

**CURRICULAR STRUCTURE FOR PART – II (Semester III) OF THE
FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING**

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION														
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES														
COURSE NAME: FULL TIME DIPLOMA IN : MECHANICAL ENGINEERING														
DURATION OF COURSE: 6 SEMESTERS														
SEMESTER: THIRD														
BRANCH: : MECHANICAL ENGINEERING														
SI No	SUBJECT	CREDITS			PERIODS			EVALUATION SCHEME						
		TH	PR	Total	L	T U	PR	INTERNAL SCHEME			ESE	PR		TOTAL MARKS
								TA	CT	TOTAL		INT	EXT	
1	Advanced Strength of Materials	2	1	3	2	-	2	5	10	15	35	25	25	100
2	Thermal Engineering-I	3	1	4	3	-	2	10	20	30	70	25	25	150
3	Manufacturing Processes I	3	2	5	3	-	4	10	20	30	70	50	50	200
4	Fundamentals of Electronics	3	1	4	3	-	2	10	20	30	70	25	25	150
5	Engineering Materials	3	0	3	3	-	-	10	20	30	70	-	-	100
6	M.E.Drawing	3	2	5	3	-	4	5	10	15	35	50	50	150
7	Professional Practice-I	0	1	1	-	-	2	-	-	-	-	25	25	50
TOTAL		17	8	25	17	-	16	50	100	150	350	200	200	900

STUDENT CONTACT HOURS PER WEEK:33 hrs
Theory and Practical Period of 60 Minutes each.
L- Lecture, TU- Tutorials, PR- Practical, INT-Internal Assessment , EXT-External Assessment, TA- Teachers Assessment, CT- Class Test, ESE- End Semester Exam.

**CURRICULAR STRUCTURE FOR PART – II (Semester IV) OF THE
FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING**

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION														
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES														
COURSE NAME: FULL TIME DIPLOMA IN : MECHANICAL ENGINEERING														
DURATION OF COURSE: 6 SEMESTERS														
SEMESTER: FOURTH														
BRANCH: : MECHANICAL ENGINEERING														
SI No	SUBJECT	CREDITS			PERIODS			EVALUATION SCHEME						
		TH	PR	Total	L	TU	PR	INTERNAL SCHEME			ESE	PR		TOTAL MARKS
								TA	CT	TOTAL		INT	EXT	
1	Development of Life Skill-II	1	1	2	1	-	2	-	-	-	-	25	25	50
2	Thermal Engineering-II	3	1	4	3	-	2	10	20	30	70	25	25	150
3	Manufacturing Processes II	3	2	5	3	-	4	10	20	30	70	50	50	200
4	Principles of Electrical Engineering	3	1	4	3	-	2	10	20	30	70	25	25	150
5	Engineering Metrology	2	1	3	2	-	2	5	10	15	35	25	25	100
6	Theory of Machines & Mechanism	3	1	4	3	-	2	10	20	30	70	25	25	150
7	Professional Practice-II	0	2	2	-	-	3	-	-	-	-	25	25	50
TOTAL		15	9	24	24	-	17	45	90	135	315	200	200	850

STUDENT CONTACT HOURS PER WEEK:32 hrs
Theory and Practical Period of 60 Minutes each.

L- Lecture, TU- Tutorials, PR- Practical, INT-Internal Assessment , EXT-External Assessment, TA- Teachers Assessment, CT- Class Test, ESE- End Semester Exam.

**CURRICULAR STRUCTURE FOR PART – III (Semester V) OF THE
FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING**

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION														
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES														
COURSE NAME: FULL TIME DIPLOMA IN : MECHANICAL ENGINEERING														
DURATION OF COURSE: 6 SEMESTERS														
SEMESTER: FIFTH														
BRANCH: : MECHANICAL ENGINEERING														
S I N O	SUBJECT	CREDITS			PERIODS			EVALUATION SCHEME						
		TH	PR	Total	L	T U	PR	INTERNAL SCHEME			ESE	PR		TOTAL MARKS
								TA	CT	TOT AL		INT	EXT	
1	Fluid Mechanics & Machinery	3	1	4	3	-	2	10	20	30	70	25	25	150
2	Advanced Manufacturing Processes	2	2	4	2	-	3	10	20	30	70	50	50	200
3	Measurement & Control	2	1	3	2	-	2	5	10	15	35	25	25	100
4	Power Engineering	3	1	4	3	-	2	10	20	30	70	25	25	150
5	Elective I (any one) a) Automobile Engineering b) Mechatronics c) Power Plant Engineering d) Tool Engineering	3	1	4	3	-	2	5	10	15	35	25	25	100
6	Industrial Project & Entrepreneurship	0	2	2	1	-	2	-	-	-	-	25	25	50
7	Computer Programming	0	2	2	1	-	2	-	-	-	-	25	25	50
8	Professional Practice-III	0	1	1	-	-	2	-	-	-	-	25	25	50
TOTAL		13	11	24	15	-	17	40	80	120	280	225	225	850
STUDENT CONTACT HOURS PER WEEK:32 hrs Theory and Practical Period of 60 Minutes each.														
L- Lecture, TU- Tutorials, PR- Practical, INT-Internal Assessment , EXT-External Assessment, TA- Teachers Assessment, CT- Class Test, ESE- End Semester Exam.														

**CURRICULAR STRUCTURE FOR PART – III (Semester VI) OF THE
FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING**

WEST BENGAL STATE COUNCIL OF TECHNICAL EDUCATION														
TEACHING AND EXAMINATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES														
COURSE NAME: FULL TIME DIPLOMA IN : MECHANICAL ENGINEERING														
DURATION OF COURSE: 6 SEMESTERS														
SEMESTER: SIXTH														
BRANCH: : MECHANICAL ENGINEERING														
SI No	SUBJECT	CREDITS			PERIODS			EVALUATION SCHEME						
		TH	PR	Total	L	TU	PR	INTERNAL SCHEME			ESE	PR		TOTAL MARKS
								TA	CT	TOTAL		INT	EXT	
1	Design of M/C Elements	4	1	5	4	-	2	10	20	30	70	25	25	150
2	Industrial Management	3	0	3	3	-	-	10	20	30	70	-	-	100
3	Fluid Power	3	1	4	3	-	2	10	20	30	70	25	25	150
4	Elective II (any one) a) Refrigeration & Air-Conditioning b) CAD-CAM & Automation c) Alternate Energy Sources & Management d) Material Handling Systems	3	1	4	3	-	2	5	10	15	35	25	25	100
5	Production Management	3	0	3	3	-	-	5	10	15	35	-	-	50
5	Project	0	3	3	-	-	6	-	-	-	-	50	50	100
6	Professional Practice-IV		2	2	-	-	4	-	-	-	-	25	25	50
7	General Viva		1	1	-	-	-	-	-	-	-		100	100
TOTAL		16	9	25	16	-	16	40	80	120	280	150	250	800
STUDENT CONTACT HOURS PER WEEK:32 hrs Theory and Practical Period of 60 Minutes each. L- Lecture, TU- Tutorials, PR- Practical, INT-Internal Assessment , EXT-External Assessment/ Assessment by all departmental lecturers for General Viva, TA- Teachers Assessment, CT- Class Test, ESE- End Semester Exam.														

Name of the Course : Mechanical Engineering			
Subject: Advanced Strength of Materials			
Course code: ME		Semester : Third	
Duration : 17 Weeks		Maximum Marks : 100	
Teaching Scheme		Examination Scheme	
Theory : 2 hrs/week		End Semester Exam: 35 Marks	
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 5 Marks	
Practical : 2 hrs/week		Internal Assessment: 10 Marks	
Credit: 3		Practical Sessional internal continuous evaluation: 25 Marks	
		Practical Sessional external examination: 25 marks	
Aim :-			
SL No			
1.	To understand & analyze various types of stresses & strains along with main causes of failure of machine parts.		
2.	To study the effect of combined stress on different machine parts.		
3.	To understand principles of machine design.		
Objective :-			
S No	The student will able to		
1	Calculate bending stress and prepare shear stress distribution diagram at different cross section in a beam		
2	Calculate maximum & minimum stresses for different machine elements under combined bending & direct stress.		
3	Understand & analyze the basic principles involved in the behavior of machine parts under load in the context of designing it.		
4	Calculate strain energy for spring and axially loaded members		
5	Estimate principal stresses and maximum shear stress for a given combined loading by analytical & Mohr's circle method.		
6	Calculate the power transmitted by the solid & hollow shafts.		
7	Understand & analyze different parameters of closed coil helical spring.		
Pre-Requisite:-			
Sl. No	Elementary knowledge on engineering mechanics		
1.	Differential and integral calculus		
2.	Elementary knowledge on strength of materials		
Contents			Hrs/week
Chapter	Name of the Topic	Hours	Marks
01	1.0 Strain Energy 1.1 Concept, derivation & use of expression for Strain energy of axially loaded members of uniform cross section under gradual, sudden / impact load (simple problems). 1.2 Strain energy due to self-weight for uniform cross section member (simple problems).	03	05
02	2.0 Bending & Shear stresses 2.1 Theory of pure bending, equation of bending. 2.2 Assumptions in the theory of bending, moment of resistance, section modulus & neutral axis (simple problems on bending stress having rectangular, circular & I section beam) 2.3 Shear stresses in beam & its distribution diagram over various cross section of beam under point load/udl (No problem)	06	08
03	3.0 Combination of Bending & Direct stresses	06	06

	3.1 Determination of maximum & minimum stresses for members under axial load, eccentric load along one principal axis, bending stresses. 3.2 Application of the above concepts for machine parts such as offset links, C-clamp, Bench vice, Drilling machine frame, stresses at base of a short column, total stress variation diagrams. (Simple problems on above applications)		
04	4.0 Principal Planes & Principal Stresses 4.1 Definition of principal plane & principal stresses. 4.2 Expression for normal and tangential stress, maximum shear stress. 4.3 Stresses on inclined planes. 4.4 Position of principal planes & planes of maximum shear. 4.5 Graphical solution using Mohr's circle of Stresses	06	06
05	5.0 Torsion of solids and hollow circular shafts: 5.1 Concept of Pure Torsion, Torsion equation for solid and hollow circular shafts, Assumptions in theory of pure Torsion. 5.2 Comparison between Solid and Hollow Shafts subjected to pure torsion (no problem on composite and non homogeneous shaft)	05	05
06	6.0 Springs: 6.1 Types of spring, uses 6.2 Determination of shear stress & its distribution, deflection, stiffness, solid length, concept of mean radius of coil & spring index (simple problem) 6.3 Spring in series & parallel.	04	05
	Sub Total:	30	35
	Internal Assessment Examination & Preparation of Semester Examination	4	
	Total:	34	

Practical:

Skills to be developed:

Intellectual skills:

1. Calculate coefficient of friction for available pair of surface and angle of repose.
2. Establish law of simple machine
3. Identification of different parts of machine and their function.
4. Interpretation failure patterns of different metal under different action.
5. Extrapolating test result or observation during test.

Motor Skills:

1. Study and demonstration of Testing Machine & its attachments (if any).
2. Sketch of standard specimen, arrangement for test on respective machines.
3. Measurement of different parameters.
4. Testing different metals and comparison of experimental result.
5. Handling Instrument.
6. Observing behavior of different metal during test.
7. Plotting graph

List of Practical: (sl. No. 1 & 2 compulsory & at least three from the rest)

1. To determine coefficient of friction of any pair of surfaces and determination of angle of repose.
2. To find MA, VR, Efficiency, Ideal Effort, Effort & Load lost in friction for various loads and establish law of machine and calculate maximum efficiency and Also check the reversibility of a machine (any two) 1) Differential axle and wheel, 2) Weston's differential pulley block, 3) Geared pulley block, 4) Single purchase crab, 5) Double purchase crab, 6) Worm and worm wheel, 7) Two sheave and three sheave pulley block, 8) Screw Jack
3. Tension Test on mild steel/ Aluminium & compression test on cast iron on Universal Testing Machine.
4. Direct Shear Test of mild steel on Universal Testing Machine.

5. Brinell Hardness Test on Mild Steel / Aluminium.
6. Rockwell hardness Test on Hardened Steel.
7. Izod & Charpy - Impact tests of a standard specimen.
8. Torsion Test on Mild steel bar.

Assignments:

1. Estimation of principal stresses and maximum shear strain for a given combined loading by analytical & Mohr's circle method. (At least two problems.)
2. Estimate cross section of machine parts under combined bending and direct stress considering respective mechanical properties.

Note: Total students have to be divided into 10 groups. Each group shall be allotted two different problems on above mentioned areas as home assignment. Problems have to be submitted by each student separately.

List of Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
R S Khurmi	Strength of Materials		S.Chand & Co
S. Ramamurtham & R Narayanan	Strength of Materials		Dhanpat Rai & Publication
R.K. Bansal	Strength of Materials		Laxmi Publication Pvt. Ltd
Sarkar & Bhandari	Advanced Strength of Materials		Tata McGraw-Hill
S.S. Rattan	Advance Strength of Material		Tata McGraw-Hill
S.S.Bhavikatti	Strength of Materials		Vikas Publishing House Pvt. Ltd
R.K. Rajput	Strength of Materials		S.Chand & Co
M. Chakraborty	Strength of Materials		S.K.Kataria
Bhandari	Design of Machine Elements		McGraw-Hill
R.S. Khurmi & J. K. Gupta	A Text Book of Machine Design		S.Chand & Co
Gambhir	Fundamental of solid mechanics		PHI

Reference books :-

R. Subramanian	Strength of Materials		Oxford Press
S.P. Timoshenko, D.H. Young	Elements of Strength of Materials		West Press Pvt. Ltd
D. S. Prakash Rao	Strength of Materials – A Practical Approach		Universities Press
Egor P Popov	Engineering Mechanics of Solid		Prentice Hall of India

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	1, 2 & 3	5	5	At least 2
B	4, 5 & 6	5	5	At least 2
From above mentioned groups total 5 questions to be attempted				5*5 = 25
A	1, 2 & 3	1	5	5*1 =5
B	4, 5 & 6	1	5	5*1 =5
Total:				35

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer.

Five No. of Experiments		5*3 =15	
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attended & respective lab note submitted in due time			
Viva-voce		10	
		Total: 25	
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer.			
Signed Lab Note Book (for five experiments)		5*2 = 10	
On spot experiment(one for each group consisting 5 students)		10	
Viva voce		5	
		Total: 25	

Name of the course: Mechanical Engg.	
Subject: Fundamentals of Electronics	
Course Code:	Semester: Third
Duration: 17 weeks	Maximum Marks: 150 Marks
Teaching Scheme:	Examination Scheme :
Theory: 3 hours./ week	Internal Examination: 20 Marks
Tutorial: hour / week	Teacher's Assessment: (Assignment & Quiz): 10 Marks
Practical: 2 hours/ week	End Semester Examination: 70 Marks
Credit: 4	Practical: Internal Sessional Continuous Evaluation: 25 Marks
Rationale:	Practical: Internal Sessional Continuous Evaluation: 25 Marks
In present day mechanical systems, application of electric and electronic engineering have larger role to play. For effective maintenance and operation of these components as well as circuits, mechanical engineers/ technicians must have perfect knowledge of fundamentals of electronics.	
Objectives:	
The student will be able to-	
<ol style="list-style-type: none"> 1. Understand the concept of P and N types of semiconductors; know the working of electronic components like semiconductors diodes, rectifiers, filters, regulators & their operation. 2. Understand the principle and working of semiconductor switching devices like SCRs, DIAC, TRIAC and optoelectronics devices, their working principles and applications. 3. Understand the concept of transistor amplifier, Oscillator, and Op-amp and their applications. 	

Content (Name of topic)		Periods	Marks
Group-A			
Unit 1	Semiconductor and Diode	8	
	1.1 Review of P-type and N-type semiconductor, Junction of P-type & N-type i.e. PN junction, Barrier voltage , depletion region ,Junction Capacitance 1.2 Forward biased & reversed biased junction, Diode symbol ,circuit diagram for characteristics (forward & reversed),Characteristics of PN junction diode, Specifications:-Forward voltage drop , Reversed saturation current, maximum forward current , power dissipation 1.3 Package view of diodes of different power ratings (to be shown during practical hours) 1.4 Zener diode: Construction, Symbol, Circuit diagram for characteristics of zener diode (Forward & Reverse),Zener & Avalanche Breakdown, Zener diode specifications – zener voltage, power dissipation, break over current, dynamic resistance & maximum reverse current.		
Unit 2	Rectifiers, Filters and Power Supply	8	
	2.1 Need of rectifier , definition ,Types of rectifier – Half wave rectifier, Full wave rectifier,(Bridge & centre tapped) Circuit operation 2.2 Input/output waveforms for voltage & current, Average (dc) value of current & voltage 2.3 (no derivation), Ripple , ripple factor , ripple frequency , PIV of diode used , efficiency of rectifier.(no derivation only definition), Comparison of three types of rectifier 2.4 Need of filters, Types of filters-A] shunt capacitor, B] Series inductor, C] LC filter ,D] π filter --- only circuit operation (no mathematical derivation),limitations & advantages 2.5 Voltage regulator- Simple voltage regulator circuit using zener, familirisation with IC regulator circuit (like 78XX , 79XX series etc.), IC 723 adjustable power supply, concept of Switch mode power supply (SMPS) block diagram only.		
Group-B			

Unit 3	Transistors, Switching and Optoelectronics Devices	8	
	<p>3.1 Bipolar Junction Transistor (BJT): Symbol of NPN & PNP types, Construction, Different types of package, Operation of NPN and PNP transistor – current flow, relation between different currents ,Transistor configurations – CB, CE, CC circuit diagram for input & output characteristics of each configuration, Input & output characteristics, Comparison between three configuration, Transistor parameters – input & output resistance and relation between them.</p> <p>3.2 Transistor specification – VCE Sat, IC Max, VCEO, ICEO, VCE Breakdown,Power dissipation.</p> <p>3.3 Field effect Transistor (FET): Symbol, Construction of JFET, Working principle and V-I characteristics of JFET, pinch- off voltage, drain resistance, transconductance, amplification factor and their relationship, Enhancement and depletion type MOSFET.</p> <p>3.4 TRIAC, DIAC, Silicon control rectifier (SCR):-Symbol, working, application (elementary ideas only) Comparison between Transistor and SCR.</p> <p>3.5 Elementary ideas of LED, LCD, photodiode, phototransistor and solar cell and their applications only.</p>		
Unit 4	Transistor Biasing	4	
	4.1 Need of biasing, concept of DC load line and AC load line,selection of Q point and Stabilization,Types of biasing circuits (no mathematical derivation) –a) Fixed biased circuit, b) Collector-to-base biased circuit,c) Voltage divider bias circuit		
	Group-C		
Unit 5	Small Signal Transistor Amplifiers	8	
	<p>5.1 Concept of amplification---Small signal amplifier using BJT, Determination of current, voltage & power gain, Input & output resistance.</p> <p>5.2 Single stage CE amplifier with voltage divider bias. Its explanation. Frequency response of single stage CE Amplifier, Bel and Decibel unit. Bandwidth & its significance.</p> <p>5.3 Cascade Amplifiers (Multistage Amplifier), Need of Multistage Amplifiers, Gain of amplifier.</p> <p>5.4 Types of amplifier coupling – RC, transformer & direct coupling.</p> <p>5.5 Two stage amplifier circuit diagram, working (briefly), frequency response, merits & demerits & applications of each.</p>		
Unit 6	Oscillator	5	
	6.1 Oscillator – Requirement of oscillator circuit, Barkhausen’s criteria of oscillator, circuit diagram and its application only -.Phase shift oscillator, Hartley oscillator, Colpitts oscillator, Crystal oscillator		
Unit 7	Op-Amp	4	
	7.1 OP-Amp Block diagram and use of op amp as - Inverting, non-inverting, summing amplifier, differentiator, integrator, buffer, comparator, Schmitt’s trigger.		
	SUB TOTAL	45	
	Internal Assessment Examination & Preparation of Semester Examination	6	
	Total	51	

Practicals

Skills to be developed: On satisfactory completion of the course, the students should be in a position to design power supply, amplifier and other analog circuits.

Intellectual Skills:

1. Interpret the results
2. Verify the tables

List of Practical: Any SIX(including MINI PROJECT)

Suggested List of Laboratory Experiments	
Sl. No.	
1.	To be familiar with the common assembly tools
2.	To be able to identify and test the following passive and active circuit elements: Resistor, capacitor, inductor, transformer, relay, switches, batteries/cells, diode, transistors, SCR, DIAC, TRIAC, LED, LCD, photodiode, phototransistors, Ics etc.
3.	To be familiar with the following basic instruments: Multimeter, oscilloscope, power supply and function generator.
4.	To practice soldering, desoldering and construct & test a battery eliminator and simple regulator circuit using Zener and ICs on a Bread Board and Vero Board.
5.	Input & output characteristics of transistor in CE mode
6.	To study VI characteristics of FET and MOSFET
7.	To study VI characteristics of SCR
8.	To determine frequency response characteristics of RC coupled amplifier circuit and calculation of bandwidth, midband gain, input impedance and output impedance for : a) Single-stage amplifier
9.	Study simple applications of OP AMP as summer

EXAMINATION SCHEME: END SEMESTER EXAMINATION

Group	Unit	Objective questions				Subjective Question			
		To be set	To be answered	Marks per question	Total Marks	To be set	To be answered	Marks per Question	Total marks
A	1,2	7	20	1	20	4	Five (at least One from each Group)	10	50
B	3,4	6				3			
C	5,6,7	7				3			

Text Books:			
Sl. No.	Name of the Author	Title of the Book	Name of the Publisher
1.	Malvino	Electronic Principles	Tata McGraw-Hill
2.	David A. Bell	Electronic Devices and Circuits	Oxford University Press
3.	Anil K. Maini	Electronics Devices and circuits	Wiley
4.	KK Ghosh	Basic Electronics	Platinum Publisher
5.	BL Theraja	Basic Electronics (Solid state)	S Chand
6.	S. Salivahanan	Electronic Devices and Circuits	Tata McGraw-Hill
7.	VK Mehta, Rohit Mehta	Principles of Electronics	S Chand
8.	Nagrath	Electronics Devices and Circuits	Prentice Hall of India
9.	Millman & Halkias	Electronic Devices and Circuits	Tata McGraw-Hill
10.	Chattopadhyay & Rakhshit	Electronic Fundamentals and Applications	New Age International
11.	Boylestad & Nashalsky	Electronic Devices and Circuits	Pearson
12.	Samar Chottopadhyay	Analog Electronics - I & II	Naba Prakashani

13.	Maitreyi Ray Kanjilal	Analog Electronics Circuits	JBBL
14.	Ganesh Babu	Linear Integrated Circuits	SCITECH
15.	JB Gupta	Electronics Devices & Circuits	Kataria & Sons
16.	Sanjay Sharma	Electronics Devices & Circuits	Kataria & Sons
17.	Mottershed	Electronic Devices and Circuits	Prentice Hall of India, N. Delhi
18.	Bhargava	Basic Electronic & Linear Circuits	Tata McGraw-Hill
19.	Sahadeb	Electronic Principle	Dhanpat Rai & Sons
20.	M.L. Anand	Modern Electronics	S Chand
21.	Dr. T. Thygrajan	Fundamentals of Electrical and Electronics Engg	SCITECH
22.	Prem Singh Jakhar	Basic Electronics	Dhanpat Rai Publishing Co
23.	Milman & Halkias	Integrated Electronics	Tata McGraw-Hill

Name of the Course : Diploma in Mechanical Engineering		
Subject: Manufacturing Process I		
Course code: ME	Semester : Third	
Duration : 17 week	Maximum Marks : 200	
Teaching Scheme	Examination Scheme	
Theory : 3 hrs/week	Semester Exam: 70 Marks	
Tutorial: hrs/week	Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 4 hrs/week	Internal Assessment: 20 Marks	
Credit: 5	Practical Sessional internal continuous evaluation: 50 Marks	
	Practical Sessional external examination: 50 marks	
Aim :-		
Sr. No		
1	The development in materials technology, computer technology and economics, coupled with knowledge about the requirements and demands of manufacturing, are the corner stones of the activities.	
Objective :-		
S No	The student will able to	
1	• Know and identify basic manufacturing processes for manufacturing different components.	
2	• Operate & control different machines and equipments.	
3	• Inspect the job for specified dimensions.	
4	• Produce jobs as per specified dimensions.	
5	• Select the specific manufacturing process for getting the desired type of output.	
6	• Adopt safety practices while working on various machines.	
Pre-Requisite:-		
Sr. No		
1	Depending on the educational background of the student, the previous knowledge is examined in order to determine if any supplementary examination in relevant subjects may be necessary.	
Contents		
Chapter	<i>Name of the Topic</i>	Hrs/week
GROUP:A		
01	<u>INTRODUCTION</u> 1.1 Classification of manufacturing processes: Shaping process, joining process & Finishing process	02
02	<u>Forging</u> 2.1 Introduction of Hot Working & Cold Working. Examples 2.2 Forging Processes – Drop forging, Upset forging, Die forging or press forging. 2.3 Types of dies - Open Die, Closed Die(Single Impression and Multi-impimpression) Closed die Forging operations - Fullering, Edging, Bending, Blocking, Finishing 2.4 Forgeable material and forgeability, Forging temperature, Grain flow in forged parts, Types of Presses and hammers.	04
03	<u>Rolling and Extrusion</u> 3.1 Principles of rolling and extrusion.	

	<p>3.2 Hot and cold rolling. 3.3 Types of rolling mills: 2 Hi, 3 Hi & 4 Hi mills. 3.4 Different rolled sections. 3.5 Methods of extrusion – Direct, Indirect, backward & impact Extrusion, Hot extrusion, Cold extrusion 3.6 Advantages, disadvantages & applications of rolling & extrusion.</p>	05
04	<p><u>Press working</u> 4.1 Types of presses and Specifications. 4.2 Press working operations - Cutting, bending, drawing, punching, banking, Notching, lancing, piercing, coining, embossing. 4.3 Die set components.- punch and die shoe, guide pin, bolster plate, stripper, stock guide, knockout. 4.4 Punch and die Clearances for blanking and piercing, effect of clearance</p>	05
GROUP:B		
05	<p><u>Lathe</u> 5.1 Cutting tool nomenclature & tool signature of single point cutting tool. 5.2 Orthogonal & oblique cutting, chip formation & type of chips 5.3 Types of lathes – Centre lathe, Capstan & Turret Lathe, CNC Lathe 5.4 Specification of Centre lathe. 5.5 Basic parts and their functions of centre lathe. 5.6 Operations and tools – Centering, facing, Turning, parting off, undercutting, grooving, Knurling, boring, thread cutting.</p>	06
06	<p><u>Drilling</u> 6.1 Classification. 6.2 Basic parts and their functions – Pillar drilling machine & Radial drilling machine. 6.3 Types of operations: drilling, boring, reaming, Counterboring, countersinking, chamfering, Spot facing, Trepanning 6.4 Specifications of drilling machine. 6.5 Types of drills and reamers</p>	04
07	<p><u>Milling</u> 7.1 Classification., Specifications& applications 7.2 Basic parts and their functions – column and knee type, universal milling machine 7.3 Types of operations(up milling, down milling) 7.4 Types of milling cutters</p>	03
GROUP:C		
08	<p><u>Casting</u> 8.1 Patterns - Material used, types, Patterns allowances, Cores, Core allowances. Core prints. 8.2 Moulds - Mould materials, Types of sand, Sand moulding, Pit moulding, machine molding. 8.3 Melting practice. Types of furnaces with specific application Cupola furnace, Electric arc furnace. 8.4 Green sand mould making process 8.5 Special casting processes: die casting, centrifugal casting, investment casting, Shell moulding 8.6 Casting defects & its remedies.</p>	08
09	<p><u>Welding</u> 9.1 Classification. 9.2 Gas welding techniques. 9.3 Types of welding flames. 9.4 Arc Welding – Principle, Equipment, Applications</p>	08

	9.5 Shielded metal arc welding. (Principle & Application) 9.6 Submerged arc welding. (Principle & Application) 9.7 TIG / MIG welding. (Principle & Application) 9.8 Resistance welding.(Principle & Application) - Spot welding, Seam welding, Projection welding 9.9 Welding defects. 9.10 Brazing and soldering: Types, Principles, Applications	
	Sub Total:	45
	Internal Assessment Examination & Preparation of Semester Examination	6
	Total	51

Practical:

Skills to be developed:

Intellectual Skills:

1. Identify basic manufacturing processes.
2. Understand the various method of operations in lathe m/c ,drill m/c & milling m/c
3. Understand the various method of forging
4. Identify joining methods for fabrication

Motor Skills:

1. Operate lathes & drilling machines.
2. Use welding machines and equipment
- 2 Use smithy/forging equipments
3. Set the tools, jobs and decide cutting parameters of machines
5. Inspect dimensions of jobs using measuring instruments

LIST OF PRACTICALS, Total 60 Hrs

- 1] Study of lathe (identify different parts, drives: (cone pulley drive& all gear drive), feed mechanism: (feed reversing mechanism and feed gear box, apron mechanism), work holding devices, tool holding devices, types of tool used in lathe work, study tool angles for a general purpose cutting tool used in lathe, setting of work and tools, operate lathe without work).
- 2] Practice on making a job involving Lathe operations like Facing, plain turning, Step Turning, grooving, knurling & chamfering; study & use of measuring instrument (batch of 10 students per job)
- 3] Study of drilling Machine (identify different parts, drive & feed mechanism, types of drill, drill holding device, work holding device, setting work and drill, operate drill machine).
- 4] Practice on making a job involving drilling operation of different diameter hole at different location, reaming operation at a particular hole, counter sinking operation at one hole. (batch of 05 students per job)
- 5] Study of different types of welding machines & equipments (Gas Welding set, Electric Arc Welding machine, Electric Resistance Welding machine), hand tools used, safety items used, connection details.& Study of different types of welding joints (Lap, Butt, Tee, Corner joint and edge joint) and different positions of welding (flat horizontal, vertical welding and over head welding); Bead practice, edge preparation, Tag welding.
- 6] Practice on making the welding joint: a) lap joint (material 25mmX6 mm MS flat – 100mm length), b) butt joint material 25mmX6 mm MS flat – 50mm length) c) T – Joint (material 25mmX6 mm MS flat – 50 mm length) d) Corner joint (material 25mmX6 mm MS flat– 50 mm length). (batch of 05 students per job)
- 7] Study of different types of cold & hot working process (Cold Working: shearing, bending, Hot working: Drawing Down, Upsetting, Punching, and Flattening), Study of tools & machines used in Smithy/Forging Shop. And Practice on different operations in smithy. (Any one from shearing, bending, drawing down, upsetting, punching, flattening).
- 8] Study & identify different types of hand tool, measuring instrument and machines used in fitting shop,

basic fitting practice like filing, drilling, tapping and making an 'L' shaped job (material: 25 X 6mm MS flat – 50mm length).

NOTE:

- a) Sl. No. 1, 3, & 5 are compulsory and submission of respective home assignments (20 Hrs.).
- b) From the rest at least 4 tasks have to be completed (40 Hrs.).

Examination Schedule Internal practical Sessional:

Making job (4 task) & submitting job sheet in scheduled time		4X5 = 20	
Viva - voce		4X2.5 = 10	
Attending classes for studying different machines and submitting respective assignment		3X4 = 12	
Viva voce & skill in operating machine		8	
Total:		50	

Examination Schedule: External practical Sessional examination
 Examiner : Lecturer in Mechanical Engineering & Foreman (Work Shop).

For Making job (4 task) & submitting signed job sheet in scheduled time		4X2.5 = 10	
On spot job		20	
viva voce on study		20	
		50	

End Semester EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3,4	08	ANY 20	1	20	4	FIVE (AT LEAST ONE FROM EACH GROUP)	10	50
B	5,6,7	06				3			
C	8,9	06				3			

Name of Authors	Titles of the Book	Edition	Name of the Publisher
S. K. Hajra Chaudary, Bose, Roy	Elements of workshop Technology – Volume I		Media Promoters and Publishers limited
S. K. Hajra Chaudary, Bose, Roy	Elements of workshop Technology – Volume II		Media Promoters and Publishers limited
B.S.Raghuwanshi	A Course in Workshop Technology Vol I & II		Dhanpat Rai & Co
D. L. Wakyl	Processes and design for manufacturing		Prentice Hall

KALPAKJIAN & SCHMID	Manufacturing Processes		Pearson Education, New Delhi
Amitabh Ghosh Mallik	Manufacturing Science		East-West Press Pvt. Ltd.
HMT, Bangalore	Production Technology		Tata Mc-Graw Hill
O. P. Khanna and Lal	Production Technology - Volume I & II		Dhanpat Rai Publications.
P. N. Rao	Manufacturing Technology Metal Cutting & Machine tools (Volume I & II)		Tata McGraw-Hill
Girling	All about Machine Tools		New age international limited.
Pabla B. S. M. Adithan	CNC machines		New age international limited.
R.B. Gupta	Production Technology		Satya Prakashan New Delhi
W.A.J. Chapman	Workshop Technology - Volume I , II & III		Viva Books (p) Ltd.
Jhon A Schey	Introduction to Manufacturing Processes		McGraw Hills International
M. Aduthan and A. B. Gupta	Manufacturing Technology		New Age International
JT. Black, Ronald A. Kohser	Degarmo's Materials and Processes in Manufacturing 11th Edition		Wiley
M.C. Shaw	Metal Cutting Principle		Oxford
A.B. Chattopadhyay	Machining & Machine Tool		Wiley
M.P. Groover	Fundamentals of Modern Manufacturing		Wiley
Jain & Chitale	Textbook of Production Engineering, 2nd ed.		PHI
DeGarmo's	Materials and Processes in manufacturing		wiley
PN Rao	CAD/CAM Principles & Applications		McGraw Hills
Sareen & Grewal	CAD/CAM theory & Concept		S. Chand
M. Mattson	CNC Programming		Cengage
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :- Nil			

Name of the Course : Mechanical Engineering				
Subject: Mechanical Engineering Drawing				
Course code: ME		Semester : Third		
Duration : 17 weeks		Maximum Marks : 150		
Teaching Scheme		Examination Scheme		
Theory : 3 hrs/week		Semester Exam: 35 Marks		
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 5 Marks		
Practical : 4 hrs/week		Internal Assessment: 10 Marks		
Credit: 5		Practical Sessional internal continuous evaluation: 50 Marks		
		Practical Sessional external examination: 50 marks		
Aim :-				
SL No				
1.	Understanding of drawing, which includes clear spatial visualization of objects and the proficiency in reading and interpreting a wide variety of production drawings.			
2.	Developing drafting skill to draw various component and assembly drawing			
3.				
Objective :-				
S No	The student will able to			
1	Interpret industrial drawings			
2	Interpret instructions related to manufacturing of components.			
3	Use IS convention of representing various machine components.			
4	Visualize the assembly of a given set of details of machine components.			
5	Know the significance & use of tolerances of size, forms & positions.			
Pre-Requisite:-				
S.No				
1	Sound pictorial ability.			
Contents			Hrs/week	
Chapter	Name of the Topic		Hours	Marks
01	Sectional Views To draw different (front view, side view and top view) orthographic and sectional views from given Isometric views of casting and machine parts.		10	
02	Intersection of solids Curves of intersection of the surfaces of the solids in the following cases (a) Prism with prism, Cylinder with cylinder, & Prism with Cylinder When (i) the axes are at 90 ⁰ and intersecting (ii) The axes are at 90 ⁰ and Offset (b) Cylinder with Cone When axis of cylinder is parallel to both the reference planes and cone resting on base on HP and with axis intersecting and offset from axis of cylinder		10	
03	Developments of Surfaces Developments of Lateral surfaces of oblique objects (cylinder, cone & pyramids) and their applications such as tray, funnel, Chimney, pipe bend, transition piece (square to circular).		10	
04	1. Standard convention using SP – 46 (1988) (a) Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber (b) Long and short break in pipe, rod and shaft.		04	

	(c) Ball and Roller bearing, pipe joints, cocks, valves, internal / external threads. (d) Various sections- Half, removed, revolved, offset, partial and aligned sections. (e) Knurling, serrated shafts, splined shafts, and chain wheels. (f) Springs with square and flat ends, Gears, sprocket wheel (g) Countersunk & counterbore. (h) Tapers		
05	Limits, Fits and Tolerances 1. Characteristics of surface roughness- Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods. 2. Introduction to ISO system of tolerancing, dimensional tolerances, elements of interchangeable system, hole & shaft based system, limits, fits & allowances. Selection of fit. 3. Geometrical tolerances, tolerances of form and position and its geometric representation. 4. General welding symbols, sectional representation and symbols used in Engineering practices	07	
06	Details to Assembly 1. Introduction- 2. Couplings – Rigid flanged coupling(for Exam) & Universal couplings 3. Bearing – Foot Step Bearing (for Exam)& Plummer block 4. Lathe tool Post (for Exam) 5. joining of two rod ends: Knuckle joint(for Exam)& socket & spigot joint (for Exam) 6. Screw Jack 7. C I pulley (for Exam)& stepped cone pulley (for Exam)	32	
07	Assembly to Details / component Drawing 1. Introduction – 2. Foot Step Bearing(for Exam) 3. Lathe Tail Stock 4. Drilling Jig (for Exam) 5. Piston & connecting rod 6. Gland and Stuffing box Assembly 7. Valve – Not more than eight parts 8. Knuckle joint (for Exam)& socket & spigot joint (for Exam) 9 Spur Gear(for Exam)	32	
	Sub Total: Lecture & Practical Classes	105	35
	Internal Assessment examination and preparation for semester examination	14	
	Grand Total:	119	

Practical:

Skills to be developed:

Intellectual skills:

1. Understand interpenetration of solid.
2. Interpret limits, fits and tolerances on a given drawing.
3. Visualize assembly of components from given details.
4. Interpret Conventional symbols as per IS code SP46.
5. Identify different materials and their properties.

Motor Skills:

1. Draw front view and top view of solids Penetrating one with other.
2. Conventionally represent limit, fits and tolerances on a given drawing as per the manufacturing processes.
3. Give surface roughness values and symbols on a part drawing
4. Setting and use of different drawing equipments.

5. Record bill of materials in assembly drawing.

List of Practical: (Use first angle method of projection)

1. Intersection of Solids: One sheet (A0 size)
2. Development of surfaces: two sheets (A0 size) of different objects.
3. Auxiliary views: One sheet (A0 size) containing 4 problems
4. Conventional Representation as per SP – 46 (1988): – as home assignment on Sketch Book
5. Limit, Fit, Tolerances and Machining Symbols: – as home assignment on Sketch Book
6. Assembly to detailed drawings of components including Bill of Materials & conventional representation of tolerances and surface finish symbols: at least five problems on A0 size sheet + balance on Sketch Book as home assignment.
7. Details to Assembly including Bill of Materials: at least five problems on A0 size sheet + balance on Sketch Book as home assignment.

Text Books:	Title of the Book	Name of Publishers
N.D.Bhatt	Machine Drawing	Charotar Publication, Anand
N.D.Bhatt	Engineering Drawing	Charotar Publication, Anand
Bureau of Indian Standards	Engineering Drawing Practice for School and colleges : IS Code SP 46 (1988)	Bureau of Indian Standards
L.K.Narayanan, P.Kannaich, K.VenkatReddy	Production Drawing	New Age International Publication
P.S.Gill	Machine Drawing	S.K.Kataria and Sons
Basant Agarwal, C M Agarwal	Engineering Drawing	Tata McGraw Hill
Sidheshwar	Machine Drawing	Tata McGraw Hill
Basudev Bhattacharyya	Machine Drawing	Oxford University Press
Barghese	Engineering Graphics	McGraw Hill
Ajeet Singh	Machine Drawing include Auto CAD	McGraw Hill
K.C. Jhon	A text book of Machine Drawing	PHI
R.K Dhawan	A text book of Machine Drawing	S. Chand

Reference books :- Nil

Practical Sessional Examination Scheme:

Practical Internal Sessional Continuous Evaluation

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer

Submission of Drawing Sheet & Home assignment in scheduled time	30
Viva voce	20
Total	50

Practical External Sessional Examination

Examiner for External Sessional Examination :	Lecturer in Mechanical Engineering / Jr. Lecturer in Mechanical Engineering
Submission of	30

signed drawing sheet & home assignment	
Viva voce	20
Total	50

SEMESTER EXAMINATION SCHEME

GROUP	CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3	03	10	1	10	03	01	10	25
B	4,5	05				00			
C	6,7	02				02	01	15	

Name of the Course : Mechanical Engineering				
Subject: Mechanical Engineering Materials				
Course code: ME		Semester : Third		
Duration : 17 weeks		Maximum Marks : 100		
Teaching Scheme		Examination Scheme		
Theory : 3 hrs/week		Internal Assessment: 20 Marks		
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks		
Practical : hrs/week		End Semester Exam: 70 Marks		
Credit: 3				
Aim :-				
S.No				
1	To provide students with a specialist education and training in the area of metals, ceramics, polymers and composites for industrial engineering applications from biomedical device manufacture to future energy solutions.			
Objective :-				
S No	The student will able to			
1	know the properties of Engineering Materials like Metals, non-metals, ferrous metals and non-ferrous metals			
2	Interpret Iron –Iron Carbide phase equilibrium diagram to find temperatures for heat treatment processes.			
3	Select the proper materials for different applications like cutting tools, dies, gears & other applications.			
4	Understand various heat treatment processes & its applications for various components to improve its mechanical properties.			
5	Understand powder metallurgy process and its applications.			
6	Understand Non Destructive testing methods & its applications			
Pre-Requisite:-Nil				
Contents			Hrs/week	
Chapter	Name of the Topic		Hours	Marks
GROUP-A				
	Mechanical Engineering Materials and their Properties			
01	1.1 Introduction, Classification and Application of Engineering materials I.S. specification of materials like plain carbon steel, Grey Cast iron, low alloy steels & bearing Materials. 1.2 Properties of metals- Physical Properties – Structure, Density, Melting point. Mechanical Properties –hardness, hardenability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion 1.3 Introduction to Corrosion, types of Corrosion, Corrosion resisting materials		05	05
02	Ferrous Metals and Alloys 2.1 Characteristics and application of ferrous metals 2.2 Phase equilibrium diagram for Iron and Iron Carbide. 2.3 Flow diagram for production of Iron and Steel, Classification, composition and uses of cast iron 2.4 Classification, composition and application of low carbon steel, medium carbon steel and high carbon steel with their chemical composition. Effect of sulphur, silicon and phosphorous on plain carbon steel. 2.5 Alloy Steels: - Low alloy steel, high alloy steel, tools steel & stainless steel. Effect of various alloying elements such as – Chromium, nickel, manganese, molybdenum, tungsten, vanadium. 2.6 Tool Steels (properties & applications): - High speed Steels (HSS), Hot & cold Working dies, shear, punches. 2.7 Magnetic materials: - Properties & Applications of commonly used magnetic materials (Permanent magnets and temporary magnets). 2.8 Special Cutting Tool Materials (Properties & Applications): Diamond, Stellites , Tungsten Carbide & Ceramics.		10	18

GROUP-B			
03	Non Ferrous Metals and Alloys 3.1 Properties, applications of Copper alloys (naval brass, muntz metal, Gun metal & bronzes), Aluminium alloys (Y-alloy & duralumin) & bearing materials like white metals, leaded bronzes & copper lead alloys. 3.2 Desired properties of bearing materials.	06	12
04	Heat Treatment of Steels 4.1 TTT Diagram 4.2 Introduction to Heat treatment processes such as Annealing, subcritical annealing, Normalizing, Hardening, Tempering (Austempering & Martempering) - Principle, Advantages, limitations and applications. 4.3 Surface Hardening - Methods of surface hardening, i) case hardening ii) Flame Hardening, iii) Induction Hardening, iv) Nitriding, v) Carburizing Principle, advantages, limitations and applications.	8	15
GROUP-C			
05	Non Metallic Materials 5.1 Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses of Thermoplastics, Thermosetting Plastics & Rubbers. 5.2 Thermoplastic Plastics – Uses of ABS, Acrylics, Nylons and Vinyls. 5.3 Thermosetting Plastics – Characteristics and uses of polyesters, Epoxies, Melamines & Bakelites. 5.4 Rubbers – Neoprene, Butadiene, Buna & Silicons – Properties & applications. 5.5 Properties and applications of following Engineering Materials – Ceramics, Abrasive, Adhesive and Insulating materials such as Cork, Asbestos, Thermocole and Glass Wool. 5.6 Introduction to Composite Materials – Properties & Applications of Laminated & Fiber reinforced materials.	08	10
06	Powder Metallurgy 6.1 Advantages, limitations and applications of Powder Metallurgy for engineering products. 6.2 Brief Description of Process of Powder Metallurgy – Powder making, blending, compacting, sintering, infiltration & impregnation. 6.3 Applications of Powder metallurgy for tungsten carbide tip tools & porous bearing.	04	05
07	Nondestructive Testing 7.1 Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing. 7.2 Nondestructive testing methods – Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrant test, Magnaflux test – Comparison & applications.	04	05
	Sub Total	45	70
	Internal Assessment Examination & Preparation of Semester Examination	06	
	Total:	51	

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
O.P.Khanna	A Text Book of Material Science and Metallurgy		Dhanpat Rai and Sons [1999]
Dr.V.D. Kodgire	Material Science and Metallurgy		Everest Publishing House
R.K.Rajput	Material Science and		S.K.Katari and Sons

	Engineering		
S.K.Hazra and Choudhari	Material Science and Processes		Indian Book Distribution Co.
Kenneth G. Budinski and Micheal K. Budinski	Engineering Materials Properties and Selection		Pearson Education, New Delhi
ASME	ASME Material Manuals		ASME
Sidney H. Avner	Introduction to Physical metallurgy		Tata Mc Graw Hill edition
P. C. Sharma	A Text Book of Production Technology.		S. Chand & Co.
Khan & Haq	Manufacturing Science		PHI
Rajan Sharma & Sharma	Heat Treatment		PHI
Rghavan	Material Science & Engineering		PHI
Avner	Engineering Materials (Physical Metallurgy)		Mc Graw Hill
V. Rajendran	Material Science		Mc Graw Hill
Smith	Material Science & Engineering		Mc Graw Hill
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :-			
1. Flow diagram of steel making processes.			
2. Flow diagram of production of pig iron.			
3. Iron & iron carbide equilibrium diagram			
4. T T T diagram			

EXAMINATION SCHEME

GROUP	CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2	06	20	1	20	3	FIVE (AT LEAST ONE FROM EACH GROUP)	10	50
B	3,4	06				3			
C	5,6,7	8				4			

Name of the Course : Mechanical Engineering			
Subject: THERMAL ENGINEERING - I			
Course code: ME		Semester : Third	
Duration : 17 weeks		Maximum Marks : 150	
Teaching Scheme		Examination Scheme	
Theory : 3 hrs/week		Internal Assessment: 20 Marks	
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 2 hrs/week		End Semester Exam: 70 Marks	
Credit: 4		Practical: Internal Sessional continuous evaluation: 25 Marks	
		Practical: External Sessional examination: 25 marks	
Aim :-			
S. No.			
1	To study of various sources of energy.		
2	To understand the concept of energy, work, heat & their conversion.		
3	To understand the concept of thermodynamics and study of various thermodynamic laws with their applications.		
4	To study the properties of gas & properties of steam and their application in different thermodynamic system.		
5	To study the basics of Heat transfer and its application.		
Objective :-			
S. No.	The Students should be able to:		
1.	<ul style="list-style-type: none"> Know various sources of energy & their applications. 		
2.	<ul style="list-style-type: none"> Apply fundamental concepts of thermodynamics to thermodynamic systems. 		
3.	<ul style="list-style-type: none"> Understand various laws of thermodynamics. 		
4.	<ul style="list-style-type: none"> Apply various gas laws & ideal gas processes to various thermodynamic systems. 		
5.	<ul style="list-style-type: none"> Understand the properties of steam and should be able to solve simple numerical of two phase system by using steam table / Mollier chart. 		
6.	<ul style="list-style-type: none"> Understand the basics of Heat transfer and its application. 		
Pre-Requisite: Elementary knowledge on Physics and basic Mathematics			
Contents			Hrs/week
THERMAL ENGINEERING- I			
Chapter		Name of the Topic	
		Hours	
		Marks	
GROUP-A			
1	1.0	SOURCES OF ENERGY	06
	1.1	Brief description of energy sources, including Classification of energy sources. Renewable and Non-Renewable sources of energy. Conventional and Non-Conventional sources of energy.	
	1.2	Brief description on available form of energy, conversion to useful form and its application.	
	1.2.1	Fossil fuels, including CNG, LPG.	
	1.2.2	Solar energy, including	

	1.2.3 1.2.4 1.2.5 1.2.6 1.2.7	Flat plate and concentrating collectors. Solar Water Heater. Photovoltaic Cell, Solar Distillation. Wind energy, Tidal energy, Geothermal energy. Biomass energy, including Biogas, Bio-diesel. Hydroelectric energy, Nuclear energy Fuel cell		
2	2.0 2.1 2.1.1 2.1.2 2.1.3 2.1.4 2.1.5 2.1.6 2.1.7 2.1.8 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.3 2.3.1 2.3.2 2.3.3 2.3.4	FUNDAMENTALS OF THERMODYNAMICS Fundamental concepts of the following: Pure substance. System, Boundary, Surrounding. Classification of system, including open system, closed system, isolated system. Properties of system, including Intrinsic and Extrinsic properties with units and its conversion like Pressure (Atmospheric Pressure, Gauge Pressure and Absolute pressure), Volume, Sp-mass and Temperature. State of a system, change of state, Path, Process. Equilibrium of a system, including Mechanical, Thermal, Chemical and Thermodynamic equilibrium. Cycle, including Thermodynamic cycle and Mechanical cycle. S.T.P and N.T.P. Energy: Definition and units of Transient energy (Work and Heat), Stored energy (P.E., K.E and Internal energy), Point Function & Path Function. Displacement work & Flow work. Definition & units of Power. Definition and units of Enthalpy. Definition of Specific heat, Specific heat at constant pressure (Cp), Specific heat at constant volume (Cv) and Adiabatic Index (Cp/Cv). Laws of Thermodynamics and their Application: Zeroth Law of Thermodynamics and Temperature measurement. Principle of Energy Conservation. First law of Thermodynamics, Simple Energy Equation for non-flow process ($Q - W = \Delta E$, Steady Flow Energy Equation and its application to system like boiler, nozzle, turbine, compressor & condenser (Simple numerical), Concept of Perpetual Motion Machine of 1 st kind, limitations of First law of Thermodynamics. Second Law of Thermodynamics: Kelvin – Plank Statement & Clausius’ Statement, Heat Engine, Heat Pump and Refrigerator, Thermal Efficiency, C.O.P., Concept of Perpetual Motion Machine of 2 nd kind, definition and units of Entropy.	10	
3	3.0 3.1 3.2 3.3 3.5	PROPERTIES OF GASES Definition and comparison of Ideal Gas & Real Gas. Charle’s Law, Boyle’s Law and Avogadro’s Law, Equation of State ($PV=mRT$), Characteristic Gas Constant and Universal Gas Constant. Relation among two Specific Heats (Cp & Cv) with Characteristic Gas Constant. Ideal gas processes: Governing equation of processes (Pressure &	10	

		Volume relations), Representation of the processes on P-V and T-S diagram, Deduce the expression to calculate Work transfer, Heat Transfer, Change of I.E., change of enthalpy and Change of Entropy for the following Processes: Constant Pressure Process, Constant volume Process, Constant temperature Process, Adiabatic Process & Polytropic Process (Simple numerical on Processes).		
		GROUP-B		
4	4.0	PROPERTIES OF STEAM	10	
	4.1	Explanation of steam generation process with the help of P-V & T-S diagram.		
	4.2	Basic terms & properties of steam: Saturation Temperature, Saturation Pressure, Saturated liquid, Dry Saturated Steam, Wet Saturated Steam, Saturated steam, Superheated Steam, Critical Temperature, Dryness Fraction, Degree of Superheat, Sensible Heat, Enthalpy of Evaporation or Latent Heat of Evaporation, Enthalpy of Steam, Specific Volume, Entropy of Steam. (Simple numerical) Steam Table & its use, Enthalpy- Entropy diagram of steam (Mollier Chart) and its use.		
	4.3	Measurement of dryness fraction: Throttling process, Steam Calorimeters, Types and Principle for calculation of Dryness Fraction of Steam using a) Throttling Calorimeter, & b) Combined Separating & Throttling Calorimeter (Simple numerical).		
	4.4	Comparison of Gas & Vapour		
	4.5	Vapour Processes: Constant Pressure, Constant Volume, Constant Entropy & Constant Temperature processes and representation of the processes on P-V, T-S & H-S diagram,(Simple numerical using Steam Table and Mollier Chart)		
5	5.0	BASIC OF HEAT TRANSFER	09	
	5.1	Explanation of Three Basic Modes of Heat Transfer (Conduction, Convection and Radiation).		
	5.2	Fourier's Law of heat conduction, Thermal Conductivity and concept of Thermal Resistance.		
	5.2.1	Heat Transfer through Plane Homogeneous Wall, Heat Transfer through Composite Wall, Heat Transfer through Hollow Cylinder and Heat Transfer through combined Conduction and Convection (Simple numerical).		
	5.3	Stefan-Boltzmann Law of heat radiation with explanation of terms with unit. (No numerical)		
	5.3.1	Definition and inter relation of Absorptivity, Reflectivity and Transmissivity		
	5.3.2	Concept of Black and Gray Bodies.		
	5.4	Principle of heat exchanger, Construction, working principle and application of Shell and Tube, Plate Type, Multiphase Heat Exchangers. (No deduction and numerical)		

Sub Total:	45	
Internal Assessment Examination & Preparation of Semester Examination	6	
Total	51	

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. Interpret steam tables, mollier chart and relationship between different thermodynamic properties.
5. Understand modes of heat transfer and concept of heat exchanges.

Motor Skills :

1. Conduct trial on solar water heating system.
2. Study of schematic layout of Wind Power Generation Plant / Biogas Plant / Hydroelectric Power Plant.
3. Conduct trial on Bomb Calorimeter for calculating the calorific value of coal.
4. Conduct trial on Dryness Fraction Measuring Instrument for calculating the dryness fraction of steam.
5. Conduct trial on the setup for calculation of thermal conductivity of metal rod.

List of Practical:

1. Study of Solar Water Heating System.
2. Study of schematic layout of Wind Power Generation Plant / Biogas Plant / Hydroelectric Power Plant.
3. Study & measurement of calorific value of solid fuel using Bomb Calorimeter.
4. Study of Pressure Gauge and its use.
5. Calculation of Characteristic Gas Constant of air based on some practical data.
6. Study and Measurement of Dryness Fraction of Steam by Dryness Fraction Measuring Instrument.
7. Determination of thermal conductivity of a solid metallic rod.
8. Verification of Stefan-Boltzmann's law.
9. Study and compare various Heat Exchangers such as Radiators, Condensers, Evaporators (Shell and Tube Heat Exchanger) & Plate Type Heat Exchangers.

Note: At least FIVE (05) no. of Practical/Study are to be conducted.

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Domkundwar V. M.	A Course in Thermal Engineering.		Dhanpat Rai & Co.
Dr. D.S.Kumar	Engineering Thermodynamics (Principles & Practices)		S.K. Kataria & Sons
P. L. Ballaney	A Course in Thermal Engineering.		Khanna Publishers
R. S. Khurmi	A text book of Thermal Engineering.		S. Chand & co. Ltd.
R. K. Rajput	A Course in Thermal Engineering.		Laxmi Publication, Delhi
Patel and Karmchandani	Heat Engine Vol. - I & II		Acharya Publication
P. K. Nag	Engineering Thermodynamics		Tata McGraw Hill
B. K. Sarkar	Thermal Engineering		Tata McGraw Hill
A.R. Basu	Thermal Engineering (Heat Power)		Dhanpat Rai & Co.
R.K. Rajput	Non Conventional Energy Sources and Utilisation		S.Chand & Company Ltd., 2012.
G.D. Rai	Non Conventional Energy Sources -		Khanna Publishers, New Delhi, 1999.
B.H.Khan	Non-Conventional Energy		Tata Mc Graw Hill, 2 nd

	Resources		Edn, 2009
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :-			
<ol style="list-style-type: none"> 1. Prepare a chart showing different sources of energy and their applications. 2. Draw P-V, T-S & H-S plane of steam and display saturated liquid line, dry saturated vapour line, wet saturated steam zone, critical point, triple point, superheated zone & under cooled liquid zone. 3. Draw P-V, T-S, H-S & P-T plane of steam and show constant pressure, constant temperature, constant volume & constant entropy line. 			

EXAMINATION SCHEME: END SEMESTER EXAMINATION

GROUP	MODULE OR CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3	12	ANY 20	1	20	6	FIVE, (AT LEAST TWO FROM EACH GROUP)	10	50
B	4,5	8				4			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time	5*3 = 15		
VIVA VOCE	10		
TOTAL	25		

EXTERNAL Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments/study)	5*2 = 10		

On spot experiment (one for each group consisting 15 students / explanation of study item)	10		
VIVA VOCE	5		
TOTAL	25		

Name of the Course : Mechanical Engineering		
Subject: Professional Practices-I		
Course code:	Semester : Third	
Duration : 17 weeks	Maximum Marks : 50	
Teaching Scheme	Examination Scheme	
Theory : hrs/week	Practical: Internal Sessional Continuous Evaluation: 25 Marks	
Tutorial: hrs/week	Practical: External Sessional Examination: 25 marks	
Practical : 2 hrs/week		
Credit: 1		
Aim :-		
S.No		
1	To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.	
Objective :-		
Sl. No.	The student will able to:	
1	<ul style="list-style-type: none"> Acquire information from different sources. 	
2	<ul style="list-style-type: none"> Prepare notes for given topic. 	
3	<ul style="list-style-type: none"> Present given topic in a seminar. 	
4	<ul style="list-style-type: none"> Interact with peers to share thoughts. 	
5	<ul style="list-style-type: none"> Prepare a report on industrial visit, expert lecture. 	
Pre-Requisite:-Nil		
Contents		
Chapter	Name of the Topic	Hrs/week
01	Industrial Visits: Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. ONE industrial visits may be arranged in the following areas / industries : <ul style="list-style-type: none"> Manufacturing organizations for observing various manufacturing processes including heat treatment. Material testing laboratories in industries or reputed organizations. Auto workshop / Garage. Plastic material processing unit. 	5 hours
02	Individual Assignments: Individual student should submit a report of the same, to form a part of the term work. Any two from the list suggested <ul style="list-style-type: none"> Process sequence of any two machine components. Write material specifications for any two composite jobs. Collection of samples of different plastic material or cutting tools with properties, specifications and applications. Preparing models using development of surfaces. Select different materials with specifications for at least 10 different machine components and list the important material properties desirable. Select 5 different carbon steels and alloy steels used in mechanical engineering applications and specify heat treatment processes employed for improving the properties. 	5 hours

	<ul style="list-style-type: none"> List the various properties and applications of following materials <ul style="list-style-type: none"> a) Ceramics b) fiber reinforcement plastics c) thermo plastic plastics d) thermo setting plastics e) rubbers. 	
03	<p>Computer Aided Mechanical Engineering Drawing using CADD software:</p> <p>Basic screen components – Starting a drawing: Open drawings, Create drawings– Co-ordinate systems: Absolute co-ordinate system, Relative co-ordinate system – Direct distance method – Saving a drawing:</p> <p>Opening an existing file – Concept of Object – Object selection methods: Pick by box, Window selection, Crossing Selection, All, Fence, Last, Previous, Add, Remove – Erasing objects: OOPS command, UNDO / REDO commands – ZOOM command – PAN command, Panning in real time – Setting units – Object snap.</p> <p>DRAW COMMANDS Drawing of LINE, CIRCLE, ARC RECTANGLE, ELLIPSE, POLYGON, POLYLINE, DONUT, MULTILINE</p> <p>EDITING COMMANDS MOVE ,COPY , OFFSET , ROTATE , SCALE , STRETCH , LENGTHEN , TRIM , EXTEND , BREAK , CHAMFER , FILLET , ARRAY , MIRROR , MEASURE , DIVIDE , EXPLODE , MATCHPROP , Editing with grips: PEDIT.</p> <p>DRAWING AIDS Layers – Layer Properties Manager dialog box – Object Properties LTSCALE Factor, Auto Tracking, REDRAW, REGEN.</p> <p>CREATING TEXT Creating single line text – Drawing special characters – Creating multiline text – Editing text – Text style</p> <p>BASIC DIMENSIONING Fundamental dimensioning terms: Dimension lines, dimension text, arrowheads, extension lines, leaders, centre marks and centrelines, alternate units – Associative dimensions – Dimensioning methods – Drawing leader, Editing dimensions by stretching – Editing dimensions by trimming & extending – Editing dimensions, Editing dimension text: , Updating dimensions ,Creating and restoring Dimension styles.</p> <p>HATCHING Basics of HATCHING – Boundary Hatch Options: Quick tab, Advance tab – Hatching around Text, Traces, Attributes, Shapes and Solids – Editing Hatch Boundary.</p> <p>PLOTTING OF DRAWINGS Plot Configuration – Pen Assignments – Paper Size & Orientation Area – Plot Rotation & Origin – Plotting Area – Scale</p> <p>PRACTICE WITH COMPLETE DRAWING Each student is required to prepare a set of 2D drawing (handle, Hooke, wrench, gasket, orthographic projections of 1st, 2nd & 3rd Semester drawing) to practice above CADD commands and any other drawings approved by the teacher-in-charge.</p> <p>Any two assembly drawing of the following:</p> <ol style="list-style-type: none"> 1] Cotter Joint. 2] Knuckle Joint 3] Screw Jack. 4] Foot step bearing. 	20 hours

	5] Universal Coupling 6] Flange Coupling 7] Tail stock 8] Piston of SI engine.	
	Total	30 hours
Text Books		
Name of Authors	Titles of the Book	Edition
Robert M. Thomas	Advanced AutoCAD	
R Cheryl	Beginning AutoCAD 2011- Exercise Book (W/2 DVDs)	
D Raker & H.Rice	Inside Autocad	
George Omura	Mastering Autocad 2010 & Autocad LT 2010	
David Frey	AutoCAD 2013 and AutoCAD LT 2013: No Experience Required	
Sham Tickoo	AutoCAD 2013 for Engineers & Designers	
OnSoft	AutoCAD 2013 & AutoCAD LT 2013	
Reference books :- Nil		
Suggested List of Laboratory Experiments :- Nil		
Suggested List of Assignments/Tutorial :- Nil		

Examination Scheme:	
Internal Practical Sessional Examination	
Topic	Marks
1 - Submission of project report on industrial visit on scheduled date.	5
2 - Submission of two reports on individual assignments on scheduled date.	5
3 - Practice of CADD software.	10
4 - Viva – voce.	5
Total:	25
External Practical Sessional Examination	
Topic	Marks
1 - Submission of signed report & assignment.	5
2 - On spot CAD Drawing.	15
3 - Viva voce.	5
Total:	25

Name of the Course : Mechanical Engineering			
Subject: THERMAL ENGINEERING - II			
Course code: ME		Semester : Forth	
Duration : 17 weeks		Maximum Marks : 150	
Teaching Scheme		Examination Scheme:	
Theory : 3 hrs/week		Internal Assessment: 20 Marks	
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 2 hrs/week		End Semester Exam: 70 Marks	
Credit: 4		Practical: Internal Sessional continuous evaluation: 25 Marks	
		Practical: External Sessional examination: 25 marks	
Aim :-			
S. No.			
1	To study the Boilers and their application in different process industries.		
2	To study the Steam Power Cycles and their application in actual power generation.		
3	To study the Steam Condensers and their application in actual power generation.		
4	To study the Air Compressors and their application in different process industries.		
5	To understand the fundamentals of Refrigeration and Air-Conditioning.		
Objective :-			
S. No.	The Students should be able to:		
1.	<ul style="list-style-type: none"> Explain construction & working principle of different Boilers and their different Mountings and Accessories. 		
2.	<ul style="list-style-type: none"> Understand the Steam Power Cycles and their application in actual power generation. 		
3.	<ul style="list-style-type: none"> Explain construction & working principle of different Steam Condensers and their utility in actual power generation. 		
4.	<ul style="list-style-type: none"> Select appropriate type and calculate performance parameters of Air Compressors to suit the requirements. 		
5.	<ul style="list-style-type: none"> Explain Refrigeration and Air-Conditioning Processes and their application. 		
Pre-Requisite: Elementary knowledge on Physics, basic Mathematics and Thermal Engineering-I			
		Contents	Hrs/week
THERMAL ENGINEERING- I			
Chapter	Name of the Topic		Hours
	GROUP-A		Marks
1	1.0	BOILERS (STEAM GENERATOR)	09
	1.1	Classification of Boilers.	
	1.2	Fire Tube & Water Tube Boilers with example, working principle, difference, applications.	
	1.3	Construction & working principle of Cochran, Babcock and Wilcox and La-Mont Boilers.	
	1.4	Definition of Boiler Mountings and Accessories, important names of Boiler Mountings and Accessories and their functions.	
	1.5	Basic conception and comparison of Stoker fired, Fluidized Bed	

	1.6	and Pulverised Fuel Boilers. Boiler Performance (Simple numerical on Boiler Performance). Boiler Draught, Classification and comparison of boiler draught and Calculation of chimney heights (Simple numerical related to chimney heights calculation)		
	1.7	Necessity of boiler feed water treatment.		
	1.8	Modern high pressure boiler & its characteristics.		
2	2.0.0 2.1.0 2.1.1 2.1.2 2.1.3 2.2.0 2.2.1 2.2.2 2.3.0 2.3.1 2.3.2 2.3.3 2.3.4	STEAM POWER CYCLES Reversible Cycle. Carnot Gas Power Cycle and Carnot Vapour Power Cycle with representation of the same on P-V & T-S diagrams. Deduction of Thermal Efficiency of Carnot Power Cycle (Simple numerical on Carnot Power Cycle with steam). Impracticability of Carnot Cycle in actual cases. Rankine Cycle with & without feed pump work and representation of the same on P-V, T-S & H-S diagrams. Comparison between Carnot and Rankine Cycles. Definition of Thermal Efficiency, Work Ratio and Specific Steam Consumption. Basic Principle, representation on P-V, T-S & H-S diagrams, labelled schematic flow diagram and utility of the following cycles: (No numerical) Modified Rankine Cycle. Simple Reheat Cycle. Simple Regenerative Cycle. Actual Reheat-Regenerative Cycle.	10	
3	3.0 3.1.0 3.1.1 3.1.2 3.1.3 3.1.4 3.2.0 3.2.1	STEAM CONDENSER Working Principle, Purpose of using and Classification of Steam Condensers. Comparison between Surface Condenser and Jet Condenser. Dalton's Law Of Partial Pressure as applicable to Condenser. Definition of Condenser Vacuum, Vacuum Efficiency and Condenser Efficiency. (No numerical) Sources of air leakage in Steam Condenser. Working Principle, Purpose of using and Classification (Natural Draught and Mechanical Draught) of Cooling Towers. Labelled schematic flow diagram of Cooling Water Circulation of a Surface Condenser with and without Cooling Tower.	08	
GROUP-B				
4	4.0.0 4.1.0 4.1.1 4.1.2	AIR COMPRESSOR Uses of Compressed Air Working Principle and Classification of Air Compressors. Definition of Compression Ratio, Compressor Capacity, Free Air	08	

	<p>4.2.0 Delivery and Swept volume. Reciprocating air compressor</p> <p>4.2.1 Construction and Working Principle of Single Stage and Two Stage Compressor.</p> <p>4.2.2 Volumetric Efficiency, Isothermal Efficiency & Mechanical Efficiency. (Simple numerical on single stage compressor)</p> <p>4.2.3 Advantages of Multi Staging.</p> <p>4.3.0 Rotary Compressor</p> <p>4.3.1 Construction and Working Principle of Screw, Lobe, Vane and Centrifugal Compressors. (No numerical)</p> <p>4.3.2 Comparison and Applications of Reciprocating and Rotary Compressors.</p> <p>4.4.0 Purification of Air to remove Oil, Moisture and Dust.</p> <p>4.5.0 Methods of energy saving in Air Compressors.</p>		
5	<p>5.0 REFRIGERATION & AIR CONDITIONING</p> <p>5.1.0 Definition of Refrigeration, Tonne of Refrigeration (Unit of Refrigeration) and Coefficient of Performance (COP) of Refrigerator & Heat Pump.</p> <p>5.1.1 Refrigerant, desirable properties of a refrigerant and common commercial refrigerants & their suitability of use.</p> <p>5.1.2 Air Refrigeration: Basic Principle, representation on P-V & T-S diagrams, labelled schematic flow diagram Bell Coleman Cycle (Reversed Joule Cycle). (Simple numerical)</p> <p>5.1.3 Vapour Compression Refrigeration: Basic Principle, representation on P-V, P-H & T-S diagrams, labelled schematic flow diagram and function of components of Ideal Vapour Compression Refrigeration Cycle. (No numerical)</p> <p>5.1.4 Application of Refrigeration System: Water Cooler, Refrigerator, Ice Plant and Cold Storage. (Labelled schematic lay-out only)</p> <p>5.2.0 Basic concept of Psychrometry including the following: Dry air & Moist air, Saturated air & Unsaturated air. Dry-bulb temperature, Wet-bulb temperature, Dew-point temperature and Psychrometer. Relative Humidity, Specific Humidity and Degree of saturation. Partial Pressure of Air & Vapour and Enthalpy of Moist Air. Psychrometric Chart. (No numerical)</p> <p>5.3.0 Definition of Air-Conditioning and classification of Air-Conditioning Systems.</p> <p>5.4.0 Schematic lay-out and representation on Psychrometric Chart of the following Air-Conditioning Processes: Sensible heating and cooling, Humidification and dehumidification, Humidification with heating and cooling, Dehumidification with heating and cooling &</p>	10	

	Mixing of two air streams (No numerical).		
		Sub Total:	45
Internal Assessment Examination & Preparation of Semester Examination			6
		Total	51

Practical:

Skills to be developed:

Intellectual Skill :

1. Understand working principle and construction of Boilers and their application.
2. Understand basic concept of Steam Power Cycles.
3. Understand working principle of Steam Condensers and cooling Tower.
4. Understand working principle of Reciprocating and Rotary Compressor.
5. Interpret Psychrometric Chart.
6. Understand different Refrigeration Cycle and Air-Conditioning Processes.

Motor Skills :

1. Collect and write technical specification of Steam Boiler.
2. Collect and write technical specification of Cooling Tower.
3. Report on visit to Steam Power Plant.
4. Conduct trial on single stage, single cylinder reciprocating compressor.
5. Conduct trial on Refrigeration Test Rig for calculation of COP, power required and refrigeration effect.

List of Practical:

1. Study of Boiler and Boiler Parts. (Both Fire Tube and Water Tube Boilers)
2. Study of Boiler Mountings and Accessories.
3. Study and compare between Surface Condenser and Jet Condenser.
4. Trace the cooling water circulation of a surface condenser with cooling tower.
5. Study of schematic layout of Steam Power Plant.
6. Study of single stage, single cylinder reciprocating compressor.
7. Collection and analysis of Manufacturer's Catalogue for Reciprocating / Rotary Compressor.
8. Study of Refrigeration Unit / Air- Conditioning Unit. (Refrigerator / Window Air-Conditioner)
9. Trial on Refrigeration Test Rig for calculation of COP, power required and refrigeration effect.

Note: At least **FIVE (05)** nos. of Practical / Study are to be conducted.

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Domkundwar V. M.	A Course in Thermal Engineering.		Dhanpat Rai & Co.
Dr. D.S.Kumar	Engineering Thermodynamics (Principles & Practices)		S.K. Kataria & Sons
P. L. Ballaney	A Course in Thermal Engineering.		Khanna Publishers
R. S. Khurmi	A text book of Thermal Engineering.		S. Chand & co. Ltd.
R. K. Rajput	A Course in Thermal Engineering.		Laxmi Publication, Delhi
Patel and Karmchandani	Heat Engine Vol. - I & II		Acharya Publication
P. K. Nag	Engineering Thermodynamics		Tata McGraw Hill
B. K. Sarkar	Thermal Engineering		Tata McGraw Hill
A.R. Basu	Thermal Engineering (Heat Power)		Dhanpat Rai & Co.

Reference books :- Nil
Suggested List of Laboratory Experiments :- Nil
Suggested List of Assignments / Tutorial :-
<ol style="list-style-type: none"> 1. Simple numerical on Carnot Power Cycle with steam. 2. Draw labelled schematic flow diagram and write function of components of the following Steam Power Cycles: <ul style="list-style-type: none"> • Simple Reheat Cycle. • Simple Regenerative Cycle. • Actual Reheat-Regenerative Cycle. 3. Show on Psychrometric Chart the following Air-Conditioning Processes: <ul style="list-style-type: none"> • Sensible heating and cooling. • Humidification and dehumidification. • Humidification with heating and cooling. • Dehumidification with heating and cooling. 4. Draw labelled schematic flow diagram of air in Multistage Air Compressor.

EXAMINATION SCHEME: END SEMESTER EXAMINATION

GROUP	MODULE OR CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3	12	ANY 20	1	20	6	FIVE, (AT LEAST TWO FROM EACH GROUP)	10	50
B	4,5	8				4			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation or study item)	10		
VIVA VOCE	5		

TOTAL	25		
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Name of the Course :Diploma in Mechanical Engineering			
Subject Title: Manufacturing Process II			
Course code: ME/		Semester : Fourth	
Duration : 17 Weeks		Maximum Marks : 200	
Teaching Scheme		Examination Scheme	
Theory : 3 hrs/week		Internal Assessment Examination: 20 Marks	
Tutorial: hrs/week		Teacher's Assessment(Assignment & Quiz): 10 Marks	
Practical : 4 hrs/week		End Semester Exam.: 70 Marks	
Credit: 5		Practical: Internal Sessional continuous evaluation: 50 Marks	
		Practical: External Sessional Examination:50 Marks	
Aim :-			
Sr. No			
1	To provide education at diploma level in aspects of production process technology which are of relevance to scientists, engineers and other professions who operate in the manufacturing and automobile industry and related sectors, particularly in the production, process and development areas.		
2	To study various types of basic production processes. To select, operate and control the appropriate processes for specific applications and production processes, surface finishing processes and plastic processes.		
Objective :-			
S No	The student will able to		
1	• Use the basic machine tools like lathe, drilling and milling, shaper machine.		
2	• .Understand the importance of surface finish and related surface finishing methods		
3	• Understand and select plastic molding processes		
Pre-Requisite:-			
S.No			
1	Knowledge of basic manufacturing processes.		
Contents			
Chapter	Name of the Topic	Hrs/week	
		Hours	Marks
01	Turning 1.0 Kinematic structure working principle & application of centre Lathe, 1.1 Taper turning methods & angle calculation of taper turning , Problems on taper turning 1.2 Thread cutting mechanism & calculation of change gears for thread cutting operation & simple problems 1.3 Cutting parameters & machining time calculation	09	
02	Shaping & planning: 2.0 Kinematic structure , working principle & application of Shaping machine 2.1 Application of planner machine 2.2 Specification of shaper machine, Different operations like making of flat surface, vertical surface, inclined surface, Slotting, pocketing, T-slot cutting, Vee-block & formed surface (grooving & straight tooth cutting for spur gear) 2.3 Cutting tools, Cutting parameters& machining time calculations.	06	
	Drilling		

03	3.0 Kinematic structure , working principle & application of Drilling machine, 3.1 Twist drill nomenclature., deep hole drilling 3.2 Cutting parameters, machining time calculation,.	03	
04	Milling and gear cutting 4.0 Kinematic structure , working principle & application of Milling machine, 4.1 Milling operations – side and face milling, straddle milling, form milling, gang milling, end milling, face milling, T- slot milling, slitting. 4.2 Cutting parameters & machining time calculation for plain milling operation 4.3 Gear cutting on milling machine –Dividing head and Indexing methods 4.4 Gear hobbing: Principle of operation, Advantages And limitations. Hobbing techniques – climb and conventional, 4.5 Gear shaping - Principle of operation, advantages, disadvantages,	10	
05	Grinding 5.1 Classification of machines , abrasive types & uses 5.2 Grinding wheel composition (Bond, grade ,grit & structure), types and shapes, Designation of a grinding wheel (specification), Factors selecting of grinding wheel 5.3 Types of Grinding operations: Cylindrical, Surface & Centre less grinding 5.4 Balancing, truing & dressing.	08	
06	Super Finishing Processes 6.1 Necessity of super finishing process & application 6.2 Honing, Lapping, Burnishing. Buffing & polishing	03	
07	Plastic Moulding 7.1 Type of plastic & application of plastic moulding 7.2 Compression moulding, transfer moulding, injection moulding, blow moulding, vacuum forming, extrusion, calendaring, rotational moulding	06	
	Total	45	

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 devices as mentioned in practical contents. The student will write assignments based on these sessions.

Skills to be developed:

Intellectual skills:

1. know the significance of various methods of taper turning, milling & gear cutting.
3. Calculate machining time for different operations.
4. Identify cutting tool nomenclature / marking systems.
5. Know the significance of various super finishing methods.
6. Understand the different processes of gear cutting.
7. Understand various plastic molding methods.

Motor Skills:

1. Operate lathe, drilling, shaping and milling machines.
3. Operate grinding machine.
4. Use the indexing mechanism.

List of Practical:

- 1) Study of shaper & Planner machine & Identify different parts, drives, clapper box, crank & slotted mechanism, feed mechanism, adjustment of length & position of stroke, work holding devices, tool holding devices, tools used , setting of tool & work also Operate shaper machine without work
- 2) Study attachment & accessories and Practice on making a job involving lathe operations like taper turning & thread cutting & use of measuring instruments (batch of 10 students per job)
- 3) Study of Milling machine & identify different parts, drives, cutter holding devices , milling cutters, dividing head

& operate milling machine without work

4) Practice on making a job involving Shaper machine with the operations like a) surface planning b) slot making c) angular machining [For example a V block] (batch of 15 students per job)

5) Practice of milling machine on making a spur gear of given module

6) Practice on making welding of flat position & vertical position , MIG& TIG welding practice on 4mm thick plate spot & seam welding (batch of 10 students per job)

7) Study of different moulding process, tools & equipments used , types of sands , preparation of sand & making a green sand mould

8) Identify, use, specification of different pattern tools, machines & measuring instruments used in pattern shop. And making simple pattern (solid pattern & split pattern having core print & core box one each) (batch of 15 students per job)

9) Study of grinding machine & identify different parts, drives ,wheel mounting process & practice one job containing surface grinding / cylindrical grinding with closed tolerances (for the job already made on shaper & lathe machine)

.10) one assignment each on tool nomenclature of single point cutting tool, twist drill & Milling cutter

.NOTE

a) Sl.No. 1, 3 & 10 are compulsory

b) From the rest 4 tasks have to be completed

Examination Schedule (Internal practical Sessional)

Name of Authors	Titles of the Book	Edition	Name of the Publisher
S. K. Hajra Chaudary, Bose, Roy	Elements of workshop Technology – Volume I & II		Media Promoters and Publishers limited
O. P. Khanna and Lal	Production Technology - Volume I & II		Dhanpat Rai Publications.
W.A.J. Chapman, S.J.Martin	Workshop Technology - Volume I , II & III		Viva Books (p) Ltd.
O.P. Khanna	A text book of Foundry Tech.		Dhanpat Rai Publications.
R.B. Gupta	Production Technology		Satya Prakashan New Delhi
H.S.Bawa	Workshop Technology Volume-I& II		Tata McGraw-Hill
John A. Schey	Introduction to Manufacturing Processes		McGraw-Hill
M. Adithan A. B. Gupta	Manufacturing Technology		New age International
Pabla B. S. M. Adithan	CNC machines		New age international limited.
B. L. Juneja	Fundamental of metal cutting and machine tools		New age international limited.
Steve Krar, Albert Check	Technology of Machine Tools.		McGraw-Hill International
P. N. Rao	CAD/CAM Principals and Applications		Tata McGraw-Hill
P. N. Rao	Manufacruting Technology Metal Cutting & Machne tools		Tata McGraw-Hill
Girling	All about Machine Tools		
Reference books :- Nil			

Suggested List of Laboratory Experiments :- Nil	
Suggested List of Assignments/Tutorial :-	
1. Schematic diagram of a centre lath showing Kinematic System And Working Principle Of Lathes	
2. Kinematic diagram & Working Principle Of milling machine	
3. Kinematic diagram And Working Principle Of shaper & planer	
4. Kinematic diagram And Working Principle Of radial drilling machine	
5. use of various attachment used in lathe, milling machine, shaper & drilling machine	

Examination Schedule Internal practical Sessional:

Making job (4 task) & submitting job sheet in scheduled time		4X5 = 20	
Viva - voce		4X2.5 = 10	
Attending classes for studying different machines and submitting respective assignment		3X4 = 12	
Viva voce & skill in operating machine		8	
Total:		50	

Examination Schedule: External practical Sessional examination
Examiner: Lecturer in Mechanical Engineering & Foreman (Work Shop).

For Making job (4 task) & submitting signed job sheet in scheduled time		4X2.5 = 10	
On spot job		20	
viva voce on study		20	
		50	

End Semester EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2	08	20	1	20	4	FIVE (AT LEAST ONE FROM EACH GROUP)	10	50
B	3,4	06				3			
C	5,6,7	06				3			



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course: Diploma in Mechanical Engineering			
Subject Title: Elements of Electrical Engineering			
Course Code: ME/	Semester: Fourth		
Duration: one Semester (17 Weeks)	Maximum Marks: 150		
Teaching Scheme	Examination Scheme		
Theory: 3 hrs./week	Internal Assessment Examination:20 Marks		
Tutorial: 0 hrs./week	Teacher's Assessment(Assignment & Quiz): 10 Marks		
Practical: 2 hrs./week	End Semester Exam.: 70 Marks		
	Practical: Internal Sessional continuous evaluation:25 Marks		
Credit: 4	Practical: External Sessional Examination:25 Marks		
Aim:			
Sl. No.			
1.	The general aim of the subject is to provide technical skills, technical awareness and the ability to analyse, develop, and manage different systems in the field of electrical engineering in a comprehensive way.		
Objective:			
Sl. No.	The students will be able to:		
1.	Identify the generation, transmission & distribution system		
2.	Identify different types of Transducers & sensors and their applications		
3.	Identify different types of measuring instruments and their applications		
4.	Identify different types of generators, motors, transformers and their Industrial applications		
5.	With information regarding electrical hazards, Fire, safety & protections, and realistic work scenarios, the student shall be able to identify and describe electrical hazards and precautions that should be taken to avoid injury in the workplace. Concept of electrical earthing.		
6.	Knowledge of electrical energy management – tariff system, cost of energy, energy conservation and energy audit.		
Pre-Requisite:			
Sl. No.			
1.	Knowledge of ELECTRICAL TECHNOLOGY as taught in the second semester.		
Contents (Theory)		Hrs./Unit	Marks
Unit: 1	Introduction to Electrical power 1.1 Energy Sources – Conventional and non conventional. 1.2 Generation of Conventional Electrical Power 1.3 Transmission of Electrical Power- Transmission voltage, Transmission system. (only fundamental) 1.4 Distribution of Electrical Power –different types, system & level of Electrical Power Distribution in brief. 1.5 Three phase supply: star and delta circuit, Line and phase current and voltage relation, expression of three phase power, simple problems on above basic relationship.	04	05
Unit: 2	Basic transducers & sensors 2.1 Introduction, different types with examples. 2.2 Some common types of Transducer & sensor element (Basic working	05	10

	principle and common application area) – strain gauge, load cell, proximity sensor (inductive and capacitive), flow rate sensor, LVDT, Piezoelectric sensor, Heat and smoke detector.		
Unit: 3	<p>Measuring Instruments:</p> <p>3.1 Introduction- Operating principles of PMMC and Moving Iron instruments (No mathematical deduction needed). Use of above instruments as ammeter and voltmeter. (No problems, only concept)</p> <p>3.2 Basic Idea on operating principles of digital multimeter, Clip on meter, Megger, Speedometer, Tachometer, (No mathematical deduction needed). Applications.</p>	05	10
Unit: 4	<p>DC Machines</p> <p>4.1. Construction and principle of operation of DC Motor, concept of back e.m.f. and torque Equations (no deduction), Simple Problems and Type of DC motors.</p> <p>4.2. identification of different parts of DC machines with their functions</p> <p>4.5 D.C motor Starter, Types, Necessity , Rating & specifications</p> <p>4.5 Speed torque characteristics of DC Motor.</p> <p>4.6 Speed control of DC motor (methods only)</p> <p>4.6 Specifications, ratings and Industrial applications of different types of DC motors.</p>	08	15
Unit: 5	<p>A. C .Machines</p> <p>5.1 Transformer:</p> <p>5.1.1 Single phase transformer: Construction, and principle of operation, types. EMF equation and transformation ratio. Various losses (only names and concept), efficiency and regulation (only equation or relations - no deduction). Simple Problems.</p> <p>5.1.2 Auto transformer (concept only), Applications.</p> <p>5.1.3 Three phase transformer – Basic idea about construction, identification of some constructional parts, accessories and their function (e.g. conservator, breather, buchholz relay, bushings etc.).</p> <p>5.1.3 Specification, rating and Applications of 1ph & 3ph transformers (with concept of power and distribution transformer).</p> <p>5.2 Induction motor:</p> <p>5.2.1 Types, Construction and principle of operation of 3 phase squirrel cage induction motor. Concept of slip, Expression of torque (no deduction), Speed torque characteristics, speed control (methods only), concept of VFD control, reversal of rotation,</p> <p>5.2.2 Starters-Types, Specification and rating.</p> <p>5.2.3 Industrial Application of both sq cage and slip ring induction motor.</p> <p>5.2.4 Single phase induction motor, universal motor, stepper motor & servo motor (concept only). Applications of these motors in various fields.</p> <p>5.3 Synchronous Machine:</p> <p>5.3.1 Construction, principle of operation of Alternator.</p> <p>5.3.2 Synchronous Motor- principle of operation, methods of starting & applications.</p>	15	15

Unit 6	Electric hazards, safety, Protections and Earthing 6.1 Electric Shock, Effects of Electrical Current On the Human Body , Electrical Emergencies- actions to be taken when an electrical emergency arises. 6.2 Fire – Different types of Fire, their causes, Fire Extinguishers, different types of fire extinguishers and their applications. 6.3 Earthing – Necessity of earthing, types of earthing (name only), Earth resistance values, Eventualities in case of failure of earthing, Common electricity rules regarding earthing (related to electrical installation of lighting & machines only).	07	10
Unit 7	Electric Energy Management 7.1 Tariff structure for different types of consumers, examples related to state electricity board/CESC or any other similar organization. 7.2 Power factor improvement (methods only) 7.3 Energy conservation – Energy conservation Act, energy efficiency, BEE Star Rating. 7.4 Energy Audit – Concept only.	04	05
Total		48	70
Contents (Practical)			
Sl. No.	Skills to be developed		
1.	Intellectual Skills: i) Identify electrical Instrument & equipment observing nameplate & various symbols. ii) Identify safety and precautionary measure to be taken before performing experiments. iii) Interpret wiring diagrams for various applications. iv) Decide the procedure for setting experiments.		
2.	Motor skills: i) Draw wiring diagram and make connections to connect electrical equipments and instruments. ii) Follow the proper procedure observing the necessary safety and take necessary reading from different instruments. iii) Record all the information specifications, rating of the instrument & equipment and also observations and result in tabular form properly. iv) Make comments on observation and result using graph, Chart, Phasor diagram etc. as applicable. v) Writing the Laboratory report in presentable way.		
List of Laboratory Experiments:			
Sl. No.	A. List of Practical:		
1.	Know your Electrical engineering Laboratory. Make list of machines, instruments, tools etc. with specification and types.		
2.	For a given resistive & inductive series & parallel circuit, select ammeter, voltmeter & wattmeter. Make the connections and measure current, voltage, power factor and power drawn by the circuit. Measure it by clip on meter & compare it.		
3.	For a given DC Shunt/Series motor, select suitable meters, make connections as per diagram, check the connections and run the motor. Take the meter readings to draw speed torque characteristics. Make suitable changes in the connections to reverse the direction of rotation.		
4.	For a given DC shunt motor prepare a circuit to control its speed above & below normal, plot its graph.		

6.	List specifications of given single phase transformer. Perform no load test on the transformer to find transformation ratio.
7.	Measure Insulation resistance of an existing Electrical lighting installation.
8.	Connect an energy meter to a single phase load, take reading & prepare energy consumption bill with present tariff structure of WBDCL / CESC / other recognized organization.
	B) Field work:
9.	Observe Electric wiring of main building / a block / workshop in your campus list the accessories used and draw a general layout (single line diagram).
10.	Observe earthing of your laboratory, measure its resistance & list its significance
	C) Mini project: (any one)
11.	Prepare a simple electric wiring circuit comprising of 2 lamps, 2 sockets, 1 fan with a fuse & check it.
12.	Prepare trouble-shooting chart of an Induction / a DC motor to identify the common faults of the motor.
13.	Prepare a list and fix the location for proper fire extinguisher and label the Escape route in case of fire in your classroom/ any Laboratory. Also put in writing other necessary information in proper location. (using standard symbols)

Text Books

Sl No.	Name of Authors	Titles of the Book	Name of Publisher
1.	E.Huges	Electrical Technology	ELBS
2.	H. Cotton	Electrical Technology	Pitman
3.	B.L.Thereja	Electrical Technology Vol –I to IV	S.Chand
4.	S.K.Bhattacharya	Electrical Machines	Tata McGraw Hill
5.	A.K.Sawhney	A Course in Electrical & Electronics Measurement & Instrumentation	Dhanpat Rai & Sons

EXAMINATION SCHEME (THEORITICAL)

GR O U P	UNIT	ONE OR TWO SENTENCE ANSWER QUESTIONS				GR O U P	UNIT	SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS			TO BE SET	<u>TO BE ANSWERED</u>	MARKS PER QUESTION	TOTAL MARKS
A	1, 6,7	6	TWENTY	ONE	1 X 20 = 20	B	1,6,7	THREE	FIVE, TAKING AT LEAST ONE FROM EACH GROUP	TEN	10 X 5 = 50
	2,3	4				C	2,3	THREE			
	4,5	10				D	4,5	FIVE			

EXAMINATION SCHEME (SESSIONAL)

1. **Continuous Internal Assessment of 25 marks** is to be carried out by the teachers throughout the Third Semester. **Distribution of marks: Performance of Job – 10 Marks (equally distributed on total no. Of possible experiment), Notebook – 10 Marks (also equally distributed on total no. Of possible experiment). Mini Project – 5 Marks.**
2. **External Assessment of 25 marks** shall be held at the end of the Third Semester on the entire syllabus. One Experiment per student from any one of the above is to be performed. Experiment is to be set by lottery system. **Distribution of marks: On spot job – 15, Viva-voce – 10.**



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Name of the Course : Diploma in Mechanical Engineering		
Subject Title: Engineering Metrology		
Course code: ME/	Semester : Fourth	
Duration : 17 weeks	Maximum Marks : 100	
	Examination Scheme:	
Teaching Scheme:	Internal Assessment: 10 Marks	
Theory : 2 hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks	
Tutorial: hrs/week	End Semester Exam: 35 Marks	
Practical : 2 hrs/week	Practical: Internal Sessional continuous evaluation: 25 Marks	
Credit: 3	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	<p>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 the student is also required to analyze the quantitative determination of physical magnitude.</p> <p>During previous semesters different systems of measurement and their units etc have been introduced in the different subjects. 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. The student is also required to analyze, Interpret and present the data collected for ensuring the quality.</p> <p>The knowledge of the subject also forms the basis for the design of mechanical measurements systems, design & drawing of mechanical components.</p>	
S No	The student will able to	
	<ol style="list-style-type: none"> 1. Select appropriate instrument/s for specific measurement. 2. Measure Physical quantity 3. Measure & adjust errors of measurement 4. Design & use of gauge system in manufacturing industry 5. Analyze and interpret the data obtained from the different measurements processes 	
Pre-Requisite:-		
S.No		
1	Unit system & basic physics	
Contents		
Chapter	<i>Name of the Topic</i>	Hrs/week
		Hours
Group A		
01	Limits, Fits ,Tolerances and Gauges Tolerances, Selective Assembly, Interchangeability, Limits Of Size, Allowances, Clearances, Interference, IS 919- 1993 , Fits, Selection Of Fits, Numerical Problems On Limits Of Size And Tolerances, , Taylor's Principle, Gauge Design, hole and shaft basis system, Plain Plug Gauge IS: 3484 -1966, Plain Ring Gauge IS: 3485 -1972, Snap Gauge IS: 3477 -1973.	05
02	Linear Measurement	04

	Description, working principle, method of reading, least count for Vernier Calipers, Micrometers(outside micrometer, Inside Micrometer, Stick Micrometers), depth gauge & Height Gauge, Feeler gauge, Slip Gauges (category, use, Selection of Slip Gauges for setting particular dimension)	
03	Angular Measurement Concept, Instruments for Angular Measurements, construction, Working principle and Use of Universal Bevel Protractor, Sine Bar, Spirit Level, Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges).	03
04	Comparators Definition, Classification, use of comparators, Working principle of different type of comparators like mechanical comparator (Dial indicator, Sigma comparator), Pneumatic comparator, Electrical Comparators, Optical Comparators, characteristics of good comparator, Relative advantages and disadvantages.	04
Group B		
05	Screw thread Measurements Terminology of thread, Pitch errors, Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch & thread angle, Working principle of floating carriage dial micrometer, Screw Thread Micrometer, pitch measuring m/c, Two wire method, thread gauge (plug gauge, ring gauge & snap gauge)	04
	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.	03
	Measurement of surface finish Primary and secondary texture, Sampling length, Lay, terminology as per IS 3073- 1967, direction of lay, Sources of lay and its significance, CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis, Working principle of stylus probe type instruments.	03
	Machine tool testing Parallelism by dial indicator, Straightness testing by straight edge, spirit level & Autocollimators, flatness testing by dial gauge, level or Autocollimators, optical flats Squareness Testing - by dial indicator, optical square, indicating method., alignment testing of lathe machine tool as per IS standard procedure.	04
	Total	30

Practical:

Skills 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

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.

LIST OF PRACTICALS

List of Practical: (Any five)

1. Standard use of basic measuring instruments. Surface plate, v-block, sprit 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, and roundness comparison.
6. Measurement of gear tooth elements by using gear tooth vernier caliper
7. Alignment Testing of lathe machine tool.

Examination Schedule Internal practical Sessional:

Attending classes, practicing programs & submitting respective assignment in time		5 x 4 = 20	
Viva - voce		5	
Total:		25	

Examination Schedule: External practical Sessional examination

Examiner: **Lecturer**

For submission of assignment in scheduled time		5 x 2 = 10	
On spot program		10	
viva voce		05	
Total		25	

Reference books :- Nil

Suggested List of Laboratory Experiments :- Nil

Suggested List of Assignments/Tutorial :- as mentioned in list of practical

G R O U P	Chapter	ONE OR TWO SENTENCE ANSWER QUESTIONS				G R O U P	Chapter	SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS			TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A		5	10	1	1 X 10 = 10	A		5	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	5	5 X 5 = 25
B		5				B		5			

List of Books:

Author	Title	Publication
N V Raghavendra L Krishnamurthy	Engineering Metrology & Measurements	Oxford
R.K.Rajput	Mechanical Measurement & Instrumentation	S.K. Kataria & Sons
R. K. Jain.	Engineering metrology	Khanna Publisher, Delhi
M. Mahajan	A text book of metrology	Dhanpat Rai and Sons,
I.C. Gupta	A text book of Engineering metrology	Dhanpat Rai and Sons,
M. Adithan and R.Bahl	Metrology Lab. Manual	T.T.T.I. Chandigarh.
K. J. Hume	A text book of Engineering metrology	Kalyani publishers
J.F.W. Galyer and C. R. Shotbolt	Metrology for Engineers	ELBS

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.



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Name of the Course : Diploma in Mechanical Engineering	
Subject Title: Theory of Machines and Mechanism	
Course code: ME/	Semester : Fourth
Duration : 17 weeks	Maximum Marks : 150
Teaching Scheme:	Examination Scheme:
Theory : 3 hrs/week	Internal Assessment: 20 Marks
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 10 Marks
Practical : 2 hrs/week	End Semester Exam: 70 Marks
Credit: 4	Practical: Internal Sessional continuous evaluation: 25 Marks
	Practical: External Sessional Examination: 25 Marks
Aim :-	
S.No	
1	To focus on understanding the concept of machines, mechanisms and their elements. Also study kinematics aspects of various links in mechanisms.
S No	The student will 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.
	Appreciate concept of balancing and Vibration.
	Develop ability to come up with innovative ideas
Pre-Requisite:-	
S.No	
1	
Contents	
Chapter	Name of the Topic
01	<p>Fundamentals and types of Mechanisms and velocity in Mechanism:</p> <p>1.1 Kinematics of Machines: - Definition of Statics, Dynamics, Kinematics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, machine and structure, inversion of mechanism.</p> <p>1.2 Inversions of Kinematic Chain:</p> <p>1.2.1 Inversion of four bar chain- four bar chain mechanism, coupled wheels of Locomotive & Pantograph.</p> <p>1.2.2 Inversion of Single Slider Crank chain- Slider Crank mechanism, Rotary I.C. Engines mechanism, Whitworth quick - return mechanism, Crank, Slotted lever quick return mechanism, hand- pump.</p> <p>1.2.3 Inversion of double slider crank chain- double slider crank mechanism, Scotch Yoke mechanism & Oldham's coupling</p> <p>1.3 Velocity of a point in mechanism:</p> <p>Determining the velocity of a point in 4-bar chain mechanism & slider-Crank mechanism by relative velocity method and instantaneous centre method (use graphical method only).</p>
	Hrs/week
	Hours
	10

02	<p>Cams and Followers:</p> <p>2.1 Concept, definition and application of Cams and Followers.</p> <p>2.2 Classification of Cams and Followers.</p> <p>2.3 Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation.</p> <p>2.4 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method).</p>	06
03	<p>Power Transmission:</p> <p>3.1 Types of Drives – Belt, Chain, Rope, Gear drives & their comparison.</p> <p>3.2 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 numerical on flat belt drive)</p> <p>3.3 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. (simple problems on gear train)</p>	08
04	<p>Flywheel and Governors:</p> <p>4.1 Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance.(simple problems on determination of mass of fly wheel using crank effort diagram)</p> <p>4.2 Governors - Types, concept, function and application & Terminology of Governors. (simple problems on watt & porter governor)</p> <p>4.3 Comparison between Flywheel and Governor.</p>	08
05	<p>Brakes, Dynamometers, Clutches & Bearings:</p> <p>5.1 Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer.</p> <p>5.2 Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake.</p> <p>5.3 Concept of Self Locking & Self energizing brakes.</p> <p>5.4 Numerical problems to find braking force and braking torque for shoe & band brake.</p> <p>5.5 Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometer.</p> <p>5.6 Clutches- Uniform pressure and Uniform Wear theories.</p> <p>5.7 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 numerical on single and Multiplate clutch).</p> <p>5.8 Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numerical.</p>	10
	<p>Balancing & Vibrations:</p> <p>6.1 Concept of balancing. Balancing of single rotating mass. Graphical</p>	03

	method for balancing of several masses revolving in same plane & different plane. 6.2 Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies.	
	Total	45

Practical:

Skills to be developed:

Intellectual Skills:

1. Understand working of different mechanism.
2. Determine velocity of link 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 diagrams of four bar mechanism & slider crank mechanism.
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 diagram.

LIST OF PRACTICALS

List of Practical: (Any seven)

- 1) Find the ratio of time of cutting stroke to the time of return stroke for quick return mechanism of a shaper machine.
- 2) Study of different types of gear train: a) simple gear train – tumbler gears for speed reversing, b) compound gear train – All geared head stock, c) reverted gear train – Back gear in lathe, d) epicyclic gear train – differential.
- 3) Determination of velocity by relative velocity method (two problems) (use graphical method).
- 4) Determination of velocity by instantaneous centre method (two problems) (use graphical method).
- 5) Draw the profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (At least two problems)
- 6) Determine the radius of rotation of fly ball (porter governor) 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 / 4- wheelers.
- 8) Determination of power transmitted by any belt drive using any one dynamometer.
- 9) Dismantling and assembly of multiplate clutch of two-wheeler / 4-wheelers.
- 10) Determine graphically balancing of several masses rotating in a single plane/ several planes (use graphical method – 2 problems).
- 11) Numerical problems to find braking force and braking torque for shoe & band brake.
- 12) Determine torque & power lost in friction for i) Simple Pivot, ii) Collar Bearing & iii) Conical pivot.
- 13) Determine of mass of fly wheel using crank effort diagram.

Examination Schedule Internal practical Sessional:

Attending classes, practicing problems & submitting respective assignment in time		20	
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Viva – voce		5	
Total:		25	
Examination Schedule: External practical Sessional examination			
Examiner: Lecturer			
For submission of assignment in scheduled time		15	
viva voce		10	
Total		25	
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :- as mentioned in list of practical			

List of Books:

Author	Title	Publication
Khurmi & Gupta	Theory of machines	S. Chand & Co
S. S. Rattan	Theory of Machine	McGraw Hill companies
P.L. Ballaney	Theory of machines	Khanna Publication
Dr. R. K. Bansal Dr. J.S. Brar	Theory of machines	Laxmi Publications
V.P. Singh	Theory of machines	Dhanpat Rai & Co
TimoShenko & Young	Theory of machines	Wiley Eastern
Jagdishlal	Theory of machines	Bombay Metro – Politan book ltd.
Ghosh - Mallik	Theory of machines	Affiliated East west press
Beven T	. Theory of machines	CBS Publication
J.E.Shigley	Theory of machines	Mc Graw Hill
Abdulla sharif	Theory of machines	Dhanpat Rai & Co

Name of the Course : Mechanical Engineering		
Subject Title: Professional Practices-II		
Course code:	Semester : Fourth	
Duration: 17 weeks	Maximum Marks : 50	
Teaching Scheme	Examination Scheme	
Theory : hrs/week	Practical: Internal Sessional Continuous Evaluation: 25 Marks	
Tutorial: hrs/week	Practical: External Sessional Examination: 25 Marks	
Practical : 3 hrs/week		
Credit: 2		
Aim :-		
S.No		
1	To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.	
Objective :-		
Sl. No.	The student will able to:	
1	<ul style="list-style-type: none"> Acquire information from different sources. 	
2	<ul style="list-style-type: none"> Prepare notes for given topic. 	
3	<ul style="list-style-type: none"> Present given topic in a seminar. 	
4	<ul style="list-style-type: none"> Interact with peers to share thoughts. 	
5	<ul style="list-style-type: none"> Prepare a report on industrial visit, expert lecture. 	
Pre-Requisite:-Nil		
Contents		Hrs/week
Chapter	Name of the Topic	
01	<p>Industrial Visits: Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. ONE industrial visits may be arranged in the following areas / industries :</p> <ul style="list-style-type: none"> Sugar Factory / Dairy / Chemical Industry / Thermal Power Plant. Machine shop having CNC machines. State Transport workshop / Auto service station. City water supply pumping station. Manufacturing unit to observe finishing and super finishing processes. <p style="text-align: center;">OR</p> <p>Mini Project / Activities: (Any one) Individual student should submit a report of the same, to form a part of the term work.</p> <ol style="list-style-type: none"> Prepare one model out of card board paper / acrylic / wood / thermocol / metal such as: i) Elliptical Trammel ii) Pantograph iii) Coupling iv) Cams and Followers. Dismantling of assembly (e.g. jig / fixtures, tool post, valves etc.) Take measurement and prepare drawings / sketches of different parts. Make a small decorative water fountain unit. Toy making with simple operating mechanisms. 	09 Hrs.

02	<p>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 :</p> <ul style="list-style-type: none"> • Engine lubricants & additives • Automotive gaskets and sealants • Engine coolants and additives • Two and Four wheeler carburetor. • Power steering • Filters • Different drives/Transmission systems in two wheelers. • Types of bearings – applications and suppliers. • Heat Exchangers • Maintenance procedure for solar equipment. 	06 Hrs.	
03	<p>Using any CADD related software following topics are to be practiced:</p> <ul style="list-style-type: none"> • Common 2D command for drawing simple sketch:- Creation of work plane, Line, Circle, Rectangle, arc, Ellipse, curve, Move, Copy, Trim, Fillet, Chamfer, Extend, offset, Array, break,; Practice on 2D Drawing. • Generation of 3 D surface & solid model: Primitive surface & solid (plane, block, sphere, cone, torus, spring, spiral). • 3D operation: Extrude, fill in, revolve, drive surface, networking surface, surface from separate curves, extension of surface, fillet, editing of surface, blend, Pocket, shaft, Groove, Hole, Slot, Stiffener, Draft, trim, curve wrapping & unwrapping; Boolean Operations: Add, Remove, Intersection; Transformation features: Translation, Rotation, mirror; Generation of 3 D Model Practice. • Extraction of 2D from 3D model: Front View, Side view, Top View, Isometric view, sectional view, limited view (broken view), Dimensioning, Inserting frame and Title Block; Practice. <p>Exercise: Rigid flange coupling, knuckle joint, tray, bracket, cylinder-cylinder intersection model, BOM.</p>	30 Hrs.	
Total		45 Hrs.	
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Robert M. Thomas	Advanced AutoCAD		Sybex BPD
R Cheryl	Beginning AutoCAD 2011-Exercise Book (W/2 DVDs)		BPB Publication
D Raker & H.Rice	Inside Autocad		BPB Publication
P.Radhakrishnan,S.Subramanian & V.Raju	CAD/CAM/CIM		New Age International

			Publication
Sham Tickoo	Autocad 2002 with Applications		Tata Mcgraw Hill
George Omura	Mastering Autocad 2010 & Autocad LT 2010		
David Frey	AutoCAD 2007 and AutoCAD LT 2007: No Experience Required		
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :- Nil			

Examination Scheme:	
Internal Practical Sessional Examination	
Topic	Marks
1 - Submission of Report on industrial visit or mini project on scheduled date.	5
2 - Submission of one assignment on information search on scheduled date.	5
3 - Practice of CADD software.	10
4 - Viva – voce.	5
Total:	25
External Practical Sessional Examination	
Topic	Marks
1 - Submission of signed report & assignment.	5
2 - On spot CADD Drawing.	15
3 - Viva voce.	5
Total:	25



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(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering		
Subject Title: Fluid Mechanics & Machinery		
Course code: ME/	Semester : Fifth	
Duration : 17 weeks	Maximum Marks : 150	
Teaching Scheme:	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 20 Marks	
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 10 Marks	
Practical : 2 hrs/week	End Semester Exam: 70 Marks	
Credit: 4	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	To develop and apply the concepts introduced in Fluid Mechanics to engineering applications in turbo machinery and flow measurement.	
2	To introduce and apply to concepts of similarity and scaling within fluid mechanics.	
3	To review flow measurement devices / techniques, from industrial machines to modern, laser-based methods.	
Objective :-		
S No	The student will 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	
Pre-Requisite:-		
S.No		
Contents		
Chapter	<i>Name of the Topic</i>	Hrs/week
GROUP:A		
01	Properties of fluid 1.1 Density, Specific gravity, Specific Weight, Specific Volume 1.2 Dynamic Viscosity, Kinematics Viscosity, Surface tension, Capillarity 1.3 Vapour Pressure, Compressibility	04
02	Fluid Pressure & Pressure Measurement 2.1 Fluid pressure, Pressure head, Pressure intensity. 2.2 Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure. 2.3 Simple and differential manometers, Bourden pressure gauge. 2.4 Concept of Total pressure on immersed bodies(flat vertical, flat inclined), center of Pressure, Pr. Distribution diagram. Note: Numericals on Manometers, Total Pressure & Centre of pressure.	08
GROUP:B		

03	Fluid Flow 3.1 Types of fluid flows: steady-unsteady, uniform-non-uniform, laminar-turbulent. 3.2 Continuity equation 3.3 Bernoulli's theorem 3.4 Venturimeter – Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturimeter. 3.5 Orifice meter – Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter 3.6 Pitot tube – Construction, Principle of Working Note: - Numericals on Venturimeter, orifice meter, pitot tube.	08
04	Flow Through Pipes 4.1 Laws of fluid friction (Laminar and turbulent) 4.2 Darcy's equation and Chezy's equation for frictional losses. 4.3 Minor losses in pipes 4.4 Hydraulic gradient and total gradient line. 4.5 Hydraulic power transmission through pipe Note: Numericals to estimate major and minor losses.	05
GROUP:C		
05	Impact of jet 5.1 Impact of jet on fixed vertical, moving vertical flat plates. 5.2 Impact of jet on curved vanes with special reference to turbines & pumps Note - Simple Numericals on work done and efficiency.	06
06	A] Centrifugal Pumps 6.1 Construction , principle of working and applications 6.2 Types of casings and impellers. 6.3 Concept of multistage 6.4 Priming and its methods, Cavitation 6.5 Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH Note:- Numerical on calculations of overall efficiency and power required to drive pumps. B] Reciprocating Pump 6.6 Construction, working principle and applications of single and double acting reciprocating pumps. 6.7 Concept of Slip, Negative slip, Cavitation and separation 6.8 Use of Air Vessel. 6.9 Indicator diagram with effect of acceleration head & frictional head. Note:- No Derivations and Numericals on reciprocating pumps.	14
	Total	45

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.

Motor Skills:

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

List of Practical: (Any Five)

01. Calibration of Bourden pressure gauge with the help of Dead Weight Pressure gauge.
02. Verification of Bernoulli's Theorem.

03. Determination of Coefficient of Discharge of Venturimeter.
 04. Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of orifice meter.
 05. Measurement of velocity of flow through pipe with the help of Pitot tube.
 05. Determination of coefficient of friction of flow through pipes.
 06. Trial on centrifugal pump to determine overall efficiency.
 07. Trial on reciprocating pump to determine overall efficiency.

List of Books:

Author	Title	Publication
Ramamrutham S.	Hydraulic, fluid mechanics & fluid machines	Dhanpat Rai and Sons ,New Delhi
C.S.P.Ojha	Fluid Mechanics & Machinery	Oxford University Press
Modi P. N. and Seth S. M.	Hydraulics and fluid mechanics including Hydraulic machines	Standard Book House. New Delhi
Streeter Victor, Bedford K.W., Wylie E.B	Fluid Mechanics	McGraw Hill Int.
K. Subramanya	One Thousand Solved Problems in Fluid Mechanics	Tata McGraw Hill
Garde	Fluid Mechanics	CITECH
R.K.Rajput	Fluid Mechanics & Hydraulic machines	S.Chand
D.S.Kumar	Fluid Mechanics & Hydraulic machines	S.K.Kataria
S.Pati	Fluid Mechanics & Hydraulic machines	Tata McGraw Hill
R.D.Bansal	Fluid Mechanics & Hydraulic machines	Laxmi Publication
Jagadishlal	Fluid Mechanics & Hydraulic machines	Metropolitan Book Company
Das,saikia & Das	Hydraulics & Hydraulic machines	P.H.I
Ramamurtham	Fluid Mechanics & Hydraulic machines	Dhanpat Rai
K.L.kumar	Fluid Mechanics	S.Chand
R.V.Raikar	Lab Manual Hydraulics &	P.H.I

	Hydraulic machines	
Ojha	Fluid Mechanics & Machinery	Oxford
Munson	Fundamentals of Fluid Mechanics	Wiley
Pump manufactures' catalogs such as Kirloskar Brothers, KSB, Kishor pumps etc.		

Reference books :- Nil

Suggested List of Laboratory Experiments :- Nil

Suggested List of Assignments/Tutorial :-

1. Numericals on Manometers, Total Pressure & Centre of pressure
2. Numericals on Venturimeter, orifice meter, pitot tube
3. Numericals to estimate major and minor losses
4. Simple Numericals on work done and efficiency on impact of jet.
5. Numericals on calculations of overall efficiency and power required to drive pumps.

End Semester Examination Scheme. Maximum Marks-70, Time Allotted-3 hrs							
Group	unit	Objective Questions		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer	Marks per question	Total marks
A	01,02	7	20	3	5, taking at least one from each group	10	50
B	03,04	7		4			
C	05,06	6		3			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for	5 x 2 = 10		

five experiments / study)			
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		

Name of the Course : MECHANICAL AND PRODUCTION ENGINEERING / PRODUCTION TECHNOLOGY (Subject Title: ADVANCED MANUFACTURING PROCESS)			
Course code:		Semester : Fifth	
Duration : 17 weeks		Maximum Marks : 200	
Teaching Scheme		Examination Scheme	
Theory : 2 hrs/week		Semester Exam: 70 Marks	
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 3 hrs/week		Internal Assessment: 20 Marks	
Credit:4		Practical Sessional internal continuous evaluation: 50 Marks	
		Practical Sessional external examination: 50 marks	
Aim :-			
S.No			
1	To know about the advancements in the area of manufacturing and production processes. To impart knowledge & skills necessary for working in modern manufacturing environment. To get familiarized with working principles and operations performed on non traditional machines, machining center, SPM, automated machines and maintenance of machine tools.		
Objective :-			
S No	The student will able to		
1	• Know different non traditional machining processes, CNC milling machines.		
2	• Understand the working of Special Purpose Machines.		
3	• Work as maintenance engineer.		
4	• Know the Operation and control of different advanced machine tools and equipments.		
5	• Produce jobs as per specified requirements by selecting the specific machining process.		
6	• Adopt safety practices while working on various machines.		
7	• Develop the mindset for modern trends in manufacturing and automation.		
Pre-Requisite:-			
S.No			
1	Knowledge of basic manufacturing processes.		
Contents			
Chapter	Name of the Topic	Hrs/week	Marks
01	Non traditional machining processes 1.1 Electrical discharge Machining. Principle of working, Setup of EDM, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, Applications e.g. microhole drilling, curve hole drilling. 1.2 Wire cut EDM - Principle of working, Setup of WEDM, controlling Parameters, Applications. 1.3 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) 1.4 Principle of working & Applications of ECM & USM .	10	
	Jigs and Fixtures Introduction. Difference between jig and fixture Different components of Jig/ fixture 3-2-1 principle of location. Types of locators and clamping devices.	4	

	General principles of jig/fixture design. Types of jigs and fixtures.		
	CNC Machine Tools: Concept of NC & CNC, CNC Turning Centre, Advantages & Disadvantages of CNC machine tools, Applications of NC/CNC Machine, Classification of CNC M/C Tools (Based on motion type, based on control loops, based on axis, based on power supply), Different components of CNC machine tools & their functions, Components of CNC System (function & application): Stepper motor, Servo motor, Encoders (rotary & linear encoder), Recirculating ball screw, Automatic tool changer, Tool magazine. work holding methods for turning centre(name & relative advantage & disadvantage), work holding methods for machining centre(name & relative advantage & disadvantage), steps in CNC process. Part Programming: concept of part programming, reference point (Machine Zero, Program Zero, Part Origin), Axis identification of Turning Centre & Machining Centre, CNC Codes for manual part programming G – codes, M- Codes, Spindle speed control, feed rate control, Tool selection) part programming for turning centre using different codes & fixed cycles (canned cycle, do-loop & Subroutine) to get step, taper, plain & circular turning, facing, external threading & parting off operation. part programming for machining centre considering Cutter radius compensation, ramp on/off motion, tool offset and using different codes, canned cycles & subroutine for generating different milled surface. CNC part program verification. Principles of computer aided part programming.	12	
4	FMS: Concept, Basic components of FMS (Different workstations, Automated material handling & storage system, computer control system), types of FMS layout, objectives of FMS, advantages & disadvantages of FMS.	4	
	Total	30	

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:(Any five):

- 1) Study of Non traditional machining process like EDM, Wire EDM , ECM ,USM & also one assignment on the processes.
- 2) Study of CNC lathe & CNC Milling machine & identify different parts, drives , automatic tool changer and also tool magazine
- 3) Practice on making Eccentric turning in a round job using centre lathe.
- 4) One assignment on part programming of straight turning , taper turning , radius forming operation in a

turning centre

- 5) Practice on making simple job like straight turning , taper turning ,radius forming by CNC lathe machine
- 6) One assignment on part programming on machining centre
- 7) Practice on making simple job by CNC machining centre
- 8) Practice on making face milling, slotting, contour machining on a machining centre
- 9) One assignment on machine tool installation process

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Amitabh Ghosh , Mallik	Manufacturing Science		East-West Press Pvt. Ltd.
HMT Bangalore	Production Technology		Tata McGraw-Hill
H.P.Garg	Industrial maintenance		S. Chand & Co. Ltd.
S. K. Hajra Chaudary, Bose, Roy	Elements of workshop Technology – Volume I & II		Media Promoters and Publishers limited
P. K. Mistra	Non conventional Machining		Narvasa Publishing House
Lindley R. Higgins	Maintenance Engg. Handbook		Mc-Graw Hill
B. L. Juneja	Fundamental of metal cutting and machine tools		New age international limited.
Steve Krar, Albert Check	Technology of Machine Tools.		Mc-Graw-Hill International
O. P. Khanna and Lal	Production Technology - Volume I & II		Dhanpat Rai Publications.
W.A.J. Chapman, S.J.Martin	Workshop Technology - Volume I , II & III		Viva Books (p) Ltd.
O.P. Khanna	A text book of Foundry Tech.		Dhanpat Rai Publications.
R.B. Gupta	Production Technology		Satya Prakashan New Delhi
H.S.Bawa	Workshop Technology Volume-I& II		Tata McGraw-Hill
John A. Schey	Introduction to Manufacturing Processes		McGraw-Hill
M. Adithan A. B. Gupta	Manufacturing Technology		New age International
Pabla B. S. M. Adithan	CNC machines		New age international limited.
B. L. Juneja	Fundamental of metal cutting and machine tools		New age international limited.
Steve Krar, Albert Check	Technology of Machine Tools.		McGraw-Hill International
P. N. Rao	CAD/CAM Principals and Applications		Tata McGraw-Hill
P. N. Rao	Manufacrating Technology Metal Cutting & Machne tools		Tata McGraw-Hill

Reference books :- Nil	
Suggested List of Laboratory Experiments :- Nil	
Suggested List of Assignments/Tutorial :- Nil	

Examination Schedule Internal practical Sessional:

Making job (4 task) & submitting job sheet in scheduled time		4X5 = 20	
Viva - voce		4X2.5 = 10	
Attending classes for studying different machines and submitting respective assignment		3X4 = 12	
Viva voce & skill in operating machine		8	
Total:		50	

Examination Schedule: External practical Sessional examination
Examiner : Lecturer in Mechanical Engineering & Foreman (Work Shop).

For Making job (4 task) & submitting signed job sheet in scheduled time		4X2.5 = 10	
On spot job		20	
viva voce on study		20	
		50	

End Semester EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2	10	20	1	20	5	FIVE (AT LEAST TWO FROM EACH GROUP)	10	50
B	3,4	10				5			



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Name of the Course : Diploma in Mechanical Engineering		
Subject Title: Measurement & Control		
Course code: ME/	Semester : Fifth	
Duration : 17 weeks	Maximum Marks : 100	
Teaching Scheme:	Examination Scheme:	
	Internal Assessment: 10 Marks	
Theory : 2 hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks	
Tutorial: hrs/week	End Semester Exam: 35 Marks	
Practical : 2 hrs/week	Practical: Internal Sessional continuous evaluation: 25 Marks	
Credit: 3	Practical: External Sessional Examination: 25 Marks	
Aim :-		
	<p style="text-align: center;">The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid changes, 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.</p>	
S No	The student will able to	
	<ol style="list-style-type: none"> 1. Understand the principle of operation of an instrument. 2. Identify different functional elements of measuring system 3. Appreciate the concept of calibration of an instrument. 4. Select Suitable measuring device for a particular application. 5. Measure different mechanical measuring quantity 6. Know the working principle of transducers. 	
Pre-Requisite:-		
S.No		
	Contents	Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
Group A		
01	Introduction to measuring system: Significance Of Measurement, block diagram of a measuring system, Functional Elements Of measurement System, Classification Of Instrument. Introduction to Control system: Function of control system, Block diagram of open loop & closed loop system, Basic elements of closed loop system.	05

	Example of measurement & control system for Heating a room at specific temperature, Maintain a particular shaft speed.	
02	Displacement measurement: Working principle & use of Potentiometer, Differential transformer (LVDT & RVDT), Capacitive element & Optical encoders.	04
03	Speed Measurement: Mechanical tachometer, Electrical Tachometer, incremental optical encoder, Eddy current drag cup tachometer, Magnetic pickup tachometer, Stroboscopic tachometer, Photoelectric tachometer, non contacting electrical tachometer (inductive pick up & capacitive pick up)	06
Group B		
04	Temperature measurement: Pressure thermometer, Resistance Temperature Detector, Platinum resistance thermometer, Thermistors, Thermocouple, Quartz thermometer, radiation pyrometer, optical pyrometer.	03
05	Flow Measurement: Variable area meter – Rotameter, Variable velocity meter – Anemometer, Special methods – ultrasonic flow meter, hot wire anemometer, electromagnetic flow meter.	03
06	Miscellaneous Measurement: Acoustic Measurement: Characteristics of Sound, sound measuring system Sound level meter (using Piezo – electric crystal type microphone). Force measurement: Electromechanical method, strain gauge load cell. Shaft power measurement: Eddy current dynamometer, Strain gauge transmission dynamometer Strain measurement: strain gauge materials, resistance strain gauge – unbounded & bonded, wire gauge, foil gauge & semiconductor gauge, strain gauge rosettes. Humidity measurement: Hair hygrometer, humistor hygrometer. Liquid level: floats, differential pressure cell	06
07	Control systems: Servomotor, mechanism & comparison of hydraulic, pneumatic, electronic control systems, proportional control action.	03
Total		30

Practical:

Skills to be developed:

Intellectual skills:

1. Analyse the result of calibration of thermister.
2. Interpret calibration curve of a rotameter.
3. Evaluate the stress induces in a strain gauge.

- Verify the characteristics of photo transistor and photo diode.

Motor skills:

- Test and calibration of a thermocouple.
- Handle various instruments.
- Draw the calibration curves of rotameter and thermister.
- Measure various parameters using instruments.

List of Practical: (Any five)

- Measurement of strain by using a basic strain gauge and hence determine the stress induced.
- Measurement of velocity of compressible fluid across a duct using Anemometer.
- Speed Measurement by using Stroboscope / Magnetic / Inductive Pick Up.
- Measurement of flow by using Rotameter.
- Calibration of given LVDT.
- Temperature control using Thermal Reed switch & Bimetal switch.
- Temperature measurement using Thermocouple.
- Determination of negative temperature coefficient and calibration of a Thermister.
- Measurement of force & weight by using a load cell.
- Liquid Level Measurement by using floats/ differential pressure cell system.
- Verify characteristics of photo transducer & photo diode.

Examination Schedule Internal practical Sessional:

Attending classes, practicing programs & submitting respective assignment in time		5 x 4 =20	
Viva - voce		5	
Total:		25	

Examination Schedule: External practical Sessional examination
 Examiner: **Lecturer**

For submission of assignment in scheduled time		5 x 2 = 10	
On spot experiment		10	
viva voce		05	
Total		25	

Reference books :- Nil

Suggested List of Laboratory Experiments :- Nil

Suggested List of Assignments/Tutorial :-

G R O U P	Chapter	ONE OR TWO SENTENCE ANSWER QUESTIONS				G R O U P	Chapter	SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS			TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A		5	10	1	1 X 10 = 100	A		5	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	5	5 X 5 = 25
B		5				B		5			

List of Books:

Sr. No.	Author	Title	Publication
	Beckwith	Mechanical Measurement	Pearson
	Doebelin	Measurement Systems	Mc Graw Hill
	N V Raghavendra L Krishnamurthy	Engineering Metrology & Measurements	Oxford
	R.K.Rajput	Mechanical Measurement & Instrumentation	S.K. Kataria & Sons
	A.K.Sawhney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi.
	R.V. Jalgaonkar	Mechanical Measurement & Control	Everest Publishing House, Pune
	Figliola	Theory & Design for Mechanical Measurements, 3ed, w/cd	Wiley
	Katta Narayana Reddy P.S.R. Krishnudu	Instrumentation & Control System	SCITECH
	John Turner Martyn Hill	Instrumentation for Engineers and Scientists	Oxford
	D.S.Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi
	C.S. Narang	Instrumentation Devices & Systems	Tata McGraw Hill Publications
	R.K.Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi
	B.C.Nakra and K.K.Chaudhry	Instrumentation, Measurement and Analysis	Tata Mc Graw Hill Publication
	Bewoor	Metrology & measurement	Tata Mc Graw Hill Publication

Name of the Course : Mechanical Engineering			
Subject: POWER ENGINEERING			
Course code: ME		Semester: Fifth.	
Duration: 17 weeks		Maximum Marks : 150	
Teaching Scheme		Examination Scheme:	
Theory : 3 hrs/week		Internal Assessment: 20 Marks	
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 2 hrs/week		End Semester Exam: 70 Marks	
Credit: 4		Practical: Internal Sessional continuous evaluation: 25 Marks	
		Practical: External Sessional examination: 25 marks	
Aim :-			
S. No.			
1	To study the Internal Combustion Engine.		
2	To understand the fundamentals of Steam Nozzle and Diffuser.		
3	To study working principle and construction of different types of Steam Turbines.		
4	To study the working principle of Gas Turbine and its industrial application.		
5	To understand the fundamentals of Jet Propulsion.		
6	To study the working principle of Hydraulic Turbines and their application in actual power generation.		
Objective :-			
S. No.	The Students should be able to:		
1	<ul style="list-style-type: none"> Describe Internal Combustion Engine and should be able to calculate various performance characteristics of IC Engines by conducting trial. 		
2	<ul style="list-style-type: none"> Explain the working principle and application of Steam Nozzle and Diffuser. 		
3	<ul style="list-style-type: none"> Describe construction and working of various types of Steam Turbines. 		
4	<ul style="list-style-type: none"> Understand working of Gas Turbine and its application. 		
5	<ul style="list-style-type: none"> Explain the basic principle of Jet Propulsion. 		
6	<ul style="list-style-type: none"> Understand working of Hydraulic Turbines and their application in actual power generation. 		
Pre-Requisite: Elementary knowledge on Physics, basic Mathematics, Thermal Engineering-I, Thermal Engineering-II and Fluid Mechanics.			
Contents			Hrs/week
POWER ENGINEERING			
Chapter	Name of the Topic		Hours
	GROUP-A		
	1.0	I.C. Engine and Pollution Control: Basic Principle, representation on P-V & T-S diagrams and deduction of Thermal Efficiency of Otto Cycle, Diesel Cycle and Dual Combustion Cycle. (Simple numerical) Classification of I.C. Engines. Working Principle, Construction with function of components and Comparison of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines.	14
	1.1		
	1.2		
	1.3		

	1.4	Hypothetical & Actual Indicator Diagram of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines.		
	1.5	Valve Timing Diagram of Two-Stroke and Four-Stroke (Petrol and Diesel) Engines.		
	1.6	Brief Description of I.C. Engine Combustion (SI & CI), Firing-order of Multi-cylinder I.C. Engine, Scavenging, Preignition, Detonation, Supercharging, Turbo-charging, Simple Carburetor, M.P.F.I. and Fuel Injection Pump.		
	1.7	Basic Concept of Governing of I.C Engine, Lubrication of I.C Engine and Cooling of I.C Engine.		
	1.8	Performance of I. C Engine – Indicator Power, Brake Power, Morse Test, Mechanical Efficiency, Thermal Efficiency, Relative Efficiency (Efficiency Ratio), Volumetric Efficiency, Specific Fuel Consumption and Heat Balance Sheet. (Simple numerical)		
	1.9	Pollutants in Exhaust Gases of Petrol and Diesel Engines, their effects on environment and possible ways of reducing the Pollutants in the Exhaust Gases.		
		GROUP-B		
	2.0	Nozzles / Diffusers and Steam Turbines:	10	
	2.1.0	Nozzles / Diffusers:		
	2.1.1	Working Principle, Classification and Application of Steam Nozzles & Diffusers.		
	2.1.2	Continuity Equation, Sonic Velocity and concept of Mach Number.		
	2.1.3	Steady Flow Energy Equation for flow through Steam Nozzles. (Simple numerical)		
	2.1.4	Concept of Critical Pressure and Critical Pressure Ratio.		
	2.2.0	Steam Turbines:		
	2.2.1	Classification of Steam Turbines		
	2.2.2	Working Principle, Construction with function of components of Simple Impulse Turbine and Simple Impulse-Reaction Turbine.		
	2.2.3	Velocity Diagrams, Work done, Power and Efficiency of Simple Impulse Turbine. (Simple numerical by using Graphical Method only)		
	2.2.4	Concept of Compounding of Steam Turbine.		
	2.2.5	Concept of Governing of Steam Turbine.		
	3.0	Gas Turbine and Jet Propulsion:	10	
	3.1.0	Gas Turbine:		
	3.1.1	Basic Principle, representation on P-V & T-S diagrams and deduction of Thermal Efficiency of Brayton or Joule Cycle. (No numerical)		
	3.1.2	Classification and Applications of Gas Turbine.		
	3.1.3	Comparison, labelled schematic flow diagram and function of components of Closed Cycle & Open Cycle Gas Turbines.		
	3.1.4	Methods to improve thermal efficiency of gas turbine		

		(Regeneration, Inter- Cooling, Reheating using T-S Diagram). (No analytical treatment)		
	3.2.0	Jet Propulsion:		
	3.2.1	Jet Propulsion – Basic Principles of Turbojet, Turbo Propeller & Ram Jet.		
	3.2.2	Rocket Propulsion- Solid Propellants and Liquid Propellants and Components & Function of Liquid Propellants Rocket Engine.		
GROUP-C				
	4.0	Hydraulic Turbines:	11	
	4.1	Classification of Hydraulic Turbines.		
	4.2	Construction and working principle of Pelton Wheel, Francis and Kaplan Turbine.		
	4.3	Draft Tubes – working principle and types, Concept of Cavitation in Turbines		
	4.4	Velocity Diagrams, Work done, Power and Efficiency of Pelton Wheel & Francis Turbine. (Simple numerical)		
	4.5	Basic concept of Governing of Turbine.		
	4.6	Specific Speed and Selection of turbine on the basis of head and discharge available.		
	4.7	Schematic Layout of Hydroelectric Power Plant.		
Sub Total:			45	
Internal Assessment Examination & Preparation of Semester Examination			6	
Total			51	
Practical:				
Skills to be developed:				
Intellectual Skill :				
<ol style="list-style-type: none"> 1. Understand working principle and construction of (four-stroke / two-stroke) Petrol and Diesel Engine. 2. Understand working principle and construction of Steam Turbines. 3. Understand working principle of Gas Turbine. 4. Understand working principle and construction of Hydraulic Turbines. 				
Motor Skills :				
<ol style="list-style-type: none"> 1. Conduct dismantling and reassembling an I.C. Engine. 2. Conduct trial on I.C. Engine Test Rig to find out the Heat Balance in an I.C. Engine. 3. Conduct trial on suitable Test Rig to determine I.P., B.P., Mechanical Efficiency and Thermal Efficiency of an I.C. Engine. 4. Report on visit to Hydroelectric Power Plant. 				
List of Practical:				
<ol style="list-style-type: none"> 1. Study of (four-stroke / two-stroke) Petrol and Diesel Engine. (If possible conduct the study by dismantling and reassembling an I.C. Engine) 2. Study of valve timing diagram of four-stroke Petrol and Diesel Engine. 3. Determination of I.P., B.P., Mechanical Efficiency and Thermal Efficiency of an I.C. Engine through suitable method. 4. Conduct trial on I.C. Engine Test Rig to find out the Heat Balance in an I.C. Engine. 5. Conduct Morse Test on Multi-cylinder Diesel / Petrol Engine. 				

6. Study of Cooling System generally installed in four-stroke (single / multi-cylinder) I.C. Engine.
7. Study of Lubrication System generally installed in two-stroke I.C. Engine.
8. Study of Steam Turbines.
9. Study of Gas Turbine.
10. Study of Water Turbines.
11. Study of schematic layout of Hydroelectric Power Plant.

Note: At least **FIVE (05)** nos. of Practical / Study are to be conducted.

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
V.M. Domkundwar	A Course in Thermal Engineering.		Dhanpat Rai & Co.
Dr. D.S.Kumar	Engineering Thermodynamics (Principles & Practices)		S.K. Kataria & Sons
P. L. Ballaney	A Course in Thermal Engineering.		Khanna Publishers
R. S. Khurmi	A text book of Thermal Engineering.		S. Chand & co. Ltd.
R. K. Rajput	A Course in Thermal Engineering.		Laxmi Publication, Delhi
Patel and Karmchandani	Heat Engine Vol. - I & II		Acharya Publication
P. K. Nag	Engineering Thermodynamics		Tata McGraw Hill
B. K. Sarkar	Thermal Engineering		Tata McGraw Hill
A.R. Basu	Thermal Engineering (Heat Power)		Dhanpat Rai & Co.
R. k. Jain	Automobile Engineering		Tata McGraw Hil
S. Ramamrutham	Hydraulic & Fluid Machines		Dhanpat Rai and Sons New Delhi
SAWHNEY	Thermal and Hydraulic Machines		PHI

Suggested List of Assignments / Tutorial :-

1. Simple numerical on Otto Cycle, Diesel Cycle, Dual Combustion Cycle and Performance of I. C Engine.
2. Simple numerical related to Velocity Diagrams, Work done, Power and Efficiency of Simple Impulse Turbine by using Graphical Method only.
3. Draw labelled schematic flow diagram and write function of components of Closed Cycle & Open Cycle Gas Turbines.
4. Simple numerical related to Velocity Diagrams, Work done, Power and Efficiency of Pelton Wheel & Francis Turbine.

EXAMINATION SCHEME: END SEMESTER EXAMINATION

GROUP	MODULE OR CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1	08	ANY 20	1	20	4	FIVE, (AT LEAST	10	50

B	2,3	07				3	ONE FROM EACH GROUP)		
C	4	05				3			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING (AUTOMOBILE ENGINEERING (ELECTIVE – I))		
Course code:	Semester : Fifth	
Duration :	Maximum Marks : 100	
Teaching Scheme	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 10 Marks	
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks	
Practical : 2 hrs/week	End Semester Exam: 35 Marks	
Credit: 4	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	To understand & apply the knowledge about various system, subsystems & their inter-relationships of the automobile for the manufacturing of advanced automotive techniques.	
Objective :-		
S No	The student will 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 resting of vehicle.	
Pre-Requisite:-NIL		
Contents		Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
Group:A		
01	Introduction of Automobile 1.1 Classification of automobiles 1.2 Vehicle layout & types 1.3 Body construction - Types & Nomenclature of car body. Introduction to aerodynamic body shapes 1.4 Automobile market in India of "on road vehicles", major manufacturers, their products & their collaborations.	03
02	Fuel supply system 2.1 Fuel feed system in S.I engine, types, gravity & pump feed system, layout of S.I engine fuel pump system, function of each components 2.2 Fuel mixing & circuit control system, carburetor, types, working principle of simple carburetor, requirement of air- fuel ratio, defects of carburetor & its remedy Circuits of carburetor, float, starting, idling, low speed, high speed & accelerating circuit Petrol injection system, types, layout & working principle of multi point fuel injection system, advantages & disadvantages 2.3 Fuel supply system in C.I engine, layout, components ,function, types, working & line diagram of common rail, individual pump system, fuel injectors, single orifice, multiple orifice	05
Group:B		
03	Automobile Transmission 3.1 Clutch- necessity, construction & working of coil spring & diaphragm spring type clutch. 3.2 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 3.3 Final drive- necessity, construction & working of propeller shaft & differential. 3.4 Axle- Type of rear axles, front axles & their applications	10

04	Control Systems 4.1 Steering system- Requirement of steering system. 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. 4.2 Brake system- construction & working of hydraulic & Pneumatic brakes. Comparison of disc & drum brake.	10
Group:C		
05	Suspension systems, wheels & Tyres 5.1 Necessity & classification of suspension system. 5.2 Working & construction of Leaf spring, rigid axle suspension. 5.3 Introduction to air suspension 5.4 Construction & working of McPherson & wishbone, trailing link suspensions. 5.5 Construction & working of telescopic shock absorbers. 5.6 Construction & working of spoked wheel, disc wheel & light alloy cast wheel. 5.7 Types of rims, their construction & working. 5.8 Construction, working & comparison of radial, cross-ply and tubed, tubeless tyre & tyre specifications 5.9 Factors affecting tyre life 5.10 Wheel Alignment and Balancing	8
06	Automobile Electrical Systems & Body 6.1 Battery- working, construction & rating of battery. 6.2 Ignition system- construction & working of electronic and CDI ignition system. 6.3 Starting system- construction & working of starting motor. 6.4 Charging system- construction & working of alternator 6.5 Wiring system-harnessing & colour codes. 6.6 Lighting system-head light, tail light, indicator light & their circuits. 6.7 Gauges- construction & working of Fuel level gauge, oil gauge and water temperature gauge. 6.8 Use of microprocessor in automobile control systems	8
	Total	44
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: (Any five) 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. Mini project :- Student will prepare a project report & present a seminar
 Title:- Automotive market In India.
 Collect following information.
 a) Top 10 Car/MUV/2W/Heavy vehicle Manufacturers in India & their sale in last 2 Years.
 b) Top 5 models of Car/MUV/2W/Heavy vehicle Manufacturers in India.
 c) New models launched in last 3 years of Car/MUV/2W/Heavy vehicle. Survey modern features in these vehicle.
 d) Proposed launches in next two years in Car/MUV/2W/Heavy vehicle. Survey modern features in these vehicle

EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2	6	10	1	10	3	FIVE AT LEAST ONE FROM EACH GROUP	5	25
B	3,4	6				4			
C	5,6	6				3			

Name of Authors	Titles of the Book	Edition	Name of the Publisher
K. K. Jain and R.B. Asthana	Automobile Engineering		Tata Mcgraw hill
William Crouse	Automobile Mechanics		Tata Mcgraw hill
SRINIVASAN	Automobile Mechanics		Tata Mcgraw hill
H.M.Sethi	Automotive Technology		Tata Mcgraw hill
G.B.S. Narang	Automobile Engineering		Khanna Publication
Harold T. Glenn	Auto Mechanics		Bennett & Mckknight
Kirpal Singh	Automobile Engineering Vol. I and Vol. II		Standard Publication
S.K.Gupta	A text book in Automobile Engineering		S.Chand
K.Ramakrishna	Automobile Engineering		P.H.I
R.K.Singal	Automobile Engineering		S.K.Kataria

C. D.

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

Reference books :- Nil

Suggested List of Laboratory Experiments :- Nil

Suggested List of Assignments/Tutorial :- Nil

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering		
Subject Title: Mechatronics (Elective I)		
Course code: ME/	Semester : Fifth	
Duration : 17 weeks	Maximum Marks : 100	
Teaching Scheme:	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 10 Marks	
	Teacher's assessment (Assignment & Quiz): 05 Marks	
Tutorial: hrs/week	End Semester Exam: 35 Marks	
Practical : 2 hrs/week	Practical: Internal Sessional continuous evaluation: 25 Marks	
Credit: 4	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	The integration of electronics engineering, electrical engineering, computer technology, and intelligent 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.	
S No	Students should be able to:	
	<ol style="list-style-type: none"> 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. 	
Pre-Requisite:-		
S.No		
1	Elementary knowledge on basic electronics, basic electrical engineering, mechanical device, hydraulic & pneumatic circuit, transducer & sensor.	
Contents		Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
Group A		
01	Concept of Mechatronics, Constituents of Mechatronics System, Application of Mechatronics in manufacturing, Introduction to Sensors & transducers, Principle of 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.	03

02	Pneumatic, Hydraulic & Electrical Actuation System : 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	03
03	Computing Elements in Mechatronics: 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. 8051 Microcontroller - Architecture, Pin configuration, working of microcontroller, Applications. Comparison of microprocessor and microcontroller , advantages and disadvantages Programmable Logic Controller - 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 of PLC	05 03 08
Group B		
04	PLC Programming – 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 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,	21
05	Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS	02
Total:		45
Suggested List of Assignments/Tutorial :- Nil		

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: (Sl. No. 3 compulsory & Atleast three from the rest)

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 (any four)
 - 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.

List of Books:

Sr.No.	Author	Title	Publication
01	Bolton W.	Mechatronics- Electronic control systems in Mechanical and Electrical Engineering	Pearson Education Ltd.
02	Histand B.H. and Alciatore D.G.	Introduction to Mechatronics and Measurement systems	Tata McGraw Hill Publishing
03	John W. Webb and Ronald Reis	Programmable Logic Controllers	Prentice Hall of India
04	NIIT	Programmable Logic Control – Principles and Applications	Prentice Hall of India
	Mitra & Sengupta	Programmable Logic Controller & Industrial Automation	Penram International Publishing
	Paul P.L. Regtien	Sensors for Mechatronics	Elsevier
	Appu Kuttan K.K.	Introduction to Mechatronics	Oxford
	Surekha Bhanot	Process Control Principles & Applications	Oxford
05	Kolk R.A. and Shetty D.	Mechatronics systems design	Vikas Publishing, New Delhi

06	Mahalik N.P.	Mechatronics principles, concepts and applications	Tata McGraw Hill Publishing
	R.K.Rajput	A Text book of Mechatronics	S. Chand
	H.M.T	Mechatronics	Tata McGraw Hill Publishing
	Ramachandran	Mechatronics	Wiley

Internal practical Sessional examination Scheme

Attending classes, practicing programs & submitting respective assignment in time		5x4= 20	
Viva - voce		5	
Total:		25	
Examination Schedule: External practical Sessional examination			
Examiner: Lecturer / Jr. Lecturer			
For submission of assignment in scheduled time		5x2= 10	
On spot activity		10	
viva voce		05	
Total		25	

G R O U P	Chapter	ONE OR TWO SENTENCE ANSWER QUESTIONS				G R O U P	Chapter	SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS			TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3	5	10	1	1 x 10 = 10	A	1,2,3	5	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	5	5 x 5 = 25
B	4,5	5				B	4,5	5			

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING (POWER PLANT ENGINEERING (ELECTIVE-I))		
Course code:	Semester : Fifth	
Duration :	Maximum Marks : 100	
Teaching Scheme	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 10 Marks	
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks	
Practical : 2 hrs/week	End Semester Exam: 35 Marks	
Credit: 4	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	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. To study the layout, components of different power plants and economic aspects of power plants.	
Objective :-		
S No	The student will 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.	
Pre-Requisite:-		
	Knowledge of basic thermodynamics & heat power	
Contents		Hrs/week
Chapter	Name of the Topic	Hours
Group:A		
01	Introduction to power plant 1.1 Power scenario in India 1.2 Types of power plants – Hydro, Nuclear, Thermal, Future trends in Power sector.	02
02	Steam power plant 2.1 Layout of steam power plant, general features of selection of site 2.2 High pressure boilers – Construction and working of Sub-critical and Super-critical boilers. 2.3 Chronological development of Boilers [Stoker Fired,Pulvarised Fuel Fired Boiler, Front Fired boilers, Tangentially Fired Boiler, Bottom Fired Boiler] 2.4 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. 2.5 Boiler Feed water treatment 2.6 Environmental aspects of steam power plant - water pollution, air pollution, emission standard and its control 2.7 Generator Cooling System.	08
Group:B		

03	Nuclear power plant 3.1 Fusion and fission reaction, general criteria for selection of site. 3.2 Elements of nuclear power station, layout, types of nuclear reactors. 3.3 Nuclear fuels, coolant & moderators. 3.4 Working of PWR, BWR, CANDU, BREEDER type reactor. 3.5 Safety precautions and waste disposals.	05
04	Gas turbine power plant 4.1 General Layout, selection of site, Gas turbine power plants in India. 4.2 components of gas turbine plants, gas turbine Fuels. 4.3 Comparison of Gas turbine plant with diesel and Steam power plant. 4.4 Environmental impact of gas turbine power plant. Waste Heat recovery	05
Group:C		
05	5.1 Sources of waste heat 5.2 Heat recovery forms & methods – Sensible and latent Heat recovery. 5.3 Use of waste heat- Agricultural, green house, Animal shelter, Aqua cultural uses, process heating. 5.4 waste Heat recovery boilers	05
06	Non conventional power generation plants 6.1 Geothermal power plant- types, economical justification 6.2 Tidal power plant- factors affecting suitability of site, working of different tidal power plants, advantages and disadvantages 6.3 Wind power plant- different types, advantages and Disadvantages. 6.4 Solar power plant 6.5 Magneto Hydro dynamics power plant 6.6 Small hydro power plant 6.7 Introduction to Plasma technology in Power Generation.	10
07	Economics and operational aspects 7.1 Prediction of load, selection of types of generation, number of generating units. 7.2 Load duration curves, cost analysis, elements, controlling the cost of power plant (simple numerical) 7.3 Major electrical equipments in power station- generator, step-up transformer, switch gear, electrical motors	8
	Total	43

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:

List of Experiments/Studies:

1. List technical details of components and subsystems of power plants.
 - a)HP & LP Heater feed cycle
 - b)Condenser Cooling System including Cooling Tower.
 - c) Generator Cooling System.
 - d)HP & LP Bypass system.
 - e)Turbine sealing system.
2. Draw layouts of different power plants
3. Operate devices using solar energy inputs

Name of Authors	Titles of the Book	Edition	Name of the Publisher
P. K. Nag	Power plant engineering		Tata Mcgraw hill
Fredrick T. Mosse	Power plant engineering		East-West press
A. Chkrabarti and M. L. Soni	A text book of Power System Engineering		Dhanpat Rai and Co
Arora and Domkundwar	A course in power plant engineering		Dhanpat Rai and Co
Thomas C. Elliott,	Standard handbook of power plant engineering 1997		Tata McGraw Hill
M.K.Gupta	Power plant engineering		P.H.I
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.			
- Pulverizes and feeders.			
- Renewable energy sources,			
(Developed by National Power Training Institute , South Ambazari Road, Nagpur)			
Reference books :- Nil			
Assignments:			
Visit to steam power plants/nuclear power plants/wind power plants/ Hydro power plants and prepare a report.(Any one Plant).			
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.			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :- Nil			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			

Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
	25		

EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2	6	10	1	10	3	FIVE AT LEAST ONE FROM EACH GROUP	5	25
B	3,4	6				4			
C	5,6,7	6				4			

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING (TOOL ENGINEERING (ELECTIVE – I))		
Course code:	Semester : Fifth	
Duration :	Maximum Marks : 100	
Teaching Scheme	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 10 Marks	
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks	
Practical : 2 hrs/week	End Semester Exam: 35 Marks	
Credit: 4	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	To impart, concepts, principles & procedures of tool engineering 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	
Objective :-		
S No	The student will 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	
Pre-Requisite:-NIL		
Contents		Hrs/week
Chapter	Name of the Topic	Hours
01	Metal Cutting 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. 1.2 Tool materials: Types, characteristics, applications. Heat treatment of tool steels, Specification of carbide tips, Types of ceramic coatings. 1.3 Cutting Tool Geometry: Single point cutting tool, drills, reamers, milling cutters.	18
02	Press Tools 2.1 Presses: Types, Specification. 2.2 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. 2.3 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. 2.4 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.	16
03	Fundamentals of Other Tools Constructional features of - Pressure Die casting dies, metal extrusion dies, injection	10

	molding dies, forging dies, plastic extrusion dies.	
	Total	44

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:(Any Five)

1. Report on Visit to press shop for study of presses.
2. Sketches of Combination Die, Progressive Die, Compound die, Inverted Die, Drawing Die and 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.

EXAMINATION SCHEME

CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
1	5	10	1	10	4	FIVE AT LEAST ONE FROM EACH CHAPTER	5	25
2	5				3			
3	3				2			

Text Books:

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Donaldson Anglin	Tool Design		Tata Mcgraw hill

P. C. Sharma	A Text Book OF Production Engineering		S Chand & Co.
H. M. T.	Production Technology		Tata Mcgraw hill
R. K. Jain	Production Technology		Khanna Publishers
A.S.T.M.E.	Fundamental of tool design.		Prentice-Hall of India.
M.H.A. Kempster	Introduction to Jig and Tool Design		Viva publ.
P. H. Joshi	Jigs and Fixtures		Tata Mc Graw Hill
P. H. Joshi	Press Tools		Tata Mc Graw Hill
American Society of Tool and Manufacturing Engineers	Tool engineers handbook 1959		McGraw-Hill
C. D.			
<ul style="list-style-type: none"> • C. D. Prepared By MSBTE under its CAI Package Program. • C. D. on various Topics of Automobile Engineering By SAE 			
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :- Nil			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		

Name of the Course : Mechanical Engineering		
Subject: INDUSTRIAL PROJECT AND ENTREPRENEURSHIP		
Course code:	Semester : Fifth	
Duration : 17 weeks	Maximum Marks : 50	
Teaching Scheme	Examination Scheme	
Theory : 1hrs/week	Internal Assessment: Marks	
Tutorial: hrs/week	Teacher's Assessment (Assignment & Quiz): Marks	
Practical : 2 hrs/week	End Semester Exam: Marks	
Credit: 2	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional examination: 25 marks	
Aim :-		
S.No		
1	To explore the emerging opportunities and to inculcate the entrepreneurial values during their educational tenure. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.	
Objective :-		
S No	The student will able to	
1	To identify and train potential entrepreneurs.	
2	To motivate the entrepreneurial instinct.	
3	To develop necessary knowledge and skills among the participants.	
4	To help in analyzing the various options to select the most appropriate product suiting to the entrepreneur and the market.	
5	To give a clear picture about the process and procedures involved in setting up an small scale Industrial unit or a bigger unit.	
6	To impart basic managerial skills and understandings to run the project efficiently and effectively.	
7	To analyze the environmental issues to be addressed relating to the proposed project.	
Pre-Requisite:-Nil		
PART A) Industrial Project 15hrs		
Following activities related to project are required to be dealt with, during this semester		
1. Form project batches & allot project guide to each batch. (Max. 4 students per batch)		
2. Each project batch should select topic / problem / work by consulting the guide & / or industry. Topic / Problem / work should be approved by Head of department.		
3. Each project batch should prepare action plan of project activities & submit the same to respective guide.		
4. 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.		
5. Action Plan should be part of the project report.		
Part B: Entrepreneurship Development 15hrs		
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.		
Develop awareness about enterprise management.		
Contents		
Chapter	Name of the Topic	Hrs/week
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.	

	<p>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</p>	
02	<p>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.</p>	
03	<p>Market Assessment 3.1) Marketing -Concept and Importance 3.2) Market Identification, Survey Key components 3.3) Market Assessment</p>	
04	<p>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. 4)Budget.</p>	
05	<p>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</p>	
06	<p>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</p>	

	Concept and process 02 6.3) Global Entrepreneur				
	Total		30 hours		
Text Books:					
Name of Authors	Titles of the Book	Edition	Name of the Publisher		
Entrepreneurship Development	E. Gorden K.Natrajan		Himalaya Publishing. Mumbai		
Entrepreneurship Development	Preferred by Colombo plan staff college for Technical education.		Tata Mc Graw Hill Publishing co. ltd. New Delhi.		
A Manual on How to Prepare a Project Report	J.B.Patel D.G.Allampally	<p>EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org</p>			
A Manual on Business Opportunity Identification & Selection	J.B.Patel S.S.Modi				
National Directory of Entrepreneur Motivator & Resource Persons.	S.B.Sareen H. Anil Kumar				
New Initiatives in Entrepreneurship Education & Training	Gautam Jain Debmuni Gupta				
A Handbook of New Entrepreneurs	P.C.Jain				
Evaluation of Entrepreneurship Development Programmes	D.N.Awasthi , Jose Sebeastian				
The Seven Business Crisis & How to Beat Them.	V.G.Patel				
Poornima M. Charantimath	Entrepreneurship Development of Small Business Enterprises				Pearson Education, New Delhi
Special Edition for MSBTE	Entrepreneurship Development				McGraw Hill Publication
Entrepreneurship Theory and Practice	J.S. Saini B.S.Rathore				Wheeler Publisher New Delhi

Entrepreneurship Development			TTTI, Bhopal / Chandigarh
Mary Coulter.	<i>Entrepreneurship in Action.</i>	2008.	Prentice Hall of India Pvt. Ltd., New Delhi.
Mohanty, S.K.	<i>Fundamentals of Entrepreneurship</i>	2009	India Pvt. Ltd., New Delhi.
Bedi	Management & Entrepreneurship		Oxford
Khatua	Project Management & Appraisal		Oxford
Nandan	<i>Fundamentals of Entrepreneurship</i>		P.H.I
Schaper	<i>Entrepreneurships</i>		Wiley
S.S.Khanka	<i>Entrepreneurial Development</i>		S.Chand

2) VIDEO CASSETTES

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

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.

Reference books :- Nil

Suggested List of Experiments :-

- 1] Field visit to successful enterprise - study of characteristics of successful entrepreneurs - case study
- 2] Communication skills - listening and note taking - simulated exercises
- 3] Development of project proposals - SWOT analysis
- 4] Development of project proposals - formulation of project plan

Suggested List of Assignments/Tutorial :-

- 1 Assess yourself-are you an entrepreneur?
- 2 Prepare a project report and study its feasibility.

Examination Scheme:	
Internal Practical Sessional Examination	
Chapter	
1 – Submission of Report within scheduled date	5
2 - submission of two assignment on scheduled date	5
3 – Practice of Assignment on Entrepreneurship	10
Viva - voce	5
Total:	25
External Practical Sessional Examination	
Report & assignment	5
On spot formation of report on Entrepreneurship	10
Viva voce	10
Total:	25



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering		
Subject Title: Computer Programming		
Course code: ME/	Semester : Fifth	
Duration : 17 weeks	Maximum Marks : 50	
Teaching Scheme:	Examination Scheme	
Theory : 1 hrs/week	Mid Semester Exam: Marks	
Tutorial: hrs/week	Assignment & Quiz: Marks:	
Practical : 2 hrs/week	End Semester Exam: Marks	
Credit: 2	Practical: Internal Sessional continuous evaluation:25 Marks	
	Practical: External Sessional Examination:25 Marks	
Aim :-		
S.No		
1		
Objective :-		
To understand how to give instructions to computers.		
To expose a student to the basic principles of programming through a structured programming language like 'C'.		
To enable the students to learn about any advanced Object Oriented programming Language.		
S No	The student will able to	
1	Break a given task into subtasks.	
2	Enhance logical thinking.	
3	Develop 'C' programs for simple applications.	
Pre-Requisite:-		
S.No		
1	Sound knowledge of computer.	
Contents		
Chapter	Name of the Topic	Hrs/week
		Hours
01	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
02	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
03	Use of Control Statements:- if-else, if-else-if, switch-case, while loop, do – while loop, for loop, break and continue. Writing, Compiling, Executing and debugging programs	05
04	Introduction to Subscripted variables, arrays, defining and declaring one and two dimensional arrays, reading and writing	03
05	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:

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

Motor Skills:

- Write program in 'C' language.
- Run and debug 'C' program successfully.

LIST OF PRACTICALS

To write simple programme having engineering application involving following statements

1. Use of Sequential structure: atleast **two** problems
2. Use of if-else, if-else-if statements: atleast **three** problems
3. Use of for statement: atleast **five** problems
4. Use of Do-While Statement: atleast **two** problems
5. Use of While statement: atleast **three** problems
6. Use of break and Continue statement: atleast **one** problems
7. Use of multiple branching Switch statement: atleast **one** problems
8. Use of different format specifiers using Scanf() and Printf(): atleast **two** problems
9. Use of one dimensional array e.g. String, finding standard deviation of a group data: atleast three problems
10. Use of two dimensional array of integers/ reals: atleast **one** problems
11. Defining a function and calling it in the main: atleast **three** problems

Examination Schedule Internal practical Sessional:

Attending classes, practicing programs & submitting respective assignment in time		20	
Viva - voce		5	
Total:		25	

Examination Schedule: External practical Sessional examinationExaminer: **Lecturer**

For submission of assignment in scheduled time		10	
On spot program		10	
viva voce		05	
Total		25	

.	
Reference books :- Nil	
Suggested List of Laboratory Experiments :- Nil	
Suggested List of Assignments/Tutorial :- as mentioned in list of practical	

List of Books:

Author	Title	Publication
Yashwant Kanitkar	Let us 'C'	BPB publications
Balguruswamy	Programming in 'C'	Tata Mc- Graw Hill
Pradip Dey & Manas Ghosh	Programming in 'C'	Oxford Higher Education
Byron Gotfried	Introduction to 'C' programming	Tata McGraw Hill
H.Arolkar	Simplifying c	Dreamtech

Name of the Course : Mechanical Engineering		
Subject Title: Professional Practices-III		
Course code:	Semester : Fifth	
Duration :	Maximum Marks : 50	
Teaching Scheme	Examination Scheme	
Theory : hrs/week	Practical: Internal Sessional Continuous Evaluation: 25 Marks.	
Tutorial: hrs/week	Practical: External Sessional Examination: 25 Marks.	
Practical : 2 hrs/week		
Credit: 1		
Aim :-		
Sl. No.		
1	To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.	
Objective :-		
Sl. No.	The student will able to:	
1	<ul style="list-style-type: none"> Acquire information from different sources. 	
2	<ul style="list-style-type: none"> Prepare notes for given topic. 	
3	<ul style="list-style-type: none"> Present given topic in a seminar. 	
4	<ul style="list-style-type: none"> Interact with peers to share thoughts. 	
5	<ul style="list-style-type: none"> Prepare a report on industrial visit, expert lecture. 	
Pre-Requisite:-Nil		
Contents		Hrs/week
Chapter	Name of the Topic	
01	Student Activities: Students in a group of 3 to 4 shall perform ANY ONE of the following activities (Other similar activities may be considered) and write a report as a part of term work. Activities : <ol style="list-style-type: none"> Collection of data regarding loan facilities or other facilities available through different organizations / banks to budding entrepreneurs. Survey and interviews of successful entrepreneurs in nearby areas. Survey of opportunities available in thrust areas identified by Government or DIC. Measuring Screw thread parameters on floating carriage dial micrometer and select the optimum diameter of wire. Survey of data regarding different types of pumps with specifications from manufacturer's catalogue, local markets, end users (any other engineering products may be considered for survey). Survey of farm implements used by farmers. 	05 Hrs.
02	Group Discussion : 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) <ol style="list-style-type: none"> CNG versus LPG as a fuel. Petrol versus Diesel as a fuel for cars. Trends in automobile market. 	05 Hrs.

	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.		
	CAM SOFTWARE COURSE: 1. Introduction of CAM software. 2. Identify Different icons and tool bar on the Screen. 3. Import Model for machining. 4. Position the Model to Reference zero point. 5. Measure the Model for Tool Selection. 6. Define the Block from which the part will be cut. 7. Define the cutting Tools to be used. 8. Define the cutting feed, rapid movement and rpm . 9. Define Set up options (Rapid Move Heights – Start and End Point). 10. Define Boundary for selected area machining. 11. Create a Roughing Tool Path Strategy. 12. Create a Finishing Tool Path Strategy. 13. Edit Tool Path . 14. Tool Path Transformation . 15. Animate and simulate the tool path. 16. Create an NC Program and output as a post-processed nc data file. 17. Save the CAM Project to an external directory.	20 Hrs.	
	Total	30 Hrs.	
Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
Mark Ratner and Daniel Ratner	Nanotechnology		Pearson Educatuion, New Delhi
Yoram Korem	Computer Control of Manufacturing System		Mcgraw Hill Publication
Sunil Chopra, Peter Meindl	Supply Chain Management		Pearson Education, New Delhi
Reference books :- Nil			
Suggested List of Laboratory Experiments :- Nil			
Suggested List of Assignments/Tutorial :- Nil			

Examination Scheme:	
Internal Practical Sessional Examination	
Topic	Marks
1 - Submission of report on student activity on scheduled date.	5
2 - Performance and submission of assignment on group discussion on scheduled date.	5
3 - Practice of CAM software.	10
4 - Viva – voce.	5

Total:	25
External Practical Sessional Examination	
Topic	Marks
1 - Submission of signed report & assignment.	5
2 - On spot CAM activity.	15
3 - Viva voce.	5
Total:	25



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering		
Subject Title: DESIGN OF MACHINE ELEMENTS		
Course code: ME/	Semester : Sixth	
Duration : 17 weeks	Maximum Marks : 150	
Teaching Scheme:	Examination Scheme:	
Theory : 4 hrs/week	Internal Assessment: 20 Marks	
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 10 Marks	
Practical : 2 hrs/week	End Semester Exam: 70 Marks	
Credit: 5	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	To enable the student to design and draw simple machine components used in small and medium scale industries. Fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Materials and Theory of Machines is essential. To develop analytical abilities to give solutions to engineering design problems.	
Objective :-		
S No	The student will able to	
1	Analyze the various modes of failure of machine components under different load patterns.	
2	Design and prepare part and assembly drawings.	
3	Use design data books and different codes of design.	
4	Select standard components with their specifications from manufacturer's catalogue.	
5	Develop drawings on CAD software	
Pre-Requisite:-NIL		
	Contents	Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
GROUP:A		
01	Introduction to Design 1.1 Machine Design philosophy and Procedures 1.2 General Considerations in Machine Design 1.3 Fundamentals:- Types of loads, concepts of stress, Strain, Stress – Strain Diagram for Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion, Principle Stresses (Simple Numerical) 1.4 Creep strain and Creep Curve 1.5 Fatigue, S-N curve, Endurance Limit. 1.6 Factor of Safety and Factors governing selection of factor of Safety. 1.7 Stress Concentration – Causes & Remedies 1.8 Converting actual load or torque into design load or torque using design factors like velocity factor, factor of safety & service factor. 1.9 Properties of Engineering materials, Designation of materials as per IS 1.10 Standardization, use of design data book, use of standards in design 1.11 Theories of Elastic Failures – Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory.	10
02	<i>Design of simple machine parts</i>	

	2.1 Cotter Joint, Knuckle Joint, 2.2 Design of Levers: - Hand/Foot Lever & Bell Crank Lever.	08
GROUP:B		
03	Design of Shafts, Keys and Couplings, Spur Gears and Pulley. 3.1 Types of Shafts, Shaft materials, Standard Sizes, Design of Shafts (Hollow and Solid) using strength and rigidity criteria, ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley 3.2 Design of Sunk Keys, Effect of Keyways on strength of shaft. 3.3 Design of Couplings – Protected type Flange Coupling, 3.4 Spur gear design considerations. Lewis equation for static beam strength of spur gear teeth. Power transmission capacity of spur gears in bending. 3.5 Design of C.I. Pulley.	14
04	Design of Fasteners 4.1 Stresses in Screwed fasteners, bolts of Uniform Strength. 4.2 Design of Bolted Joints subjected to eccentric loading. 4.3 Design of parallel and transverse fillet welds, axially loaded symmetrical section, Merits and demerits of screwed and welded joints	08
GROUP:C		
05	Antifriction Bearings 5.1 Classification of Bearings – Sliding contact & rolling contact. 5.2 Terminology of Ball bearings – life load relationship, basic static load rating and basic dynamic load rating, limiting speed. Selection of ball bearings using manufacturer's catalogue.	08
06	Ergonomics & Aesthetic consideration in design 6.1 Ergonomics of Design – Man –Machine relationship. Design of Equipment for control, environment & safety. 6.2 Aesthetic considerations regarding shape, size, color & surface finish.	04
07	Estimating & Costing 7.1 Definition of estimating and costing, elements of costing, overhead 7.2 Determination of weight of various parts such as simple bush, flanged pipe, Lathe centre, Rivets, Bolts & Nuts, Simple spanner, Simple crank & connecting Rod. 7.3 Estimation of selling price of cast part such as C.I.pulley, Coupling, and Wooden pattern of flange. 7.4 Estimation of fabricated job such as Simple chimney, Funnel, Cylindrical tank	08
	Total	60

Assignments:

Skills to be developed:

Intellectual skills:

1. Understand the basic philosophy and fundamentals of Machine Design.
2. Apply and use the basic knowledge of earlier subjects like mechanical Engineering. materials, strength of materials and theory of machines.
3. Analyse and evaluate the loads, forces, stresses involved in components and subassemblies and decide the dimensions.
4. Understand the modes of failures of m/c components and decide the design criteria and equations.

5. Understand the concept of standardization and selecting standard components.

6. Understand the methods of computer aided design practices.

Motor skills:

1. Draw the components assembly as per the designed dimensions.

2. Modify drawings and design as per requirement.

3. Use the different design software.

4. Use different design data books and IS codes.

1. IS/ International Codes

a) IS 4218: 1967 ISO Metric Threads

b) IS 2693: 1964 Cast Iron Flexible Couplings

c) IS 2292: 1963 Taper keys & Keyways

d) IS 2293: 1963 Gib Head Keys & Keyways

e) IS 2389: 1963 Bolts, Screws, Nuts & Lock Nuts

f) IS 4694: 1968 Square threads

g) IS 808: 1967 Structural Steel

h) SKF Catalogue for Bearings

2. SOFTWARE

1) Think 3 CAD Software developed by acebrain.

2) E-Yantra Software, developed by FEAST.

Suggested List of Laboratory Experiments : - Nil

Suggested List of Assignments/Tutorial :

S.No List of Assignments:

1 Assignment on selection of materials for given applications [at least two applications should be covered] using design data book. List the mechanical properties of material selected.

2 Problems on design of simple machine parts like Cotter Joint, Knuckle Joint, Bell Crank Lever, C.I. Pulley (One example on each component) with free hand sketches.

3 Design Project: Observe the system where transmission of power takes place through shaft, Keys, coupling, pulley and belt drive. Get the required information regarding power transmitted (power output by motor or engine etc.). By selecting suitable materials, design the shaft, key and coupling. Also select suitable Ball Bearing from Manufacture's catalogue. Prepare design report and assembly drawing indicating overall dimensions, tolerances, and surface finish. Also prepare bill of materials. (Activity should be completed in a group of five to six students) .

4. Assignments on overhead cost calculation, selling price calculation,

5. Assignments on weight and cost calculation of different parts.

6. Survey of Prime movers – Electric motors / I.C. Engines available in the market along with specifications suitable for your design project. Survey report should be prepared with the relevant catalogue.

End Semester Examination Scheme. Maximum Marks-70, Time Allotted-3 hrs							
Group	unit	Objective Questions		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer	Marks per question	Total marks
A	01,02,03	8	20	4	5, taking at least one from each group	10	50
B	04,05	6		3			
C	06,07	6		3			

List of Books:

Author	Title	Publication
Sharma & Agwarwal	Machine Design	S.K. KATARIA
A.R.Basu	Machine Design Drawing, Estimating and Costing	Dhanpat Rai
V.B.Bhandari	Introduction to Machine Design	Tata Mc- Graw Hill

P.Kannaiah	Machine Design	Scitech
R.S.khurmi	Machine Design	S.Chand
R.K.Jain	Machine Design	Khanna Publication
Joseph Edward Shigley	Mechanical Engg. Design	Mc- Graw Hill
PSG Coimbtore	Design Data Book	PSG Coimbtore Mechanics
Abdulla Shariff	Hand Book of Properties of Engineering Materials & Design Data for Machine Elements	Dhanpat Rai & Sons

Reference books :

Author	Title	Publication
Robert L.Mott,Jong Tang	Machine Elements in Mechanical Design	Pearson
Jack A. Collins, Henry R. Busby	Mechanical Design of Machine Elements and Machines	Willey Publications

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg.			
Submission of Five No. of Assignments in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg.			
Submission of Signed Note Book	5 x 2 = 10		
VIVA VOCE	15		
TOTAL	25		

Name of the Course : DIPLOMA IN PRODUCTION ENGINEERING / TECHNOLOGY (SUBJECT TITLE: INDUSTRIALMANAGEMENT)		
Course code:	Semester : Six	
Duration : 17 week	Maximum Marks : 100	
Teaching Scheme	Examination Scheme	
Theory : 3 hrs/week	Semester Exam: 70 Marks	
Tutorial: hrs/week	Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 4 hrs/week	Internal Assessment: 20 Marks	
Credit: 3		
Aim :-		
	To study the techniques for improvement in productivity of the people and equipment. to plan the production schedule accordingly organize material supply for the manufacturing activities. To minimize the direct and indirect cost by optimizing the use of resources available. To learn accounting process, inventory control and process planning. Modern manufacturing system employ techniques such as JIT, TPM , FMS, 5'S', kaizen which should be known to the technician.	
Objective :-		
S No	The student will able to	
1	Familiarize environment in the world of work	
2	Explain the importance of management process in Business.	
3	Identify various components of management	
4	Describe Role & Responsibilities of a Technician in an Organizational Structure.	
5	Apply various rules and regulations concerned with Business & Social Responsibilities of the Technician	
Pre-Requisite:-Nil		
Contents		Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
GROUP:A		
01	Overview Of Business 1.1. Types of Business <input type="checkbox"/> Service <input type="checkbox"/> Manufacturing <input type="checkbox"/> Trade 1.2. Industrial sectors Introduction to <input type="checkbox"/> Engineering industry <input type="checkbox"/> Process industry <input type="checkbox"/> Textile industry <input type="checkbox"/> Chemical industry <input type="checkbox"/> Agro industry 1.3 Globalization <input type="checkbox"/> Introduction <input type="checkbox"/> Advantages & disadvantages w.r.t. India 1.4 Intellectual Property Rights (I.P.R.)	04
02	Management Process 2.1 What is Management? <input type="checkbox"/> Evolution <input type="checkbox"/> Various definitions <input type="checkbox"/> Concept of management <input type="checkbox"/> Levels of management <input type="checkbox"/> Administration & management <input type="checkbox"/> Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management <input type="checkbox"/> Planning	04

	<input type="checkbox"/> Organizing <input type="checkbox"/> Directing <input type="checkbox"/> Controlling 2.4 Social responsibility and Environmental dimension of management.	
GROUP:B		
03	Organizational Management 3.1 Organization :- <input type="checkbox"/> Definition <input type="checkbox"/> Steps in organization 3.2 Types of organization <input type="checkbox"/> Line <input type="checkbox"/> Line & staff <input type="checkbox"/> Functional <input type="checkbox"/> Project 3.3 Departmentation <input type="checkbox"/> Centralized & Decentralized <input type="checkbox"/> Authority & Responsibility <input type="checkbox"/> Span of Control 3.4 Forms of ownership <input type="checkbox"/> Proprietorship <input type="checkbox"/> Partnership <input type="checkbox"/> Joint stock <input type="checkbox"/> Co-operative Society <input type="checkbox"/> Govt. Sector	06
04	Human Resource Management 4.1 Personnel Management <input type="checkbox"/> Introduction <input type="checkbox"/> Definition <input type="checkbox"/> Objectives <input type="checkbox"/> Functions 4.2 Staffing <input type="checkbox"/> Introduction to HR Planning <input type="checkbox"/> Recruitment Procedure 4.3 Personnel– Training & Development <input type="checkbox"/> Types of training <input type="checkbox"/> Induction <input type="checkbox"/> Skill Enhancement 4.4 Grievance handling 4.5 Leadership & Motivation <input type="checkbox"/> Maslow's Theory of Motivation 4.6 Safety Management <input type="checkbox"/> Causes of accident <input type="checkbox"/> Safety precautions 4.7 Introduction to – <input type="checkbox"/> Factory Act <input type="checkbox"/> ESI Act <input type="checkbox"/> Workmen Compensation Act <input type="checkbox"/> Industrial Dispute Act	10
GROUP:C		
05	Financial Management 5.1. Financial Management- Objectives & Functions 5.2. Capital Generation & Management <input type="checkbox"/> Types of Capitals	08

	<input type="checkbox"/> Sources of raising Capital 5.3. Budgets and accounts <input type="checkbox"/> Types of Budgets <input type="checkbox"/> Production Budget (including Variance Report) <input type="checkbox"/> Labour Budget <input type="checkbox"/> Different financial ratios. <input type="checkbox"/> Introduction to Profit & Loss Account (only concepts) ; Balance Sheet 5.4 Introduction to – <input type="checkbox"/> Excise Tax <input type="checkbox"/> Service Tax <input type="checkbox"/> Income Tax <input type="checkbox"/> VAT <input type="checkbox"/> Custom Duty	
06	Materials Management 6.1. Inventory Management (No Numerical) <input type="checkbox"/> Meaning & Objectives 6.2 ABC Analysis 6.3 Economic Order Quantity(EOQ) 6.4 Stores function, Stores system, BIN card, Materials issue request(MIR), Pricing of materials <input type="checkbox"/> Introduction & Graphical Representation 6.4 Purchase Procedure <input type="checkbox"/> Objects of Purchasing <input type="checkbox"/> Functions of Purchase Dept. <input type="checkbox"/> Steps in Purchasing 6.5 Modern Techniques of Material Management <input type="checkbox"/> Introductory treatment to JIT / SAP / ERP	08
07	Safety Engineering 7.1 Accidents-causes of accidents, Welfare measures. 7.2 Need for safety 7.3 Organization for safety 7.4 Safety committee 7.8 Safety programmes 7.9 Safety measures	05
	Total	45

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Dr. O.P. Khanna	Industrial Engg & Management		Dhanpat Rai & sons New Delhi
V.Arun Viswanath, Anoop. S. Nair, S.L.Sabu	Industrial Engineering and Management		SCITECh Publication(s) Pvt. Ltd
A. Bhat & A. Kumar	Management Principles, Processes & Practices		Oxford University Press
Dr. S.C. Saksena	Business Administration & Management		Sahitya Bhavan Agra
W.H. Newman E.Kirby Warren Andrew R. McGill	The process of Management		Prentice- Hall
Rustom S. Davar	Industrial Management		Khanna Publication

Banga & Sharma	Industrial Organisation & Management		Khanna Publication
Jhamb & Bokil	Industrial Management		Everest Publication , Pune
N V S Raju	Industrial Engg & Management		Cengage

Reference books :- Nil

Suggested List of Assignments/Tutorial :-

1. Preparation of financial budget of any organization.
2. Preparation of chart for fire safety.
3. Preparation of chart for personal, Tools & Equipments and products safety.
4. Preparation of chart to avoid accident.
5. Preparation of chart to show the different financial ratios.
6. Preparation of chart to show the different types of organization.

End Semester Examination Scheme. Maximum Marks-70, Time Allotted-3 hrs

Group	unit	Objective Questions		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer	Marks per question	Total marks
A	01,02	7	25	3	5, taking at least one from each group	10	50
B	03,04	7		3			
C	05,06,07	11		4			

Suggested List of Laboratory Experiments :- Nil

Suggested List of Assignments/Tutorial :- Nil

Name of the Course : Mechanical Engineering				
Subject: FLUID POWER				
Course code: ME		Semester: Sixth.		
Duration: 17 weeks		Maximum Marks : 150		
Teaching Scheme		Examination Scheme:		
Theory : 3 hrs/week		Internal Assessment: 20 Marks		
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks		
Practical : 2 hrs/week		End Semester Exam: 70 Marks		
Credit: 4		Practical: Internal Sessional continuous evaluation: 25 Marks		
		Practical: External Sessional examination: 25 marks		
Aim :-				
S. No.				
1	To impart the basic concept of Fluid power system.			
2	To understand the applications of Hydraulic and Pneumatic Systems in industries as clean source of motive power, convenient way of power transmission and easier way of automation.			
3	To understand the limitations of Hydraulic and Pneumatic Systems.			
Objective :-				
S. No.	The Students should be able to:			
1	• Identify various components of Hydraulic & Pneumatic Systems.			
2	• Know the working principle of various components used for Hydraulic & Pneumatic Systems.			
3	• Select appropriate components required for simple Hydraulic and Pneumatic Circuits.			
4	• List probable causes of faults or defects in the components of Hydraulic & Pneumatic Circuits.			
Pre-Requisite: Elementary knowledge on Physics, Thermal Engineering and Fluid Mechanics & Machinery.				
Contents			Hrs/week	
FLUID POWER				
Chapter	Name of the Topic		Hours	Marks
GROUP-A				
01	1.0	Introduction to Fluid Power Systems: Introduction, components and General layout of Fluid Power Systems. Comparison of Hydraulic & Pneumatic System. Practical applications of Fluid Power Systems. Advantages and Limitations of Fluid Power Systems.	10	
	1.1			
	1.2			
	1.3			
	1.4			
02	2	Components of Hydraulic Systems: Types, Construction, Working Principle and Symbols of the following Components: 2.1 Pumps – Vane pump, Gear pump, and Piston pump. 2.2 Valves – 2.2.1 Pressure control valves – Pressure relief valve, Pressure reducing valve, Pressure unloading valve. 2.2.2 Direction control valves – Poppet valve, Spool valve, 3/2, 4/2 & 4/3 D.C. valves, Sequence valves, valve actuation. 2.2.3 Flow control valves – Pressure compensated, Non Pressure compensated flow control valve. 2.3 Actuators – 2.3.1 Rotary Actuators - Hydraulic motors	13	
	2.0			
	2.1			
	2.2			
	2.2.1			
	2.2.2			
	2.2.3			
	2.3			
	2.3.1			

	2.3.2 2.4 2.4.1	Linear Actuators – Cylinders - single acting, double acting & mountings. Accessories – Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Intensifier, Accumulators.		
03	3.0 3.1 3.2 3.3 3.4	Hydraulic Circuits: Meter in, Meter out circuits & pump unloading cut Bleed off circuit Sequencing circuit Hydraulic circuits for Milling machine, Shaper machine, Motion synchronization circuit.	12	
GROUP-B				
04	4 4.0 4.1 4.2 4.3 4.3.1 4.3.2 4.4	Components of Pneumatic System: Types, Construction, Working Principle and Symbols of the following Components: Compressor – Reciprocating & Rotary compressors. Control Valves – Pressure regulating valves, Flow Control valves and Direction Control Valves. Actuators – Rotary actuator - Air motors. Linear actuator- Cylinders- single acting, double acting. Accessories – Pipes, Hoses, Fittings, FRL unit.	10	
05	5.0 5.1 5.2	Pneumatic Circuits: Speed control circuits. Sequencing circuits.	10	
Sub Total:			45	
Internal Assessment Examination & Preparation of Semester Examination			6	
Total			51	
<p>Practical: Skills to be developed: Intellectual Skill : 1. Prepare simple Hydraulic & Pneumatic Circuits. 2. Compare the performance of Hydraulic & Pneumatic Systems. 3. Identify the faults & suggest remedies in Hydraulic & Pneumatic Circuits. 4. Select proper Circuit considering its Application.</p> <p>Motor Skills : 1. Connect different Components as per given Drawing. 2. Perform repairing and replacement of defective components in the Circuit. 3. Draw the Hydraulic and Pneumatic Circuits using Symbols.</p> <p>List of Practical: 1. Study of Vane pump/ Gear pump generally used in Hydraulic System. 2. Study of Direction Control Valve generally used in Hydraulic / Pneumatic System. 3. Study of Rotary / Linear (single acting / double acting) Actuator generally used in Hydraulic / Pneumatic System. 4. Study of FRL Unit generally used in Pneumatic System. 5. Study of Hydraulic Trainer System & Pneumatic Trainer system</p>				

6. Design, Prepare & operate of Meter in and Meter out Circuit.
 7. Design, Prepare & operate of Sequencing Circuit.
 8. Design, Prepare & operate of Hydraulic Circuit for Shaper Machine.
 9. Design, Prepare & operate of Pneumatic Circuit for Speed Control of Double Acting Cylinders.
 10. Design, Prepare & operate of Pneumatic Circuit for Speed Control of Pneumatic Motor.
 11. Design, Prepare & operate a pneumatic circuit for lifting & then holding a load.
- Note:** At least **FIVE (05)** nos. of Practical / Study are to be conducted.

Text Books

Name of Authors	Titles of the Book	Edition	Name of the Publisher
A. Esposito	Fluid Power with Application		Pearson
S.R. Majumdar	Oil Hydraulic System- Principle and maintenance		Tata McGraw Hill
S.R. Majumdar	Pneumatics Systems- Principles and Maintenance		Tata McGraw Hill
Jagadeesha	Fluid Power Generation ,Transmission & Control		Wiley
P.joji	Pneumatic Controls		Wiley
Ilango & Soundararajan	Introduction to Hydraulics and Pneumatics, 2nd ed		Prentice Hall India
Stewart	Hydraulics and Pneumatics		Taraporewala Publication
Farel Bradbury	Hydraulic System & Maintenance		ILIFFE Books, London
Charles Hedges	Industrial Fluid Power		Womack Educational Publications
Peter Rhoner	Industrial Hydraulic Control		Prentice Hall
Hicks Pippenger	Industrial Hydraulics		McGraw Hill International

Suggested List of Assignments / Tutorial :-

1. Draw Hydraulic Meter in and Meter out Circuits by using Symbols.
2. Draw Pneumatic Sequencing circuit by using Symbols.
3. Draw Hydraulic Circuit for Shaper Machine by using Symbols.
4. Draw Hydraulic Circuit for Speed Control of Hydraulic Motor by using Symbols.

EXAMINATION SCHEME: END SEMESTER EXAMINATION

GROUP	MODULE OR CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3	12	ANY 20	1	20	7	FIVE, (AT LEAST ONE FROM EACH GROUP)	10	50
B	4,5	08				3			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering	
Subject Title: REFRIGERATION AND AIR CONDITIONING (Elective-II)	
Course code: ME/	Semester : Sixth
Duration : 17 weeks	Maximum Marks : 100
Teaching Scheme:	Examination Scheme:
Theory : 3 hrs/week	Internal Assessment: 10 Marks
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks
Practical : 2 hrs/week	End Semester Exam: 35 Marks
	Practical: Internal Sessional continuous evaluation: 25 Marks
	Practical: External Sessional Examination: 25 Marks
Credit: 4	
Aim :-	
S.No	
1	<p>This subject is classified as an Applied Technology. The 21st century predicts revolutionary developments in Refrigeration and Air Conditioning. Refrigeration and Air conditioning is one of the most meaningful job areas for diploma holders in Mechanical Engineering. Considering the wide and increasing use of Refrigeration and Air conditioning for domestic, commercial and industrial applications and the challenges put by the use of Refrigeration and air conditioning equipments in existing stage, it is absolutely necessary that Diploma Engineers should learn this subject. They should know the processes, equipments, systems of Refrigeration and Air Conditioning with their functioning, maintenance, repairs and measures to meet the challenges of the near future in this area.</p>
S No	The student will able to
	<ol style="list-style-type: none"> 1. Describe types, working principles and construction of Refrigeration and Air Conditioning systems. 2. Calculate performance of refrigeration and air conditioning system. 3. Use various charts and tables used in refrigeration and air conditioning. 4. Enlist properties of refrigerants, their applications and effects on environment. 5. Identify various components and controls used in refrigeration and air conditioning. 6. Describe various air conditioning systems and their applications. 7. Estimate cooling and heating loads. 8. Identify and describe different components of air distribution system.

Pre-Requisite:-		
S.No	Elementary knowledge on thermal engineering & Power engineering	
1		
Contents		Hrs/w eek
Chapter	Name of the Topic	Hours
Group A		
01	Basics of Refrigeration 1.1 Definition of refrigeration. 1.2 Necessity of refrigeration 1.3 Concept of heat engine, heat pump and refrigerator. 1.5 Unit of refrigeration, C.O.P. and refrigerating effect. 1.6 Major application areas of R.A.C. like domestic, commercial and industrial.	03
02	Refrigeration Cycles 2.1 Reversed Carnot Cycle and its representation on PV and TS diagram & determination of COP. 2.2 Air Refrigeration Cycles: - - Bell Coleman air refrigerator, it's representation on PV and TS diagram, types and applications like air craft refrigeration using simple air cooling system. - (Simple numerical on Reversed Carnot cycle.) 2.3 Vapour Compression Cycle (V.C.C): - - Principle, Components, Representation on P-H and T-S diagram, COP, , Effect of superheating, under cooling, suction pressure and discharge pressure, (simple numerical), Actual V.C.C. - Introduction to multistage V.C.C., its necessity, advantages. 2.4 Vapour Absorption system : - - Flow diagram and working principle of aqua- ammonia system (simple & practical) - Flow diagram and working principle of Electrolux Refrigeration System, - Desirable properties of Refrigerant and absorbent used in Vapour Absorption System. - Comparison of above Refrigeration Cycles.	14
03	Refrigerants 3.1 Classification of refrigerants. 3.2 Desirable properties of refrigerants. 3.3 Nomenclature of refrigerants. 3.4 Selection of refrigerant for specific applications. 3.5 Concept of Green House Effect, Ozone depletion, Global warming. 3.6 Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants.	06
04	Equipment selection 4.1 Components of Vapour Compression Refrigeration System 4.1.1 Compressors: - Classification, Construction and working of open type, hermetic, centrifugal, rotary, screw and scroll compressor and their applications. 4.1.2 Condensers: - Classification, description of air cooled and water cooled condensers,	10

	<p>comparison and applications</p> <ul style="list-style-type: none"> - Evaporative condensers. <p>4.1.3 Expansion devices:</p> <ul style="list-style-type: none"> - Types: - Capillary tube, automatic, thermostatic and their applications <p>4.1.4 Evaporators and chillers: -</p> <ul style="list-style-type: none"> - Classification of evaporators Construction and working of Bare tube, Plate surface, finned, shell and tube, flooded and dry expansion evaporator - Capacity of evaporator and their applications <p>4.2 Draw the flow diagram of the following Vapour compression refrigeration system and label the type of components & refrigerant used: Water coolers, ice plants, cold storage, domestic refrigerator</p>	
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Group B

05	<p>Psychrometry</p> <p>5.1 Definition and necessity of air conditioning.</p> <p>5.2 Properties of Air, Dalton's law of partial pressure</p> <p>5.3 Psychrometric chart</p> <p>5.4 Discussion on Psychrometric processes using Psychrometric chart & flow diagram, Concept of Bypass Factor, ADP, SHF, RSHF, ERSHF, and GSHF.</p> <p>5.5 Adiabatic mixing of Air streams</p> <p>5.6 Simple numerical using Psychrometric chart</p> <p>5.7 Equipments used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils</p>	8
06	<p>Air- conditioning systems</p> <p>7.1 Classification of A.C. systems</p> <p>7.2 Industrial and commercial A.C. systems</p> <p>7.3 Summer, winter and year round A.C. systems</p> <p>7.4 Central and unitary A.C. systems</p> <p>7.5 Application areas of A.C. systems</p>	04
		45

Practical:

Skills to be developed:

Intellectual skills:

1. Identify various components of refrigeration and air conditioning equipment
2. Analyse cooling load based on application.
3. Interpret psychrometric chart to find various properties of air.
4. Observe working of test rigs and calculate coefficient of performance.

Motor skills:

1. Handle various tools used for refrigeration and air conditioning plant maintenance
2. Use of temperature, pressure, energy measuring devices
3. Draw the layout of central Air conditioning plant

List of Practical:

Group A: (Any five)

1. Trial on water cooler test rig.
3. Visit to cold storage
4. Demonstration of domestic refrigerator in View of construction, operation and controls used.
5. Demonstration of various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC.
6. Identification of components of 'hermetically sealed compressor'.
7. Visit to repair and maintenance workshop in view of use of various tools and charging procedure.
8. Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).
9. Trial on A.C. test rig.
10. Visit to central A.C. plant in view of ducting system and Air distribution system (e.g. frozen food industry/ice- cream industry/mushroom plants/textile industries).

Assignments:

1. Prepare a chart mentioning name VCC equipments and their applications.
2. Prepare a chart mentioning different Refrigerants & their specific application.
3. Prepare Air distribution system of central air conditioning system.
4. Two problems on VCC.
5. Two problems on Air refrigeration cycle.
6. One problem on each Psychrometric process using Psychrometric chart.
7. Flow diagram of simple air craft cooling system

Examination Schedule: Internal practical Sessional examination

Examiner: **Lecturer / Jr. Lecturer**

Attending classes, practicing programs & submitting respective assignment in time (both groups)		4x5 =20	
Viva - voce		5	
Total:		25	

Examination Schedule: External practical Sessional examination

Examiner: **Lecturer / Jr. Lecturer**

For submission of assignment in scheduled time		2x5= 10	
On spot activity		10	
viva voce		05	
Total		25	

Reference books :- Nil	
Suggested List of Laboratory Experiments :- Nil	
Suggested List of Assignments/Tutorial :- as mentioned in list of practical	

List of Books:

Sr. No	Author	Title	Publisher
01	R.S.Khurmi	Refrigeration and Air Conditioning	S.Chand and Co
02	R.K. Rajput	Refrigeration and Air Conditioning	S.K.KATARIA
03	Arora and Domkundwar	Refrigeration and Air Conditioning	Dhanpat Rai and Sons
04	Manohar Prasad	Refrigeration and Air Conditioning	New Age Publications
05	P.N.Ananthanarayanan	Refrigeration and Air Conditioning	Tata McGraw Hill
06	Roy Dossat	Principles of Refrigeration	Pearson Education
07	Edwin P. Anderson	Commercial Refrigeration	Taraporevala Sons & Co
08	Arora	Refrigeration and Air Conditioning	P.H.I
09	C.P.Arora	Refrigeration and Air Conditioning	Tata McGraw Hill
10	P.L.Ballany	Refrigeration and Air Conditioning	Khanna publishers

G R O U P	Chapter	ONE OR TWO SENTENCE ANSWER QUESTIONS				G R O U P	Chapter	SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS			TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,3,4	6	10	1	1 x 10 = 10	A	1,2,3,4	6	FIVE, TAKING AT LEAST TWO FROM EACH GROUP	5	5 X 5 = 25
B	5,6	4				B	5,6	4			



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering		
Subject Title: CAD-CAM & AUTOMATION		
Course code: ME/	Semester : sixth	
Duration : 17 weeks	Maximum Marks : 100	
Teaching Scheme:	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 10 Marks	
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks	
Practical : 2 hrs/week	End Semester Exam: 35 Marks	
	Practical: Internal Sessional continuous evaluation: 25 Marks	
Credit: 4	Practical: External Sessional Examination: 25 Marks	
Aim :-		
S.No		
1	The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time .To satisfy this need the use of CAD/CAM & automation is inevitable .To satisfy industrial need, diploma engineer should be able to cope with CAD/CAM technology. With this intention this subject is introduced in the curriculum.	
S No	The student will able to	
1	<ol style="list-style-type: none"> 1. Understand the fundamentals & use CAD. 2. Conceptualize drafting and modelling in CAD. 3. Prepare CNC part programming. 4. Operate CNC machines. 5. Conceptualize automation and FMS. 	
Pre-Requisite:-		
S.No		
1	Knowledge on engineering graphics, engineering drawing, mechanical engineering drawing, basic idea on manufacturing technology, transducer & sensor, fluid power. .	
Contents		
Chapter	<i>Name of the Topic</i>	Hrs/week Hours
Group A		
01	Introduction to CAD/CAM Computers in industrial manufacturing. Product Cycle, CAD/CAM CAD/CAM hardware:- basic structure, CPU, Memory, I/O devices, Storage devices and system configuration.	05
02	Geometric Modelling Requirement of geometric modelling, Types of geometric models. Geometric construction method-sweep, solid modelling- Primitives & Boolean operations, free formed surfaces (Classification of surface only) (No	10

	numerical treatment)	
Group B		
03	Introduction to computer numerical Control Introduction - NC, CNC, DNC, Advantages of CNC, The coordinate system in CNC, Motion control system - point to point, straight line, Continuous path (Contouring). Application of CNC.	05
04	Part programming Fundamentals, manual part programming, NC –Words, Programming format, part programming, use of subroutines and do loops, computer aided part programming (APT).	12
Group C		
05	Industrial Robotics Introduction, physical configuration, basic robot motions, technical features such as - work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. Application – Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.	08
06	Automation Basic elements of automated system, advanced automation functions, levels of automation. Flexible manufacturing system :-Introduction, FMS equipment, FMS application, Introduction to CIM	05
		45
<p>Practical:</p> <p>Skills to be developed:</p> <p>Intellectual Skills:</p> <ol style="list-style-type: none"> 1. Interpret the various features in the menu of solid modeling package. 2. Synthesize various parts or components in an assembly. 3. Prepare cnc programmes for various jobs. 4. Understand the concept of finite element method. 5. Prepare a report of visits. <p>Motor skills:</p> <ol style="list-style-type: none"> 1. Operate a turning center and a machining center. 2. Operate and use solid modeling packages for drawing of assemblies. 3. Draw sketches of assemblies for converting into solid models. 4. Handle various tools used in cnc. <p>List of Practical: ((Any five)</p> <ol style="list-style-type: none"> 1. Two assignments on CAD for 2D drafting (Using AutoCAD) 2. Two assignments on CAD for 3D Modelling. (Using any 3-D Modelling software like CATIA, ProE, Solidworks, Solid Edge etc.) 3. Two assignments on CAM Software. 		

4. Manufacturing one turning and one Milling component on CNC.
5. At least four assignments on part programming using subroutines do loops for turning and milling component.
6. Report writing on visit to industry having CNC machine.
7. Report writing on visit to industry having robot Application.
8. Report writing on visit to Industry having Automation in manufacturing.

Examination Schedule Internal practical Sessional:

Attending classes, practicing programs / practical task & submitting respective assignment in time		20	
Viva - voce		5	
Total:		25	

Examination Schedule: External practical Sessional examination

Examiner: Lecturer			
For submission of assignment in scheduled time		10	
On spot activity		10	
viva voce		05	
Total		25	

Reference books :- Nil

Suggested List of Laboratory Experiments :- Nil

Suggested List of Assignments/Tutorial :- as mentioned in list of practical

List of Books:

Sr. No	Author	Title	Publication
01	P.N.Rao	CAD/CAM Principles and Applications	Tata McGraw-Hill
02	RadhaKrishna P. & Subramanyam	CAD/CAM/CIM	Wiley EasternLtd
03	B.S.Pabla and M.Adithan	CNC Machine	New age International(P)Ltd
04	H.K.SHIVANANDA, M.M.BENAL	Flexible Manufacturing System	New age International(P)Ltd

05	Groover M.P. & Zimmers Jr	Computer Aided design and manufacturing	Prentice hall of India
06	K. Sareen C. Grewal	CAD & CAM Theory and Concepts	S. Chand
07	J.S.Narang	CNC Machine & Automation	Dhanpat Rai & CO

G R O U P	Chapter	ONE OR TWO SENTENCE ANSWER QUESTIONS				G R O U P	Chapter	SUBJECTIVE QUESTIONS			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS			TO BE SET	<i>TO BE ANSWERED</i>	MARKS PER QUESTION	TOTAL MARKS
A	1,2	3	10	1	1 X 10 = 10	A	1,2	3	FIVE, TAKING AT LEAST ONE FROM EACH GROUP	5	5 X 5 = 25
B	3,4	4				B	3,4	5			
C	5,6	3				C	5,6	2			

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING		
Subject Title: ALTERNATE ENERGY SOURCES AND MANAGEMENT (ELECTIVE II)		
Course code:	Semester : Sixth	
Duration : 17 weeks	Maximum Marks : 100	
Teaching Scheme	Examination Scheme:	
Theory : 3 hrs/week	Internal Assessment: 10Marks	
Tutorial: hrs/week	Teacher's Assessment (Assignment & Quiz): 5 Marks	
Practical : 2 hrs/week	End Semester Exam: 35 Marks	
Credit: 4	Practical: Internal Sessional continuous evaluation: 25 Marks	
	Practical: External Sessional examination: 25 Marks	
Aim :-		
S.No		
1	To develop, operate and maintain alternative energy sources systems. It is therefore essential to know basics of energy conversion, conservation, energy audit and waste heat recovery techniques.	
Objective :-		
S No	The student will able to	
1	Develop awareness for effective utilization of alternative energy sources.	
2	Identify different components of solar energy and wind energy devices.	
3	Identify and analyze biomass plant.	
4	Identify and apply energy conservation techniques for commonly used power absorbing and generating devices.	
5	Apply principles of energy conservation and energy management techniques.	
Pre-Requisite:-		
	Nil	
Contents		Hrs/week
Chapter	Name of the Topic	Hours
Group:A		
01	Introduction to Energy Sources 1.1 Introduction. 1.2 Major sources of energy: Renewable and Non-renewable. 1.3 Primary and secondary energy sources. 1.4 Energy Scenario: - Prospects of alternate energy sources. - Need of Alternate energy sources	02
02	Solar Energy 2.1 Principle of conversion of solar energy into heat and electricity 2.2 Solar Radiation: Solar Radiations at earth's surface Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle 2.3 Applications of Solar energy: - - Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations - Space heating and cooling. - Photovoltaic electric conversion. - Solar distillation, Solar cooking and furnace. - Solar pumping and Green House. Agriculture and Industrial process heat. (no derivations and numericals)	08
Group:B		
	Wind Energy 3.1 Basic Principle of wind energy conversion. 3.2 Power in wind, Available wind power formulation, Power coefficient,	

03	<p>Maximum power</p> <p>3.3 Main considerations in selecting a site for wind mills.</p> <p>3.4 Advantages and limitations of wind energy conversion.</p> <p>3.5 Classification of wind mills</p> <p>3.6 Construction and working of horizontal and vertical axis wind mills, their comparison</p> <p>3.7 Main applications of wind energy for power generation and pumping.</p>	05
04	<p>Energy from Biomass</p> <p>4.1 Common species recommended for biomass.</p> <p>4.2 Methods for obtaining energy from biomass</p> <p>4.3 Thermal classification of biomass</p> <p>a) Gasified, b) Fixed bed and fluidized</p> <p>4.4 Application of gasifier</p> <p>4.5 Biodiesel production and application</p> <p>4.6 Agriculture waste as a biomass</p> <p>4.7 Biomass digester</p> <p>4.8 Comparison of Biomass with conventional fuels</p>	05
Group:C		
05	<p>Energy Conservation & Management:-</p> <p>5.1 Global and Indian energy market</p> <p>5.2 Energy scenario in various sectors and Indian economy</p> <p>5.3 Need and importance of energy conservation and management</p> <p>5.4 Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.</p>	05
06	<p>Energy Conservation Techniques</p> <p>6.1 Distribution of energy consumption</p> <p>6.2 Principles of energy conservation.</p> <p>6.3 Energy audit</p> <p>6.4 Types of audit</p> <p>6.5 Methods of energy conservation</p> <p>6.6 Cogeneration and its application</p> <p>6.7 Combined cycle system</p> <p>6.8 Concept of energy management</p> <p>6.9 Study of different energy management techniques like</p> <ul style="list-style-type: none"> - Analysis of input - Reuse and recycling of waste - Energy education - Conservative technique and energy audit 	08
07	<p>Economic approach of Energy Conservation</p> <p>7.1 Costing of utilities like steam, compressed air, electricity and water.</p> <p>7.2 Ways of improving boiler efficiency</p> <p>7.3 Thermal insulation, Critical thickness of insulation</p> <p>7.4 Waste heat recovery systems, their applications, criteria for installing unit.</p> <p>7.5 An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.</p>	08
	Total	41

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.

- a) HP & LP Heater feed cycle
- b) Condenser Cooling System including Cooling Tower.
- c) Generator Cooling System.
- d) HP & LP Bypass system.
- e) Turbine sealing system.

2. Draw layouts of different power plants

3. Operate devices using solar energy inputs

EXAMINATION SCHEME

GROUP	MODULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2	3	10	1	10	3	FIVE AT LEAST ONE FROM EACH GROUP	5	25
B	3,4	4				4			
C	5,6,7	3				4			

Name of Authors	Titles of the Book	Edition	Name of the Publisher
R.K.Rajput	Non conventional energy Sources & utilization		S.Chand & Co
Boyle	Renewable Energy		Oxford University Press
Dr B.H.Khan	Non conventional energy Resources		Tata Mcgraw hill
G. D. Rai	Non conventional energy sources		Khanna publication
S. P. Sukhatme	Solar energy		Tata McGraw Hill
H. P. Garg	Solar energy		Tata Mcgraw hill
P.H. Henderson	India- The energy sector		Oxford University Press
D. A. Ray	Industrial energy conservation		Pergaman Press
W. C. Turner	Energy management handbook		Wiley Press
K. M. Mittal	Non-conventional energy source -		Wheeler Publishing, New Delhi
Krupal Singh Jogi	Energy resource management		Sarup and sons
Ghosh, Tushar K., Prelas, Mark A.	Energy Resources and Systems		Springer

2. Cassettes/CD/websites:

1. CDs developed by National Power Training Institute, (Under the ministry of Power, Government of India) Opposite VNIT, South Ambazari road, Nagpur
2. Website of Bureau of Energy and Efficiency. (www.bee-india.nic.in)
3. Website for Akshay Urja News Bulletin. (www.mnes.nic.in)

Reference books :- Nil

Visit to steam power plants/nuclear power plants/wind power plants/ Hydro power plants

	and prepare a report.(Any one Plant).
	To collect information about global and Indian energy market.
	To perform an experiment on solar flat plate collector used for water heating.
	To study construction and working of photo voltaic cell.
	To study construction, working and maintenance of solar cooker.
	To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
	To visit a biomass/ biogas plant of municipal waste or else where.
	To perform energy audit for workshop/Office/Home/SSI unit.
	To study of various waste heat recovery devices.
Suggested List of Laboratory Experiments :- Nil	
Suggested List of Assignments/Tutorial :- Nil	

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		

Name of the Course : Mechanical Engineering				
Subject: MATERIAL HANDLING SYSTEM (ELECTIVE II)				
Course code: ME		Semester: Sixth.		
Duration: 17 weeks		Maximum Marks : 100		
Teaching Scheme		Examination Scheme:		
Theory : 3 hrs/week		Internal Assessment: 10Marks		
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 5 Marks		
Practical : 2 hrs/week		End Semester Exam: 35 Marks		
Credit: 4		Practical: Internal Sessional continuous evaluation: 25 Marks		
		Practical: External Sessional examination: 25 Marks		
Aim :-				
S. No.				
1	To know the operational features of the material handling equipment & its practical application, carrying parts & products in a shop from one work station to another and from shop to another shop or taking care of stockpiling and reclaiming operations, material handling equipment/systems enable the process to go on without interruptions & at a predetermined space. To understand, select, operate and maintain the material handling equipments.			
Objective :-				
S. No.	The Students should be able to:			
1	• Understand constructional & operational features of various materials handling systems.			
2	• Identify, compare & select proper material handling equipment for specified applications.			
3	• Know the controls & safety measures incorporated on material handling equipment.			
4	• Understand different material handling processes used in industries.			
5	• Appreciate the role of material handling devices in mechanization & automation of industrial process.			
Pre-Requisite: Nil				
Contents			Hrs/week	
MATERIAL HANDLING SYSTEM (ELECTIVE II)				
Chapter	Name of the Topic		Hours	Marks
GROUP-A				
01	1.0	Introduction to Material Handling System Over view of basic principles, equipments and operations, importance of material handling equipments in relation to productivity and cost of production. Principle groups of equipment. Unit load, bulk load and their designation by code, various load handling attachments	6	
	1.1			
	1.2			
02	2.0	Hoisting Machinery & Equipments Construction, working principle and application of Hand Operated Hoists, Electric Hoists and Winch. Essential parts, operating principle of EOT Cranes. Long travel & cross travel mechanisms, break arrangement and safety arrangement of EOT Cranes. Essential parts, operating principle of Jib Crane, portal, semi-portal and mobile Crane. Basic principle of level lifting mechanism, luffing gear hoisting mechanism and slewing gear mechanism of Crane. Constructional details and applications of Bucket Elevator.	12	
	2.1			
	2.2			
	2.3			

GROUP-B				
03	3.0 3.1	Conveying Machinery: Essential components, operating principle and applications of Belt Conveyors, Roller Conveyors, Screw Conveyors, Pneumatic Conveyors and Hydraulic Conveyors.	12	
04	4.0 4.1	Surface Transportation Equipment: Construction, working principle and application of trackless equipment such as Hand Operated Trucks, Powered Trucks, Tractors, AGV- Automatic Guided Vehicle and Industrial Trailers.	10	
05	5.0 5.1	Selection of Material Handling Equipment: Factors affecting choice of material handling equipment such as type of loads, hourly capacity of the unit, direction & length of travel, methods of stocking at initial, final & intermediate points, nature of production process involved, specific load conditions & economics of material handling system.	5	
Sub Total:			45	
Internal Assessment Examination & Preparation of Semester Examination			6	
Total			51	
<p>Practical: Skills to be developed: Intellectual Skill :</p> <ol style="list-style-type: none"> 1. Understand the working principle of equipment/devices. 2. Identify & name major component of material handling device. 3. Understand role of material handling equipment in the industrial process. 4. Understand & appreciate safety instrumentation for equipment. <p>Motor Skills :</p> <ol style="list-style-type: none"> 1. Identify & select the material handling devices for a given application. 2. Operate the working model of material handling equipment. 3. Ability to implement preventive maintenance schedule of material handling devices. <p>List of Practical:</p> <ol style="list-style-type: none"> 1. Study & demonstration of Hand Operated Hoists / Electric Hoists / Winch. 2. Study & demonstration of any one type of conveyor – belt, Screw, pneumatic, hydraulic. 3. Study and demonstration of any one type of crane (working model or actual). 4. Study and demonstration of fork lift truck (using electric drive or diesel engine). 5. Study and demonstration of Bucket Elevator. 6. Study of preventive maintenance schedule of any one major material handling equipment using operation manual. 7. Visit to coal handling plant of thermal power plant or cement industry to observe working of different types of bulk material handling devices (at least three equipments). Write report of the visit. 8. Collect and write detail specifications of any two major material handling devices. 9. Collect photographs of ten different types of cranes used in industries. Write name and specific utility of each. 10. Collect photographs of ten different types of conveyers used in industries. Write name and specific utility of each. <p>Note: At least FIVE (05) nos. of Practical / Study are to be conducted.</p>				

Text Books			
Name of Authors	Titles of the Book	Edition	Name of the Publisher
S. Ray	Introduction to Materials Handling		New Age international (P) Ltd.
T.K. Ray	Mechanical Handling of Materials		Asian Books Pvt. Ltd.
N. Rundenko	Material Handling Equipment		Peace Publisher, Moscow
M. P. Alexandrov	Material Handling Equipment		MIR Publisher, Moscow
Y. I. Oberman	Material Handling		MIR Publisher, Moscow
R. B. Chowdary & G. R. N. Tagore	Material Handling Equipment		Khanna Publisher, Delhi
T. H. Allegri	Material Handling (Principles & Practice)		CBS Publisher, Delhi
J. M. Apple	Plant Layout & Materials Handling		John Wiley Publishers.
J. R. Immer	Material Handling		Mc Graw Hill, New York
Suggested List of Assignments / Tutorial :-			
1. Write with suitable diagram the essential parts and their function of Bucket Elevator. 2. Write with suitable diagram the essential parts and their function of a Fork Lift Truck. 3. Write with suitable diagram the essential parts and their function of a Screw Conveyor. 4. Write the names and their specific use of different Hand Operated Trucks used in actual industries.			

EXAMINATION SCHEME: END SEMESTER EXAMINATION

GROUP	MODULE OR CHAPTER	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTION			
		TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS	TO BE SET	TO BE ANSWERED	MARKS PER QUESTION	TOTAL MARKS
A	1,2,	5	10	1	10	5	FIVE, (AT LEAST TWO FROM EACH GROUP)	5	25
B	3,4,5	5				5			

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Five No. of Experiments / Study attended & respective lab note submitted in due time.	5 x 3 = 15		
VIVA VOCE	10		
TOTAL	25		
External Examination: Examiner- Lecturer in Mechanical Engg. / Jr. Lecturer			
Submission of Signed Lab Note Book (for five experiments / study)	5 x 2 = 10		
On spot experiment / study (one for each group consisting 15 students / explanation on study item)	10		
VIVA VOCE	5		
TOTAL	25		

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING		
Subject: PRODUCTION MANAGEMENT		
Course code:	Semester : Sixth	
Duration : 17 week	Maximum Marks : 100	
Teaching Scheme	Examination Scheme	
Theory : 3 hrs/week	Semester Exam: 70 Marks	
Tutorial: hrs/week	Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : hrs/week	Internal Assessment: 20 Marks	
Credit: 3		
Aim :-		
	To study the techniques for improvement in productivity of the people and equipment. to plan the production schedule accordingly organize material supply for the manufacturing activities. To minimize the direct and indirect cost by optimizing the use of resources available. To learn accounting process, inventory control and process planning. Modern manufacturing system employ techniques such as JIT, TPM , FMS, 5'S', kaizen which should be known to the technician.	
Objective :-		
S No	The student will able to	
1	Understand importance of productivity and factors for improvement of productivity.	
2	Know different production systems and modern trends in manufacturing systems.	
3	Find the break even point for manufacturing a product.	
4	Prepare / modify layout of production system.	
5	Select suitable material handling devices and plant facilities.	
	Prepare process plan and specify toolings for it.	
	Prepare process chart for analysis of existing process.	
	Use pert & cpm techniques for scheduling and controlling the manufacturing activities.	
	Apply techniques of method study and work measurement for improvement of existing manufacturing methods.	
	Find the economic order quantity (eoq) for given situation.	
Pre-Requisite:-Nil		
	Contents	Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
GROUP:A		
01	Production System Production - Definition , Types of production systems Productivity - Importance , Measurement of Productivity , Techniques of improving productivity Elements of cost- Fixed cost, Variable Cost. Break even analysis, Calculation of Break even point.	05
02	Plant location, Plant layout and Material Handling Plant Location - Importance of Site Selection, Factors affecting Site Selection, Government Policies, and relaxation for Backward Areas. Plant Layout - Objectives, types, design principles, characteristics of Plant Layout, Symptoms of Bad Plant Layout. Group technology , Cellular layout, Material handling – Need, Principles and Types of material handling devices – conveyors , Hoist & cranes , forklift truck, trolleys, Pipes, Automated Guided Vehicles (AGV's) Selection of Material Handling systems and Devices.	05
GROUP:B		

03	<p>Process Planning Planning of Processes from raw material to finished product, Factors affecting Process Planning, Deciding sequence of operations, Operation Sheet, Combined operations, Determination of Inspection Stages. Selection of Machine Techniques of assembly planning, Types of assembly. Plant Capacity, Machine Capacity, Plant Efficiency. Numerical not to be asked,</p>	05
04	<p>Production Planning and Control Routing, Sequencing [n job 2 machines], Scheduling, Dispatching, Meaning of Control, Progressive Control, Gantt chart. Concept of Line balancing,</p>	03
GROUP:C		
05	<p>Work Study Method Study- Objectives, Procedure, Selection of work. Recording Techniques - Process Charts – Outline process chart, Flow process chart, Two Hand process chart, Multiple activity chart, Flow diagram, String diagram, Travel chart. Micro motion study-Critical Examination, Principles of Motion Economy. Concept of ergonomics and workplace layout. Work Measurement - Objectives, procedure , Time Study, Time Study Equipments. Stop Watch Time Study, Standard Time, Work Sampling, Analytical Estimating, Predetermined Motion Time Study, Allowances, Calculation of Standard Time, Concept of Merit Rating.</p>	08
06	<p>Maintenance of machine Tools: Types of maintenance, repair cycle analysis, repair complexity, maintenance manual, maintenance records, housekeeping, Introduction to total production maintenance(TPM).</p>	04
07	<p>Quality Control: A) Quality: Definitions, meaning of quality of product and services, quality characteristics, quality of design, quality of conformance, quality of performance, concept of reliability, cost, quantity assurance, cost of rework and repair, quality and inspection, inspection stage. B) Total Quality Management(TQM): 1. Principles of total quantity management. i) customer focus. ii) Commitment by top management. iii) Continuous improvement-PDCA, Quality Circles. iv) Employee empowerment(JIDOKA). -Quality Audit: Concept of audit practices, lead assessor certification. -Six sigma: Statistical meaning, methodology of system improvement, DMAIC cycle, yellow belt, green belt, black belt certification. C) ISO 9000 Series & other standards:</p>	09

	Concept, ISO 9000 series quality standards, Qs 14000, Standards certification, other Quality systems.	
08	Modern Trends Just In Time manufacturing – Pull and push types of manufacturing systems, Waste reduction, 5'S', inventory reduction, single piece production systems. Concept of continuous improvement (Kaizen) – DMIAC cycle, Brain storming. Poka Yoke. Concept of Rapid Prototyping Concept of Flexible manufacturing system	06
	Total	45

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Kanishka Bedi	Production & Operations Management		Oxford University Press
L.C. Jhamb	Industrial Management		Everest
James C. Rigs	Production System, Planning, Analysis & Control		N.Y.Wiley & Sons
M.T.Telsang	Production & Operation Management		S.Chand
Buffa	Modern Production & Operation Management		Wiley
A.Bhattacharya & A.Kumar	Management Principles, Processes & Practices		Oxford University Press
O.P. Khanna	Industrial Engineering and Management		Dhanpat Rai & Sons
ILO	Work Study		ILO Geneva
Terry Wireman	Total productive maintenance		Industrial press inc.
Taiichi ohno	Toyota production system		Productivity Press

Reference books :- Nil

Suggested List of Assignments/Tutorial :-

- 1. Making a conceptual layout of an Engg. Industry conforming ISO 9000 series.**
- 2. Preparation of EOQ model.**
- 3. Preparation of a flow process and operation process chart.**
- 4. Preparation of a chart of Total Quality Management.**

End Semester Examination Scheme. Maximum Marks-70, Time Allotted-3 hrs							
Group	unit	Objective Questions		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer	Marks per question	Total marks
A	01,02	4		2	5, taking at least one from each group	10	50
B	03,04	6	20	4			
C	05,06,07	10		4			
Suggested List of Laboratory Experiments :- Nil							

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING (INDUSTRIAL PROJECT)	
Course code: ME	Semester: Sixth.
Duration: 17 weeks	Maximum Marks : 100
Teaching Scheme	Examination Scheme:
Theory : hrs/week	Practical: Internal Sessional continuous evaluation: 50 Marks
Tutorial: hrs/week	Practical: External Sessional examination: 50 Marks
Practical : 6 hrs/week	
Credit: 3	
Aim :-	
S. No.	
1	To solve the problems involving drawings, designs, manufacturing, installation, testing and maintenance of machines. In order to cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, and to enhance the generic skills & professional skills.
Objective :-	
	The Students should be able to:
	<ol style="list-style-type: none"> 1. Identify, analyze & define the problem. 2. Generate alternative solutions to the problem identified. 3. Compare & select feasible solutions from alternatives generated. 4. Design, develop, manufacture & operate equipment/program. 5. Acquire higher-level technical knowledge by studying recent development in mechanical engineering field. 6. Compare machines/devices/apparatus for performance practices. 7. Work effectively in a team.
Pre-Requisite: Nil	
Contents:	
Part A-Project	
<p>A batch of maximum 4 students will select a problem and then plan, organize & execute the project work of solving the problem in a specified duration. Student is expected to apply the knowledge & skills acquired. Batch may select any one problem/project work from following categories.</p> <p>a) Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/ demonstration models, etc. Report involving aspects of drawing, process sheets, costing, Installation, commissioning & testing should be prepared and submitted.</p> <p>b) Design & fabrication of mechanisms, machines, Devices, etc. Report involving aspects of designing & fabricating should be prepared & submitted</p> <p>c) Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots etc.</p> <p>d) Industry sponsored projects- project related with solving the problems identified by industry should be selected. One person / engineer from industry is expected to work as co- guide along with guide from institution.</p> <p>e) Literature survey based projects: Project related with collection tabulation, classification, analysis & presentation of the information. Topic selected must be related with latest technological developments in mechanical or mechatronics field, and should not be a part of diploma curriculum. Report should be of min 60 pages.</p> <p>f) Investigative projects- Project related with investigations of causes for change in performance or structure of machine or component under different constraints through experimentation and data analysis.</p> <p>g) Maintenance based projects: The institute may have some machine/ equipment/ system which are lying idle due to lack of maintenance. Students may select the specific machines/equipment/system. Overhaul</p>	

it, repair it and bring it to working condition. The systematic procedure for maintenance to be followed and the report of the activity are submitted.

h) Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement, data collection, data analysis and data interpretation be undertaken.

i) Low cost automation projects: Project based on hydraulic/pneumatic circuits resulting into low cost automated equipment useful in the identified areas.

j) Innovative/ Creative projects – Projects related with design, develop & implementation of new concept for some identified useful activity using PLC, robotics, non-conventional energy sources, CIM , mechatronics, etc.

k) Environmental management systems projects: Projects related with pollution control, Solid waste management, liquid waste management, Industrial hygiene, etc, Working model or case study should be undertaken.

l) Market research/ survey based projects: Projected related with identification of extent of demand, sales forecasting, Comparative study of marketing strategies, Comparative study of channels of distribution, Impact of variables on sales volume, etc. The project involves extensive survey & market research activities information to be collected through various mechanisms/tools & report is prepared.

m) Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.

n) Project can be selected other than the area specified above. Project should provide viable and feasible solution to the problem identified. Report should be of min 50 pages.

Part B- Seminar

Every student will prepare & deliver the seminar. Evaluation of seminar will be carried out by panel of at least three teaching staff from mechanical/ production /automobile department.

1. Selection of topic for the seminar should be finalized in consultation with teacher guide allotted for the batch to which student belongs.

2. Seminar report should be of min.10 & max. 20 pages & it should be certified by guide teacher and head of the department

3. for presentation of seminar, following guide lines are expected to be followed:-

a) Time for presentation of seminar: 7 to 10 minutes /student.

b) Time for question/answer : 2 to 3 minutes /student

c) use of audio visual aids or power point presentation is desirable.

4. Topic of the seminar should not be from diploma curriculum.

5. Seminar can be on project selected by batch.

Skills To Be Developed:

Intellectual Skills

1. Design the related machine components & mechanism.

2. Convert innovative or creative idea into reality.

3. Understand & interpret drawings & mechanisms

4. Select the viable, feasible & optimum alternative from different alternatives.

Motors skills

1. Use of skills learnt in workshop practical.

2. Assemble parts or components to form machine or mechanisms.

3. Classify & analyze the information collected.

4. Implement the solution of problem effectively.

Notes: 1) Project group size: Maximum 4 students

2) Project report will be of minimum 40 pages unless otherwise specified.

3) Project diary should be maintained by each student.

Name of Authors	Titles of the Book	Edition	Name of the Publisher
Karl Smith	Project management & team work		Tata- Mc Graw Hill
Clifford gray & Erik Lasson	Project management		Tata- Mc Graw Hill

EXAMINATION SCHEME FOR PRACTICAL SESSIONAL

Internal Examination: Examiner- Lecturer in Mechanical Engg.			
On Project Work & submission of project within schedule time.	30		
Seminar on Project Work	10		
Viva-voce	10		
TOTAL	50		
External Examination: Examiner- Lecturer in Mechanical Engg.			
On Project Work	20		
Viva-voce	30		
TOTAL	50		

Name of the Course : Mechanical Engineering		
Subject Title: Professional Practices-IV		
Course code:	Semester: Sixth.	
Duration :	Maximum Marks : 50	
Teaching Scheme	Examination Scheme	
Theory : hrs/week	Practical: Internal Sessional Continuous Evaluation: 25 Marks	
Tutorial: hrs/week	Practical: External Sessional Examination: 25 Marks	
Practical : 4 hrs/week		
Credit: 2		
Aim :-		
Sl. No.		
1	To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.	
Objective :-		
Sl. No.	The student will able to:	
1	<ul style="list-style-type: none"> Acquire information from different sources. 	
2	<ul style="list-style-type: none"> Prepare notes for given topic. 	
3	<ul style="list-style-type: none"> Present given topic in a seminar. 	
4	<ul style="list-style-type: none"> Interact with peers to share thoughts. 	
5	<ul style="list-style-type: none"> Prepare a report on industrial visit, expert lecture 	
Pre-Requisite:-Nil		
Contents		
Chapter	Name of the Topic	Hrs/week
01	Group Discussion : (Two topics) The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic for group discussions may be selected by the faculty members. Some of the suggested topics are: <ul style="list-style-type: none"> i) Solar Vehicles / Electric Vehicles. ii) Auto Vehicles – Comparison. iii) Two stroke versus four stroke engines. iv) Recycling of plastics and other waste material. v) Attributes of product design. vi) Creativity and innovativeness. vii) Energy conservation in institutes. viii) Value engineering. ix) Revolution in communication technology. x) Pneumatic tools and equipments. xi) Wear mechanisms. 	10 Hrs.
02	Seminar on technical topic: Individual student should present a seminar on technical topic and also submit a brief report on the same as a part of term work. The seminar topic may be suggested by the faculty members.	20 Hrs.
03	Study of Open Source Softwares: 1]LibreOffice Unit:1 Installation Of LibreOffice and Introduction to LibreOffice Writer Unit:2 Introduction to LibreOffice Calc Unit:3 Introduction to LibreOffice Impress Unit: 4 Introduction to LibreOffice Base Unit: 5 Introduction to LibreOffice Math Unit: 6 Introduction to LibreOffice Draw	30 Hrs.

	2] Scilab Unit:1 Introduction and Installation Of Scilab and Vector Operations Unit:2 Matrix Operations and Scripts and functions Unit:3 Conditional Branching and Iterations and Plotting in Scilab Unit: 4 ODES and Polynomials in Scilab Unit: 5 SBHS and Introduction to X-Cos in Scilab	
	Total	60 Hrs.
<u>Recommended Text Books:</u> It is alright to go ahead with teaching from the prescribed books as per the existing syllabus. Text books can be referred from the link given below.		
<u>Text Books link for LibreOffice:</u> <ul style="list-style-type: none"> http://www.taming-libreoffice.com/category/books 		
<u>Recommended Text Books:</u> Introduction to MATLAB & ITS Open Source Equivalent SCILAB and hands on demonstration: <ol style="list-style-type: none"> 1. Introduction and Installation Of MATLAB & SCILAB and Vector Operations 2. Matrix Operations and Scripts and functions 3. Conditional Branching and Iterations and Plotting in Scilab 4. SBHS and Introduction to X-Cos in Scilab 5. Matlab programming by Singh (PHI) 6. Matlab.by Rudrapratap Oxford 		

Examination Scheme:	
Internal Practical Sessional Examination	
Topic	Marks
1 - Performance and submission of assignment on group discussion on scheduled date.	5
2 - Performance and submission of assignment on seminar on scheduled date.	5
3 - Practice on open source software.	10
4 - Viva – voce.	5
Total:	25
External Practical Sessional Examination	
Topic	Marks
1 - Submission of signed report & assignment.	5
2 - On spot open source software activity.	15
3 - Viva voce.	5
Total:	25

Name of the Course: Diploma in Mechanical Engineering			
Subject: General Viva-Voce			
Course Code:	AE	Semester:	Sixth
Duration:	N.A	Maximum Marks:	100
Teaching Scheme :	N.A	Examination Scheme :	viva-voce
Theory:	Nil	Continuous Internal Examination :	Nil
Tutorial:	Nil	End Semester Exam.:	Nil
Practical:	Nil	End Semester Examination (viva-voce):	100 Marks
Credit:	3		
Aim :			
The object of conducting Grand viva-voce is to assess out going students on their general understanding of all subjects (Theory, practical, laboratory etc.) taught and also on expected technical sense / ability developed being an engineer during this periods.			
Examination Scheme (at semester end): Grand Viva-voce			Total Marks : 100
<ul style="list-style-type: none"> • End Semester Examination (viva-voce): - 100 marks. Examiner -Internal Lecturers headed by HOD (Mechanical)			