericals on reciprocating pumps.</p>	09	14
		08	10
Total		64	100

Practical:

Skills to be developed:

Intellectual Skills:

- 1) Select and use appropriate flow measuring device.
- 2) Select and use appropriate pressure measuring device.
- 3) Analyze the performance of pumps and turbines.

Motor Skills:

- 1) Use flow measuring device.
- 2) Use pressure measuring device.
- 3) Operate pumps and turbines.

List of Practical:

1. Calibration of Bourden pressure gauge with the help of Dead Weight Pressure gauge.
2. Verification of Bernoulli's Theorem.
3. Determination of Coefficient of Discharge of Venturimeter.
4. Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of orifice meter.
5. Determination of coefficient of friction of flow through pipes.
6. Trial on Pelton wheel to determine overall efficiency.
7. Trial on centrifugal pump to determine overall efficiency.
8. Trial on reciprocating pump to determine overall efficiency.
9. To determine minor losses for flow through pipes.

Learning Resources:**Books:**

Sr. No	Author	Title	Publication
01	Ramamrutham S.	Hydraulic, fluid mechanics & fluid machines	Dhanpat Rai and Sons New Delhi
02	Modi P. N. and Seth S. M.	Hydraulics and fluid mechanics including Hydraulic machines	Standard Book House. New Delhi
03	Streeter Victor, Bedford K.W., Wylie E.B	Fluid Mechanics	McGraw Hill Int.
04	K. Subramanya	One Thousand Solved Problems in Fluid Mechanics	Tata McGraw Hill
05	Pump manufactures' catalogs such as Kirloskar Brothers, KSB, Kishor pumps etc.		

Course Name : Mechanical Engineering Group

Course Code : ME/AE/PT/PG/MH/MI/FE

Semester : Fourth

Subject Title : Computer Programming

Subject Code : 12094

Teaching and Examination Scheme:

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

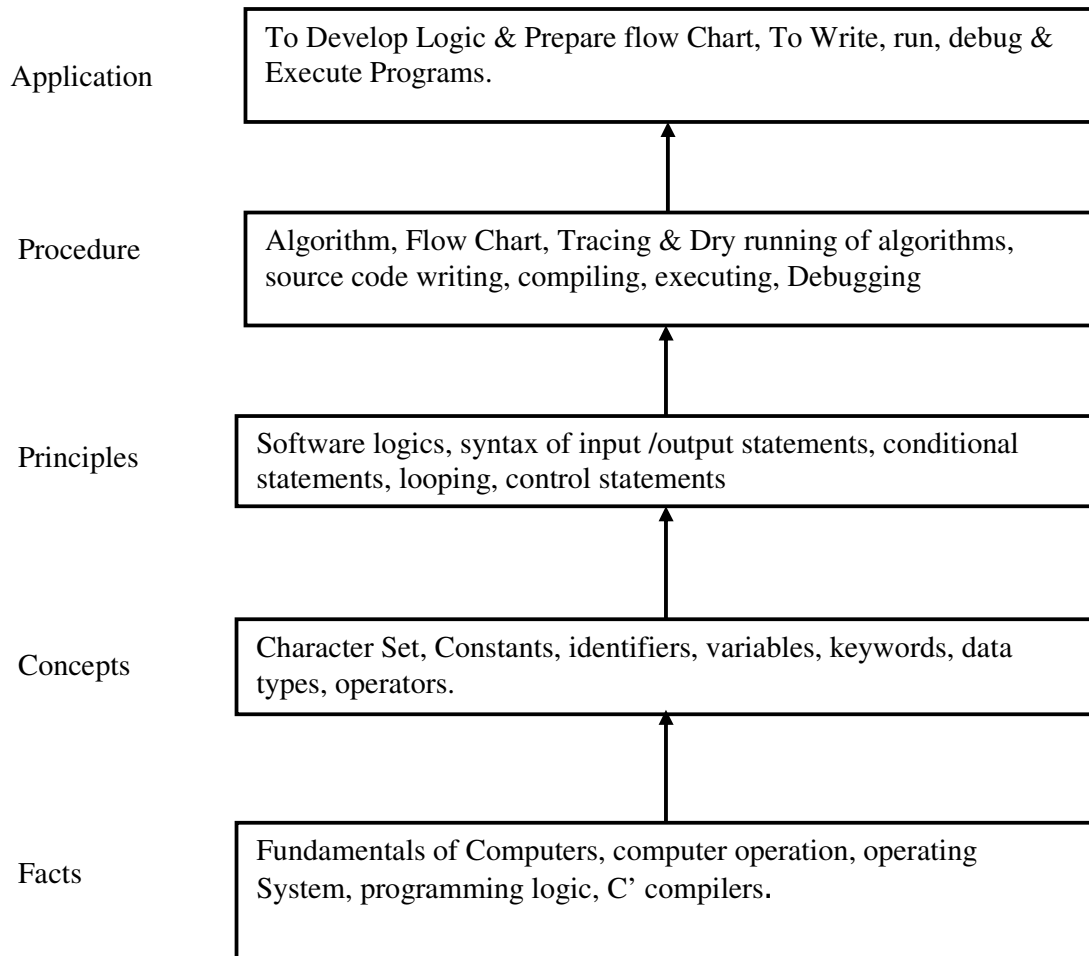
Rationale:

In advanced age of computer, it becomes essential to understand how to give instructions to computers. This course intends to expose a student to the basic principles of programming through a structured programming language like 'C'. Study of this course would enable the students to learn any advanced Object Oriented Language.

Objectives:

Students should be able to:

1. Break a given task into subtasks.
2. Enhance logical thinking.
3. Develop 'C' programs for simple applications.

Learning Structure:

Contents: Theory

Chapter	Name of the Topic	Hours
1.	Introduction - Problem, definition and analysis, algorithm, flow charts, tracing and dry running of algorithms. Introduction to 'C' programming, simple program using Turbo 'C' compiler and execution of 'C' program	02
2.	C Fundamentals: Character set, constants, data types, identifiers, key words, variable declarations Types of Operators – unary, binary, arithmetic, relational, logical, assignment. Hierarchy of operators, expressions, library functions, Use of input/output functions viz. Printf(), Scanf(), getch(), putch()	03
3.	Use of Control Statements:- if-else, while loop, do – while loop, for loop, switch, break and continue. Writing, Compiling, Executing and debugging programs	05
4.	Introduction to Subscripted variables, arrays, defining and declaring one and two dimensional arrays, reading and writing	03
5.	Concept of String, string input / output functions Defining and accessing a user defined functions, Passing of arguments, declaration of function prototypes Storage classes: automatic, external, static variables	03
Total		16

Practical:**Skills to be developed:**

Intellectual Skills:

1. Prepare and interpret flow chart of a given problem.
2. Represent data in various forms.
3. Use various control statements and functions

Motor Skills:

1. Write program in 'C' language.
2. Run and debug 'C' program successfully.

List of Practical:

To write simple programme having engineering application involving following statements

1. Use of Sequential structure
2. Use of if-else statements
3. Use of for statement
4. Use of Do-While Statement

5. Use of While statement
6. Use of brake and Continue statement
7. Use of multiple branching Switch statement
8. Use of different format specifiers using Scanf() and Printf()
9. Use of one dimensional array e.g. String, finding standard deviation of a group data
10. Use of two dimensional array of integers/ reals
11. Defining a function and calling it in the main

Learning Resources:**Books:**

Sr. No.	Author	Title	Publication
01	Byron Gotfried	Introduction to 'C' programming	Tata McGraw Hill
02	Yashwant Kanitkar	Let us 'C'	BPB publications
03	Denis Ritchie and Kerninghan	Introduction to 'C' programming	Prantice Hall Publications
04	Balguruswamy	Programming in 'C'	Tata Mc- Graw Hill

Course Name : Mechanical Engineering Group

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

Semester : Fourth

Subject Title : Professional Practices-IV

Subject Code : 12095

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	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 their 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.

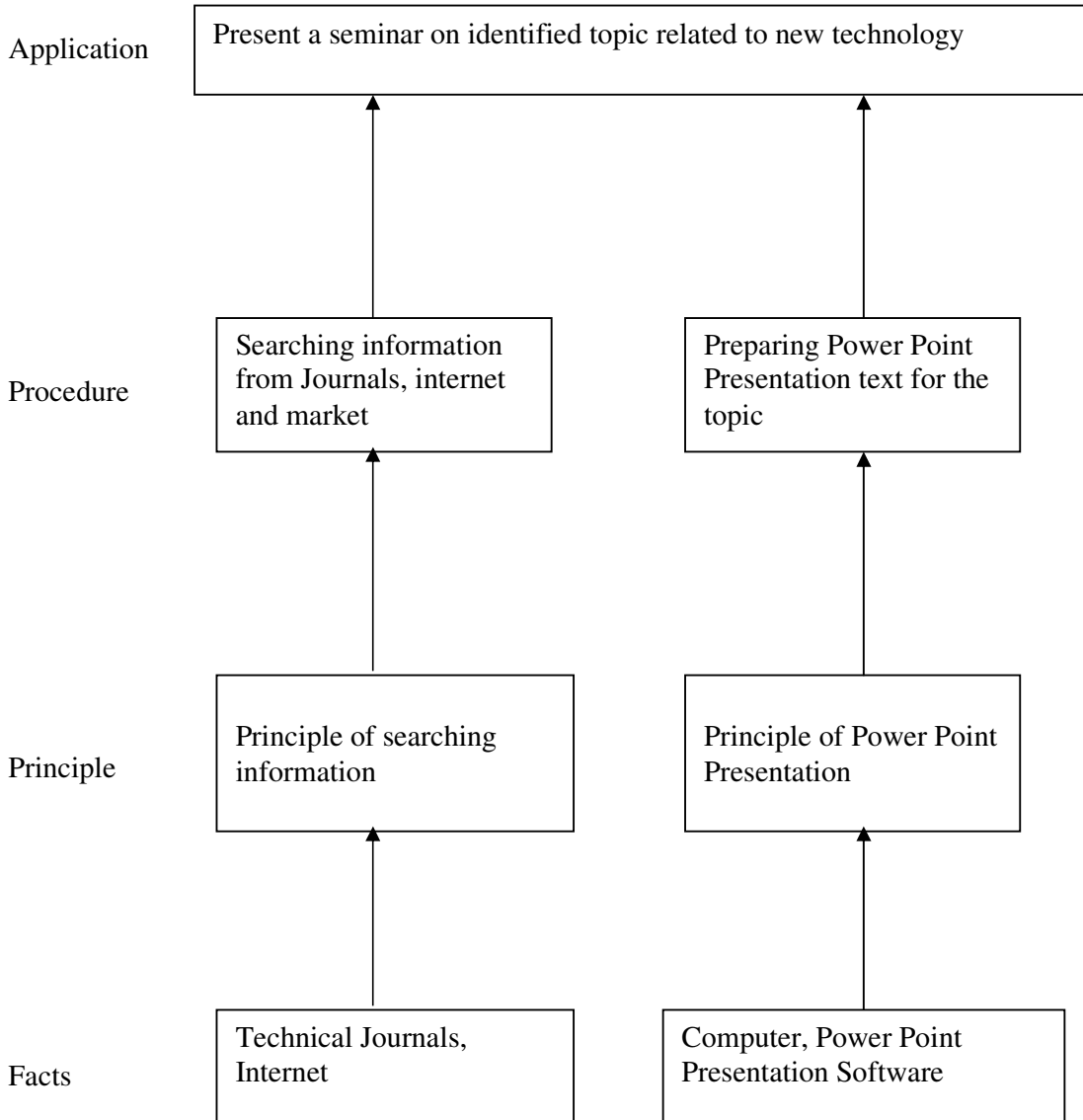
Objectives:

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:

Sr. No.	Activities	Hours
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Industrial Visits		
Mini Project / Activities : (any one) model out of card board paper / acrylic / wood / thermocoll / metal such as : i)	12 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. The industrial visits may be arranged in the following areas / industries: Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant. i) Machine shop having CNC machines. ii) ST workshop / Auto service station iii) City water supply pumping station iv) Manufacturing unit to observe finishing and super finishing processes.	14
Elliptical Trammel Pantograph Coupling Cams and Followers Geneva mechanism	Lectures by Professional / Industrial Expert lectures to be organized from any two of the following areas: ii) Interview Techniques. iii) Modern Boilers – Provisions in IBR iv) Applications of Sensors and Transducers v) Alternate fuels – CNG / LPG , Biodiesel, Ethanol, hydrogen Piping technology	06
a) Dismantling of assembly (e.g. jig / fixtures, tool post, valves etc.) Take measure ment and prepare drawings / sketches of	Information Search : Information search can be done through manufacturer's catalogue, websites, magazines, books etc. and submit a report any one topic. Following topics are suggested : i) Engine lubricants & additives ii) Automotive gaskets and sealants iii) Engine coolants and additives iv) Two and Four wheeler carburetor. v) Power steering vi) Filters vii) Different drives/Transmission systems in two wheelers. viii) Types of bearings – applications and suppliers. ix) Heat Exchangers x) Maintenance procedure for solar equipment. xi) Tools holder on general purpose machines and drilling machines.	08
different parts b) Make a small decorative water fountain unit Toy making with simple operating mechanisms.	Seminar : Seminar topic shall be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes)	08
Total		48

Content: