

**SHRI VILEPARLE KELVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC
PART TIME**

DISCIPLINE : MECHANICAL ENGINEERING.

w.e.f. batch admitted june 2008 (progressivly)

SEMESTER : FIRST.

Effective from the academic term: JULY-NOV.2008

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCEME OF INSTRUCTIONS & PERIODS PER WEEK			NO. OF PAPERS, DURATION & MARKS					SCHEME OF E	
			L	P	D	T	Cr	NP	HRS	Mks	SSL	Theory paper
1	Communication skill	SS-23	3	-	-	-	3	1	3	100	20	80
2	Mathematics 1	MA-15	3	-	-	1	4	1	3	100	20	80
3	Chemistry	SC-27	4	4	-	-	8	1	3	100	20	80
4	Engineering Drawing 1	ME-16	2	-	6	-	8	1	3	100	20	80
	TOTAL		12	4	06	01	23	-	-	-	80	320
			Total periods (23)									Total marks = (5

- * Compulsory
 SSL - Sessional
 # Internal only
 T/W – Term work
 ** External only
 period
- L – Lecture period
 P – Practical period
 D – Drg. Practical
 Pract. - Practical
 T – Tutorial period
 NP – No. of papers
 MKS – Marks
- (1) Unless stated, T.W. will be assessed by considering Cr. - Credits the external examiner based on the continuous assessment by the concerned internal faculty
- (2) Unless stated, practical/oral(P/O),oral will be jointly by the internal & external examiners.
- (3) Each lecture/practical/drawing/tutorial is one hour duration.

(1) SUBJECT DETAILS :

Course : mechanical	Semester : 1
1.1 Communication Skill (SS-23)	Duration : 16 Weeks
Group : Basic (B*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEME :

Scheme of Instructions and Periods per Week				No. of papers, duration and Marks			Scheme of Examination						Scheme L/Pr/Cr	
L	P	D	T	Cr	NP	Hrs	Mks	SSL	Th paper	T/W	Prac	Oral	Total	tical
3	-	-	-	3	1	3	100	20	80	-	-	-	100	303

(3) RATIONALE :

In take level of the students is S.S.C or is Equivalent. These students have studies English for minimum of 6 years. Expected level of heir Active Vocabulary is 2500 words from the Nagpur list of High Frequency words. However, in practice it was found that the students, practically from the vernacular medium have only 1500 words at their command. They need to have course in English subject to offset this situation. Therefore, the first semester engineering course students need to study English.

Further, in this age of information, Communication Skill is essential to everyone. This is equally true in the case of Engineers. Engineers having sound knowledge of the technical subjects should be able to communicate the same to his superiors, peers and subordinates in their routine work environment.

Having a sound Communication Skill will enable the engineering students to learn and interprets the subject effectively. This saves time and money and enhances the effectiveness of the engineer's performance.

(4) OBJECTIVES :

(i) The student will increase his English vocabulary to a minimum of 2500 words (Nagpur List) through the prescribed text and grammar exercises by various techniques such as synonyms, Antonyms, One word substitutes, Prefixes & Suffixes and Comprehension of new words, Idioms and Prepositional Phrases. Students will be able to use principles to solve problems in Mathematics at Higher Semester level.

(ii) Students will understand the various uses of grammar items such as Voice in English sentences, Degrees of Comparison, Tenses, Direct and Indirect Speech in formation of various kind of sentences.

(iii) Students will master the important structures of English sentences to enhance their communication skill so that they can interact (orally and in writing) with people at different levels and in different situations with confidence.

(iv) This subject will enable the engineering students to understand the following:

- Effective Oral Communication
- Better Written Communication
- How to Improve Human Relations
- How to Improve Barriers to Communication
- The need for Enhancing Personality

(5) DETAILED CONTENTS :

Chapter	Content	Marks	Hours
	<u>SECTION – I</u>		
01	Five lessons as five units from the prescribed English Book as described in the section ‘Reference’ Below	20	08
02	Parts of Speech 2.1 Nouns, Pronouns & Adjectives 2.2 Verbs & Adverbs 2.3 Prepositions, Conjunctions, etc.	06	01
03	Sentences 3.1 Synthesis of Sentences 3.2 Tenses 3.3 Degree of Comparison 3.4 Transformation of four kinds of sentences- Assertive, Imperative, Interrogative and Exclamatory	10	02
04	Essay/Paragraph/Report Writing 4.1 Long Essay		

	4.2 Short Paragraph 4.3 Report Writing-Visits, Accidents, Trouble, Maintenance, Memo	16	05
05	Letters 5.1 Formal & Informal 5.2 Letters for Inquiry, Order, Complaint, Application for Job	16	05
	SECTION – II		
06	Dialogue Writing	06	01
07	Technical Description 7.1 Theory and Practice (Language)	08	02
08	Business Correspondence 8.1 Importance of Business Correspondence Format of a Business Letter 8.2 Types of Layout 8.3 Cardinal Qualities of Business Letter	24	08
09	Notices and Instructions 9.1 Theory and Layout 9.2 Types of Notices 9.3 Tender Notice (Theory and Specimen)	24	06
10	Background of Industry 10.1 Definition of Terms-Industry, Industrialisation, Etc. 10.2 Factors of Production, Infrastructure 10.3 Industrial Estates Small Scale Industries, Trade Unions.	10	02
	Total	(82)	(24)

06 IMPLEMENTATION STRATEGY (PLANNING) :

(i) Five units from the prescribed text book (English fir Technical Students-T.T.T.I. Chandigarh), Lessons in the prescribed text book are used as guidelines for explaining the techniques os essay/dialogue writing.

(ii) Teaching Plan

(iii) Grammar items are covered along with the units of lessons

(iv) Home assignments and class room participation

(7) REFERENCE BOOKS :

Sr. No.	Author	Title	Year of Publication	Publishers & Address
1.	Dr. (Mrs.) Urmila Rai Dr. S.M. Rai	Business Communication	2002	Himalaya Publishing House
2.	Edited Lessons	Communication Skill for Technical Students(National Project on Communication Skill, Chandigarh)	1998	Somaiya Publications Pvt. Ltd., Mumbai & New Delhi
3.	Wren & Martin	Grammar & Compositon	2002	Chand Publications , New Delhi
4.	J.C.Nesfield	English Grammar, Compositon & Usage	1994	Mc.Milan, Madras
5.	Krishna Mohan Meera Banerji	Developing Communication Skill	2004	McMilan India Ltd., New Delhi

1. SUBJECT DETAILS :

S	Course: mechanical	Semester: I
	weeks	Duration: 16
	Subject: 1.2 Mathematics-I	Code : MA-15
	Group : Basic (B*)	Compulsory

2. TEACHING AND EXAMINATION SCHEME :

Scheme of instruction and periods per week					No. of papers, duration and Marks			Scheme of Examination						Scheme L/Pr/Cr
L	P	D	T	Cr	NP	Hrs	Mks	SSL	Theory Paper	T/W	Pract	Oral	Total	
3	-	-	1	4	1	3	100	20	80	-	-	-	100	404

3. RATIONALE :

Algebra, Trigonometry and Coordinate Geometry are introduced as prerequisite for the topics to be studied later on to solve the engineering problems.

4. OBJECTIVES:

1. The students will be able to use the Mathematical Methods to solve the engineering problems.
2. Students will be able to use principles to solve problem in Mathematics at Higher Semester level

5. DETAILED CONTENTS :

Chapter	Content	Marks	Hours
01	Section-I		
	1.0 Trigonometry		
	1.1 Trigonometric ratio of any angle, Definition of Radian,	08	02
	length of arc of sector $s = r\theta$,	24	06
	area of Sector $A = \frac{1}{2}r^2\theta$	12	04
		12	04
	1.2 Trigonometric ratios of allied, compound angles and multiple angles	06	02
	1.3 Inverse trigonometric functions		
	1.4 Properties and solution of triangle		
	1.5 Solution of Trigonometric equation by graph		
(02)	Matrices		
	2.1 Definition of a matrix of order $m \times n$. type of	02	01

matrices	04	01
2.2 Addition and subtraction of two matrices	04	01
2.3 Multiplication of a matrix by a scalar, multiplication of two matrices.	10	03
2.4 Singular and Non-singular matrices. Transpose of a matrix. Adjoint of matrix, Inverse of a matrix A by findings Adj. A solution of simultaneous equation by using a matrix	----	----
	(82)	(24)

SECTION-II

(03) Algebra

3.1 Determinant	18	05
3.2 Partial fractions	16	04
	24	08
3.3 Binomial Theorem		
	16	04
3.4 Progression (A.P./G.P.)		
	08	03
3.5 Permutations and Combinations		
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	(82)	(24)

Total

(6) IMPLEMENTATION STRATEGY (PLANNING)

Conducting lectures as per the teaching plan and conducting tutorials.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Year of Publication	Publishers & Address
(i)	S.P.Deshpande	Mathematics for Polytechnic Students-I & II	1998	Pune Vidyarthi Graha Prakashan Pune-30
(ii)	G.V. Kumbhojkar	Engineering Mathematics – I & II	1999	Jamnadas & Co.
(iii)	Patel/Rawal & others	Applied Mathematics-I	2002	Nirali Prakashan, Mumbai

1. SUBJECT DETAILS:

Course : mechanical	Semester : I
Subject : Chemistry	Duration :16 Weeks Code : SC – 27
Group : Basic	Compulsory

2. TEACHING AND EXAMINATION SCHEME:

Scheme of instruction and periods per week					No. of papers, duration and marks			Scheme of examination					Scheme L/Pr/Cr	
L	P	D	T	C	N	Hr	Mk	SS	Theor	T/W	Prac	Ora		Tota
				r	P	s	s	L	y		t	l	l	
4	4	-	-	8	1	3	100	20	80	25	50	-	175	4 4 8

3. RATIONALE :

This subject is classified under the category of Basic Sciences. It intends to develop the understanding of fundamental principles of chemistry and also impart knowledge of various engineering material. This will form the base for the better understanding of the other core technology and technological subjects of different branches.

4. OBJECTIVES :

After studying the subject the student will be able to

1. Understand basic principles of chemistry.
2. Apply the principles to other subject.
3. Identify different engineering materials.
4. Compare the properties of different engineering materials and select engineering materials for various purposes.
5. Apply his knowledge on day to day basis.

5. DETAILED CONTENTS :

SECTION-I

Chapter	Content	Marks	Hours
1.	1.0 Atomic Structure:	16	07

- 1.1 Bohr's Theory of an atom
- 1.2 Quantum numbers
- 1.3 Orbits and orbitals, shape of s and p orbitals
- 1.4 Pauli's exclusion principle
- 1.5 Hund's rule
- 1.6 Aufbau principle
- 1.7 Electronic configuration of first twenty elements
- 1.8 Study of inert gases
- 1.9 Nuclear stability mass defect and binding energy
- 1.10 Bonding electrovalency and covalency.

Applications

Civil engineering

To understand the behaviour of any material

Mechanical engineering

Material sciences , behaviour of material for various applications

Electrical engineering

Fundamental of electricity like conductivity, resistivity, selection of materials

Electronics

To understand semiconductors, diodes, transistors

Plastic engineering

Polymerization , bonding

Chemical engineering

Reaction of different types, bonding ,unit operations, chemical process technology

Practice :

- i) Volumetric analysis
- ii) Qualitative analysis

- | | | | |
|----|---|----|----|
| 2. | 2.0 Electrochemistry : | 10 | 05 |
| | 2.1 Atom, ion | | |
| | 2.2 Arrhenius.theory, degree of ionization | | |
| | 2.3 Mechanism of electrolysis | | |
| | 2.4 Numerical problems based on its applications industrial | | |
| | 2.5 Applications of electrolysis | | |

Applications

Civil engineering

Corrosion control

Mechanical engineering

Electroplating of various materials, in foundry for making patterns and moulds ,material science

Electrical engineering

Electrochemical reactions , batteries, electrochemical cells

Electronics

Manufacture of PCB

Plastic engineering

Electroplating of different plastic materials

Chemical engineering

Electroplating, different electrolysis process, unit operations, chemical process technology, distillation and filtration

3. **3.0 pH –** 04 02
- 3.1 Concept of pH
 - 3.2 pH scale applications of pH in industry
 - 3.3 Examples based on hydrogen ion and hydroxyl ion concentration

Applications

Civil engineering

Concreting and quality of water

Mechanical engineering

Selection of water fir cooling towers, other air-conditioning and refrigeration purposes, boilers , lube oils

Electrical engineering

Transformer oils and other instruments

Electronics

Manufacture of PCB

Plastic engineering

Reactions conditions, ABS plastic and alloys

Chemical engineering

Reaction conditions instrumentation, plant utility, chemical reaction engineering and pollution

4. **4.0 Metallurgy :** 16 07
- 4.1 Types of metals & properties
 - 4.2 General metallurgical processes
 - 4.3 Metallurgy of iron- extraction of iron by blast furnace
 - 4.4 Classification of steel – Based on its carbon content and its applications. Properties of cast iron, wrought iron and steel. Effects of elements on properties of steel
 - 4.5 Heat treatment of steel – Hardening tempering,

annealing and normalizing
4.6 Metallurgy of aluminum by Hall's process.

Applications

Civil engineering

Engineering material

Mechanical engineering

Manufacturing of engineering tools and machine parts

Electrical engineering

Electrical engineering materials

Electronics

PCB and parts of machines

Plastic engineering

Machines and reinforced plastics

Chemical engineering

Metals for construction of plant utilities

5. **5.0 Alloys :** 09 02
- 5.1 Definition and purposes of alloying
- 5.2 Methods of preparation of alloys
- 5.3 Properties, composition and application of certain non ferrous alloys.
- | | | |
|---------------|------------------|-------------------|
| (i) Duralumin | (ii) Magnalium | (iii) Monel metal |
| (iv) Alnico | (v) Babbit metal | (vi) Gun metal |
| (vii) Brass | (viii) Bronze | |

Applications

Civil engineering

Engineering material

Mechanical engineering

Material sciences

Electrical engineering

Soldering and welding

Electronics

Thermocouple and soldering

Plastic engineering

Alloys and moulds

Chemical engineering

Petrochemicals , material of construction, chemical process technology

6. **6.0 Corrosion :** 18 07

- 6.1 Definition and types of Corrosion
- 6.2 Mechanism of corrosion
- 6.3 Factors affecting corrosion
- 6.4 Methods of prevention of corrosion.
 - (i) Applying protective coatings on the surface of metal by hot dipping – galvanizing and tinning.
 - (ii) Metal cladding.
 - (iii) Electroplating.
 - (iv) Spraying.
 - (v) Sherardizing.

Applications

Civil engineering

Building repair and maintenance, concreting

Mechanical engineering

Selection of materials and prevention against corrosion

Electrical engineering

Dam conditions, maintenance of appliances, transmission of cables

Electronics

Machine parts and machine frames

Plastic engineering

Fiber reinforced plastics, bridges

Chemical engineering

Chemical process technology, pollution, material of construction

- | | | | |
|----|---|----|----|
| 7. | 7.0 Protective Coatings : | 09 | 02 |
| | 7.1 Paints | | |
| | 7.2 Characteristics of good paint | | |
| | 7.3 Constituents of paints and their applications | | |
| | 7.4 Varnishes | | |
| | 7.5 Types & characteristics of varnishes | | |
| | 7.6 Applications | | |

Applications

Civil engineering

Engineering materials

Mechanical engineering

Material sciences

Electrical engineering

Electrical instruments & materials

Electronics

PCB making

Plastic engineering

Galvanizing , electroplating & plastics paints

Chemical engineering

Chemical process technology, pollution, material of construction

SECTION – II

8. **8.0 Water :**

22

09

- 8.1 Impurities in natural water, physical and chemical characteristics of drinking water.
- 8.2 Hard water - Expression and estimation of hardness of water
- 8.3 Examples on the removal of hardness of water
- 8.4 Disadvantages of hard water in domestic industrial applications. Boiler feed water – Disadvantages due to hard water in the boiler
- 8.5 Methods of softening hard water.
 - (i) Deionisation process.
 - (ii) Calgon process.
 - (iii) Soda ash process.
 - (iv) Permutit – Zeolite process disadvantages of hard water in domestic and industrial applications.
- 8.6 Sterilization of water – chlorination + ozonisation
- 8.7 Sewage – disadvantages & treatment

Applications

Civil Engineering

Concreting

Mechanical Engineering

Hydraulics, Boilers and Engines

Electrical Engineering

Maintenance of machines, Batteries and Inverters

Electronics

Water Base Indicators

Plastic Engineering

Estimation and Manufacture of Resins

Chemical Engineering

Plant Utility, Heat Transfer Operations, Pollution and Pollution Control

Practice :

- i) Determination of hardness of water
- ii) Determination of chloride content of water

9. **9.0 Fuels :** 18 08
- 9.1 Definition and classification of fuels
- 9.2 Calorific value of fuel units and definition
- 9.3 Coal types and analysis of coal.
 i) proximate ii) Ultimate analysis
- 9.4 Characteristics of a good fuel
- 9.5 Crude petroleum – catalytic cruding fractional distillation of crude petroleum.
 Knocking of petrol in internal combustion engine and octane number.
- 9.6 Gaseous fuel – Calorific value, composition and applications of i) water gas ii) LPG iii) Coal gas
 iv) Producer gas v) Natural gas

Applications

Civil Engineering

Manufacturing of bricks and Preparation of Concrete mixtures

Mechanical Engineering

Thermodynamics, thermal engines, Power Engines

Electrical Engineering

Power generating stations

Electronics

Preparation of spare parts of machines

Plastic Engineering

Soldering and Welding

Chemical Engineering

Plant Utility, Petrochemicals

10. **10.0 Lubricants :** 18 08
- 10.1 Definition and types of lubricants
- 10.2 Types of lubrication fluid film lubrication
 Boundary lubrication, extreme pressure lubrication
- 10.3 Properties of lubricants.
 i) Degree of acidity ii) Saponification number iii) Viscosity
 iv) Viscosity index v) Flash and fire point vi) Pour point + Cloud point.
 Working of Penskey Martin's apparatus to determine flash and fire point. Working of redwood viscometer to determine viscosity.

Applications

Civil Engineering

Selection of lubrication for civil work and small machines

Mechanical Engineering

I.C. Engines, other types of Engines, Machines

Electrical Engineering

Maintenance and working of machines

Electronics

Maintenance of machines and its parts

Plastic Engineering

Silicon release and mould release agents

Chemical Engineering

Chemical Process Technology, Plant Utility, Petrochemicals and unit operations

10.4 Functions and Engineering applications of lubricants

Practice :

Demonstration of following experiments :

- i) Abel flashmeter
- ii) Redwood viscometer
- iii) Penskey Marteins apparatus

11. **11.0 Rubber and Plastics :** 10 04

11.1 Plastics – Definition – types of plastics

11.2 Properties of plastics

11.3 engineering application of plastics

11.4 Rubber – natural and synthetic rubber properties – elasticity, abrasion resistance Tack industrial

11.5 Applications of rubber.

Applications**Civil Engineering**

Preparation of Plumbing machines parts, taps, washers etc.

Mechanical Engineering

Manufacturing Processes

Electrical Engineering

Preparations of Electric wires and cables

Electronics

Preparations of PCB and wires of machines.

Plastic Engineering

Plastic Technology, Packaging, Co-polymer of Plastics and Additives.

Chemical Engineering

Chemical Process Technology, Petrochemicals

12. **12.0 Pollution and its control :** 14 03

12.1 Causes of pollution – air pollution types of air pollutants.

- Gases – sulphur dioxide, sulphur trioxide carbon monoxide, nitrogen dioxide, carbon dioxide, control of air

pollution.

12.2 Water pollution :

Sources of water pollution, methods of preventing water pollution.

12.3 Radioactive pollution

12.4 Noise pollution

12.5 Disadvantages of pollution

12.6 Control of Pollution

Applications

Civil Engineering

Drainage and Water Supply, Sewage Treatment

Mechanical Engineering

Thermodynamics and I.C. Engines

Electrical Engineering

Recycling of Electrical Goods

Electronics

Recycling of Electronic Goods

Plastic Engineering

Recycling of Plastics, Pollution control, Chlorofluoro Carbons and Decrease of carbons in Atmosphere

Chemical Engineering

Pollution Control and Waste Disposal, Plant Utility And Petrochemicals.

Total Number of Marks=82; Theory Hours= 32; Practical Hours= 64

6. IMPLEMENTATION STRATEGY (PLANNING) :

1. **Theory topics and practice experiments should be done simultaneously. This will help the students to understand the topics.**
2. Question papers for the periodical test should cover the topics which have been taught. To test the understanding.

7. REFERENCE :

Sr.No.	Author	Title	Publishers & Address
1.	Jain and Jain	Chemistry of Engineering Materials	Dhanpat Rai Publishing Co. New Delhi
2.	Narkhede & Thatte	Engineering Chemistry	-
3.	Mahadeokar & Dr. U.P. Kodgire	Chemistry for Engineering students	Everest Publishing House, Pune

4.	B.S. Godbole	Applied Chemistry	Satyaprakashan, New Delhi
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1. SUBJECT DETAILS:

Course: Mechanical Engineering	Semester : I Duration : 16 Weeks
Subject: Engineering Drawing – I	Code : ME-16
Group : Core	Compulsory

2. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme	Credits	Examination Scheme and Maximum Marks
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Theory Hrs Per Week	Practical Hrs per Week		Paper			TH	Sessional	T/W	Oral	Total
			Hrs	NP	Mks					
02	06	08	3	01	100	80	20	50	50	200

3. RATIONALE:

Engineering drawing is a language of engineers. It is classified as engineering science subject. It describes scientific facts, principles and technique of drawing in order to visualize and express the ideas and to convey the instructions through drawings without ambiguity. In engineering drawing – I, student will study concept of orthographic projections, isometric projection, isometric view, ideas of two dimensional and three dimensional objects, oblique, projections, curves etc.

4. OBJECTIVES:

Engineering drawing helps in understanding design of parts, assembly, structure etc. used in engineering field. It supports technology and technical subjects. By achieving visualization and drawing skills, the student will successfully discharge his role on shop floor, design department and inspection department etc.

5. DETAILED CONTENTS:

Chapter	Content	Marks	Hours
<u>SECTION-I</u>			
01	1.0 Introduction :		02
	1.1 Importance of Engineering Drawing for the study of technical courses		
	1.2 Drawing instruments, types of lines and dimensioning (lettering and numbering for term work or assignment)		03
	Practice :		09
	1. A2 size sheet to be drawn containing four problems on letter lines and dimensioning techniques.		
	2. Home Assignments: One sheet containing four problems		
02	2.0 Principle, Planes and Quadrants:	-	02
	2.1 Concept of principle planes and quadrants		
	2.2 I and III angle method of projections		
03	3.0 Orthographic Views :	-	02

	3.1 Projections of various objects having flat and curved surfaces using 1 st and 3 rd angle projection method.		
	Practice:	-	12
	1. One sheet on orthographic projection for objects with linear features		
04	4.0 Conversion of Pictorial View :	20	05
	4.1 Conversion of pictorial views in to non-sectional orthographic views. The objects may have slots, holes cavities etc.		
	Practice:	-	12
	1. One sheet with non sectional orthographic views for the objects with curvilinear features.		
	2. Home Assignments: One sheet containing four problems		
05	5.0 Oblique Projections :	30	04
	5.1 Oblique projections of curvilinear feature on non oblique plane only.		
	Practice:	-	12
	1. One sheet having four problems of oblique projection for the curvilinear features on non oblique plane.		
	2. Home Assignments: One sheet containing four problems		
06	6.0 Engineering curves :	30	04
	6.1 Cycloidal curves: Cycloid, epicycloids, hypocycloid (Simple cases)		
	6.2 Involute of circle and polygon (simple cases)		
	6.3 Helix on cylinder (not on cone)		
	Practice:	-	12
	1. One sheet with four Problems containing cycloid, epicycloids, hypocycloid , Involute and Helix.		
	2. Home Assignments: One sheet containing four problems		
SECTION-II			
07	7.0 Conversion of Pictorial View in Sectional Orthographic:	20	04
	7.1 Conversion of pictorial views with cutting plane into sectional orthographic projection (full section only)		
	Practice:		
	1. Four problems on sheet(full section plane)		
	2. Home Assignments: One sheet containing four problems		12
08	8.0 Isometric Views and Projections:	40	05
	8.1 Isometric Views and Projections of linear and curvilinear features.		
	Practice:		12

1. One sheet with four problems on Isometric view having linear and curvilinear features.
2. On sheet with four problems on Isometric projection having linear and curvilinear features.
3. Home Assignments: One sheet containing four problems

09	9.0 Engineering Curves: 9.1 Ellipse: Oblong, arcs of circle and concentric circle method. 9.2 Parabola: Eccentricity and rectangular methods. 9.3 Hyperbola : Eccentricity and rectangular methods. Practice: 1. Four problems on Ellipse Parabola and Hyperbola 2. Home Assignments: One sheet containing four problems	20	04
			12

6. IMPLEMENTATION STRATEGY (PLANNING) :

In depth study and understanding of the subject will be implemented by adoption of the following strategy :

1. Theory Teaching Plan
2. Term Work Plan for practical giving problems to draw in the class.
3. Home assignment to practice at home
4. Conduct of three periodical test
5. Use of OHP models and charts during theory class and practical periods

7. REFERENCE BOOKS :

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
1.	N.D.Bhatt and Panchal	Geometrical and Machine drawing	14 th	2000	Rupalee Pub.Opp. Amul Dairy, Court Rd, Anand
2.	R.K. Dhawan	Engineering drawing	2 nd	2001	S.Chand & Co.Ltd., Ram Nagar New Delhi-110 055
3.	R.K. Dhawan	Machine drawing	2 nd	2001	S.Chand & Co. Ltd ,Ram Nagar New Delhi-110 055
4.	M.L. Dabhade	Engineering Graphics	4 th	1995	Mrs.VA.Velhankar 1030, Model Colony, B-12,Akash Ganga Pune-411 016

SHRI VILEPARLE KELVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

PART TIME

DISCIPLINE: MECHANICAL ENGINEERING.
admitted june 2008 (progressive)

w.e.f. batch

SEMESTER: SECOND
the academic term: DEC-08/JAN- MAY 09

Effective from

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION						Group/Com/Opti
			L	P	D	T	Cr	NP	HRS	Mks	SSL	Theory paper	T/W	Pract.	Oral	TOTAL	
1	Development of Generic skills	DG-1	2	-	-	1	3	1	3	100	20	80	-	-	-	100	B*
2	Mathematics-II	MA-25	3	-	-	1	4	1	3	100	20	80	-	-	-	100	B*
3	Physics	SC-17	4	4	-	-	8	1	3	100	20	80	25	50	-	175	B*
4	Engineering Drawing -II	ME-36	2	-	6	-	8	1	4	100	20	80	50	-	50	200	C*
			Total periods (23)								Total marks = (575)						

1. Subject Details

Course: mechanical Engineering	Semester: II
Subject: Development of Generic Skills	Code :DG-1
Group: Basic	Compulsory

2. Teaching and Examination Scheme

Teaching Scheme			Examination Scheme							
Theory Hrs Per Week	Practical Hrs per Week	Credits	Hrs	NP	Mks	Th	Sess	T/W	Prac	Total
03	--	03	03	01	100	80	20	--	--	100

3. RATIONALE

The skills of Project Management have become important in all types of business and at all levels of work hierarchy. The purpose of development of Generic Skills is to develop the necessary skills, which will make students confident and competent in managing and executing engineering projects.

4. GENERAL OBJECTIVES

Over a period of time it has been observed that effectively of polytechnic students, their utility at work place can be enhanced by imparting generic skills right from entry in the polytechnic. The generic skills are life skills, they are lifelong skills, whose edge needs to be sharpened every moment.

The content is divided into 4 logical units:

1. Information
2. Communication Skills
3. Self Development
4. Task Management

It is designed by keeping self in focus with a clear objective of developing Generic Skills, to enhance the capabilities in the field of searching, assimilating and using information on job. Developing self and managing given tasks, finally to present himself as a technomenger.

It is an effort to develop student that enables him to be successful in finding a practical and reaction solution to any problem he comes across. It covers more or less all aspects of life skills. The development of subject is progressively ascending parallel to development of study in polytechnic.

5. Theory Contents:

1. Information Sources (Periods:2hrs; Mks-10)

Introduction, Types of Information sources, Print Media, Documentary Sources, Non-Documentary Sources, Non-Print Media, Electronic Media, Conclusion.

2. Information Centre (Periods:2hrs; Mks-10)

Introduction, Classification, Services, Conclusion.

3. Procedure for Information Search (Periods:4hrs; Mks-20)

Introduction, Need of Approach, Types of Approach, Steps for Information Search, Preparation of Biographic Card, Preparation of Index Card, Conclusion.

4. Learning (Periods: 4hrs; Mks-20)

Introduction, Concept of Learning, Basic Model of Learning, Principles of Learning, Conclusion.

5. Memory & Cognition (Periods: 4hrs; Mks-20)

Introduction, Basic Concepts, Dual Store Model of Memory, Sensor register Characteristics, Attention,: Factors affecting attention, Figure Ground Rule, Working memory(WM); Characteristics of WM, Control Processes in WM, Long Term Memory in LTM: Characteristics of LTM, Control Processes in LTM, Organization of knowledge, Conclusion.

6. Meta Cognition & Study Strategies (Periods:4hrs; Mks-20)

Introduction, Meta Cognitive Knowledge, Self Regulated Learning, Effective Learning and Study Strategies(Covert): Selective attention, Maintain Rehearsal, Meaning learning Reflection, Internal Organization, Elaboration-----** Visualization, Effective learning strategies: Effective reading, Effective listening, Notes Taking, Conclusion.

7. Learning on Job (Periods: 4hrs; Mks-20)

Introduction, Definition, Identify General and Specific Skills, Workplace as a System, Types of System, Conclusion.

8. Learning Practical Skills (Periods: 2hrs; Mks-10)

Introduction, Process of Performing the job, Domains of Learning Job, Conclusion.

9. Testing of Acquired Skills (Periods:2hrs; Mks-10)

Introduction, Objectives, Process for Skill Analysis, Conclusion.

UNIT II COMMUNICATION SKILLS

10. Basis of Communication (Periods:2hrs; Mks-10)

Definition, Concept of Communication, Communication Cycle, Communication, Conclusion.

11. Techniques of Communication (Periods: 2hrs; Mks-10)

Introduction, Oral Communication, Written Communication, Body Language, Conclusion.

S. No.	Main Topics	No of Contact Hrs	Marks	Weightage %	#M/E/D
1	Information sources	2	10	7	E
2	Information Centre	2	10	7	E
3	Process For Information Search	4	20	11	M
4	Learning	4	20	11	M
5	Memory and Cognition	4	20	12	M
6	Meta Cognition & Study Strategies	4	20	12	D
7	Learning on Job	4	20	12	E

1. SUBJECT DETAILS:

Course: Mechanical	Semester: II
Subject: Mathematics – II (MA-25)	Duration: 16 Weeks
Group: Basic (B *)	Compulsory

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instruction and Periods per week					No of papers, duration and Marks			Scheme of Examination						Scheme L/Pr.Cr.
L	P	D	T	Cr	Np	Hrs	Mks	SSL	Theory Paper	T/W	Pract	Oral	Total	
3	-	-	1	4	1	3	100	20	80	-	-	-	100	404

3. RATIONALE:

1. Creating aptitude for Mathematics of Higher Semesters
2. Focusing attention of problem solving in liberal sense. This aspect should take care of
 - (a) Intelligent combination of techniques.
 - (b) Mathematization or mathematical modeling of problems involved in various branches of knowledge.

3. Nurturing the higher order mental process of logical reasoning with rigor and precision.

4. OBJECTIVES:

These topics are introduced as

1. Prerequisite for many topics such as integral calculus, differential equations, Fourier series etc. to be studied later.
2. To introduce the applications commonly required.

5. DETAILED CONTENTS:

Chapter	Content	Marks	Hours
SECTION – I			
01	Co-ordinate Geometry		
	1.1 Straight line: Slope of a line; X and Y intercepts of a line, point of Intersection of two straight lines, Acute angle between intersecting lines, Perpendicular distance of a point from the line, distance between two parallel lines.	12	40
	1.2 Circle: Centre-Radius form of an equation of a circle, General equation of a circle.	10	32
	1.3 Equation of a chord, tangent and normal to any circle.	02	10
		<hr/>	<hr/>
		(24)	(82)
SECTION – II			
02.	Complex Number		
	2.1 Definition of a complex number	02	06
	2.2 Elementary Operations	02	06

2.3	Polar form of a complex number, exponential form of a complex number	04	14
2.4	Argand diagram	02	06
3.	Vector Algebra		
		01	04
3.1	Scalars and Vectors		
3.2	Addition of Vectors.	01	04
3.3	Dot product and cross product	01	04
3.4	Scalar triple product	01	04
3.5	Application: work done by a force, moment of a force about a point. Area of a parallelogram Area of a triangle .Volume of the parallelepiped	04	08
04.	Function		
4.1	Values of a function, type of functions	02	10
4.2	Limits	04	16
		<hr/>	<hr/>
		(24)	(82)

6. IMPLEMENTATION STRATEGY (PLANNING):

Conducting lectures as per the teaching plan and conduction tutorials.

7. REFERENCE BOOKS:

Sr. No.	Author	Title	Year of Publication	Publishers & Address
1.	S. P. Deshpande	Mathematics for Polytechnic Students – I & II	1998	Pune Vidyarthi Graha Prakashan, Pune-30
2.	G. V. Kumbhojkar	Engineering Mathematics-I & II	1999	Jamnadas & Co
3.	Patel /Rawal & others	Applied Mathematics-I	2002	Nirali Prakashan, Mumbai

1.SUBJECT DETAILS :

Course: Mechanical Engineering	Semester : II
	Duration: 16 weeks
Subject : PHYSICS	Code : SC – 17
Group: Basic	Compulsory

2. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							Scheme	
Theory Hrs. Per Week	Practical Hrs. Per Week		Paper			TH	SSL	T/W	Pract		Total
		Hrs	Np	Mks							
04	04	08	03	01	100	80	20	25	50	175	448

3. RATIONALE: The student has to attain a remarkable knowledge level regarding properties of materials and laws of Physics. This foundation is required at the First Year Diploma Level of various branches of Engineering and is laid by incorporating a Theory and Practical approach with due stress on practical application aspect of the subject. This is emphasized by widening scope for laboratory work, selecting such text and specialized reference books.

4. OBJECTIVES: After acquiring knowledge of Laws of Physics and co-relation of its Principles, the Student will:

- (i) Be able to understand Application (of theoretical principles) to work
- (ii) Appreciate the importance of precision involved in measurements.

5. DETAILED CONTENTS:

A. THEORY CONTENTS :

	Marks	Period
Unit: Introductory talk	-	02
To understand : Assertion of the statement which specifies relation between Engineering and Applied Physics. Importance of implementing precision measurements.		
Chapter: (i) Subject introduction with review of past work – `Science`, Physics`, Matter and its structure, forms; `Physics` as science of measurement; unit; systems- CGS, MKS etc. multiples and submultiples (ii) SI units and Standards- meter(m), kilogram (kg), second (s), degree Kelvin (K), candela (cd), ampere (A), mole		

SECTION-I

Marks	Hours
26	08

Unit- I General Physics

Chapter 1 : Elasticity

- 1.1 Elasticity, perfectly elastic, plastic, rigid body.
- 1.2 Stress, Strain, Hooke's law; Modulus of elasticity.
- 1.3 Young's modulus, Bulk modulus, Rigidity modulus; Poisson's ratio.
- 1.4 Young's modulus by Searle's apparatus, constant of elasticity. by Searle's method.
- 1.5 Elastic behavior of wire
- 1.6 Engineering applications.
- 1.7 Numerical problems.

Chapter 2: Viscosity

- 2.1 Viscosity, Streamline flow; critical Velocity.
- 2.2 Newton's Formula; Coefficient of viscosity; `poise`.
- 2.3 Poiseuille's equation, Poiseuille's Method
- 2.4 Stokes' law; Stokes; formula; Stokes method.
- 2.5 Reynold's number.
- 2.6 Applications.
- 2.7 Numerical problems

Unit-II Heat and Thermodynamics

Chapter 3: Thermometry :

3.1 Zeroth law of thermodynamics.

3.2 Platinum resistance thermometer, Standard gas thermometer,
Optical pyrometer

Chapter 4 Specific heats of gases – Cp and Cv

4.1 Specific heat at constant pressure and at constant volume-

Molar, In terms of enthalpy

4.2 Relation between Cp and Cv

4.3 Numerical problems

Chapter 5 Concepts of Thermodynamics

5.1 Heat and energy; Joule's law; Mechanical equivalent of heat.

5.2 First law of thermodynamics

5.3 Isothermal and Adiabatic Processes

5.4 Thermodynamics processes- Reversible; Irreversible.

5.5 Cycle P-V diagram

5.6 Elementary ideas of heat engine

5.7 Concept of entropy

Chapter 6: Heat Transfer – Conduction

6.1 Heat conduction- idea of steady states; temperature gradient ; coefficient of thermal conductivity.

6.2 Thermal conductivity of a good conductor- Searle's method

6.3 Thermal conductivity of an insulator- lee's method.

6.4 Thermal conductivity of rubber tube by calorimetric

6.5 Temperature of interface

6.6 Numerical problems

Unit III Sound

Chapter 7 Simple Harmonic Motion (S.H.M.)

7.1 General equations of S.H.M.; Graphical representations;
Characteristics of S.H.M.

7.2 Numerical problems

Chapter 8: Waves and Oscillations

- 8.1 Progressive waves(transverse and longitudinal)-equation.
- 8.2 Principle of superposition; Stationary waves.
- 8.3 Free oscillation and forced oscillations, resonance.
- 8.4 Vibrations of air column-velocity of sound by resonance tube closed at one end.
- 8.5 Vibrations in strings- frequency of A.C Supply by Sonometer
- 8.6 Numerical problems.

Chapter 9: Intensity of Sound

- 9.1 Loudness and phon
(Absolute) intensity of sound; standard intensity; intensity level in bel, decibel Logarithmic law
- 9.2 Data for various sources of sound and their intensity in decibel.

Chapter 10 Acoustics and reverberation:

- 10.1 Reverberation, Sabine`s formula Conditions for good acoustics, Noise reduction and sound insulation Numerical problems
- 10.2 Ultrasonic-production and Application; Sonic, Subsonic, Supersonic.

SECTION-II

Unit IV Optics

24 06

Chapter 11 Photoelectricity:

- 11.1 Photoelectric effect- Planck`s hypothesis Einstein`s equation; Characteristics
- 11.2 Photocell- photo emissive; photo conductive; photovoltaic Applications Numerical problems

Chapter 12 Elementary ideas of Interference, Diffraction and Polarization

- 12.1 Interference Conditions for steady interference pattern, Thin films, Newton`s rings, optical flatness, Applications
- 12.2 Diffraction, Grating, Applications
- 12.3 Polarization, Polarimeter; Photoelasticity, Applications

Unit V Electricity and Magnetism

30 10

Chapter 13 Static electricity

- 13.1 Coulomb's law; Electric field; Intensity, Electric line of force
Flux density; Electric potential-Absolute, Numerical problems
Potential; Potential difference (p.d.); Expression for potential
at a point
- 13.2 Capacitance; farad; Principle of capacitor, Capacitor; Parallel
plate capacitor; Combinations: Capacitors " In Series ", " In
Parallel; Energy of capacity; Numerical problems.

Chapter 14 Current Electricity

- 14.1 Specific resistance; Ohm's law as applied to complete circuit- e.m.f. and p.d.
- 14.2 Wheatstone's network and Wheatstone's bridge (W.B.) (metre
bridge) Post Office Box (P.O.B.)
- 14.3 Potentiometer
- 14.4 Application
- 14.5 Numerical Problems.

Chapter 15 Electromagnetism

- 15.1 Current carrying conductor in the magnetic field, 'ampere' the SI
Unit of current.
- 15.2 Rectangular coil carrying current placed in uniform magnetic field,
Galvanometer-Moving coil' 'Mirror', Current Sensitivity.
- 15.3 Principle of Shunt, Ammeter, Voltmeter.

Chapter 16 Magnetism

- 16.1 Magnetic materials; Dia, Para and Ferromagnetism; Modern
concept of magnetism.
- 16.2 Susceptibility, Magnetic hysteresis; Magnetic shielding.
- 16.3 Applications.

Chapter 17 Thermoelectricity

- 17.1 Thermocouple, Seebeck and Peltier effect; thermo e.m.f vs temperature relation.
- 17.2 Thermocouple as thermometer

Unit VI: Modern Physics:

28

10

Chapter 18 Bohr's Theory for hydrogen atom

- 18.1 Bohr's postulates
- 18.2 Radii of orbits and energies; Rydberg constant; Bohr model-Energy
level diagram for hydrogen atom and spectral series.

Chapter 19 Crystal Structure

19.1 Crystalline and Amorphous solids, , Unit cell space-lattice cubic crystal structures- simple cubic(S.C), Body centred cubic (B.C.C), Face centred cubic (F.C.C),Atomic radius Co-ordination number, Number of atoms per unit cell; Atomic radius, Packing density..

19.2 Atomic planes and spacing, Miller indices.

Chapter 20 Elementary ideas of Lasers and Masers

20.1 Introduction related to acronym Spontaneous and stimulated (Induced) emission, Essential requirements of laser- Active medium, Resonant cavity, Pumping.

20.2 Ammonia maser, Ruby Laser; Helium –Neon Laser.

20.3 Energy and momentum of laser photon, Properties and applications.

20.4 Holography .

Chapter 21 Band theory of solids ; Semiconductors

21.1 Energy bands in solids and classification of materials in to conductors, semiconductors and insulators.

21.2, semiconductors Intrinsic ; Extrinsic – P Type and N Type; P-N junction.

Chapter 22 Elementary ideas of Fibre optics and Superconductivity

22.1 Total internal reflection and critical angle; wave guide for light, Optical fibre- Step index, Graded index ; Applications.

22.2 Principle of Superconductivity –Zero ohmic resistance; critical field; Meissner effect; Super conducting state, materials, properties and applications

LIST OF EXPERIMENTS

Experiments to be performed :

Section-I (ANY 09)

1	Use of Measuring Instruments – Vernier Callipers, Micrometer Screw Gauge, Spherometer
2	Elastic Constants by Searle's Method
3	Young's Modulus by Searle's Apparatus
4	Surface Tension by Capillary Rise Method <u>OR</u> Viscosity by Poiseuille's Method <u>OR</u> Viscosity by Stokes' Method.
5	Thermal Conductivity of a Good Conductor by Searle's Apparatus
6	Ratio of Specific Heats Cp/Cv by Clement and Desorme's Apparatus
7	Thermal Conductivity of Rubber Tube by Calorimetric Method.
8	Thermal Conductivity of an Insulator by Lee's Method
9	Velocity of Sound by Resonance.
10	Velocity of Sound by C.R.O
11	Frequency of A.C. Supply by Sonometer and Verification by C.R.O.

Section – II (ANY 08)

12	Study of Spectrometer (Minimum Deviation and Refractive Index and Angle of Prism
13	Wavelength of Laser Beam (He-Ne) by Diffraction Grating.
14	Specific Rotation by Polarimeter
15	J' by Electrical Method and Specific Heat of Oil by Electrical Heating.

16	Use of Wheatstone's Bridge and Post Office Box (Resistance, Specific Resistance and Temp.Coefficient of Resistance).
17	Use of Potentiometer (Principle, Comparison of e.m.f.s of Cells, Internal Resistance of Cell and Calibration of Voltmeter with the Principle COMPULSORY and ANY ONE of the Other Three).
18	Wavelength of Light by Diffraction Grating
19	Determination of Rydberg Constant.
20	Study of Crystal Structure.

Demonstration Experiments : (ANY 07)

(i)	e.m.f. of a Thermocouple
(ii)	Spectra of Ionised Gases
(iii)	Poisson's Ratio for Rubber Tube
(iv)	Study of Photocell
(v)	Temperature of Flame (Optical Pyrometer)
(vi)	Hysteresis by C.R.O.
(vii)	Study of Newton's Rings
(viii)	Study of Para and Diamagnetism by Electromagnet
(ix)	Study of Ultrasonics
(x)	Study of Photoelastic Bench
(xi)	Optical Principles of O.H.P
(xii)	Use of Precision Measuring Instruments (Dial Vernier, Dial Micrometer, Travelling Microscope etc.)

Term-Work :

Compulsory term-work on the list of experiments written in a journal and carrying 50 marks on timely submission basis specified at the index sheet of Physics Journal.

Scheme of Practical Examination :

1	Each candidate will be examined in one experiment from among those prescribed in the syllabus. The duration of the experiment will be two hours
2	Each candidate will be asked to draw by lots any two experiments (one from section-I and the other from section-II). Out of the experiments so drawn by him/her, he/she will be asked to prefer any one experiment which he/she will be able to perform with confidence.
	Change of experiment shall be discouraged and if absolutely necessary, 05 marks will be deducted for the same after due verification of the laboratory records of the candidate.
3	The performance of the candidate in the practical examination will be assessed out of 50 Marks as shown in the following scheme

Scheme of assessment :

- (a) Connections, adjustment and Observations 20 Marks
- (b) Circuit diagram, figures and tabulation10 Marks
- (c) Formula, calculations and graphs if any10 Marks
- (d) Oral 5 Marks
- (e) Correct answer or appropriate result 5 Marks

Total : 50 Marks

4	Each candidate will be jointly examined by both external and internal examiners
5	Certain demonstration experiments are coupled with certain conventional experiments during the examination. Marks allotted for demonstration experiments are 15 and marks for conventional experiments are 35. The conventional experiment is assessed out of 50 as mentioned under 4 in the above scheme and then converted out of 35. Assessment of a demonstration experiment is judged by answers (Oral or Written) given by candidate in front of the relevant demonstration set up.
6	If any candidate is unable to draw a correct circuit diagram, the same may be given by the examiner on request so that the candidate may continue the experiment. However, five marks will be deducted for the same
7	While assessing, the overall performance and the ability of the candidate to handle the apparatus independently, will be considered.

6. IMPLEMENTATION STRATEGY (PLANNING) :

1. Theory- Lesson Plan
2. Practical – Scheme of marking for T/W; Scheme of assessment for Pract. Exam.

7. (a) TEXT BOOKS :

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
1.	R.K.Gaur and S.L. Gupta	Engineering Physics	Any	181-96 2001 Reprint 2004	Dhanpat Rai & Sons.
2.	M.R.	Physics for Engineers	Any	1976	New Age

	Shrinivasan				International
3.	P.G. Kshirsagar and M. N. Avadhunulu	A Text Book of Engineering Physics	Any	1992 Reprint 93, till 05	S. Chand and Co. Ltd
4.	Gambhir, Durgapal and Banerjee	Introductory Physics, Vols. 1, 2 and 3	Any	1972	Wiley Eastern

(b) REFERENCE BOOKS :

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
1.	Resnik and Halliday	Physics, Vols. 1 and 2	Any	1986	Wiley Eastern.
2.	B.L. Theraja.	Engineering Physics	Any	1062 Reprint 74-87 1975, 76,78,79,80, 81,82,83	S. Chand & Co. Ltd
3.	B.L. Theraja.	Modern Physics	Any	1062 Reprint 74-87 1975, 76,78,79,80, 81,82,83	S. Chand & Co. Ltd

1. SUBJECT DETAILS :

Course: Mechanical Engineering	Semester : II Duration : 16 Weeks
Subject: Engineering Drawing – II	Code : ME-36
Group :Core	Compulsory

2. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme			Examination Scheme							
Theory Hrs Per Week	Practical Hrs per Week	Credits	Hrs	NP	Mks	Th	Sess	T/W	Prac	Total
02	06	08	04	01	100	80	20	50	50	200

3. RATIONALE:

Engineering drawing is a language of engineers. It is classified as engineering science subject. It describes scientific facts, principles and technique of drawing in order to visualize and express the ideas and to convey the instructions through drawings without ambiguity. In engineering drawing – II students will study interpretation of give orthographic views to find out the missing views/sectional, no-sectional or orthographic

	and cones with axis inclined to both the reference planes.		
	Practice: 1. One sheet with four problems	-	12
	2. Home Assignments: One sheet containing four problems		
05	5.0 Thread Profiles and Screw Fasteners :	20	05
	5.1 Different profiles of threads		
	5.2 Conventional representations of left hand – right hand threads, single and multistart square threads, external and internal threads.		
	5.3 Different types of nuts.		
	5.4 Different types of bolts.		
	5.5 Lock nuts (Castle, slotted nut, simond’s nut etc) use of plane and spring washers.		
	Practice: 1. One sheet with Problems on various screw fastners to be sketched by free hand.	-	15
	2. Home Assignments: One sheet containing four problems		
06	6.0 Keys and Couplings :	30	05
	6.1 Detail and assembly drawing of different keys and couplings i.e. flange, oldhalm, flexible, universal etc.		
	Practice:		12
	1. One sheet with problems of keys and coupling to be sketched by free hand and problem on drawing of assembly of a coupling.		09
	2. A problem of a coupling to draw the details from the assembly.		
	3. Home Assignments: One sheet containing four problems		

6. IMPLEMENTATION STRATEGY (PLANNING) :

In depth study and understanding of the subject will be implemented by adoption of the following strategy :

6. Theory Teaching Plan
7. Term Work Plan for practical giving problems to draw in the class.
8. Home assignment to practice at home
9. Conduct of three periodical test
10. Use of OHP models and charge during theory class and practical periods

7. REFERENCE BOOKS :

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
1.	N.D.Bhatt and Panchal	Geometrical and Machine drawing	14 th	2000	Rupalee Pub.Opp. Amul Dairy, Court Rd, Anand
2.	R.K. Dhawan	Engineering drawing	2 nd	2001	S.Chand & Co.Ltd., Ram Nagar New Delhi-110 055
3.	R.K. Dhawan	Machine drawing	2 nd	2001	S.Chand & Co. Ltd ,Ram Nagar New Delhi-110 055
4.	M.L. Dabhade	Engineering Graphics	4 th	1995	Mrs.VA.Velhankar 1030, Model Colony, B-12,Akash Ganga Pune-411 016

Information to the paper setter/examiner regarding the distribution of topics section wise :

SECTION – I

Sr.No.	Topics	Periods	Marks
1	Sectional Views : <ul style="list-style-type: none">• Full section, half sectioned offset section concept.		-
2	Missing Views : <ul style="list-style-type: none">• Given two views (f.v.- t.v. or f.v.s.v.) deriving the third view non sectional or sectional.		25
3.	Projection of straight lines : <ul style="list-style-type: none">• Projections of lines inclined to both the reference planes (no traces)		10
4.	Projection of planes :		15

Projection of plane – regular polygons and circle.
inclined to both the reference planes.

SECTION – II

- | | | |
|----|---|----|
| 5. | Projections of solids :
Projection of solids like prisms, pyramids, cylinders
and cones with axis inclined to both the reference
planes | 15 |
| 6. | Thread profiles and screw fasteners : <ul style="list-style-type: none">• Different profiles of threads• Conventional representations of left hand –
right hand threads, single and multistart
square threads, external and internal threads• Different types of nuts• Different types of bolts• Lock nuts (Castle, slotted nut simond's nut
etc. use of plane and spring washers.) | 15 |
| 7. | Keys and couplings : <ul style="list-style-type: none">• Detail and assembly drawing of different keys
and couplings i.e. flange, oldhalm, flexible,
universal etc. | 20 |

**SHRI VILEPARLE KELVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC**

PART TIME

DISCIPLINE: MECHANICAL ENGINEERING.
batch admitted june 2008 (progressive)

w.e.f.

SEMESTER: THIRD
from the academic term: JULY-NOV.2009

Effective

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION		
			L	P	D	T	Cr	NP	HRS	Mks	SSL	Theory paper	T/W
1	Applied mechanics	AM-16	3	2	-	-	5	1	3	100	20	80	25
2	Engineering drawing -III	ME-37	2	4	6	-	6	1	4	100	20	80	50
3	Workshop technology	ME-26	-	5	-	-	5	-	-	-	-	-	50
4	Power Engg -I	ME-38	2	2	-	-	4	1	3	100	20	80	50
	TOTAL		08	09	06	00	21	-	-	-	60	240	175
			Total periods (21)								Total marks = (625)		

1SUBJECT DETAILS :

Course : Mechanical Engineering	Semester : 1
Subject : Applied Mechanics	Duration : 16 Weeks
Group : C* Core	Code : AM-16
	Compulsory

1. TEACHING AND EXAMINATION SCHEME :

Teaching Scheme		Credits	Examination scheme and Maximum marks						
Theory Hrs per Week	Practical Hrs Per Week		Paper			Theory Marks Reduced To	Sessional Marks Reduced To	Term Work	Practicals /Orals
		Hrs	N/P	Mks					
3	2	5	3	1	100	80	20	25	125

2. RATIONALE :

Applied Mechanics is the study of forces and their effect on the moving or stationery bodies. Also the concept of mechanics will be useful to understand the further subjects' materials and structures, analysis of structures and design.

3. OBJECTIVES:

Students will be able to:

- (1) Understand the force / force system air their effect on a body.
- (2) Apply the concept of mechanics to the real situation.
- (3) Build the pre-requisite of higher semester subject related to designs.

4. DETAILED CONTENTS:

Section I

Chapter	Topics	Period	Marks
1	Introduction to Mechanics 1.1 Mechanics definitions, Statics & Dynamics, Kinematics, Kinetics 1.2 Fundamentals units of measurements (FPS,MKS,SI), Derived Units, Conversion of Units, Scalars & Vectors with examples 1.3 Definition of particle, body and rigid body, mass & Weight.	02	06
2	Resolution of Forces 2.1 Concept of force, definition, units, graphical Representation of force 2.2 Concept of System of forces, non-coplanar, coplanar, Concurrent, Parallel, non-concurrent & non-parallel Forces. 2.3 Resolution of a force into two components along any Directions. 2.4 Resolution of a force into two components at right Angles to each other by analytical method. (Applications levers, chain & links, connected bodies like trains etc.)	04	14
3	Composition of Forces 3.1 Composition, Resultant of force 3.2 Law of Parallelogram of forces, 3.3 Moment of force, couples lever arm, 3.4 Varignon's theorem 3.5 Resultant of Coplanar concurrent, parallel, And non-concurrent, non parallel forces (Applications in shafts, crane, joints of trusses, etc.)	04	14
4	Equilibrium 4.1 Definition of equilibrant, relation between Resultant and	06	20

Equilibrant, Conditions of Equilibrium Types of
Equilibrium Stable, Unstable and Neutral equilibrium

4.2 Equilibrium of coplanar concurrent forces, Lami's theorem

4.3 Equilibrium of coplanar parallel forces & coplanar
Non-concurrent Forces.

4.4 Analytical conditions of equilibrium for coplanar concurrent
& non-concurrent forces.

(Applications of crane stability, link mechanism, inclined
Plane, wedges, anchor blocks for water pipelines, balance,
lever, pulley and pulley blocks)

PRACTICALS :

(a) Simple roof truss

(b) Bell Crank Lever

(c) Levers of different types

(d) Extension of springs

(e) Compression of Springs

Beam Reactions

4.1 Types of supports(Constraints, simple, Roller, hinged

And fixed.

4.2 Types of Beams, simply supported, hinged and roller

Supported, cantilever, overhanging Beams.

5.3 Types of loads, point(concentrated) load, uniformly
Distributed load(U. D. L), Uniformly Varying Load
(U.V.L)*.

5.4 Problems on above combination of loads.

(Applications like bearings of shafts, guy, rocker and roller
support of railway bridges)

*No problems on U. V. L

6. **Centre of Gravity** 04 14
- 6.1 Centre of Gravity of Solids, Control of plain laminar, Definition.
- 6.2 Concept of parallel forces applied to find c.g and centroid, centroidal/c.g. axes of a body/lamina, c.g of basic Regular shapes.
- 6.3 Applications like floating bodies, dams and retaining wall sections beams columns sections(rolled steel) Simple and built up sections.
- Practical :**
- (a)Centroid of plane laminas.

Section II

7.	Friction	04	14
	7.1	Definition, types of friction, statics friction, dynamic Friction.	
	7.2	fundamental laws of statics friction, coefficient of Friction, cone of friction, angle of friction, angle of Repose, rolling friction.	
	7.3	study of inclined plane, wedge and block system, Ladder friction.	
		(Application of in clutches, brakes, dynamometers, journals, Belt and rope drives, stators and rotors in electric motors, Bearings)	
		Practical :	
		(a) Friction between wooden surfaces.	
		(b) Friction between wooden surfaces and glass, metal Surfaces	

8.	Rectilinear Motion	04	14
	8.1 Definition of kinematics, rectilinear motion, displacement Speed, velocity acceleration.		
	8.2 Equation of rectilinear motion with uniform acceleration.		
	8.3 Velocity – time diagrams, motion under gravity. (Application to velocity of connecting rod, piston crank etc., v- t diagram for electric traction)		
 9.	 Force, mass and acceleration.	 3	 10
	9.1 Newton’s laws of motion, relation between force, mass And acceleration.		
	9.2 Applications like motion of train on slopes etc.		
	9.3 Concept of Momentum and Impulse, conservation of moment (Application like centrifugal devices, motion of train on Slopes etc. power hammers, pile driving, fly presses etc.)		
 10.	 Work, energy and power.	 04	 14
	10.1 Work done by a body, definition, application.		
	10.2 Energy definition and types, potential and kinetic energy, conservation of energy and applications like Energy stored in Fly wheel, water reservoirs etc.		
	10.3 Power definition, application to rated power Machine (motors) and efficiency calculations. (Application like energy stored in a flywheel, water reservoir, po requirements of machines, efficiency calculations in machines)		
 11.	 Simple lifting machines (Application topic)	 4	 14
	11.1 Definition : Mechanical advantage, velocity ratio, efficiency, relation between them, friction in machines In terms of load and effort.		
	11.2 Law of machines, maximum MA, Maximum efficiency,		

- Condition of reversibility of machine.
- 11.3 Study of machines—simple and differential axle and Wheel.
- 11.4 Weston differential pulley block, simple screw jack, worm and worm wheel, single and double purchase Crab winch, system of pulleys.

12	Graphics Statics.	5	16
	12.1 Space diagram, Bows Notation		
	12.2 Law of triangle of forces, polygon of forces, force/vector Diagram.		
	12.3 Resultant and Equilibrium of Concurrent forces.		
	12.4 Polar diagram, funicular polygon.		
	12.5 Resultant and Equilibrium of Non-Concurrent forces And non- parallel forces.		
	12.6 Applications in finding reactions of beams, stresses In simple frames.		
	Total	48	164

6. PRACTICALS:

Term Work consists of Journal containing minimum 10 experiments performed of the following in the Laboratory.

- 1) Extension / Compression of the spring.
- 2) Bell Crank Lever.
- 3) Two/Three Sheave Pulley Block.
- 4) Simple Screw Jack.
- 5) Single / Double Purchase Crab Winch.
- 6) Differential Axle & Wheel.
- 7) Centroid of Plane Lamina.
- 8) Sheer Leg & Derrick Crane.
- 9) Resultant of Non Concurrent Non Parallel Forces.
- 10) Friction.
- 11) Jib Crane.
- 12) Graphic Statics.
- 13) Moment of Inertia of Flywheel.

7. Reference Books:

2	4	6	4	1	100	80	20	50	50	200
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(3) RATIONALE

Drawing is a graphical language of engineers. Technician works in industries as supervisor of production, maintenance of machines, inspection, etc. In whatever capacity he/she may be working, he/she has to read, interpret and prepare drawing of various types of machine components, dies, assemblies etc. He is required to understand, assimilate and analyze the drawings completely which eventually leads to efficient performance of manufacturing. Hence the basic skills of reading and interpreting the drawing is atmost important and involves preparation of parts using symbols of fit, tolerance, surface finish, etc.

(4) OBJECTIVES

Engineering drawing – III includes study of solid geometry as sections of solids, development of surfaces of solids and intersection of surfaces of two solids. It also includes study of various assemblies (sub-assemblies) and detailed drawings of machine parts of assembly, such as joints, bearing, jigs and fixtures, machine vice, screw jack, tool post, etc. It also includes symbols of welding, tolerances, limits, fits, surface finish and their applications. After learning this subject, the detail and assembly drawing of various machine parts with conventional representation and various symbols is understood for drawing and interpretation.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours	
			Theory	Practical
	SECTION-I			
(01)	Section of Solids 1.1 Auxiliary inclined and auxiliary vertical sections of prism, pyramid, cylinder and cone 1.2 Projection of true shape of the sections (Axis of solid/plane inclined to one reference plane)	20	04	-
	Practice Sheet/s (i) A drawing sheet on four problems of sections of solids (ii) Home Assignment: A drawing sheet on four problems of sections of solids.	-	-	8
(02)	Auxiliary Projection 2.1 Auxiliary projections of machine parts	20	04	-

	2.2 Use of auxiliary projections for solid geometry			
	Practice Sheet/s	-	-	8
	(i) A drawing sheet on four problems of auxiliary projections.			
	(ii) Home Assignment: A drawing sheet on four problems of auxiliary projections.			
(03)	Details and Assembly of Machine Parts	24	04	-
	3.1 Screw jack, vices, tool post, simple tailstock, jigs and fixtures (with about 8 parts excluding standard parts like nuts, studs, bolts, pins, washers, etc.)			
	Practice Sheet/s	-	-	8
	(i) A drawing sheet on two problems of assembly/ details drawing of machine parts.			
	(ii) Home Assignment- A drawing sheet on two problems of assembly/ details drawing of machine parts.			
(04)	Working Drawing	18	04	-
	4.1 Weld symbols			
	4.2 Machining and surface finish symbols			
	4.3 Limits, fits and tolerances			
	4.4 Geometrical tolerances			
	4.5 Representation of the above symbols and tolerances on part drawing			
	Practice Sheet/s	-	-	8
	(i) A drawing sheet on two problems of working drawing of detail/ assembly.			
		(82)	(16)	(32)

Total

SECTION-II

(05)	Interpenetration of Surfaces of Solids	24	04	-
	5.1 Intersections of surfaces of the solids with axis			

	perpendicular or parallel to reference planes			
	5.2 Intersection of two prisms			
	5.3 Intersection of two cylinders			
	5.4 Intersection of prism and cylinder			
	5.5 Intersection of pyramid and prism			
	5.6 Intersection of cone and cylinder			
		-	-	8
	Practice Sheet/s			
	(i) A drawing sheet on four problems of intersection of surfaces of solids.			
	(ii) Home Assignment: A drawing sheet on four problems of Intersection of surfaces of solids			
(06)		24	04	-
	Development of Lateral Surfaces of Solids			
	6.1 Development of lateral surfaces of prisms, pyramids, cone and cylinder			
	6.2 Antidevelopment	-	-	8
	Practice Sheet/s			
	(i) Drawing sheets on eight problems of development and sections of solids.			
	(ii) Home Assignments: A drawing sheet on six problems of development and sections of solids			
(07)		18	04	-
	Joints			
	7.1 Cotter, cotter joints and knuckle joints			
		-	-	4
	7.2 Assembly and details of joints			
	Practice Sheet/s			
	(i) A drawing sheet on assembly/details of joints			
(08)		16	04	-
	Frictional (Bush) Bearing			
	8.1 Solid bearing			
	8.2 Bush bearing			
	8.3 Plummer block			
	8.4 Pivot (Foot Step) bearing			
	8.5 Assembly and details of bearings.			
	Practice Sheet/s			
		-	-	(8)

- (i) A drawing sheet on assembly/details of bearings - - (04)
(ii) **Project-** Chart and model making on above topics by individual or group.

(82) (16) (32)

Total

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by the following strategy

- (i) Lesson plan
- (ii) Use of charts, models, transparencies
- (iii) Use of a devices

(7) REFERENCE BOOKS

Sr N O	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	N.D.Bhatt and Panchal	Geometrical and Machine drawing	14 th	2000	Rupalee Pub.Opp. Amul Dairy, Court Rd, Anand-388 001
(ii)	R.K. Dhawan	Engineering drawing	2 nd	2001	S.Chand & Co. Ltd, Ram Nagar, New Delhi-110 055
(iii)	R.K. Dhawan	Machine drawing	2 nd	2001	S.Chand & Co. Ltd., Ram Nagar, New Delhi-110 055
(iv)	M.L. Dabhade	Engineering Graphics	4 th	1995	Mrs.VA.Velhankar 1030, Model Colony, B-12,Akash Ganga, Pune-411 016

Course: Mechanical (ME-26)
Workshop Technology
Group: Core(C)

Semester - I
Duration – 16 weeks
Compulsory

2) Teaching and Examination Scheme

Scheme of Instructions & Periods / Week					No. of Papers, Duration & Marks			Scheme of Examination						Scheme L/Pr/Cr
L	P	D	T	Cr	NP	Hrs	Mks	SSL	Theory Paper	T/W	Practical	Oral	Total	
-	5	-	-	5	-	-	-	-	-	50	-	50	100	055

3) Rationale

Production is a value adding activity, where raw material is converted into finished goods, by using different resources like man, machine, materials, methods etc. Handling of different tools & equipments is a part of production system. So students should be aware of methods of handling of different tools and safe practices. This subject deals with identification of tools, its applications, precautions, handling procedures, etc.

Objectives

- 1) The students will be able to understand workshop activities.
- 2) They will be able to select right tools and right manufacturing processes for performing the job correctly.
- 3) They will be able to use different fitting tools like files, hacksaws, hammers, try square, chisel (cross-cut chisel), centre punch etc and carpentry tools like cross-cut saw, jack plate, firemen chisel, rasp file, marking gauge, mallet, scriber etc.
- 4) They will be able to read dimensions and able to do marking required for making the job.
- 5) Practical
5 periods per week (two times)

Sr No	Title	Hrs
1)	Dimension of carpentry tool & one carpentry joint	(25)
2)	One pattern	(25)
3)	Demonstration of fitting tools & one job of drilling and tapping	(15)
4)	One job of keyway Sawing/filing	(15)

Total – 80

Assignment: (1) Notebook containing the procedure and the diagram of above jobs.

Bhopal book

(2) Notebook containing write-up from Workshop practices TTTI
on above hand tools.

(1) SUBJECT DETAILS

Course: Mechanical Engineering

Semester: III

**Duration: 16
Weeks**

3.3 Power Engineering – I (ME-38)

Group : Core (C*)

Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Lecture (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term Work	Pr Oral	Total
		Hrs	No. of Paper	Marks						
2	2	4	3	1	100	80	20	50	50	200

(3) RATIONALE

I.C. engines, steam engines, steam turbines, gas turbines are widely used for power generation, etc. I.C. engines are widely used for transportation purpose in all means of transportations i.e. road, railways, air and water. Therefore the principle of construction and working of such prime movers and machines, the analysis of their performance are highly relevant to mechanical engineers. A air compressors are used in almost all industries including operation of pneumatic tools.

(4) OBJECTIVES

Students will be able to :

- Understand the construction and working of different types of I.C. engines and their subsystems.
- Design and conduct test on I.C. engines.
- Understand the working and application of different types of air compressor's.
- Understand thermodynamics.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours	
			Theory	Practical

SECTION – I

(01)	General thermodynamics	12	03	-
	1.1 Principles such as first and second law of thermodynamics & limitations			
	1.2 Perfect gases and vapours			
	1.3 Laws of perfect gases			
	1.4 Specific heats and their relation with gas constant.			
	1.5 General gas equation and characteristic gas equation of perfect gases.			
	1.6 Thermodynamic properties of gases, Internal energy, enthalpy, entropy, work done			

	1.7 Compression and expansion processes			
	1.8 Heating and cooling processes			
(02)	Different Thermodynamic Processes	15	03	-
	2.1 Representation of processes on P-V and T-S diagrams			
	2.2 Calculations of work done, heat transfer, change in internal energy, change in enthalpy and change in entropy, etc.			
	2.3 Different processes			
	(a) Constant volume process			
	(b) Constant pressure process			
	(c) Constant temperature process			
	(d) Constant entropy process (Isentropic process)			
	(e) Polytropic process			
(03)	Air Standard Cycles	25	03	-
	3.1 Assumptions of air standard cycles			
	3.2 Representation of different cycles on P-V and T-S diagrams			
	3.3 Calculations of efficiencies and mean effective pressure of the following Air cycles			
	(a) Carnot Cycle			
	(b) Otto Cycle			
	(c) Diesel Cycle			
	(d) Dual Cycle			
(04)	Air Compressors	30	7	
	4.1 Introduction			
	4.2 Application of compressed air			
	4.3 Classification of compressor			
	(a) Reciprocating & rotary	-	-	
	(b) Single acting & double acting			
	(c) Single stage & multi stage			
	4.4 Terminology of reciprocating air compressor			
	4.5 Multi staging of reciprocating air compressor			
	4.6 Advantages of inter cooling			
	4.7 Types of inter cooling			
	4.8 Derivation of workdone with & without clearance			
	4.9 Derivation of workdone for multi staging reciprocating air compressor			
	4.10 Efficiencies of reciprocating air compressor			
	4.11 Calculation of workdone ,power & efficiencies			
	4.12 Introduction of rotary air compressor types, vane blower, centrifugal & axial flow.			
	4.13 Difference between reciprocating & rotary air compressor			

4.14 Air motors, introduction & applications

Practical/s

- (i) Study of reciprocating air Compressors. 02
- (ii) Study of rotary air Compressors

Total	(82)	16	(02)
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SECTION – II

(05)	Internal Combustion Engines 5.1 Applications of I.C. engines 5.2 Classifications of I.C. engines 5.3 Merits v/s other prime movers 5.4 Principles of working 5.5 Constructional details of petrol, diesel and gas engines. 5.6 Working of petrol, diesel and gas engines 5.7 Working cycles 5.8 Two stroke and four stroke engines Practical/s (i) General study of I.C. Engines (ii) Study of S.I. and C.I. Engines (iii) Study of Two and Four Strokes Engines	16	03	
(06)	Different Systems 6.1 Ignition systems of I.C Engines 6.2 Fuel supply system of I.C Engines 6.3 Cooling systems 6.4 Lubrication systems 6.5 Governings of I.C.Engines Practical/s (i) Study of Petrol Engines and its special features like carburetor and spark plug (ii) Study of diesel engines and its special features like fuel pump, fuel injectors and nozzles (iii) Study of cooling and lubrication of I.C. engines (iv) Study of ignition systems used in S.I. Engines	24	04	-
(07)	Performance and Testing of I.C. Engines 7.1 Calculation of mean effective pressure	20	05	-

7.2	Calculation of indicated power			
7.3	Calculation of brake power			
7.4	Calculation of mechanical efficiency			
7.5	Calculation of thermal efficiencies			
7.6	Calculation of fuel consumption			
7.7	Calculation of specific fuel consumptions			
7.8	Methods of finding indicated and brake power			
7.9	Morse test for finding I.P. of multi-cylinder engines			
7.10	Study of dynamometers			
7.11	Speed-torque and load – Torque characteristics of I.C. Engines			
	Practical/s			02
	(i) Conduct the trial on single cylinder four strokes C.I. Engine			
	(ii) Conduct the trial on 3 cylinders engine to calculate indicated power (MORSE TEST)			
(08)	Study of Wankel Engine	08	02	-
	8.1 Principle, construction and working			
	Practical Sheets:			
	(i) Study of Wankel Engine	-	-	01
(09)	Supercharging and Turbo Charging of I.C. Engines	08	01	-
	9.1 Advantages, applications and working of super charged and turbo charge engines.			
(10)	Maintenance of I.C. Engines	06	01	-
	10.1 Starting of I.C. engines			
	10.2 Stopping of I.C. engines			
	10.3 Common faults, causes and remedies of I.C. engines			
	Practical/s			03
	(i) Dismantling and assembling of I.C. Engines			
	(ii) Starting, stopping and governing of I.C. Engines			
	(iii) Common faults detected, causes and remedies of I.C. Engines			
	Total	(82)	(16)	(13)

(6) IMPLEMENTATION & STRATEGY (PLANNING)

- (i) Teaching Plan
- (ii) Lesson Plan
- (iii) Visits, use of charts, and models.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	Patel Karamchandani	Heat Engines	17	2000	Acharya Publication, Vadodara
(ii)	P.L. Ballaney	Thermal Engineering	24	2003	Khanna Publication, New Delhi
(iv)	R.S.Khurmi	Thermal Engineering	12	2000	S.Chand New Delhi
(iv)	S. Dombkundwar	Thermal Engineering	5 th Revised	2001	DhanpatRai and Co. Pvt. Ltd. New Delhi-06
(v)	Mathur Sharma	Internal Combustion Engines	8 th	1999	DhanpatRai & Sons New Delhi

SHRI VILEPARLE KELVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

PART TIME

DISCIPLINE: MECHANICAL ENGINEERING.
admitted june 2008 (progressive)

w.e.f. batch

SEMESTER: FOURTH
the academic term: DEC-08/JAN- MAY 09

effective from

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION						Group Com Opti
			L	P	D	T	Cr	NP	HRS	Mks	SSL	Theory paper	T/W	Pract.	Oral	TOTAL	
1	Fabrication technology	ME-46	2	4	-	-	6	1	3	100	20	80	25	-	50	175	C*
2	Strength of materials & structures	AM-38	2	2	-	-	4	1	3	100	20	80	25	-	50	175	C*
3	Fundamental of Computer networking & system	CA-54	2	3	-	-	5	-	-	-	20	-	50	50	-	120	C*
4	Basic Electrical & Electronics	EE-32	3	2	-	-	5	1	3	100	20	80	50	25	-	175	C*
5	Power Engg.- II	ME-49	2	2	-	-	4	1	3	100	20	80	50	50		200	A
	TOTAL		13	13			24	-	-	-	100	320	200	125	100	845	
			Total periods 24								Total marks = (845)						

1 SUBJECT DETAILS :

Course: All	Semester: II
Subject: Fabrication Technology	Duration: 16 Weeks
Code: ME – 45	
Group: Core (C*)	Compulsory

2. TEACHING AND EXAMINATION SCHEME:

Teaching Scheme		Credit	Examination Scheme and Maximum Marks						
Theory Hrs. per week	Practical Hrs. per week		Papers		TH	Sessional	T/W	Practical	Total
			Hrs	Paper No.	Marks	Marks	Marks	Marks	Marks
02	04	06	03	01	80	20	25	50	175

3. RATIONALE :

Fabrication technology is a subject of engineering which deals with sheet metal works. Practical applications of sheet metals, press tools terminology. Applications of press tools. Various fabrications process like welding, brazing, soldering and its practical application in day to day life.

4. OBJECTIVES :

It develops understanding of properties of sheet metal. This helps to understand working & maintenance of welding equipments. Knowledge of welding, Brazing, Soldering processes, cold & hot working processes.

5. DETAILED CONTENTS :

SECTION – I

Chapters	Contents	Marks	Hours	
			Th	Pr
1.	Sheet Metal Works :	20	05	
	Ferrous & Non ferrous materials require for making sheets, sheet metal tools. Properties of sheet metal, sheet metal gauge. Sheet metal joints: types of Hems & seams.			
2.	Introduction to Press Tools :	40	06	
	Concept of shearing & punching. Principles & Methods of shearing. Definition of Blanking & Punching. Types of dies like progressive, compound & combination die. Terminology used in dies.			
3.	Mechanical cold working of Metals:	22	05	
	Terminology used for Bending & Rolling. Definition of rolling & bending. Different types of cold working processes like drawing, deep drawing, forming, peening, extrusion, ring rolling & bending.			
Total		82	16	

SECTION – II

4.	Mechanical Hot working of Metals:	18	03	
	Meaning of Hot working, Recrystallization temperature, Different types of Hot working processes.			
5.	Welding:	18	05	
	Principle of welding, weldability, welding Representation, various welding joints. Different types of Gas welding processes & detail of Oxy-acetylene process. Different type's arc welding processes like carbon, Twin carbon, Shielded metal, Submerged, TIG, MIG, and Plasma arc welding.			
6.	Brazing:	10	03	
	Definition. Material used for brazing, flux used in brazing, flux materials, Brazing process.			
7.	Soldering:	10	02	
	Definition. Material used for soldering, flux used in brazing, flux materials, soldering process.			
8.	Bolted Joints:	14	03	
	Thread terminology. Left hand & Right hand threads. Types of bolts, nuts locking arrangements for nuts.			
Total		82	16	

Teaching Plane	Use of Overhead Projector, charts & Caulk Board.
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TERM WORK :

Sr.No.	JOBS	Hours
01.	Job of arc welding.	8 Hrs.
02.	Demonstration of gas welding.	8 Hrs.
03.	One job of sheet metal working including bending and shearing (Involved riveting also).	16 Hrs.
04.	One simple job involving soldering/brazing.	16 Hrs.

05. One job of preparing nut and bolts using dies and taps.

16 Hrs.

64 Hrs.

6. IMPLEMENTATION STRATEGY (PLANNING) :

1. Lesson Planning
2. Use of Transparencies (OHP)
3. Practical jobs/demonstration
4. Use of hand tools and machine tools

7. REFERENCE BOOKS :

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
1.	S.K. Hajara Choudhury, A.K. Hajara Choudhury	Elements of workshop technology (vol.I)	9 th	1997	Media promoters and publishers Pvt. Ltd.
3.	F.J.M. Smith	Basic Fabrication and welding Engg.	3 rd	1984	Longman Craft student series Engg.

(1) SUBJECT DETAILS

Course: Mechanical Engineering

Semester: IV

<p>4.3 Strength of Materials & Structures (AM-38)</p> <p>Group : Core (C*)</p>	<p>Duration: 16 Weeks</p> <p>Compulsory</p>
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(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term-Work	Practical/Oral	Total
		Hrs	No of paper	Marks						
2	2	4	3	1	100	80	20	25	50	125

(3) RATIONALE

Strength of materials is fundamental structural engineering subject which gives idea about stresses and strains in various materials, their properties and behaviour under different conditions. Also this subject is a pre-requisite subject to higher semester subjects like design of machines, theory of machines.

(4) OBJECTIVES

The students will be able to:

- (i) Define and distinguishes different types of stresses
- (ii) Work out the stresses under different conditions of loadings/forces
- (iii) Predict the mode of failure
- (iv) Predict the state of a body subjected to system of forces

(5) DETAILED CONTENTS

Chapter	Contents	Period	Marks
	SECTION – I		
(01)	Stress and Strain	5	26
	1.1 Definition of rigid body, plastic body and		

elasticity

1.2 Definition of strain, stress, modulus of elasticity

1.3 Classification of stress, strain

1.4 Deformation of body due to axial load

1.5 Deformation of body of varying cross-section due to axial load, maximum stress and minimum stress induced

1.6 Stresses in bars of composite section

1.7 temperature stress and strain, coefficient of thermal expansion

1.8 temperature stress in bars of composite section

1.9 Shear stress, complementary shear stress, state of simple shear, modulus of rigidity

1.10 punching shear

Practical

1.1 Study of universal testing machine

1.2 Tension test on mild steel bar

1.3 Shear test on mild steel bar

(02)

02

10

Elastic Constants

2.1 Definition of lateral strain, Poisson's ratio

2.2 change in lateral dimensions

2.3 Volumetric strain due to axial force and change in volume

2.4 Bi-axial and tri-axial stresses and volumetric strain

2.5 Definition of bulk modulus, change in volume

2.6 Relation between modulus of elasticity, modulus of rigidity and bulk modulus.

(03)

02

10

Strain Energy

3.1 Types of loading-gradual, sudden and impact load

3.2 Definition of strain energy, modulus of resilience and proof resilience

3.3 Comparison of stresses due to gradual load, sudden load and impact load. Instantaneous stress induced in the body

3.4 Strain energy stored due to gradual, sudden and impact load in the body.

Practical

3.1 Izod impact test on mild steel, brass, copper and cast iron

(04)	Principle Planes And Stresses 4.1 Stresses on oblique plane i.e. normal stress and tangential stress 4.2 definition of principle planes and principle stresses 4.3 Principal planes and principal stresses due to bi-axial stress system (Analytical and Graphical method) 4.4 Principal plne and principal stresses due to complex stress system (Analytical and graphical method)	02	10
(05)	Moment of inertia 5.1 concept of moment of inertia M.I. of planes areas such as rectangle ,triangle ,circle ,semicircle and quarter circle; 5.2 Parallel axis and perpendicular axis theorem M.I. of composite sections, built up sections, symmetrical and unseymetrical sections, radius of gyration ,polar moment of inertia.	02	10
(06)	Columns & struts 6.1 Defination ,types of end conditions for column, classification of column. 6.2 Buckling of axially loaded compression member, effective length, radius of gyration, slenderness ratio.Moment of resistance of beam section 6.3 Euler's theory and rankine's theory assumptions, buckling loads ,factor of safety , safe load 6.4 Application of Rankine's and euler's theory, designing solid circular or hollow circular sections	03	16
		(16)	(82)

Total

SECTION-II

(07)	Shear force & bending moment diagram 7.1 Defination of shear force and bending moment, relation between SF & BM	02	06
------	---	----	----

and load.

7.2 SF & BM diagram for simply supported ,cantilever and ver hang beams subjected to combination of point load, uniformly distributed load.

(08) 03 20

Bending & shearing stresses in beams

8.1 concept of pure bending, theory of simple bending, assumption in theo of bending, neutral axis, bending stresses and their nature, bending stress distribution diagram

8.2 Application of theory of bending to symmetrical & unsymmetrical beam sections.

8.3 Shear stress equation , meaning of terms in equation, shear stress distribution for for rectangular, angle section, channel section, circular sections and T-sections. Euler`s theory of long column (formula only)

8.4 Relation between max. shear stress & average shear stress.

Practical:-

1. Transverse test on beam

(09) 02 10

Deflection of beams

9.1 concept of slope deflection & radius of curvature

9.2 Simple problems on cantilever & simply supported beams subjected to various loads using standard formulae.

Practical/s

- (i) Deflection test

(10) 5 04

Torsion

10.1 Defination of torsion, theory of pure torsion, assumption, equation of torsion,angle of twist, torsional rigidity, polar section modulus.

- 10.2 Torque transmitted by shaft
- 10.3 Strength of shaft & stiffness of shaft
- 10.4 Power transmitted by shaft, design of shaft

Practical:-

Spring test

(11) 02 10

Direct & bending stresses

- 11.1 Concept of direct & eccentric load
- 11.2 Uniaxial and biaxial bending of short compression member
- 11.3 Stress distribution across the section ,resultant stress, condition for no tension, middle third rule, core of the section.

(12) 02 10

Stresses in shells

- 12.1 Defination of thin cylindrical & spherical shells
- 12.2 Stresses in the walls of thin cylindrical & spherical shells due to internal pressure ,circumferencial & longitudinal stresses
- 12.3 Change in dimensions, change in volume due to internal pressure

(32) (164)

Total

Term work shall consist of practical on following (minimum 10)

- 1) Types of beams.(moment of inertia)
- 2) Tension test on standard mild steel specimen
- 3) Shear test on standard mild steel specimen
- 4) Izod impact test
- 5) Brinell's hardness test
- 6) Bend test in bars & flats
- 7) Transverse test on beam.
- 8) Deflection test
- 9) Columns & struts
- 10) Spring test
- 11) Tension test on welded joints
- 12) Graphics (SF & BM diagrams,minimum 4 problems covering all types of loading)
- 13) Graphics (mohr's stress circles)

6. IMPLEMENTING STRATEGY (PLANNING):

1. Teaching plan
2. Models

7. REFERENCE BOOKS:

Sr. no.	Authors	Title	Edition	Year of Publication	Publisher & address
1	Khurmi R.S.	Strength of materials	9th	2004	S.Chand Co.Mumbai
2	Ramamurtham R.Narayanan	Strength of materials	14th	2003	Dhanapatri Pub.3917, New Delhi
3	S.S.Bhavikatti	Strength of materials	2nd	2005	Vikas Publishing House pvt ltd. New Delhi-14
4	Sunil M. Deo	Strength of materials	7th	2002	Nirali Publication Mumbai

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: III
3.4 Basic Electrical & Electronic (EE-34)	Duration:16 Weeks
Group : Core (C*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term Work	Prac tical / Oral	Total
			Hrs	No. of Paper	Marks					
3	2	5	3	1	100	80	20	25	25	150

(3) RATIONALE

To teach the student facts, concepts, principles and procedure of operation and control of electric M/c. and applications of electrical energy in manufacturing industry which enables him to work as supervisor in a shop and as an assistant in research and development department.

(4) OBJECTIVES

Students will be able to:

- (i) Understand the concept and principle of A.C fundamentals, which can be applied to rectify electrical faults and acquire supervisory role
- (ii) Understand the working and construction of different types of machines which will help them to discharge role as a supervisor in all technology areas and assist in carrying out investigation work
- (iii) Select the drive for a given application.
- (iv) Understand the working of electronic devices, circuits and their industrial application.
- (v) Understand the fundamentals of microprocessor & microcontrollers and their application.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours
SECTION-I			
(01)	Basic Concept & Principle Of Electrical Engineering 1.1 Ohm's law, Law of electromagnetic induction 1.2 A.C.Fundamentals Concept of 1 ϕ & 3 ϕ AC Supply, P.F Active & reactive power	04	02
(02)	DC Motors 2.1 D.C.Motor working principle 2.2 Types of D.C. Motor 2.3 Characterises & application	06	03
(03)	Transformer 3.1 Working principle 3.2 Construction 3.3 Core type & Shell type transformer 3.4 EMF Equation	14	04

	3.5 Turn ratio, Current ratio & Voltage ratio		
	3.6 Concept of auto transformer & 3 ϕ transformer		
(04)	A.C. Motors	30	03
	4.1 Classification		
	4.2 3 ϕ Induction motor – principle, construction, type & application		
	4.3 1 ϕ Induction motor types & application		
	4.4 Synchronous motor principle of operation, application		
(05)	Electrical Drives	14	04
	5.1 Advantage of electrical device		
	5.2 Classification		
	5.3 Selection of drive		
	5.4 Different enclosure & method of mounting		
(06)	Electrical Heating	14	05
	6.1 Principle of electrical heating		
	6.2 Resistance heating, Induction heating & Di-electric heating principles		
	6.3 Procedure to select furnace for heating		
(07)	Awareness About Electropower Generation	06	03
	7.1 Different types of Power plants		
	7.2 Lay out diagram		
	Total	(82)	(24)

SECTION-II

(08)	Introduction To Electronic Devices	20	04
	8.1 Semiconductor intrinsic & extrinsic		
	8.2 Diode: P-N Junction diode, symbol, working & characteristics		
	8.3 Zener diode : Symbol, working, characteristics, transistor Bipolar junction transistor (BJT), Field effect transistor (FET), Unijunction transistor (UJT), symbol, working & characteristics		
	8.4 Power device : Silicon control rectifier (SCR), DIAC & TRIAC, symbol, working & characteristics		

8.5 Photo devices : Photo diode photo transistor :
symbol, working & characteristics

Practicals

- (i) Identification of different active components used in electronics laboratory.
- (ii) To plot V-I characteristics of P-N Junction diode & Zener diode, interpret the results.
- (iii) To plot the V-I characteristics of UJT & interpret the result
- (iv) Determine the V-I characteristics of SCR & interpret the result

(09)	Rectifiers & Filter Circuits	10	02
	9.1 Rectifier : Half Wave, Full Wave & Bridge Type (single & three phase)		
	9.2 Filters		
	Practicals		
	(i) Study of half wave & Full wave Bridge rectifier		
	(ii) Study of zener voltage regulator		
(10)	Amplifier	08	02
	10.1 Single stage transistor in CE configuration, frequency response		
	10.2 Two stage transistor amplifier, RC coupled		
	10.3 Introduction of power amplifier, classification, single ended class A amplifier		
	Practicals		
	(i) To plot frequency response of single phase RC coupled amplifier & find out off frequency		
(11)	Oscillator	05	01
	1.11 Concept & working		
(12)	Power Control Circuits	22	04
	12.1 Transducer : Temperature, Pressure, Displacement		
	12.2 Electronic timers		
	12.3 Level & Temperature control circuits		
	12.4 Speed control circuit		
	Practicals		
	(i) Study of electronic timers		
	(ii)		
	(iii)		

- (13) **Digital Circuits** 10 02
- 13.1 Study of logic gates (AND, OR, NOT, NOR, NAND, EXOR, EX-NOR, symbol & truth table)
- 13.2 Study of flip-flops (S-R & J-K) Symbol of working principle, truth table
- 13.3 Study of working principle of the following with the help of block diagram - Encoder, Decoder, Multiplexer, De-Multiplexer, Shift register & Counter
- 13.4 Study of display – LCD, LOD, Seven segment display
- Practicals**
- (i) Verification of truth table of logic gates – And, NOT, OR.
- (ii) Study of Multiplexer
- (iii) Study of Ripple counter
- (14) **Introduction To Microprocessor & Microcontroller** 07 01

Total

 (82) (16)

(6) IMPLEMENTATION STRATEGY (PLANNING)

- (i) The syllabus is taught as per the lesson plans using charts & demonstration of machine in the electrical laboratory.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publishing	Publisher & address
(i)	B.L Thereja (volume I & II)	Electrical Technology:	3 rd	2002	S. Chand & Company
(ii)	V.N.Mittal	Basic Elect.Engg.	9 th	1997	Tata Megraw-hill
(iii)	Samarjit Ghosh	Fundamental of Electrical and Electronics Engineering	1 st	2003	Practice Hall India
(iv)	U. A. Bakshi & A. P. Godse	Basic Electrical and Electronics Engineering	1 st	2001	Technical Publication, Pune.
(v)		Basic Electronics & liner Circuit	35 th	2001/2002	T.T.T.I Chandigarh

					THM
(vi)		Electronic device & Circuit	26th	2002	FHI
(vii)		Digital Electronics	8th	2003	Tata Megraw- hill

1. Subject Details

Course: Mechanical Engineering	Semester I
Subject: COMPUTER CONCEPTS AND NETWORKING	Duration: 16 weeks
Group: Core	Code : CA-14
	Compulsory

2. Teaching and Examination Scheme

Teaching Scheme			Credits	Examination Scheme and Maximum Marks							
Theory Hrs Per Wk.	Pract Hrs per wk	Tut Hrs per wk		Paper			TH Reduced to	Sessional Marks	T/W	Pract l	Total
			Hrs	N/P	Mks						
2	3	-	5	-	-	-	-	50	50	50	150

3. RATIONALE:

This subject envisages to make the students know the fundamentals of computer systems and its organization. It will enable the students to comprehend the organisation and working of various units of personal computer system for storing and processing information. It will also help the students to have hands on experience of operating systems and different application software used for office automation, day to day problems sharing in particular for creating business documents, data analysis graphical representations and business presentations. It also deals with basics of Internet technology available services internet connectivity and accessing information on internet. The student will also familiarize themselves with case study on Linux o.s., its design architecture, command structures, utilities and Linux.

4. OBJECTIVES:

The student will be able to:

1. Get familiarized with computerisation.
2. Utilise computers in engineering /technical field.
3. Use computer concepts for Microsoft applications
4. Prepare Inplant/Project reports.
5. Promote Computer Literacy and Programming Skills.
6. Made to expose towards computer area.
7. Learn networking concepts
8. Operate Internet/e-mail facility
9. Study of Linux as Operating System and Shell Programming.

5. DETAILED CONTENTS :

Chapter	Content	Marks	Hours
1	<p>1.0 Fundamentals of Computer concepts</p> <p>1.0 To acquaint with computer Hardware and Software, To get familiar with various operating system (DOS);</p> <p>1.2 To use DOS internal commands ;To familiarise with DOS external commands;</p> <p>1.3 To study of computer specifications PC,PC-XT, PC-AT, Pentium and its applications,</p> <p>1.4 General architecture of computers; Computer peripherals (I/O Device),CD player , Storage units , floppy diskette , printers and output peripherals;</p> <p>1.5 General computer terms, computer software, applications software, operating systems, utilities packages, languages, advantages of software and application packages.</p> <p>Practice: 1. Study of Computer hardware and peripherals</p>	20	06
2.	<p>2.0 Introduction to Windows:</p> <p>2.1 Structure of a Window, Basic techniques for working in Windows.</p> <p>2.2 Using Menus</p> <p>2.3 Working with A dialogue box, Type of Options</p> <p>2.4 Starting Windows , Task Bar, Start Menu</p> <p>Practice: 1. Study of DOS Internal and External Commands</p> <p>2.Getting started with Windows by using different menus and working with dialogue box</p> <p>3. Study of Control panel , Screen saver and Help commands using Windows</p>	10	05

3.	<p>3.0 Introduction to WORD package</p> <p>3.1 Starting Word; The Word Screen; Getting to Word Document:</p> <p>3.2 Typing and Editing : Editing text, Copying and Moving, Typing Special Characters (Symbols);</p> <p>3.3 Some common features: Changing the case of text, Moving & copying text with drag and drop, Justifying text.</p> <p>3.4 Creating bulleted & numbered lists, Arranging and moving between open documents.</p> <p>3.5 Finding and replacing, formatting.</p> <p>3.6 Using the spell checker, Checking grammar.</p> <p>Practice: 1. Creating, Editing and Saving a document , Table using</p> <p style="padding-left: 40px;">Word package creating</p> <p style="padding-left: 40px;">2. Document with Table ,editing using special characters & saving.</p> <p style="padding-left: 40px;">3. Study of tool bar menus like Standard , Formatting , Tables and Borders</p> <p style="padding-left: 40px;">4. Study of spell check , find , replace , go to , page setup , print preview and print commands.</p>	15	02
4	<p>4.0 Concepts of POWER POINT</p> <p>4.1 What is Business graphics : Types of Business Graphics, How to make an effective presentation,</p> <p>4.2 Physical aspects of presentation; A Presentation Graphics package ;</p> <p>4.3 Creating a presentation : creating a Title slide, Creating a Graph, Creating Tables, Make Organization Chart, To Save and close presentation; Working with Tools: Create , Edit, Move, Delete , Resize , Format text object, Working with Graphics tools;</p> <p>4.4 Slide show</p> <p>Practice: 1. Creating a new presentation and getting acquainted with</p> <p style="padding-left: 40px;">various menus like FILE, EDIT, VIEW, INSERT, FORMAT, TOOLS, SLIDESHOW</p> <p style="padding-left: 40px;">2 Choosing Auto Layout and working with tools and to prepare a slide show</p> <p style="padding-left: 40px;">3. To study special effects using one slide show demonstration</p>	15	02
5	<p>5.0 Fundamentals of EXCEL</p> <p>5.1 Starting EXCEL: What is a spreadsheet creating & editing spreadsheet, modifying the sheet.</p> <p>5.2 Study of Toolbars, Formula bar and Status bar.</p> <p>5.3 Inserting Header and footer, cells, rows, columns, worksheet.</p>	15	02

	<p>5.4 Formatting individual cells row, column, sheet, manipulating data by using Sort.</p> <p>5.5 Saving and Retrieving saved worksheet.</p> <p>Practice: 1.Creating Spread Sheet for various combination of computational tables.</p>		
	SECTION-II		
6	<p>6.0 Linux Fundamentals</p> <p>6.1 Linux Fundamentals:- Basics of Unix and Linux.</p> <p>6.2 Multi-User and Multitasking capacities of Linux, change of password, the file types, structure of file system, important directories of the file system.</p> <p>Practice: 1.Linux basic commands.</p> <p>2.Linux Advanced commands</p>	25	06
7	<p>7.0 Introduction to Shell Programming :</p> <p>7.1 What is Shell</p> <p>7.2 Tools for working with Linux and Shell programming, Function of Shell</p> <p>7.3 Access permission of file in Linux, editing files with V1, important commands related to V1 editor.</p> <p>7.4 Introduction to Bash Shell Basics, Shell Bash variables, basics scripts element (input/output).</p> <p>7.5 Simple Shell Programs.</p> <p>Practice: 1.CREATING FILE USING V1 editor, editing, saving file and quit from V1 editor.</p> <p>2. Study of different run levels.</p> <p>3. Shell programming-I</p> <p>4. Shell programming-II.</p> <p>5. Study of KDE environment</p>	24	05
8	<p>8.0 Networking and LAN commands</p> <p>8.1 Network Concept and classification;</p> <p>8.2 Local Area Network(LAN) : LAN Topology, LAN Software/ Operating System.</p> <p>8.3 LAN commands and elementary Administrative commands like</p> <p style="padding-left: 40px;">ATTACH, BROADCAST CAPTURE, LOGIN, LOGOUT, MAP, REVOKE, RIGHTS, SYSCON, SYSTIME.</p> <p>Practice: 1. Networking concepts and LAN commands.</p> <p style="padding-left: 40px;">2.Introduction to administrative command like</p> <p style="padding-left: 80px;">Create</p> <p style="padding-left: 80px;">Users, Mapping , Assigning , etc.</p>	20	02
9	<p>9.0 Introduction to INTERNET :</p> <p>9.1 What is INTERNET, Application of INTERNET</p> <p>9.2 E-mail, TELNET, WWW, Study of various search engine using</p> <p style="padding-left: 40px;">LYNX, LOGIN PROCEDURE.</p> <p>9.3 Study of INTERNET EXPLORER, Creating mailing</p>	20	02

	<p>account, Difference between SHELL and TCP/IP account. 9.4 Surfing using WORLD WIDE WEB information relating to employment, education, alumni. Practice: 1. Internet terms , Use of Shell account and study of mailing , Software to send & receive mail on Hard Disk. 2. To study internet explorer package & retrieve education related information from TCP/IP account and downloading procedure.</p>		
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Note:- Minimum of twelve experiments must be performed /completed in journal for approval of term work acceptance other than the 75% requirement of attendance.

Sr. No.	Main Topics	No. of Contact Hrs.	Marks	Weightage	
				%	# M / E / D
1.	Fundamentals of Computer concepts	06	20	12	E
2.	Introduction to Windows	05	10	07	E
3.	Introduction to WORD package	02	15	09	M
4.	Concepts of POWER POINT	02	15	09	M
5.	Fundamentals of EXCEL	02	15	09	M
6.	Linux Fundamentals	06	25	16	M
7.	Introduction to Shell Programming	05	24	14	M
8.	Networking and LAN commands	02	20	12	M
9.	Introduction to INTERNET	05	26	16	E
Total		32	164	100%	#

(# M=Most Essential, E=Essential, D=Desirable)

6. IMPLEMENTATION STRATEGY (Planning)

- i) Teaching Plan
- ii) Lesson Plan
- iii) Assignments

7. REFERENCE BOOKS :

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & address
1	Hunt & Shelly.	Computer and Common			

		sense			
2	V. Rajaraman	Computer Fundamentals			(Prentice hall)
3		PC Guide for Windows			(ITC Publication / Galgotia publication)
4	Galgotia.	Learning Word 6.0 for Windows step-by-step			
5	Preilerson	Linux: The computer reference – 5/E			
6		Unleashed Linux			
7		Mastering MS Office			BPP Publication
8	U.D. Black	Data Communications and Distributed Networks			Prentice-Hall

SUBJECT DETAILS

Course: Mechanical Engineering	Semester: IV
4.5 Power Engineering – II (ME-49)	Duration: 16 Weeks
Group : Application (A)	Optional

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks						
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral
		Hrs	No of paper	Marks					
2	2	5	3	1	100	50	50	50	200

(3) RATIONALE

Steam (Thermal) power plants are widely used for power generation (Electrical Power). Study of thermal power plants is essential for the mechanical engineers.

Gas turbines and jet propulsions are important for power generation, aeronautics and for use in defence. Use of refrigeration and air conditioning is finding wider application both in industrial and domestic fields.

(4) OBJECTIVES

Students will be able to :

- (i) understand the working of steam turbine which is widely used for the generation of electricity and also understand the important components of thermal power plant.**
- (ii) understand the working of gas turbine cycle.**
- (iii) understand the principles of various jet propulsion systems.**

- (iv) understand the principles of various refrigeration & air conditioning system.
- (v) understand the facts ,concepts and modes of heat transfer.

(5) DETAILED CONTENTS

	Contents	Marks	Hours	
			Theory	Practical
	SECTION – I			
(01)	Steam 1.1 Generation of steam 1.2 Types of steam 1.3 Properties of steam like dryness fraction, internal energy, specific enthalpy, specific volume, specific entropy of dry ,wet and superheated steam	08	02	-
(02)	Steam Boilers 2.1 Principle of steam generation 2.2 Requirement of steam 2.3 General description & principles of working 2.4 Classifications of steam boilers 2.5 Applications of steam boilers	15	02	-
		-	-	02

2.6 Principles parts of steam boilers - - 02

2.7 Water tube and fire tube boilers

2.8 Boiler mountings like water level indicator, pressure gauges, safety valves, steam stop valve, fusible plug, blow off cock valve, high pressure and low level valve etc.

2.9 Boiler accessories like economiser, air preheater & superheater etc

Practical/s

(i) Study of boilers-Water tube and fire tube boilers

(ii) Study of boiler mountings and accessories

(03) 07 01 -

High Pressure Boilers

3.1 La-mont boiler

3.2 Loeffler boiler

3.3 Benson boiler

3.4 Velox boiler - 01

Practical/s

(i) Study of high pressure boilers

(04) 06 01 -

Performance of Boiler

4.1 Boiler efficiency

4.2 Load performance

4.3 Inspection of boilers

4.4 Starting & stopping of boilers

(05)	<p>Steam Engine</p> <p>5.1 General description</p> <p>5.2 Principles and working of a simple steam engine</p> <p>5.3 P-V and T-S diagram of thermodynamic cycle of steam engines</p> <p>5.4 Calculation of indicated power, break power and efficiencies of steam engines</p> <p>Practical/s</p> <p>(i) Study of steam engines</p>	08	02	-
(06)	<p>Steam Power Plant</p> <p>6.1 General description</p> <p>6.2 Cycles</p> <p style="padding-left: 20px;">(a) Rankine cycle</p> <p style="padding-left: 20px;">(b) Modified rankine cycle</p> <p>6.3 P-V, T-S and h-s diagrams of above cycles</p> <p>6.4 Calculation of efficiencies and specific steam consumption</p>	10	02	-

	6.5 Applications of above cycles.			
(07)	Steam Nozzles	08	01	-
	7.1 Types of steam nozzles			
	7.2 Flow of steam through nozzles			
	7.3 Construction and working of convergent and divergent nozzles			
	7.4 Calculation of area and velocity at throat and exit			
	7.5 Condition for maximum discharge			
	7.6 Effect of friction			
	7.7 Nozzle efficiency			
(08)	Steam Condensers	12	01	-
	8.1 Types of steam condensers			
	8.2 Applications of steam condenser			
	8.3 Construction and working of jet and surface condenser	--	--	01
	8.4 Air pumps			
	Practical/s			
	(i) Study of steam condensers			
(09)	Steam Turbines	08	02	
	9.1 Classification of steam turbines			
	9.2 Principles of working of impulse and reaction turbines			
	9.3 Compounding and governing of steam turbine			
	9.4 Velocity diagrams of impulse and reaction turbine			
	9.5 Performance of steam turbines			
	9.6 Efficiencies of turbines			
	Practicals			
	(i) Study of steam turbines			
	(ii) Study of compoundings and governings of steam turbine			
		(82)	(16)	(07)

SECTION II

(10)	Heat transfer 10.1 Modes of heat transfer e.g.-conduction ,convection & radiation 10.2 Conduction-introduction 10.3 Fourier law of heat conduction 10.4 Thermal conductivity ,thermal resistance 10.5 The material-conductors & insulators 10.6 Heat transfer by conduction through Flat surfaces Cylindrical surfaces Spherical surfaces Simple numericals on steady state	20	06	-
(11)	Heat transfer by convection 11.1 Introduction and applications 11.2 Types-free convection Forced convection 11.3 Overall heat transfer co-efficient	08	01	-
(12)	Heat transfer by radiation 12.1 introduction 12.2 Stefan boltzman law 12.3 Kirchoff's law 12.4 Black body ,grey body ,white body ,etc...	08	01	-

(13)	<p>Heat exchangers</p> <p>13.1 Introduction & applications Classification</p> <p>13.2 Counter flow & parallel flow in Heat exchangers</p> <p>13.3 Derivation & simple numerical On log mean temperature</p> <p>13.4 Heat transfer in condenser and Evaporator</p> <p>13.5 Simple numerical</p>	16	03	-
(14)	<p>Plants for generation of power</p> <p>14.1 Thermal power plant</p> <p>14.2 Hydroelectric power plant</p> <p>14.3 Nuclear power plant</p> <p>Practicals</p>	15	02	-
(15)	<p>Study of power plants(industrial visit)</p> <p>Gas turbine</p> <p>15.1 Classification of gas turbine</p> <p>15.2 Principle of working of constant Pressure close & open cycle gas Turbine ,constant volume gas turbine</p> <p>Practicals</p> <p>(i) Study of gas turbine</p>	06	01	-
(16)	<p>Aircraft engines</p> <p>16.1 Principles of working of turbo-jet and turbo- prop engines</p> <p>16.2 Applications of air craft engines</p> <p>Practical/s</p> <p>(i) Study of air craft engines</p>	06	01	-
(17)	<p>Refrigeration & air conditioning</p>	08	01	-

17.1 Introduction Refrigeration and
airconditioning

17.2 Importance of refrigeration
and air

- - 01

conditioning

17.3 Applications for example
refrigerator and air

conditioners

Practical/s

- (i) Study of refrigeration and air conditioning
(Introduction)

82 16 04

(6) IMPLEMENTATION STRATEGY (PLANNING)

- (i) Teaching Plan
- (ii) Visits, Use of charts, models

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	Patel Karamchandani	Heat engines	17 th	2000	Acharya Publication, Vadodara
(ii)	P.L. Ballaney	Thermal Engineering	24 th	2003	Khanna Publication, New Delhi

(iii)	R.S.Khurmi	Thermal Engineering	12 th	2000	S.Chand, New Delhi
(iv)	Dombkundwar S.	Thermal Engineering	5 th Revised	2001	Dhanpat Rai and Co. Pvt. Ltd. New Delhi- 06

**SHRI VILEPARLE KELVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC**

PART TIME

DISCIPLINE: MECHANICAL ENGINEERING.
batch admitted june 2008 (progressive)

w.e.f.

SEMESTER:FIFTH
from the academic term: JULY-NOV.2009

Effective

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION			
			L	P	D	T	Cr	NP	HR S	Mks	SSL	Theory paper	T/W	Prac
1	Mathematics -III	MA-35	3	-	-	1	4	1	3	100	20	80	-	-
2	Foundry Technology & Material science	ME-66	2	2	-	-	4	1	3	100	20	80	50	50
3	# Fluid Mechanics & Hyd. Machines	ME-48	2	2	-	-	4	1	3	100	20	80	50	50
4	Mechanism	ME-47	3	2	-	-	5	1	3	100	20	80	50	-
5	Computer Aided Graphics	CA-03	2	4	-	-	6	1	3	100	20	80	50	50
	TOTAL		12	10	00	01	23	-	-	-	100	320	200	150
			Total periods 23								Total marks = (900)			

(1) SUBJECTCT DETAILS

Course: Mechanical Engineering	Semester: III
	Duration: 16 Weeks
3.5 Mathematics – III (MA-35)	
Group : C*	

Optional

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Tutorial (Hrs Per Week)		Paper			Theory	Sessional Marks	Term Work	Prac - tical/ Oral	Total
		Hrs	No. of Paper	Marks						
3	1	4	3	1	100	80	20	-	-	100

(3) RATIONALE

1. Creating aptitude for Mathematics of Higher Semesters
2. Focusing attention of problem solving in liberal sense. This aspect should take care of
 - (a) Intelligent combination of techniques.
 - (b) Mathematization or mathematical modeling of problems involved in various branches of knowledge.
3. Nurturing the higher order mental process of logical reasoning with rigor and precision.
4. Developing conceptual clarity & habit of abstracting a given concrete situation and to put it in precise language with the ingredients of the problems on hand.

(4) OBJECTIVES

Differential calculus is introduced as

1. Prerequisite for many topics such as integral calculus, differential equations, Fourier series etc. to be studied later.
2. To introduce the applications commonly required.

(5) DETAIL CONTENTS

Chapter	Content	Marks	Hours
SECTION I			
(01.)	Differentiation	57	16
	1.1 Definition		
	1.2 Derivative by first principle		
	1.3 List of derivative of standard function		
	1.4 Methods of differentiation		
	1.5 Derivative of explicit & implicit		
	1.6 Derivative of parametric function		

1.7 Derivative of Inverse function		
1.8 Derivative of function with respect to another function		
1.9 Successive Differentiation		
1.10 n^{th} derivative of function		
1.11 Leibnitz theorem	25	08
1.12 Application of Derivative		
1.13 (i) Geometric meaning of derivative		
(ii) Equation of tangent, normal to given curve		
(iii) Derivative as a rate measure-velocity, Acceleration, Related Rate		
(iv) Maxima/Minima of Function		
(v) Radius of Curvature		
Total	(82)	(24)

SECTION-II

(02) Integral Calculus	82	24
2.1 Integration as inverse of differentiation		
2.2 Methods of Integration, substitution by parts, partial fraction.		
2.3 Definite integral & their properties, Reduction formulae (No proof)		
2.4 Application: Mean Value & R.M.S. Value		
Total	(82)	(24)

(6) IMPLEMENTATION STRATEGY (PLANNING)

Lectures are conducted as per teaching plan and tutorials are conducted in the class.

(7) REFERENCE BOOKS

Sr. No	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	S. P. Deshpande	Mathematics for Polytechnic Students –II	1 st	1998	Pune Vidyarthi Griha Prakashan, Pune
(ii)	Dr. B. S. Grewal	Higher Engineering Mathematics	35 th	2000	Khanna Publishers 2B, New Delhi
(iii)	J. N. Wartikar P. N. Wartikar	Applied Mathematics	7 th	1989	Pune Vidyarthi Griha Prakashan, Pune

(iv)	B. M. Patel J. M. Rawal P. B. Bahatkar K. R. Ansari D. M. Hadke A. S. Singh	Applied Mathematics	7 th	2002	Nirali Prakashan, Mumbai
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(1) SUBJECT DETAILS

Course: Mechanical Engineering

Semester: VIth

Duration: 16 weeks

6.4 Subject – Foundry Technology & Material Science

Code –ME 66

Group: C*

Compulsory

(2) TEACHING AND EXAMINATION SCHEME

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs. Per Week)	Practicals (Hrs. Per Week)		Paper			Theory	Sessional Marks	Term Work	Practical/Oral	Total
			Hrs	No.Of Paper	Marks					
02	02	04	03	01	100	80	20	50	50	200

(3) RATIONALE

Mechanical engineering branch is related with industries where raw material is extracted in the form of ore, is purified and converted into pure metal form with the help of furnaces. The syllabus comprises of casting, Forging and the subject will also help the students to understand common metallic materials used in industries and also the familiarity of metal treatments.

(4) OBJECTIVE

- The student may be able to do patterns.
- The students may be able to prepare core box.
- They will be able to understand casting process and defects in casting.
- The student will understand properties of material.

e) The will know about metallurgy and heat treatment process.

(5) DETAILED CONTENTS

SECTION - I

Sr.No.	Contents	Hours	Marks
01	Pattern Making 1.1 Definition and its use. 1.2 Materials used 1.3 Types of patterns 1.4 Code used in practice. 1.5 Definition- Core, Core print, Core types and types of core boxes.	05	20
	Practical		
	1) Two different types of patterns preparation 2) Preparation of one core box.	18	-
02	Moulding		
	2.1 Different methods of Moulding and core making. 2.2 Sand moulding, Machine moulding, CO2 moulding and Shell moulding. 2.3 Moulding and core making materials and their properties.	04	17
Sr.No.	Contents	Hours	Marks
	Practical		
	Visit to foundry – To study different types of Moulding processes and preparation of moulding sand.	02	-
03	Foundry Furnaces		
	3.1 Types of Furnaces – Construction, working and application of Cupola Furnace, Arc furnace- Indirect and Direct arc furnace.	02	15
	Practical	02	
	Visit to Foundry - To observe working of different types of furnaces.		
04	Casting		
	4.1 Types of casting- Gravity die, Pressure die, Centrifugal casting. 4.2 Application, Limitation and accuracy of each process. 4.3 Defects in casting – causes and remedies.	03	20
	Practical	02	-
	Visit to factory – To study different casting processes and inspection of castings.		
05	Forging		
	5.1 Forging process – Introduction to -Drop forging, Upset forging, Die forging 5.2 Types of dies – Open die, Close die (Single impression) Close die forging operation – Fullering, Edging, and Bending.	02	10

Section II

Sr.No.	Contents	Hours	Marks
06	Engineering materials and their properties		
	6.1 Introduction, Classification and Application of Engineering materials.		

	6.2 Properties of metals –Density, Melting point, Strength, Elasticity, Ductility, Malleability, Plasticity, Toughness, Hardness, Harden ability, Brittleness, Thermal conductivity, Electrical conductivity, Thermal coefficient of expansion 6.4 Factors considered in selection of materials 6.5 Material selection process.	04	18
	Practical i) Material identification of typical components. ii) Selecting Metals for mechanical working.	06	-
07	Ferrous metals and alloys		
	7.1 Classification, Application and composition of low carbon steel, Medium Carbon steel, High carbon steel. 7.2 Alloy steels – Tool steel, Stainless steel, Cutting tool material – High speed steel 7.3 Effect of alloying elements – Carbon, Silicon, Nickel, Manganese, Phosphorus, chromium, Molybdenum, Vanadium,	03	15

Sr.No.	Contents	Hours	Marks
08	Non ferrous metals and alloys		
	8.1 Classification, Application and composition of - Copper alloys - Naval brass, Muntz metal, Gun metal and bronzes. Aluminium alloys – Duraluminium and bearing materials like white metal and leaded bronzes.	02	15
09	Heat treatment of steels		
	9.1 Heat treatment process – Principle, Advantages, limitations and application Of - Annealing, Normalizing, Hardening and Tempering.	03	18
	Practical iii) Study of surface Hardening methods – i) Case hardening ii) Flame Hardening. iv) Visit to Industry -To study Heat treatment process, Melting process, effect of alloying elements and Microstructure	09	-
10	Non metallic Materials		
	10.1 Properties and applications of Ceramics and Abrasive materials 10.2 Introduction to Thermoplastic - ABS, Acrylic. 10.3 Introduction Thermosetting plastic – Bakelites.	02	08
11	Powder metallurgy		
	11.1 Introduction to Powder metallurgy process 11.2 Advantages, limitation and Applications of Powder metallurgy process for Tungsten carbide tip tools.	02	08
	Practical i) Study of cooling curves. ii) Study of iron – iron carbide equilibrium diagram.	09	--

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by adopting the following strategy. (Teaching plan)

- i) Lesson plan.
- ii) Use of charts, models and transparencies.
- iii) Use of actual devices.
- iv) Visit to manufacturing unit

(7) REFERENCE BOOKS –

Sr.No.	Author	Title	Publication
01	O.P. Khanna	Material Science and Metallurgy	Dhanpat Rai and Sons.
02	Dr. V.D. Kodgire	Material Science and Metallurgy	Everest Publishing House
03	R.K.Rajput	Material Science and Engineering	S.K.Katari and Sons
04	Lakhtin	Engineering Physical Metallurgy	Peace Publication
05	Higgins	Engineering Metallurgy process Vol. I & II	Tata Mc Graw Hill
06	ASM Vol. I	Properties and selection Iron and steel.	ASM America
07	ASM Vol. V	Heat Treatment	ASM America
08	O.P. Khanna, S.M. Lal	Foundry Technology	Dhanpatrai and Sons
09	Hajra Choudhary	Workshop Technology Vol. I	Media Promoters.

1) SUBJET DETAILS:**COURSE: MECHANICAL ENGINEERING****SEMESTER: IV****4.2 FLUID MECHANICS & HYDRAULICS MACHINERY**

DURATION: 16 WEEKS

CODE: ME-48

GROUP: CORE (C*)

COMPULSARY

2) TEACHING AND EXAMINATION SCHEME:

Teaching scheme		Credits	Examination scheme and maximum marks							
Theory (Hrs per week)	Practical (Hrs per week)		Paper			Theory	Sessional	Term work	pract- cal	Total
			Hrs	No. of paper	Marks	Marks	Marks	Marks	Marks	Marks
2	2	4	3	1	100	80	20	50	50	200

3) RATIONALE:

Fluid Mechanics and Hydraulics Machinery is a subject in engineering which deals with transformation of energy stored in a fluid to produce useful work output. The machines in industries are required to perform number of functions such as moving, holding, pressing and lifting etc. which requires motion and force. The analysis of forces and friction for static and moving fluid is considered in continuation with force analysis studied under physics and applied mechanics.

The machines in industries are required to perform number of functions such as moving; holding, pressing and lifting etc. which requires motion and force. This subject helps to understand, operate, maintain and design of various hydraulics and pneumatic circuits used in the industry. It makes them understand various parts of machines like pumps, actuators, valves etc.

4) OBJECTIVE:

It develops understanding of properties of steady and moving fluids. This helps to understand construction, working, installation, applications and performance of equipments such as pumps, turbines etc.

Student will be able to identify various components of hydraulic and pneumatic systems, know the working principle of various components used for hydraulic and pneumatic systems. They will be able to select appropriate components required for simple hydraulic and pneumatic systems, list probable causes of faults or defects in the components. This helps to develop the similar circuits for job holding and tool operation in machine tools. It also helps in mass production, low cost automation which will increase productivity.

5) DETAILED CONTENTS

SECTION-I

Chapter	Contents	Marks	Hours	
			Th	Pract.
01	Properties of Fluids 1.1 Mass density, specific weight, specific gravity, specific volume. 1.2 Viscosity, cohesion and adhesion, surface tension, capillarity. 1.3 Vapour pressure, compressibility.	10	02	
02	Fluid pressure and pressure measurements 2.1 Fluid pressure, pressure head, intensity of pressure. 2.2 Concept of atmospheric, gauge pressure, vacuum and absolute pressure. 2.3 Peizometer tube, simple and differential manometers. 2.4 Bourdon's pressure gauge, diaphragm pressure gauge, dead weight pressure gauge.	10	02	
03	Static pressure 3.1 Pascal's law and its applications. 3.2 Total pressure and centre of pressure for immersed plane surfaces such as rectangular,triangular,circular etc.	10	02	
04	Flow of fluids 4.1 Types of flows 4.2 Law of continuity 4.3 Bernoulli's theorem 4.4 Applications of Bernoulli's theorem such as Venturimeter,orifice plate (construction, working and derivation of discharge) 4.5 Pitot tube. Practical/s i) Verification of Bernoulli's theorem. ii) Determination of co-efficient of discharge for venturimeter and orifice plate.	16	03	02 02
05	Flow through simple pipes 5.1 Laws of fluid friction for laminar and turbulent flow. 5.2 Darcy's and Chezy's equation for frictional loss 5.3 Loss of head due to sudden enlargement, contraction, Obstruction, bends, loss at inlet and exit. 5.4 Total energy line and total gradient line Practical/s i) Determination of loss of head due to friction in pipes. ii) Determination of loss of head due to bends, sudden enlargement, sudden contraction.	16	03	02 02
06	Hydraulic systems 6.1 Introduction to oil hydraulic systems Practical layout of hydraulic systems, General layout of hydraulic systems, Merits and demerits of oil hydraulic systems.	20	04	

	<p>6.2 Pumps for hydraulic systems -(Fixed displacement pumps only) Classification, Construction and working of gear, gerotor, vane, axial Piston, radial piston, balanced vane, and bent axis piston pump</p> <p>6.3 Valves for hydraulic systems Construction, working and symbols of pressure relief valve, pressure reducing valve, and pressure override valve. Construction, working and symbols of check valve, flow control valve, sequence valve. Construction, working and symbols of poppet valve, spool valve, 3/2, 4/2 direction control valve.</p> <p>6.4 Actuators and accessories for hydraulic systems Construction, working and symbols of linear actuators-single acting, double acting; rotary actuators-hydraulic motors.</p> <p>6.5 Hydraulic circuits Construction and working of basic hydraulic circuits such as meter-in, meter-out, bleed off, sequential, regenerative circuits. Symbols and their labels of components.</p> <p>Practical/s (i) Study of rotary pumps. (ii) Study of meter-in, meter-out, bleed off circuits. (iii) Study of sequencing circuit.</p>			<p>02 03 03</p>
Total		82	16	16

SECTION-II

07	<p>Centrifugal pumps 7.1 Construction and working of centrifugal pump 7.2 Types of casings and impellers 7.3 Calculation of manometric efficiency, overall efficiency, velocity diagram 7.4 Multistage of centrifugal pump 7.5 Net positive suction head, cavitations. 7.6 Testing of centrifugal pump 7.7 Troubleshooting 7.8 Characteristics curves 7.9 Specification and selection of centrifugal pump.</p> <p>Practical/s Trial on centrifugal pump.-To determine total head, pump. efficiency, Overall efficiency and volumetric efficiency.</p>	35	7	04
08	<p>Reciprocating pumps 8.1 Construction and working of single and double acting</p>	10	02	

	<p>Reciprocating pumps.</p> <p>8.2 Concept of slip, negative slip, Cavitation and separation</p> <p>8.3 Indicator diagram with effect of acceleration and friction head.</p> <p>8.4 Air vessel.</p> <p>Practical/s</p> <p>Trial on reciprocating pump.-To determine total head, pump efficiency, Overall efficiency and volumetric efficiency.</p>			02
09	<p>Hydraulic Turbines</p> <p>9.1 Layout of hydroelectric power plant.</p> <p>9.2 Classification and selection of hydraulic turbines.</p> <p>9.3 Construction and working of Pelton wheel, Francis turbine, Kaplan turbine</p> <p>9.4 Comparison of turbines.</p> <p>9.5 Functions, types of draft tube.cavitation in turbines. (No numerical on hydraulic turbine)</p> <p>Practical/s</p> <p>i) Trial on Pelton wheel-To study operation of turbine to determine power Output and efficiency</p> <p>ii) Study and demonstration of Francis turbine.</p>	16	03	04 02
10	<p>Pneumatic systems</p> <p>10.1 Introduction of pneumatic systems- Applications of pneumatic systems, General layout of pneumatic systems, Merits and limitations of pneumatic systems.</p> <p>10.2 Valves for pneumatic systems- Construction, working and symbols of spool type, poppet type valves. Construction, working and symbols of flow control valve, shuttle valve, and quick exhaust valve.</p> <p>10.3 FRL unit.</p> <p>10.4 Pneumatic Circuits Control of single acting cylinder using pilot operated valve, flow control valve, exhaust throttling, Control of double acting cylinder, sequencing circuit.</p> <p>Practical/s</p> <p>(i) Study of pneumatic circuit for speed control of single and double acting cylinders.</p> <p>(ii) Study of pneumatic circuit for speed control of Pneumatic motor.</p>	21	04	02 02
Total		82	16	16

6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by adopting the following strategy.(Teaching plan)

- i) Lesson plan.
- ii) Use of charts, models and transparencies.
- iii) Use of actual devices.

7) REFERANCE BOOKS

Sr.No.	Author	Title	Edition	Year of publication	Publishers and address
1	R.S.Khurmi	Fluid Mechanics & Hydraulics machinery	First	2001	S Chand and co. ,New Delhi
2	Jagdish lal	Fluid Mechanics & Hydraulics machinery	Second	1986	Metropolitan book co. pvt.ltd.
3	Modi P.N. and Seth S. M.	Hydraulics and Fluid Mechanics including Hydraulics machines	Eleventh	1973	Standard book house , New Delhi
4	Sperry Vickers	Hydraulics manual	XII	2002	Vickers Sperry international, Mumbai
5	S.R.Majumdar	Oil Hydraulic system Principle and Maintenance	VI Reprint	2004	Tata McGraw hill publishing company limited, New Delhi-110063
6	S.R.Majumdar	Pneumatic system Principle and Maintenance	XI Reprint	2004	Tata McGraw hill publishing company limited, New Delhi-110063
7	H.L.Stewart	Hydraulics and Pneumatics power for	-	2001	Industrial Press inc.New York,U.S.A.

		production			
8	J.J.Pipenger	Industrial Hydraulics	-	1981	McGraw Hill, New York, U.S.A.

1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: IV
4.1 Mechanisms (ME-47)	Duration: 16 Weeks
Group : Core (C*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term-Work	Practical/ Oral	Total
		Hrs	No of paper	Marks						
3	2	5	3	1	100	50	50	50	50	125

(3) RATIONALE

The student has to work for design, production, maintenance of machines, assemblies, sub-assemblies, etc. He should be aware of working considering motion/power for various drives and other machine components. This subject is continuation of physics, engineering drawing, mechanics & base for machine design. It

also forms part of mechanical technology, manufacturing engineering, production engineering, etc.

(4) OBJECTIVES

The objectives include study of various mechanical drives commonly used. It includes use of friction in belt drive, clutch & brake. Losses due to friction in bearing. The study of special purpose drive likes cam drive and frictional clutches. The use of vector diagram to calculate velocity & acceleration of links in simple mechanisms. Basics, classification & application of gears and basic study of flywheel and governor.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours	
			Theory	Practical
SECTION – I				
(01)	Kinematics 1.1 Basic of kinematics 1.2 Types of kinematics pairs 1.3 Various simple mechanisms, its inversions for working and application Practical/s (i) Terminology for kinematics	10	04	-
(02)	Velocity and Acceleration Diagrams 2.1 Basics, types of velocity and acceleration – Angular, linear motion and co-relation 2.2 Absolute, relative velocity and acceleration for Simple mechanisms – single and double crank mechanism uniform & changing angular velocity of crank 2.3 Use of velocity and acceleration diagrams to find velocity & acceleration of various elements/points on simple mechanisms 2.4 Use of Klein’s and Bannett’s construction for single crank mechanism with uniform angular velocity (Coriolis acceleration component to be excluded) Practical/s (i) Simple mechanisms and inversions (ii) Velocity and acceleration (Vector diagram)	20	10	-
		-	-	04
(03)	Gear	16	06	-

	3.1 Gear terminology			
	3.2 Types of gears and applications			
	3.3 Law of gearing and sliding velocity			
	3.4 Profiles of gear tooth and comparison, interference in involutes profile.			
	Practical/s	-	-	04
	(i) Gear Terminology			
	(ii) Types of gears			
(04)	Gear Trains	16	06	-
	4.1 Classification of gear trains			
	4.2 Designing of simple spur gear train for number of teeth and exact center to center distance for given velocity ratio, module and approximate center to center distance			
	4.3 To find speed of different gears and arm for epi-cyclic gear train (Simple & Compound)			
	Practical/s	-	-	06
	(i) Types of gear trains			
	(ii) Differential gear system			
	(iii) Four speed gear box (Sliding mesh)			
(05)	Cam	20	06	-
	5.1 Type of cams & followers			
	5.2 Cam terminology			
	5.3 Design of radial (disc) cam profile for knife/roller/flat faced follower having uniform velocity/S.H.M./uniform acceleration and retardation			
	Practical/s	-	-	04
	(i) Cam terminology and classification of cams and followers			
	(ii) Cam profile drawings			
	Total	(82)	(32)	(20)

SECTION – II

(06)	Mechanical Drives	10	04	-
	6.1 Drives & classification			
	6.2 Types of mechanical drives			
	6.3 Positive & non-positive drives, comparison			
	Practical/s	-	-	02
	(i) Types of mechanical drives			
(07)	Belt, Rope and Chain Drive	20	08	-
	7.1 Types of belt drives, open/cross, flat/V/rope, simple/compound, etc; types of pulleys			
	7.2 Velocity ratio for belt drive, consideration of			

	slip & belt thickness, creep & its effect			
	7.3 Calculation of length of belt for open/cross belt drive, approximation of it, angle of contact			
	7.4 Working tension, initial tension, centrifugal tension, safe tension and their relation for belt & rope drive consideration of co-efficient of friction, contact angle & groove angle of grooved pulley			
	7.5 Power transmission calculation for belt drive, to find dimension of belt/pulley for given power & max. power			
	7.6 Comparison between various belt drives			
	7.7 Chain drives & its comparisons with other mechanical drives			
	7.8 Types of chains & applications, consideration of velocity ratio of chain drive			
	Practical/s	-	-	04
	(i) Belt drives			
	(ii) Chain drives			
(08)	Brakes	16	06	-
	8.1 Introduction, operating systems, brake material characteristics			
	8.2 Types of mechanical brakes			
	8.3 Simple problem for single, double, band and band & block brake for torque/power/force applied	-	-	02
	Practical/s			
	(i) Different types of brakes and its classification			
(09)	Bearing	10	04	-
	9.1 Friction in bearing			
	9.2 Types & co-relation with clutch			
	9.3 Uniform intensity of pressure & uniform wear conditions			
	9.4 Power loss & designing of frictional bearings			
	9.5 Antifriction bearings and types			
	Practical/s	-	-	02
	(i) Different type of bearings			
(10)	Clutches	16	06	-
	10.1 Working of frictional clutches			
	10.2 Types of frictional clutches			
	10.3 Friction torque/power calculation to find dimensions of clutch			
	10.4 Centrifugal clutch, construction & working, Its comparison with other clutches			
	Practical/s			

	(i) Different type of clutches	-	-	02
(11)	Flywheel & Governors	10	04	-
	11.1 Introduction to flywheel			
	11.2 Function of flywheel			
	11.3 Introduction to governor			
	11.4 Function & types of governor			
	11.5 Comparison between flywheel & governors			
	Total	(82)	(32)	(12)

(6) IMPLEMENTATION STRATEGY (PLANNING)

- (i) Teaching Plan
- (ii) Models
- (iii) Charts.

(7) REFERENCE BOOKS

Sr No	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	Khurmi & Gupta	Theory of machines	5 th	1995	Eurasia Pub.House Pvt Ltd New Delhi-110055
(ii)	Rattan S.S.	Theory of machines	1 st	1993	Tata Mcgra Hill Pub Co.Ltd
(iii)	Ballaney P.L.	Theory of machines	5 th	1987	Khanna Publication New Delhi-110006
(iv)	H.M.Shah and H.M.Nadkarni	Theory of machines	2 nd	1982	Dhanpatrai & Sons New Delhi 110 006
(v)	Ghosh & Mallick	Design of machine elements & mechanisms	1 st	2002	East West Pub. New Delhi
(vi)	Bevan	Theory of machines	1 st	1984	CBC Pub New Delhi

(1) SUBJECT DETAILS

Course: Mechanical Engineering

Semester: IV

Duration: 16 Weeks

4.7 Computer Aided Graphics (CA-03)

Group : Application (A)

Optional

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term Work	Prac tical/ Oral	Total
		Hrs	No. of Paper	Marks						
2	4	6	3	1	100	80	20	50	50	200

(3) RATIONALE

This subject is introduced to make the student aware of computer aided graphics. A fair knowledge of this subject is essential for the mechanical engineers. Since there are new emerging areas of Computer Aided Manufacturing Computer Integrated Manufacturing. To work in this environment every one should be familiar with the methods of drawing & design using softwares. Also area of automated production requires drawing with AutoCAD, IDEAs, UNIGRAPHICS, etc. It consumes less time to put an ideas in the form of drawing.

(4) OBJECTIVES

It develops understanding of basics for study of primitive drawing. This helps to understand the complex assembly which can be divided into a smaller primitives. They will get an overall idea about implementing it in actual mechanical engineering. They will be able to implement the concept of Layer, Bill of Materials, Tolerance, etc. They will get an idea how data in one form can be converted into another to be used in a similar software.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours	
			Theory	Practical

SECTION – I

(01)	Introduction to Computer Peripherals 1.1 General ideas, study of printers plotters, digitisers, mouse, joystick, etc. 1.2 Introduction to AutoCAD 1.3 Concept and terminology, introducing different features, program operation, features, advance	10	04	-
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	drafting.	-	-	04
	Practical			
	(i) To study the operation of different peripherals			
(02)	Installation and File Management	06	03	-
	2.1 Loading AutoCAD, different library files			
	2.2 Familiarization with editing plotting, configuring			
	2.3 Converting of graphics with computer aided instruction. Understanding the mathematical terms.	-	-	04
	Practical			
	(i) To install Autocad, study of main execution file, configuration file and supporting file with main menu.			
(03)	Drawing commands	18	03	-
	3.1 Basics drawing commands to draw primitives like line, point, arc, circle, etc.			
	3.2 Drawing commands like pline, donut, hatch, etc.			
(04)	Utility commands	18	02	-
	4.1 Utility commands like end, save, status etc.			
	4.2 Edit & inquiry commands -			
	Commands like copy, move, erase, area etc.	-	-	16
	Practical			
	(i) To study of basic drawing, utility, edit and enquiry commands.			
(05)	Display and setting commands	12	02	-
	5.1 Display commands like zoom, pan, view, regeneration, etc.			
	5.2 Setting commands like grid, ortho, axis, etc.	-	-	04
	Practical			
	(i)To study display commands and drawing aid feature.			
(06)	Layer and shape files	18	02	
	6.1 Concept and use of layer command			
	6.2 Creation of shape file.			
	6.3 Creating line type, creating font style etc.			

	Total	(82)	(16)	(28)
SECTION – II				
(07)	Complex Object Drawing 7.1 Using block, wblock, insert, etc. 7.2 Setting commands with prototype drawing file.	12	02	
(08)	Attribute for Bill of Material 8.1 Attribute commands like ATTDEF, ATTDISP, ATTEDIT, ATTEXT (cdf, sdf, dxf), ASCTEXT.	12	02	-
	Practical (i) To study of attributes and bill of material	-	-	04
(09)	Dimensioning of Special Features 9.1 Different dimensions type, dimensioning adding tolerances, center, radius, leader, status, dim variable 9.2 Study of hatch pattern 9.3 Study of script and slide show.	18	02	-
	Practical/s (i) To study hatch pattern, line type, sketch, layer, dimension commands (ii) To study customization of menu using macros.	-	-	12
(10)	Three Dimensional Drawing 10.1 Commands, V point, hide, view, 3D-view, elevation 3D-polyline, 3D-face, 3D mesh. 10.2 UCS, UCSICON, change property 10.3 TABSURF, REVSURF, EDGESURF, 3DARRAY 10.4 3D Operation like ADD, SUBTRACT, etc	20	05	-
	Practical/s 1. (a) To study 3D Command (b) To draw an actually drafted design.	-	-	12
(11)	Introduction to Customization and Application 11.1 Customization of menu, different types of available menu 11.2 Application in the areas of mechanical engineering like drawing of CAM profile 11.3 Slide show for slider crank mechanism	20	05	-
		-	-	08

Practical/s

(i) Drawing application using AUTOCAD

Total

(82)

(16)

(36)

(6) IMPLEMENTATION STRATEGY (PLANNING)

- (i) Use of Auto Cad Drawing Files in practicals
- (ii) Lecture Plan

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	George Omura	Mastering Autocad 14	1 st	1997	BPB Publication, New Delhi
(ii)	-	Autocad Reference Manual 2004	-	2004	Autodesk

MANDAL`S
POLYTECHNIC

SHRI VILEPARLE KELVANI
SHRI BHAGUBHAI MAFATLAL

PART TIME

DISCIPLINE: MECHANICAL ENGINEERING.
batch admitted june 2008 (progressive)

w.e.f.

SEMESTER: SIXTH
from the academic term: DEC-09/JAN- MAY 10

fective

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION			
			L	P	D	T	Cr	NP	HR S	Mks	SSL	Theory paper	T/W	Pr
1	Manufacturing process	ME-39	2	3	-	-	5	1	3	100	20	80	50	-
2	# Automation & CAD-CAM	ME-06	2	2	-	-	4	1	3	100	20	80	25	-
3	Industrial Engg.	ME-86	2	2	-	-	4	1	3	100	20	80	25	-
4	# Industrial Management - I	ME-01	3	0		-	3	1	3	100	20	80	-	-
5	Automobile Engg.	ME-68	2	2	-	-	4	1	3	100	20	80	25	-
	TOTAL		11	9	-	-	20	-	-	-	100	400	125	-
			Total periods 20								Total marks = (775)			

- Diploma Award Subject.

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: III
3.3 Manufacturing Processes (ME-39)	Duration: 16 Weeks
Group : Core (C*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term Work	Oral	Total
		Hrs	No. of Paper	Marks						
2	3	5	3	1	100	80	20	50	50	200

(3) RATIONALE

A product industry comprises of machines. Number of processes being carried out on different machines. They have different principles of working. To go to an industry it is essential to know how these machines work and help in producing different products.

(4) OBJECTIVES

- (i) The students will be able to understand how a machine works and what operations can be carried out on it.
- (ii) They will be able to handle the machine and work on it efficiently.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours
SECTION – I			
(01)	Lathe Machine	24	06
	1.1 Introduction and working principle		
	1.2 Classification specification and alignment test		
	1.3 Study of various operations done on lathe with use of various accessories, methods of taper turning, screw cutting, lathe tool geometry, tool materials, speed & feeds & factor affecting them.		

Practical Sheets:

	(i) One job of eccentric turning		
	(ii) One job of external V and square threading, taper turning knurling, shoulder cutting, chamfering and centering		
(02)	Capstan and Turret Lathe	16	04
	2.1 Classification, specification, working comparison with other lathe.		
	2.2 Work holding, tool holding devices like		
	(a) Straight cutter holder		
	(b) Adjustable/ Plain angle cutter holder		
	(c) Multiple cutter holder		
	(d) Offset Cutter holder		
	(e) Combination tool holder		
	(f) Knee tool holder		
	(g) V steady box tool holder		
(03)	Shaper & Planer	26	04
	3.1 Constructional details, specifications & alignment tests, operation performed		
	3.2 Different methods of work holding		
(04)	Slotting Machines	16	02
	4.1 Constructional details specifications & alignments		
	4.2 Operations performed		
	4.3 Work holding devices		
	Total	<hr style="width: 100%; border: 0.5px solid black; margin-bottom: 5px;"/> (82)	(16)

SECTION – II

(05)	Milling Machine	32	06
	5.1 Introduction and classification of milling machines		
	5.2 Constructional details		
	5.3 Milling methods & different milling operations		
	5.4 Study of different types of cutters, elements of milling cutter		
	5.5 Use of dividing head		
	5.6 Different methods of indexing		
(06)	Drilling and Boring Machines	30	06
	6.1 Classification and construction of various operations performed on them		
	6.2 Twist drill nomenclature, its material and methods of holding on machine		

(07)

20

04

Broaching and sawing Machines

7.1 Introduction, type of broaching and sawing m/cs

7.2 Constructional details of broach

7.3 Advantages and limitations of broaching

7.4 Specification and selection of saw blades

(82)

(16)

Total

(6) PRACTICALS

Sr. No.	Title	Hours
(i)	Turning jobs with	
	(i) 'V' threading tapering Internal 'V' threading and straight turning, step turning	16 Hrs.
	(ii) square threading, Tapering Straight turnings	16 Hrs.
	(iii) eccentric turnings	16 Hrs.
	Total	48 Hrs.

(7) IMPLEMENTATION STRATEGY (PLANNING)

- (i) Lectures and practical jobs
- (ii) Charts and handouts
- (iii) Slide showing for milling
- (iv) Showing of different types of broaches

(8) REFERENCE BOOKS

Sr No	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	S.K.Hajara Chaudhary A.K.Hajra Chaudhary	Workshop Technology Vol-II	9 th	1997	Media promoters and publishers Ltd, New Delhi
(ii)	B.S.Raghuvanshi	Workshop Technology Vol-II	9 th	1997	Dhanpatrai & Co. New Delhi
(iii)	W.A.J.Chapman S. J. Martin	Workshop Technology Vol-1,2,3	5 th (Indian)	1998	Viva Books Pvt. Ltd., NewDelhi

AUTOMATION & CAD CAM

1) SUBJECT DETAILS

COURSE: MECHANICAL ENGINEERING

SEM: VI

CODE: ME-06

DURATION: 16 WEEKS

GROUP: APPLICATION (A)

compulsory

2) TEACHING & EXAMINATION SCHEME

Teaching Scheme		Credits	Examination Scheme & Maximum Marks							
Theory (Hrs/Week)	Practical (Hrs/Week)		Paper			Theory	Sessional Marks	Term Work	Practical/ Oral	Total
		Hrs	No. of paper	Marks						
2	2	4	3	1	100	80	20	25	25	150

3) RATIONAL:

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. The prerequisites of this subject have been introduced in earlier subject such as engineering graphics, engineering drawing & mechanical engineering drawing.

4) OBJECTIVES:

Student should be able to:

1. Understand the fundamentals & use of CAD,
2. Conceptualize drafting and modeling in CAD,
3. Prepare APT part programming.
4. Conceptualize automation and FMS
5. Knowledge of advanced pneumatic circuits.

5) CONCEPT THEORY

Section-1

1-introduction

1.1 Definition of automation

marks hours

Th Pr

08 02 03 -

1.2 Types of automation

1.3 Reason for automation

1.4 Arguments for and against automation

2-Production operations

10 02 02

2.1 Manufacturing industries

2.2 Types of production

2.3 Functioning in manufacturing

2.4 Organization and information processes in manufactory

2.5 Automation strategies

Practical: 1 to study the production operation.

3-Programmable logic control (PLC)

24 04 04 -

3.1 plc hardware

3.2 PLC compared with other control system

3.3 basics of plc programming

3.4 data controls

3.5 plc sequencer and shift registers

3.6 timers and counters

Practical : plc programming

4-Types of automated production systems

16 03 04

4.1 Automated flow lines

4.2 Methods of work part transport

4.3 Automation for machinery operations.

4.4 General terminology and analysis.

4.5 analysis of transfer lines

Practical: 1-Assignment on production system.

5-Automated assembly system

Material handling & storage system.

24 05 04

5.1 Types of automated assembly systems

5.2 Parts feeding devices.

5.3 automated guided vehicle systems

5.4 quantitative analysis of agv systems

5.5 automated storage /retrieval systems

5.6 quantitative analysis of AS/RS systems

Practical: Assignment on automated assembly line.

Section 2

6-Industrial robotics 16 03
 04
 6.1 Introductions
 6.2Physical configuration
 6.3Basic robot motion
 6.4 Technical features such as –work, volume, preciation
 And speed of movement, weight carrying capacity
 6.5End effectors
 6.6Robot sensors
 6.7Application of robotics
 -material transfer, machine loading, welding, spray coating,
 Processing operation, assembly, inspection
Practical: 1Report writing on visit to industry having robot &
 Its inspection
 2 practical on pick place robot

7-Flexible manufacturing systems, 16 03
 02
 7.1What Is FMS
 7.2FMS workstations
 7.3Computer control systems
 7.4Planning FMS
Practical: Assignment on FMS

8-Qulity control & automated inspection 16 03 02
 8.1Inpection and testing
 8.2Sensors technologies for automated inspection
 8.3Machine vision
 8.4Optical inspection methods
 8.5Noncontacted inspection methods
Practical: Assignment on quality control & automated inspection

9- Computer aided design 18 03 04
 9.1 the design process
 9.2 applications of computer in design process
 9.3 cad hardware
 9.4 geometrical modeling techniques
 A wire frame modeling
 B surface modeling
 C so;id modeling
 9.5 software modules

Practical: Assignment on CAD

10 Computer integrated manufacturing 18 4 04

- 10.1 computer aided manufacturing
- A manufacturing planning
 - B Manufacturing control
 - C computerized elements of CIM system
- 10.2 computerized manufacturing planning systems
- A computer aided process planning
 - B computer integrated productin planning systems
 - C material requirements planning
 - D capacity Planning
- 10.3 Shop floor control and automatic identification techniques
- A shop floor control
 - B Factory data collection systems
 - C Automatic identification techniques
 - D bar code technology
 - E automated data collection systems
- 10.4 Computer networks for manufacturing
- 10.5 future automated factory
- Practical: assignment on CIM
- 6) IMPLEMENTATION STRATEGY (PLANNING)**
1. Writing teaching plan
 2. Demonstration of models,
 3. Fcilitating industrial visit.

7) BOOKS FOR REFERENCE

Sr.no.	Name & year of publication	Title	Name of author	Edition
1	Prentice Hall of India Pvt Ltd, 1998	Automation , production systems , and CIM	Mikell groover	1998
2	PHI Learning Private Limited New delhi	Programmable Logic Control	NIIT	2008
3	Prentice Hall of India Pvt Ltd, 1996	Programmable logic controll	John W Webb	2008
4	Prentice Hall of India Pvt Ltd, 2003	Cad/cam	Mikell groover	2003
5	New age International ltd	CAD/CAM/CIM	P radhakrishnan	12003
6	Prentice Hall of	CAD/ CIM	N. Nageshwara	2007

	India Pvt Ltd, 1998	Principles & Application	Rao	
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(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: III
3.6 Industrial Engineering (ME-86)	Duration: 16 Weeks
Group : Application (A)	Optional

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term Work	Prac - tical/	Total
		Hrs	No. of Paper	Marks						
2	2	4	3	1	100	80	20	25	-	125

(3) RATIONALE

Industrial engineering plays a vital role in increasing the productivity. Various Ind. Engg. Techniques are used to analyze and improve the work methods to eliminate waste, proper allocation & utilization of resources. Ind. Engg. is a profession in which a knowledge of mathematical & natural science gained by study, experience & practice is applied with judgment to develop the ways to utilize economically the materials, other natural resources and forces of nature for the benefit of mankind.

(4) OBJECTIVES

- (iii) To make them understand the concept of Industrial engineering.
- (iv) To make them understand the relationship between production and productivity.
- (v) To make them understand how work study technique helps to improve production and productivity.

(vi) To make them understand the basic wages and incentive schemes.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours
SECTION – I			
(01)	Introduction 1.4 History and contribution of Ind. Engg., activities objectives of Industrial Engineering. 1.5 Techniques of Ind. Engg.	08	02
(02)	Production and Productivity 2.1 Introduction, concept, benefit 2.2 Relationship between production and productivity 2.3 Productivity measures. Practical /s (i) Assignment on production and productivity	08	02
(03)	Work Study 3.1 Introduction, work study procedure 3.2 Work study and management, supervisor, worker 3.3 Concept of work content 3.4 Techniques to reduce excess work content Practical /s (i) Assignment on total work content	16	03
(04)	Method Study 4.1 Introduction, objective, steps involved in method study 4.2 Selection of job 4.3 Recording technique 4.4 Critical examination 4.5 Development & selection of new method 4.6 Micro-motion study 4.7 Cyclegraph, chrono-cyclegraph 4.8 Principles of motion economy Practical /s (i) Assignment on procedure of method study (ii) Assignment on recording technique (iii) Assignment on micro-motion study	45	08
(05)	Introduction to Ergonomics 5.1 Objectives, applications	05	01
Total		(82)	(16)

SECTION – II

(06)	Work Measurement 6.1 Introduction 6.2 Techniques of work measurement 6.3 Elements of time study 6.4 Performance rating 6.5 Allowances 6.6 Computation of standard time 6.7 Work sampling 6.8 P.M.T.S. Practical /s (i) Assignment on techniques of work measurement (ii) Assignment on calculation of standard time	40	08
(07)	Job Evaluation & Merit Rating 7.1 Introduction, objectives, procedure 7.2 Job evaluation system - Ranking method, factor comparison method, merit rating Practical /s (i) Assignment on job evaluation and merit rating	16	03
(08)	Wages and Incentives 8.1 Introduction 8.2 Types of wage payments 8.3 Incentive schemes Practical /s (i) Assignment on wages and incentives	16	03
(09)	Process Mapping 9.1 Concept of BPR 9.2 Flexible manufacturing system Practical /s (i) Assignment on BPR and FMS	10	02
	Total	(82)	(16)

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by using

- (v) Teaching Plan
- (vi) Use of Charts, models and transparencies
- (vii) Use of other teaching methods such as case study , group discussion, etc

(7) REFERENCE BOOKS

Sr No	Author	Title	Editio n	Year of Publication	Publishers & Address
(i)	I.L.O.	Work - Study	4 th	1994	Universal Pub. Corpn., 534, Kalbadevi Rd, Mumbai-400 002
(ii)	Ralph M. Barnes	Motion & Time Study Design and Measurement of works	7 th	1981	Dhanpatrai & Co. New Delhi
(iii)	Marvin E. Mundel	Motion & Time Study	6 th	1998	Prentice Hall of India, New Delhi
(iv)	Martand Telsang	Industrial Engg. & Production Management	2 nd	2002	S. Chand & co. 7361, Ram Nagar New Delhi-55

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1. SUBJECT DETAILS :

Course : mechanical	Semester : IV Duration :16 Weeks
4.6Subject : Industrial Management - I	Code : ME-01
Group : Compulsory	Compulsory

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory Hrs. Per Week	Practical Hrs. Per Week		Paper			TH	Sessional	T/W	Pract.	Total
		Hrs.	Np	Mks						
03	-	03	03	01	100	80	20	-	-	100

3. RATIONALE :

Management is the process of getting work done through work force to achieve the objectives of the organization. This subject “Industrial Management-I” covers the fundamentals principles, objectives, process and various processes and activities of management.

Along with attaining the necessary technical knowledge, the technical students also require some inputs in management areas so as to enable them to carry out their work effectively and efficiently.

This subject will enable the students to understand various processes and activities in an industrial organization.

4. OBJECTIVES :

1. To understand the process of formation and promotion of Industry/Organization.
2. To understand the necessary Management/ Supervisory skills required by the technical students.
3. To know the basic principles of Supervision.
4. To understand the Basics of Quality Management, Maintenance & Industrial Safety.
5. To understand the principles and practices in Human Resources Management.

5. DETAILED CONTENTS :

SECTION-I

Chapter	Content	Marks	Hours
1.	Introduction to Indian Industry 1.1 Meaning - Definition 1.2 Classification of Industry 1.3 Location of Industry 1.4 Importance of Industry 1.5 Resources for Industry	15	06
2.	Types of Ownership of Industry 2.1 Proprietorship 2.2 Partnership 2.3 Private Ltd Company 2.4 Public Ltd Company 2.5 Co-operative Enterprises 2.6 Public Sector Enterprises	17	04

3.	Supervisor & Supervision	20	06
	3.1 Introduction		
	3.2 Role of Supervisor in an organization		
	3.3 Responsibilities of supervisor		
	3.4 Quality of Supervisor		
	3.5 Skills of Supervisor		
	3.6 Functions of Supervisor		
4.	Leadership	15	04
	4.1 Meaning and Nature		
	4.2 Qualities of good leaders		
	4.3 Types of leadership		
	4.4 Supervisors role as leader		
5.	Motivation	15	04
	5.1 Meaning		
	5.2 Needs and expectations Workmen		
	5.3 Types of Motives: Primary & Secondary Motives		
	5.4 Affiliation motive, power motive and achievement motive.		
	5.5 Role of supervisor in motivating the workmen		
		82	24

SECTION – II

6.	Industrial Training	16	04
	6.1 Need and Importance of training.		
	6.2 Methods and Techniques of training.		
	6.3 Training and Development of manpower.		
	6.4 Supervisor as a Trainer.		

7.	Maintenance 7.1 Need for Maintenance of Machinery. 7.2 Types of Maintenance. 7.3 Maintenance and Productivity. 7.4 Role of Supervisor in shopfloor maintenance.	16	04
8.	Quality Management 8.1 Meaning, Purpose. 8.2 Areas of application and scope. 8.3 T.Q.M. 8.4 ISO and its application.	16	04
9.	Industrial Safety 9.1 Meaning and Importance. 9.2 Accidents – Causes of Accidents. 9.3 Effects of Accidents. 9.4 Prevention of Accidents. 9.5 Safety devices and system.	16	06
10.	Industrial Relations 10.1 Meaning and Importance. 10.2 Types of Industrial Relations. 10.3 Industrial disputes – Causes. 10.4 Methods and machinery for resolving industrial disputes. 10.5 Trade union – Its role in maintaining industrial peace.	18	06
		82	24

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	T.R.Banga and S.C. Sharma	Industrial Organization & Engineering Economics	10 th	2001	Khanna Publication
(ii)	O.P.Khanna	Industrial	5 th	1988	Ganpat Rai

		Management			
(iii)	T.R. Banga & S.C. Sharma	Industrial Organization & Management	19 th	2003	Khanna Publication
(iv)	K.C.Jain L.N.Agarwal	Production Planning Control & Industrial Management	7 th	1989	Khanna Publication
(v)	Giridhar Gyani	Training Manual on ISO 9000 and TQM	7 th	1997	Raj Publishing House, Jaipure.

(1) SUBJECT DETAILS

COURSE: MECHANICAL ENGINEERING

SEMESTER: VIth

AUTOMOBILE ENGINEERING

Code – ME - 88

Duration: 16 weeks

Group: APPLICATION (A)

OPTIONAL

(2) TEACHING AND EXAMINATION SCHEME

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs. Per Week)	Practical's (Hrs. Per Week)		Paper			Theory	Sessional Marks	Term Work	Practical	Total
			Hrs	No. Of Paper	Marks					
02	02	05	03	01	100	80	20	25	25	150

(3) RATIONALE

Automobile engineering. A technology subject has applications of various subjects taught earlier. All the major global players in automobile sector have launched their product in India. Automobile sector has major employment potential for diploma holders. Automobile servicing in particular offers good job opportunities as village, town & city level. This course in Automobile Engineering will make student understand & apply the knowledge about various system, subsystems & their inter-relationships.

(4) OBJECTIVE

Student will learn about automotive market in India. They will be able to identify and explain construction and working of various automotive systems and subsystems. Students will learn to carry out maintenance and performance testing of vehicle.

(5) DETAILED CONTENTS

SECTION - I

Sr.No.	Contents	Marks	Th (hrs)
01	Introduction To Automobiles 1.1 constructional features of different types of engines used in automobiles Their characteristics. 1.2 Study of various engine components and their materials. 1.3 Classification of automobiles. 1.4 Vehicle layout and types. 1.5 Body construction-types and nomenclature of car body, Introduction to aerodynamic body shapes. 1.6Automobile market in India of “on road vehicles”, major manufacturers, their	20	04

	products and their collaboration.		
02	<p>Automobile transmission</p> <p>2.1 Clutch-necessity, construction and working of coil spring and diaphragm spring type clutch.</p> <p>2.2 Gear Box-Tractive effort and Tractive resistance, types of G.B., Construction and working of constant mesh G.B. and synchromesh G.B., epicyclic G.B., Torque converter, over drive, transfer case.</p> <p>2.3 Final drive-Necessity, construction and working of propeller shaft and differential.</p> <p>2.4 Axle-type of rear axles, front axles and their applications</p> <p>Practical/s</p> <p>(i) Study and demonstration of single plate coil clutch and diaphragm spring type clutch.</p> <p>(ii) Study and demonstration of Synchromesh gearbox.</p> <p>(iii) Study and demonstration of differential.</p>	35	7
03	<p>Control system</p> <p>3.1 Steering system- Requirement of steering system, Construction and working of steering linkage, Steering gear box- Construction and working of rack and pinion and re-circulating ball type gearbox. Introduction to power steering, Steering geometry-camber, caster, toe-in, toe-out, kingpin inclination and their effects.</p> <p>3.2 Break system-construction and working of hydraulic and pneumatic brakes, Comparison of discs and drum brake.</p> <p>Practical/s</p> <p>(i) Study and demonstration of Rack and pinion steering gearbox.</p> <p>(ii) Study and demonstration of hydraulic brake system.</p>	27	5
TOTAL		82	16

Section II

Sr.No.	Contents	Marks	Th (hrs)	Prac (hr)
04	<p>Suspension System, Wheels and tyres</p> <p>4.1 Necessity and classification of suspension system.</p> <p>4.2 Working and construction of leaf spring, rigid axle suspension.</p> <p>4.3 Introduction to air suspension.</p> <p>4.4 Construction and working of McPherson and Wishbone trailing link suspensions.</p> <p>4.5 Construction and working of telescopic shock absorbers.</p> <p>4.6 Construction and working of spoked wheel, disc wheel and light alloy cast wheel.</p> <p>4.7 Types of rims, their construction and working.</p> <p>4.8 Construction, working and comparison of radial, cross-ply and tubed, tubeless tyre and tyre specifications.</p> <p>4.9 Factors effecting tyre life.</p>	27	05	

	4.10 Wheel alignment and balancing. Practical/s (i) Study and demonstration of rigid axle suspension.			02
05	Automobile Electrical System and Body 5.1 Battery-working, construction and rating of battery. 5.2 Ignition-system, construction and working of electronic and CDI ignition system. 5.3 Starting system-construction and working of starting motor. 5.4 Charging system-construction and working of alternator. 5.5 Wiring system-harnessing and colour codes. 5.6 Lighting system-head light, tail light, indicator light and their circuits. 5.7 Gauges, construction and working of fuel level gauge, oil gauge and water temperature gauge. 5.8 Use of microprocessor in automobile control system. Practical/s (i) Testing of battery and charging system.	35	7	02
06	Vehicle Testing and Maintenance 6.1 Need of vehicle testing, Vehicle tests standards, Different vehicle tests. 6.2 Maintenance- Trouble shooting and Service procedures, Overhauling-engine tune up. Tools and equipments for overhaul and repair. 6.3 Organization and management of service station, Testing equipments. 6.4 Pollution due to vehicle emissions, exhaust emission control system and regulations. Practical/s (i) Carrying out preventive maintenance of four wheeler as per manufacturer's specifications. (ii) Carrying out preventive maintenance of two wheeler as per manufacturer's specifications. (iii) Study of LPG/CNG kit retrofitting. (iv) Visit to four wheeler service station and any automobile manufacturing unit.	20	04	04 04 02 08
Total		82	16	22

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by adopting the following strategy. (Teaching plan)

- i) Lesson plan.
- ii) Use of charts, models and transparencies.

- iii) Use of actual devices.
- iv) Visit to automobile manufacturing unit and service station.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of publication	Publisher & Address
01	William Crouse	Automotive Mechanics			McGraw hill publishing company New York, U.S.A.
02	Dr. Kripal Singh	Automobile Engineering Vol .I And II			Standard publications.
03	Joseph Heitner	Automotive Mechanics..	II	1967	Affiliated Eastern Law House.
04	K.K.Jain and R,B.Asthana	Automobile Engineering			Tata McGraw hill publishing company limited, New Delhi- 110063
05	G.B.S.Narang	Automobile Engineering			Tata McGraw hill publishing company limited, New Delhi- 110063

MANDAL`S

POLYTECHNIC

SHRI VILEPARLE KELVANI

SHRI BHAGUBHAI MAFATLAL

PART-TIME

**DISCIPLINE: MECHANICAL ENGINEERING.
w.e.f. batch admitted june 2008 (progressive)**

SEMESTER: SEVENTH
effective from the academic term: DEC-09/JAN- MAY 10

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION		
			L	P	D	T	Cr	NP	HRS	Mks	SSL	Theory paper	T/W
1	# Modern Production Processes	ME-97	2	2	-	-	4	1	3	100	20	80	25
2	# Design of Machine Element	ME-97	3	3	-	-	6	1	4	100	20	80	50
3	# Production Management	ME-78	2	2	-	-	4	1	3	100	20	80	25
4	Mathematics - IV	MA-45	3	-	-	1	4	1	3	100	20	80	-
5	Mechanical Measurements & Control	ME-69	2	2	-	-	4	1	3	100	20	80	25
6	Industrial Management-II	ME-02	3	-	-	-	3	1	3	100	20	80	-
	TOTAL		15	9	-	1	25	-	-	-	120	480	125
			Total periods (25)								Total marks = (825)		

- Diploma Award Subject.

SUBJECT DETAILS

Course: Mechanical Engineering	Semester:VI
Modern Production Processes (ME- 87)	Duration : 16 Weeks
Group: Core (C*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme	Credits	Examination Scheme & Maximum Marks
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Theory (Hrs/Week)	Practical (Hrs/Week)		Paper			Theory	Sessional Marks	Term Work	Practical/ Oral	Total
			Hrs	No. of papers	Marks					
2	2	4	3	1	100	50	50	50	50	200

(3) RATIONALE:

From last few decades engineering industries have witnessed a rapid growth in the development of harder & difficult to machine materials such as carbides, stainless steel, nimonics, heat resisting steels etc. For such material conventional machine is uneconomical and degree of accuracy and surface finish attainable are poor. So it is the need for the development of process concepts in metal machining.

(4) OBJECTIVE:

- (1) Students will be able to understand the different metal finishing process.
- (2) Student will be able to understand the grinding process, sheet metal process, gear manufacturing & thread manufacturing process.
- (3) Student will be able to operate grinding machine, milling machine, press tool.
- (4) Student will be able to understand the principle of unconventional machining process.
- (5) Student will be able to write part program using G – code.

SECTION –I

CHAPTER	CONTENTS	MARKS	HOURS
(1)	Metal finishing process	10	02
(1.1)	Metal spraying, Oxidizing, Tumbling		
(1.2)	Honing, Lapping, Burnishing, Polishing		
(2)	Grinding	25	05
(2.1)	Introduction to Grinding Process		
(2.2)	Types of Grinding Machines		
(2.3)	Grinding Wheel		
(2.4)	Bonds & Bonding Process		
(2.5)	Grit, Grade & structure of Grinding Wheel		
(2.6)	Wheel shape & sizes		
(2.7)	Selection of Grinding Wheel		
(2.8)	Standard marking system of Grinding Wheel		
(2.9)	Mounting of Grinding Wheel		
(2.10)	Balancing of Grinding Wheel		
(2.11)	Truing & Dressing of Grinding Wheel		
(3)	Sheet Metal Work	17	04
(3.1)	Introduction to Press Tool		
(3.2)	Shearing action & operations		
(3.3)	Classification of Dies & its various elements		
(3.4)	Drawing & Draw Die design		
(3.5)	Bending, Types of Bending Dies, Bending length & force calculation		

(4)	Numerical Control/ Computerized Numerical Control	30	05
(4.1)	Introduction		
(4.2)	NC & its components		
(4.3)	Position & Motion control in NC machines		
(4.4)	NC system		
(4.5)	Tool positioning modes		
(4.6)	NC part programming		
(4.7)	N- code, G- code, M- code		
(4.8)	Elementary exercise on part programming		

SECTION –II

(5)	Gear manufacturing	30	04
(5.1)	Introduction		
(5.2)	Gear cutting on milling machine		
(5.3)	Dividing head & Indexing methods		
(5.4)	Simple Indexing		
(5.5)	Compound Indexing		
(5.6)	Gear Hobbing		
(5.7)	Gear shaping		
(5.8)	Gear finishing process		
(6)	Thread Manufacturing	15	03
(6.1)	Introduction		
(6.2)	Tread chasing		
(6.3)	Thread milling		
(6.4)	Thread rolling		
(7)	Modern Machining Methods	20	05
(7.1)	Introduction		
(7.2)	Principle ,Advantages, Limitations & Application of Electro chemical machining / Grinding Electro discharged machining / wire cut EDM Ultrasonic machining Leaser beam machining Electro beam machining Plasma arc machining Abrasive jet machining		
(8)	Plastic Moulding	17	04
(8.1)	Introduction		
(8.2)	Types of plastics		
(8.3)	Compression Moulding		
(8.4)	Injection Moulding		
(8.5)	Blow Moulding		
(8.6)	Extrusion		

(7) PRACTICALS:

- (i) A job on tool grinding

- (ii) A composite job comprising different machining operation.
- (iii) A job on thread cutting.

(8) REFERENCE BOOKS:

Sr.No	Author	Title	Edition	Year Of publication	Publishers & Address
(i)	S.K. Hajara Choudhary A.K. Hajara Choudhary	Workshop technology Vol-II	14 th	2007	Media promotors & publisher ltd. New Delhi
(ii)	B.S. Raghuvanshi	Workshop technology Vol-II	9 th	1997	Dhanpatrai & Co. New Delhi
(iii)	W.A.J.Chapman	Workshop technology Vol-I, II, III	3 rd	1998	Viva Books Pvt.Ltd. New Delhi Mumbai
(iv)	B.S.Pabla M.Adithan	CNC Machines	1 st	1994	New Age International Pvt.Ltd Daryaganj New Delhi.

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VII
7.2 Machine Design Practice (ME- 95)	Duration: 16 Weeks
Group : Application (A*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral	Total
			Hrs	No of paper	Marks					
3	3	6	4	1	100	80	20	50	25	175

(3) RATIONALE

The product produced will be used under different conditions such as overload, cold climate, excessive heat, exposed to moisture from atmospheres. The product has to sustain these conditions and work efficiently. Different types of stresses are developed during production. The product has to withstand different type of stresses. The failure of the product will lead to loss of life of the users. The subject deals with designing of the product to withstand these variations.

(4) OBJECTIVES

The students will able :

- (i) to identify different types of stresses.
- (ii) to identify different types of load acting.
- (iii) to select proper raw material.
- (iv) to suggest ideal manufacturing process.

(5) DETAILED CONTENTS

Chapter	Content	Marks	Hours
	SECTION-I		

(01)	Introduction 1.1 Introduction to design 1.2 Types of loads and stresses acting on machine components & examples 1.3 Material specifications and selection 1.4 Elastic stress, yield stress, ultimate stress and design stress & factor of safety, consideration in deciding safety factor 1.5 Simple problems	12	04
(02)	Design of Joints 2.1 Design of cotter joint 2.2 Design of knuckle joint Practical/s (i) Design of rod joints	16	04
(03)	Design of Shafts 3.1 Shafts, axle and spindles 3.2 Design of shafts subjected to torsion alone 3.3 Design of shafts subjected to torsion and bending 3.4 Line shafts	16	04
(04)	Design of Coupling 4.1 Classification and application 4.2 Design of single and split muff couplings 4.3 Design of flange couplings 4.4 Selection of flexible coupling Practical/s (i) Design of shaft coupling	16	06
(05)	Design of Bearing 5.1 Selection of bearings from handbook	10	02
(06)	Design of Springs 6.1 Types of springs, classification and application 6.2 Design of helical compression and tension springs, torque and deflection equations, Wahl's stress factor, end connections	12	04

Total

SECTION – II

(07)	Design of Power Screws 7.1 Power screw profiles & designation, application and selection 7.2 Design of simple power screws and screw jacks	16	04
	Practical/s (i) Design of power screws		
(08)	Design of Lever 8.1 Design of hand and foot levers 8.2 Design of bell crank levers	16	04
(09)	Design of Machine Parts Subjected to Eccentric Loading 9.1 Direct stresses and bending stresses 9.2 Design of offset links & C-frames	12	04
(10)	Design of Bolted Joints 10.1 Types of bolts and locking arrangements 10.2 Types of gaskets and applications 10.3 Bolted joints subjected to eccentric loading	12	04
	Practical/s (i) Design of composite assignment consisting of above topics such as Shafts, Springs, Brackets, Bolts, Levers, etc.		
(11)	Design of Welded Joints 11.1 Types of welded joints, advantages and practical applications 11.2 Size of weld and strength of welded joints 11.3 Welded joints subjected to bending and torsion 11.4 Welded joints subjected to eccentric loading	10	04
(12)	Design of Gears 12.1 Types of gears, terminology and applications 12.2 Design of spur gears & simple gear calculations & Lewi's formula 12.3 Mounting of gears	16	04
	Practical/s (i) Design of gear drive		
	Total	<hr/>	<hr/>
		(82)	(24)

(6) IMPLEMENTATION STRATEGY (PLANNING)

- (i) Students are made conversant with use of design standards and handbooks. Term work consists of designs and preparation of working drawing of simple machines.**

Practical examination :

consists of an oral based on theory and term work.

- (ii) Teaching Plan**

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	R.S. Khurmi & J.K. Gupta	Machine design	7 th	2004	Eurasia Publishing House Pvt Ltd., 7361, Ramnagar, New Delhi, Anand 398 001
(ii)	N.C. Pandya & C.S. Shah	Elements of machine design	6 th	1983	Charotar Publishing Opp. Amul Dairy, Anand 388 001
(iii)	M.F. Spott	Design of machine elements	5 th	1978	Prentice Hall of India Private Limited New Delhi 110 001

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VII
7.4 Production Management (ME- 78)	Duration: 16 Weeks
Group : Management (M*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral	Total
			Hrs	No of paper	Marks					
2	2	4	3	1	100	80	20	25	25	150

(3) RATIONALE

Today's organisation has to accommodate new product, volume changes, new technologies and management philosophies due to changing environment. There is a constant pressure to improve all work processes to meet the demands of changing environment.

Production Management plays a pioneering role as a change agent in the organisation as system integrators with strong mathematical, statistical, technical and management background.

(4) OBJECTIVES

- (i) To make the student understand concept of production system and production management
- (ii) To make the students understand effective utilization of the various resources required for production & service facilities available to produce the product.
- (iii) To make them able to work effectively on the shop floor.
- (iv) To make them understand the advanced productivity techniques.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours
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SECTION – I

(01.) 16 05

General

1.1 Production

1.2 Departments and functions

1.3 Inter-relationship

Practical/s

(i) Assignment on working of a company

(02.) 50 14

Design of Production System

2.1 Production system

2.2 Types of production

2.3 Plant location

2.4 Plant layout – their types

2.5 Tools & techniques of plant layout

2.6 Product design and development

2.7 Break even analysis

2.8 Standardization, simplification & specialization

2.9 Make buy decision

Practical/s

(i) Assignment on production system

(ii) Assignment on plant layout

(iii) Assignment on Product design and development

(03.) 16 05

Material Handling

3.1 Introduction

3.2 Principle of material handling.

3.3 Material handling equipment

Practical/s

(i) Assignment on Material Handling System

(82) (24)

Total

SECTION – II

(04.) 65 19

Planning and Control

4.1 Production, planning & control

- 4.2 Sales forecasting
- 4.3 Scheduling
- 4.5 PERT & CPM
- 4.6 Linear programming
- 4.7 Assignment models
- 4.8 Sequencing models

Practical/s

- (i) Assignment on production, planning and control
- (ii) Assignment on PERT & CPM
- (iii) Assignment on linear programming
- (iv) Assignment on assignment and sequencing models

(05)

17

05

Inventory Control

- 5.1 Elements of control procedure
- 5.2 Inventory control system, types
- 5.3 EOQ, safety stock
- 5.4 ABC analysis
- 5.5 Just in time

Practical/s

- (i) Assignment on inventory control system

(82)

(24)

Total

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by using

- (i) Teaching Plan
- (ii) Use of Charts, models and transparencies
- (iii) Use of other teaching methods such as case study, group discussion etc.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	Eilon Samuel	Elements of Production Planning & Control	-	1989	Universal Pub. 534, Kalbadevi Rd Mumbai-400 002
(ii)	Elwood S. Buffe Rakesh K.Sarin	Modern Production Operation Management	8 th	1987	John Witey & Sons INC., 605,3 rd

					Avenue, New York
(iii)	Hamdy A. Taha	Operation Research	6 th	2000	Prentice Hall of India Pvt.Ltd New Delhi-110 001
(iv)	V.K.Kapoor	Operation Research	7 th	2001	Sultan Chand & Sons, 23, Daryaganj New Delhi-110 002
(v)	Martand Telsang	Industrial Engineering & Production Management	2 nd	2002	S.Chand & Co. 7361, Ram nagar, New Delhi 110055

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: IV
4.4 Advanced Mathematics (MA-45)	Duration: 16 Weeks
Group : A	Optional

(2) TEACHING AND EXAMINATION SCHEME

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Tutorial (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral	Total
		Hrs	No of paper	Marks						
03	-	4	3	1	100	80	20	-	-	100

(3) RATIONAL

Advance Mathematics is classified as basic science subject which comprises the facts, concept and principles of mathematics. These can be applied to solve problems in civil, mechanical and plastic engineering courses.

(4) OBJECTIVES

- (i) The student will be able to evaluate integrals with the help of definition, formulae, methods and theorems.
- (ii) Student will evaluate problems with the help of definition and properties of definite integral and reduction formulae.
- (iii) The student will be able to represent complex no. as Argands Diagram. Using algebra of vectors student will be able to find work done by a force, moment of a force about a point. Area of triangle. Volume of parrallelopiped.
- (iv) The student will solve simultaneous equation by using matrices.

(5) DETAILED CONTENTS

Chapter	Content	Marks	Hours
	SECTION I		
(01)	Application of Definite Integrals 1.1 Length of the arc 1.2 Area 1.3 Volume 1.4 Centre of gravity 1.5 Moment of inertia	42	16
(02)	2.0 Complex Numbers 2.1 De Moivre's Theorem 2.2 Roots of a complex number 2.3 Circular and hyperbolic functions of complex numbers relation between them. 2.4 Separation of real & imaginary part of a complex no.	42	16
	SECTION – II		
(03)	3.0 Laplace Transformation 3.1 Introduction, Definition 3.2 Laplace transforms of elementary functions $1, t^n, e^{at}, \sin(at), \cos(at)$	24	12
(04)	3.3 Properties of Laplace transforms 3.4 Inverse Laplace transforms 3.5 Transform of derivatives and integrals 4.0 Differential Equation 4.1 Formation of differential equation 4.2 Differential Equation of first order and first degree 4.3 Differential equation of higher order with constant equation coefficients such as $f(D)y = X$ where $X = e^{ax}, \sin(ax + b), \cos(ax + b), x^m, e^{ax} V,$	60	20

where,

V is a function x.

4.4 Applications of differential equation

(6) IMPLEMENTATION STRATEGY (PLANNING)

Lectures are conducted as per teaching plan and conducting tutorials.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	Dr.B.S. Grewal	Higher Engineering Mathematics	35 th	2000	Khanna Publisher, 2/B Delhi 110006
(ii)	S.P. Deshpande	Mathematics for Polytechnic Students –II	1 st	1998	Vidyarthi Graha Prakashan, Pune
(iii)	B.M. Patel J.M. Patel	Applied Mathematics	7 th	2002	Nirali Prakashan, Mumbai

(1) SUBJECT DETAILS

Course: Diploma in Mechanical Engineering

Semester: VIth

Subject: Mechanical Measurement & Control

Code – ME - 69

Group: A

Optional

(2) TEACHING AND EXAMINATION SCHEME

Teaching Scheme	Credits	Examination Scheme and Maximum Marks
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Theory (Hrs. Per Week)	Practicals (Hrs. Per Week)		Paper			Theory	Sessional Marks	Term Work	Pract/oral	Total
			Hrs	No.Of Paper	Marks					
03	02	05	03	01	100	80	20	25	25	150

(3) RATIONALE

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

(4) OBJECTIVE

Student will be able to:

1. Understand the principle of operation of an instrument.
2. Appreciate the concept of an instrument.
3. Select suitable measuring device for a particular application.
4. Distinguish between various types of errors.

(5) DETAILED CONTENTS

SECTION -I

Sr.No.	Contents	Hours	Marks
01	<p>Significance of measurement, classification of instruments, static terms and characteristics –range and span, accuracy and precision, reliability, calibration, hysteresis and dead zone, drift, sensitivity, threshold and resolution, repeatability, and reproducibility, linearity. Dynamic error, overshoot. Measurement of error- classification of errors, environmental errors, signal transducers:</p> <p>Classification of transducers-active and passive, resistive, inductive, capacitive, piezo, resistive, thermo resistive specification, selection and application for pressure, temperature, flow ,humidity displacement, velocity, force, strain sound.</p> <p>Practice : A report of the following experiments performed in the laboratory.</p> <ol style="list-style-type: none"> 1. Displacement measurement by inductive transducer. 	8	36
02	<p>Control systems Block diagram of automatic control system, closed loop system, open loop system, feed back control system, feed forward control system, servomotor mechanism, comparison of hydraulic, pneumatic, electronic control system proportion control action.</p> <p>Practice: A report of the following experiments performed in the laboratory.</p> <ol style="list-style-type: none"> 1. Speed measurement by using stroboscope/magnetic/inductive pick up. 	4	30

03	<p>Displacement measurement Potentiometer, LVDT, eddy current Generation type, speed measurement- Mechanical tachometer, revolution counter & timer, slipping clutch tachometer, electrical tachometer, and contactless electrical tachometer.</p> <p>Practice: A report of the following experiments performed in the laboratory. 1. Displacement measurement by inductive transducer.</p>	4	16
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Section II

Sr.No.	Contents	Hours	Marks
04	<p>Temperature measurements- Non-electrical methods-bimetal and liquid in glass thermometer, pressure thermometer electrical methods-RTD, platinum resistance thermometer, thermistor. Thermoelectrical methods-elements of thermocouple, law of intermediate temperature, law of intermediate metals, thermo emf measurmnt.</p> <p>Practice: A report of the following experiments performed in the laboratory. 1. Temperature control using thermal reed switch & bimetal switch.</p>	4	20
05	<p>Flow measurements- Variablehead flow meters, variable area meter-rotameter, Strain Measurement- Stress-relation, types of strain gauges, strain gauge materials, resistance strain gauge-bonded and unbounded, types (foil, semiconductor, wire wound gauges).</p> <p>Practice: A report of the following experiments performed in the laboratory. 1. Measurement of flow by using rotameter.</p>	7	36
06	<p>Miscellaneous Measurement Humidity measurement –hair hygrometer, humisor hygrometer Liquid level measurement –direct and indirect methods Force measurement-Tool Dynamometer (Mechanical type) Shaft Power Measurement –Eddy Current Dynamometer, Strain Gauge Transmission dynamometer. Practice: A report of the following experiments performe in the laboratory. 1. Measurement of force & weight by using a load cell. 2. Liquid Level Measurement by using Capacitive Transducer system.</p>	5	26

(6) IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan

2. Lesson Plan
3. Use Of Models, Charts.

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Publisher & Address
01	A.K.Sawney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi.
02	R.V.Jalgaonkar	Mechanical Measurements & Control	Everest Publishing House, Pune.
03	D.S.Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi.
04	C S.Narang.	Instrumentation Devices & systems	Tata McGraw hill publications.
05	R.K.Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi.
06	B.C Nakra and K.KChaudhary	Instrumentation, Measurement and Analysis.	Tata McGraw hill publications.

1. SUBJECT DETAIL'S:

COURSE: ALL DECIPLINES	SEMESTER: VII
SUBJECT: INDUSTRIAL MANAGEMENT – II	CODE:ME-02
COUMPULSORY:-M*	

2. TEACHING & EXAMINATION SCHEME:

Teaching Scheme	Credits	Examination Scheme & Maximum Mark's
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Theory Hrs Per Wk	Practical Hrs. Per Wk		Paper			TH	Sessional Marks	T/W	Pract	Total
			Hrs	N/P	Mks					
03	-	03	03	01	100	80	20	-	-	100

3. RATIONALE:

Management is the process of getting work done through work force to achieve the objectives of the organization. This subject "Industrial Management" covers the fundamentals principles, objectives, process and the various activities of the management. Along with attaining the necessary technical knowledge, the technical students also require some inputs in management areas so as to enable them to carry out their work effectively and efficiently. This subject will enable us to understand various process and activities in an industrial organization.

- 4. OBJECTIVES:**
1. To know the process of management
 2. To understand the organizational structure and its importance
 3. To know the various functional areas of an organization
 4. To understand the basics of costing and finance
 5. To understand the various functions of marketing
 6. To enable the students applying basic principles of management in their work life
5. DETAILED CONTENT:

SECTION-I

CHAPTER	CONTENT	MARKS	HOURS
01	MANAGEMENT 1.0 Introduction to management 1.1 Meaning, definition & importance 1.2 Relevance of management to engineers 1.3 Principles of management	12	05
02	FUNCTIONS OF MANAGEMENT 2.0 Functions of management 2.1 Planning organizing 2.2 Directing, communicating 2.3 Motivating & co-ordinating 2.4 Controlling	15	04
03	ORGANIZATIONAL STRUCTURE 3.0 Meaning, types & factors determining structure 3.1 Line organization 3.2 Functional organization 3.3 Line & staff organization 3.4 Project based organization	15	05
04	PROCUREMENT 4.0 Purchase procedures 4.1 Types of purchase 4.2 Principles of purchase 4.3 inventory & inventory control 4.4 Duties of store keeper	15	04
05	HUMAN RESOURSE MANAGEMENT 5.0 Importance of human resource to industry 5.1 Recruitment, selection & placement of man power 5.2 Employee welfare measures in industry 5.3 Training & development 5.4 Self management	25	06

	5.5 Time management		
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SECTION-II

CHAPTER	CONTENT	MARKS	HOURS
06	MARKETING 6.0 Importance of marketing 6.1 Sales & marketing – Difference 6.2 Product life cycles & marketing strategies 6.3 Channels of distribution 6.4 Packaging & advertising 6.5 Export marketing	15	05
07	FINANCE 7.0 Sources of finance 7.1 Working capital & fixed capital 7.2 Financial statements of the company 7.3 Financial ratios 7.4 Budgets & budgetary control	20	06
08	COST & COST CALCULATION 8.0 Objectives of cost calculation 8.1 Classification of costs – bases 8.2 variable & fixed cost 8.3 Direct & indirect cost 8.4 Functional costs 8.5 Cost control & cost reduction 8.6 Overheads & types of overheads 8.7 Cost calculation of a product 8.8 Break even analysis	25	06
09	DEPRECIATION 9.0 Meaning & importance 9.1 Causes of depreciation 9.2 Methods of calculation of depreciation 9.3 Machine replacement – factors to be considered	10	03
10	TIME VALUE OF MONEY 10.0 Equivalence 10.1 Simple & compound interest 10.2 Present worth method 10.3 Future worth method 10.4 Sinking fund method 10.5 Capital recovery method	12	04

BOOKS RECOMMENDED:

AUTHOR	TITLE	PUBLISHER
1. T.R.Banga & S.C.sharma	Industrial organization & engineering economics	Khanna publication
2. O.P.Khanna	Industrial management	Ganpat rai
3. K.C.Jain & Agarwal	Production planning & Industrial management	Khanna publication

**SHRI VILEPARLE KELVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL**

POLYTECHNIC

PART TIME

**DISCIPLINE: MECHANICAL ENGINEERING.
admitted june 2008 (progressive)**

w.e.f. batch

**SEMESTER: EIGHTH
from the academic term: JULY- NOV.2011**

Effective

TECHNICAL & EXAMINATION SCHEMES

Sr no	SUBJECT	SUBJECT CODE	SCHEME OF INSTRUCTIONS & PERIODS PER WEEK					NO. OF PAPERS, DURATION & MARKS			SCHEME OF EXAMINATION				
			L	P	D	T	Cr	NP	HRS	Mks	SSL	Theory paper	T/W	Pract.	
1	# Tool design & process planning	ME-77	2	3	-	-	5	1	3	100	20	80	50		
2	# Metrology & quality control	ME-05	2	2	-	-	4	1	3	100	20	80	25	50	
3	# Project & Seminar	ME-80	-	3	-	-	3	-	-	-	-	-	50		
4	Mechatronics	ME-88	2	2	-	-	4	1	3	100	20	80	25		
5	World class Manufacturing practices	ME-89	2	2	-	-	4	1	3	100	20	80	25		
6	Refri & Air Conditioning	ME-98	3	2	-	-	5	1	3	100	20	80	25	50	
	TOTAL		11	14	-	-	25	-	-	-	100	400	200	100	
			Total periods (25)									Total marks = (925)			

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VII
7.5 Tool Design and Process Planning (ME- 77)	Duration: 16 Weeks
Group : Application (A*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral	Total
		Hrs	No of paper	Marks						
2	3	5	3	1	100	80	20	50	25	175

(3) RATIONALE

With an advent of technology there are many advances in manufacturing processes and equipments. Knowledge of conventional tools and working on them with the help of jigs and fixtures for holding the work piece and guiding the tools is very important in production engineering and Process Planning is used for the production of a part or product. So, it is the linkage between product design and product manufacturing which will help to reduce manufacturing time, cost and scope for interchangeability of components.

(4) OBJECTIVES

- (i) The students will be able to design the jigs and fixtures for different components
- (ii) The student will be able to design a press tool for a given component
- (iii) The student will be able to write a process sheet

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours
	SECTION – I		
(01)	Tool Design 1.1 Introduction 1.2 Objective 1.3 Economics 1.4 Analysis of small tool costs	12	03
(02)	Cutting tool design 2.1 Metal cutting principles 2.2 Cutting tools selection 2.3 Chip formation 2.4 Tools wear	15	03
(03)	Work Holding 3.1 Principle 3.2 Locating principles 3.3 Work Piece Surface 3.4 Types of locations 3.5 Degree of Freedom 3.6 Basic locating Rules 3.7 Location Tolerances 3.8 Fool Proofing 3.9 Types of locator 3.9.1 Clamping Principles	<hr/> 22	<hr/> 04

		<hr/>	
	3.9.2 Types of clamps		
(04)	Jig Design	23	04
	4.1 Principles		
	4.2 Developing Preliminary jig design		
	4.3 Drill jigs		
	4.4 Types of drill jigs		
	Practicals		
	1 – Design and drawing of drill jig		
(05)	Plastic Moulds	10	02
	5.1 Introduction		
	5.2 Types		
	5.3 Basic Elements		
		Total	
		82	16
	SECTION – II		
(06)	Fixture design	22	05
	6.1 Principles		
	6.2 Developing Preliminary fixture design		
	6.3 Types of the fixture		
	Practicals		
	Design and drawing of fixture		
(07)	Press Working	<hr/> 30	<hr/> 07
	7.1 Power Presses		
	7.2 Cutting Operations		
		<hr/>	<hr/>

	7.3 Die & punch design for bending, forming & drawing die	
	7.4 Design for progressive die	
	Practicals	
	1 – Design and drawing of punch & die for bending, forming & Drawing	
	2 – Design and drawing of progressive die	
(08)		30 04

Process planning

8.1 Introduction

- 8.2 Role of process planning engineer
- 8.3 Steps to process planning
- 8.4 Time data, equipment & tooling to the sequence process
- 8.5 Factors influencing process selection
- 8.6 Process chart
- Practicals
- 1 –Construction of process planning Sheet for the given job

Total	82	16
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(6) IMPLEMENTATION STRATEGY (PLANNING)

- (i) Lectures/(Use of OHP)
- (ii) Fabrication projects on jig, fixtures and press tools
- (iii) Design of jig fixture and press tools
- (iv) Hand outs and part prints for the above topics
- (v) Teaching Plan

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	Donald Eary & Gerald Johnson	Process Engineering	-	1962	Prentice Hall Eagle Wood Cliff New Delhi-110 001
(ii)	Cyril Donaldson Frank Wilson	Tool Design	27 th	2000	Prentice Hall Eagle Wood Cliff New Delhi-110 001

(iii)	P. H. Joshi	Jigs & Fixtures	10 th	1984	Tata Mcgraw Hill, New Delhi
(iv)	M. H. Kempster	Introduction to jig & tool design	-	-	Viva Book Pvt. Ltd. Pune
(v)	Vukota Boljanovic	Sheet Metal Forming Processes & Die Design	-	-	Industrial Press Inc. Newyork
(vi)	P. C. Sharma	Production Engineering	-	-	S. Chand

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VII
7.1 Metrology & Quality Control (ME- 05)	Duration: 16 Weeks
Group : Application (A*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term-Work	Practical/Oral	Total
		Hrs	No of paper	Marks						
2	2	4	3	1	100	80	20	25	25	150

(3) RATIONALE

The mechanical engineering technician often comes across measuring various parameters of machined components and the appropriate fitment of interchangeable components in assemblies. For the above purpose he/she is also required to analyze the quantitative determination of physical magnitude and ensure the control of quality.

The different methods and instruments which can be used for linear and angular measurements, geometrical parameters (like surface finish, square ness, parallelism, roundness, etc.) and the use of gauges and system of limits, fits, tolerances, etc. are often required to be dealt in detail by diploma technician on the shop floor. He/she isalso required to analyze, interpret and present the data collected graphically & statistically for ensuring the quality.

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

(4) OBJECTIVES

It develops understanding of construction, working and use of different measuring instruments. It develops understanding of selection of appropriate instruments for specific measurements. It also develops understanding of different statistical quality control tools used to improve quality of product.

(5) DETAILED CONTENTS

Chapter	Contents	Marks	Hours	
			Theory	Practical
SECTION – I				
(01)	Introduction To Metrology	06	01	-
	1.1 Definition of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology			
	1.2 Need of inspection			
	1.3 Concepts of Precision Accuracy, Sensitivity, Readability, Traceability, Reproducibility.			
	1.4 Sources of errors, Factors affecting accuracy, Selection of instruments, Precaution while using instruments for getting higher precision and accuracy			
	Practical/s			02
	i. Study and use of Vernier Caliper			02
	ii. Study and use of Screw Micrometer			02
	iii. Study and use of Vernier Depth Gauge			02
	iv. Study and use of Depth Micrometer			01
	v. Study and use of Inside Micrometer			

(02)	Standard of measurements 2.1 Definition and introduction and comparison - line standard, End standard and wavelength standard comparison 2.2 Slip gauge and its accessories, Length bars.	06	01	-
(03)				
Comparators				
3.1 Definition, requirement of good comparator.				
3.2 Working principles of comparators, Use of comparators, Dial indicator , Johansson Mikrokator ,Sigma Comparator, Pneumatic comparator, Electrical, Electronic comparators.				
3.3 Advantages and Disadvantages				
Practical/s				
(i) Study and use of Mechanical Comparator				
(ii) Study and use of Dial Micrometer				
(iii) Study and use of Dial Bore Gauge				
(04)				
Angle Measuring Instruments				
4.1 Concept of angle measurement, instruments for angle measurement				
4.2 Working and use of Bevel Protractor, Sine Bar, Spirit Level, Sine Centre, Clinometrer, Angle Gauges, Autocollimator				
Practical/s				
(i) Study and use of Bevel Protractor				

(ii) Use of Sine Bar

(05)	Limits, Fits, Tolerances and Limit Gauges	08	02
	5.1 Concept of Limits, Fits, Tolerances.		
	5.2 Interchangeability and Selective Assembly.		
	5.3 Hole and Shaft basis system		
	5.4 Taylor's Principle of gauge design		
	5.5 Design of plug and ring gauges		
(06)	Metrology of Screw Threads	10	02
	6.1 Errors in threads, pitch errors		
	6.2 Measurement of elements such as major dia. Minor dia. Effective dia. Pitch and angle for external threads. (Two wire method, three wire method, thread micrometer, floating carriage micrometer)		
	Practical/s		
	i To find the major diameter, minor diameter, pitch and angle of thread on tool maker's microscope.		02
	ii Study of Screw Pitch Micrometer		01
(07)	Gear Measurement	5	03
	7.1 Analytical and functional inspection, Rolling Test, Measurement of tooth thickness, gear tooth vernier.		
	7.2 Errors in gears such as backlash run out, Composite		01
	Practical/s		
	(i) Study of gear tooth vernier		

(08) 08 01

Measurement and Surface Finish

- 8.1 primary and secondary texture, sampling length, Lay, ClA, Ra, RMS, Rz, values and their interpretation
- 8.2 Various techniques of qualitative analysis, working principle of stylus probe instruments such as Tomlinson surface meter

(09) 10 01

Measurement and Testing

- 9.1 testing straightness- Wedge method, use of spirit level and autocollimator.
 - 9.2 Testing flatness - use of spirit level/ Autocollimator, use of optical flat
 - 9.3 Square ness testing – Indicator Method, Use of Optical Square
 - 9.4 Tool Maker’s microscope 01
 - 9.5 Profile projector
- Practical/s**
i use optical flat to inspect flatness of slip gauges

Total 82 16 23

SECTION II

(10) **Quality Control** 14 04

- 10.1 Measuring of Quality, Quality Control.
 - 10.2 Inspection stages, comparison between inspection and quality control
 - 10.3 Meaning of quality of design, quality of conformance, quality of performance, factors affecting them
 - 10.4 Cost of quality, value of quality, optimum Quality of design.
 - 10.5 Concept of reliability/
 - 10.6 Quality assurance
 - 10.7 Vendor Ratings, Vendor quality ratings
-

(11)

14 04

Total Quality Management

- 11.1 Principles of TQM – customer focus, commitment by top management, continuous improvement- PDCA, quality circles, employ empowerment (JIDOKA)
- 11.2 Quality audit – concept of audit practices, lead Assessor certification.
- 11.3 Six Sigma – statistical meaning, methodology Of system improvement, DMAIC cycle, Yellow belt, green belt, black belt certification.

(12)_

06 02

ISO 9000 Series and other standards

- 12.1 Concept, ISO 9000 series quality standards.
- 12.2 QS 14000, standards in general its evaluation and implications, necessity of ISO certification
- 12.3 Other quality systems.

(13)

38 11

Statistical Quality Control

- 13.1 Meaning and importance of SQC
- 13.2 Variable and attribute measurement, chance and assignable causes of variation.
- 13.3 Frequency Histogram, Polygon, Bar Chart.
- 13.4 Normal distribution curve – characteristics, uses, process capability, capable and incapable process, possible relations of process in control with USL and LSL, Cp, Cpk.
- 13.5 Control chart for variables – X and R chart (calculations of trial control limits, revised control limits, interpretation and conclusion)
- 13.6 Control Chart for attributes – P chart, np Chart c chart (calculations of trial control limits, revised control limits, interpretation and conclusion.)
- 13.7 Pareto analysis, cause and effect diagram, Scatter diagram.

Practical/s

- i Quality control by statistical methods. Plotting the charts from given data.

01
02
02

(a) Frequency Histogram.	02
(b) Normal distribution curve	02
(c) Control Chart for average and range	02
(d) Control chart for fraction defectives	02
(e) Control chart for no. of defectives	

(14)

10 03

Acceptance sampling

- 14.1 Concept, comparison with 100% inspection
- 14.2 Type of sampling plans, merits and demerits
- 14.3 Operating characteristic curve- importance, Significance, producers risk, consumers risk, AQL, IQL, LTPD, AOQL.

82 16 09

TOTAL

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the the subject will be implemented by adopting the following strategy. (teaching plan)

- (i) Lesson Plan
- (ii) Use of charts, models and transparencies.
- (iii) Use of actual devices

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
(i)	R.K. Jain	Engineering Metrology	12 th	2005	Khanna Publishers, 2B-Nath Market, Delhi-06
(ii)	I.C. Gupta	Engineering Metrology	13 th	2002	Dhanpatrai & Sons
(iii)	M.S. Mahajan	Statistical Quality Control	16 th	2002	Dhanpatrai & Sons 1682, Nai Sarak, Delhi
(iv)	Grant Leavenworth	Statistical Quality Control	2 nd	1988	Tata McGraw Hill Book Co. Singapore
(v)	J.M. Juran	Quality Planning & Analysis	3 rd	1995	Tata McGraw Hill 4/12 Asat Ali Road New Delhi-02
(vi)	Besterfield, Dale H.	Total Quality Management	3 rd		Prentice Hall, New Delhi

(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VII
7.6Project (ME -79)	Duration: 16 Weeks
Group : Application (A*)	Compulsory

(2) TEACHING AND EXAMINATION SCHEMES

Teaching scheme		Credits	Examination Scheme and Maximum Marks		
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Term-Work (project report)	Presentation & Oral	Total
0	3	3	50	50	100

(3) RATIONALE:

The diploma engineers have to face problems related to drawing / design of assembly/ machine processes, installation, testing, etc. To solve such problems, they should develop systematic approach and the same will be induced in them.

4) OBJECTIVE:

Project develops the ability to visualize the problems related to design and drawing, assembly testing, etc. They have to develop a prototype or model of a project etc. It can be an advanced analysis. The group project work develops skills and attitude to work in teams specially when the nature of work is project based.

5) SELECTION PROCESS:

- 1) Selection of topic from the group of topics by a group of students(not more than 8)
- 2) Detailed discussion with HOD / Sr. staff / other staff members who will guide.

3) Submitting of synopsis of it along with all details including financial requirements

6) IMPLEMENTATION STRATEGY(Planning)

- 1) Study of objectives of the project
- 2) Data collection and design calculations (as applicable)
- 3) Drawings of Sub-assembly/ assembly
- 4) Procurement of raw material/s
- 5) Machining
- 6) Assembly
- 7) Testing

7) References covering the following points:

- 1) Data Collection
- 2) Information from Industries
- 3) Use of reference Books
- 4) Use of Data books like borings / shafts / steels / section, etc.
- 5) Use of standards.

(1) SUBJECT DETAILS

Course: Mechanical Engineering

Semester: VIth
Duration: 16 weeks
Code – ME - 88

Mechatronics

Group:

Elective

(2) TEACHING AND EXAMINATION SCHEME

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs. Per Week)	Practicals (Hrs. Per Week)		Paper			Theory	Sessional Marks	Term Work	Practical	Total
			Hrs	No.Of Paper	Marks					
02	02	04	03	01	100	80	20	25	25	150

(3) RATIONALE

Mechatronics is an exciting interdisciplinary field of engineering based on Mechanical Engineering, Electronics Engineering, Controls Engineering & Computer Engineering, which deals with advanced hybrid systems, Electro-Pneumatic systems, Electro-Hydraulic systems, Softwares, Microprocessors, Programmable Timers to create useful products & to improve productivity.

(4) OBJECTIVE

It develops understanding of the study of automata from an engineering perspective & serves the purpose of controlling the advanced hybrid system. This helps to understand mechatronics system in industries business & home automation.

(5) DETAILED CONTENTS

SECTION - I

Sr.No.	Contents	Hours	Marks
01	Introduction to mechatronics, Definition, Mechatronics systems in factory, business & home automation. Overview of Microprocessor, Microcontroller & Microcomputer system.	04	25
02	Introduction to Sensors, Transducers & Actuators Principle, working and application of – Limit switches, proximity switches like inductive, capacitive and optical (deflection and touch beam type), Thumb wheel switches magnetic reed switches, optical encoders-displacement, measurement, rotary, incremental, opto-couplers. Actuators – 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	04	27
03	8085 & 8086 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,LBD,I/O device, ADC,DAC etc.	05	20
Sr.No.	Contents	Hours	Marks
04	8051 Microcontroller- Architecture, Pin configuration, working of microcontroller and applications. Applications Comparison of microprocessor and microcontroller, advantages and disadvantages.	03	10

Section II

Sr.No.	Contents	Hours	Marks
05	Selection of a PLC programming equipment, Programming formats Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions. Register basics timer functions, counter functions. Intermediate functions – Arithmetic functions, number comparison and number conversion functions. Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions, FIFO and LIFO functions, File Arithmetic and logic function.	10	30
06	Introduction to Automatic control systems – Open loop and Close loop systems. Servo mechanism, process control system. Positive and Negative feedback.	02	20
07	ONS and CLR functions and their applications PLC digital bit functions and applications. Sequencer functions and cascading of sequencers. PLC matrix functions Discrete and analog operation of PLC, Networking of PLCs. PLC auxiliary commands and functions.	02	20

08	Online, Offline, Stop/run modes of operations. Uploading/ Downloading between PLC and PC, Introduction to SCADA and DCS	02	12
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05) List of Practical –

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

(6) IMPLEMENTATION STRATEGY (PLANNING)

In depth study and understanding of the subject will be implemented by adopting the following strategy. (Teaching plan)

- i) Lesson plan.
- ii) Use of charts, models and transparencies.
- iii) Use of actual devices.
- iv) Visit to manufacturing unit .

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Publisher & Address
01	Bolton W.	Mechatronics – Electronic control system in Mechanical and Electrical Engineering	Pearson Education Ltd.
02	Histand B.H. and Alciatore D.G.	Introduction to Mechatronics and Measurement system.	Tata McGraw Hill
03	John W. Wrbb and Ronald Reis	Programmable Logic controllers..	Prentice Hall of India.
04	NIIT	Programmable Logic control- Principles and Applications.	Prentice Hall of India
05	Mahalik N.P.	Mechatronics principles, concepts and applications.	Tata McGraw Hill
06	Fawceett J.R.	Pneumatic circuits and low cost automation	-----

07	Gaonkar R.S.,	Microprocessor Architecture, programming and applications with 8085	Wiley Eastern Ltd.
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(1) SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VI
Subject : World class manufacturing system	Duration: 16 Weeks
Group : Optional	Code-89

(2) TEACHING AND EXAMINATION SCHEMES

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral	Total
		Hrs	No of paper	Marks						
2	2	4	3	1	100	80	20	25	25	150

3) RATIONALE

The term world class manufacturing is popularly used to denote a standard of excellence. World class manufacturing is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful and thus target for elimination. World class manufactures are the one that possess the knowledge and technology to produce the product and services of continually improving quality.

(4) OBJECTIVES

The students will be able to :

- Explain the importance of lean manufacturing.
- Describe 5 's' and its implementation steps.
- Describe value added and non-value added work.
- Describe T.P maintenance implementation.
- Explain how kanban reduce waste.
- Describe and compute takt time.

(5) DETAILED CONTENTS

Chapter	Content	Marks	Hours
SECTION-I			
		05	2
1	Lean manufacturing		
1.1	Introduction to lean		
1.2	Need principles		
1.3	Implementation	20	3
2	5 –‘S’		
2.1	Introduction		
2.2	Need for 5 ‘S’		
2.3	Implementation		
	PRACTICALS		
	1)study of 5 ‘S’		
		16	2
3	Value stream mapping (material and information flow mapping)		
3.1	Introduction		
3.2	Implementation		
3.3	Value stream mapping tools like		
	a) process activity mapping		
	b)product variety funnel mapping		
	c)quality filter mapping		
	d) forrester effect mapping		
	e)decision point analysis		
	PRACTICALS		
	1)study of value steam mapping tools		

4	Total productive maintenance	16	03
4.1	Introduction		
4.2	Implementation		
4.3	Types of maintenance		
	PRACTICALS		
	study of total productive maintenance		
		15	03
	Manufacturing /Office cells OR Group Technology		
5.1	Introduction		
5.2	Design		
	a) process design b)Product design		
	practicals-		
	1)Study of group technology		
6	Kanban	12	03
6.1	Introduction		
6.2	Implementation		
6.3	Types		
	a)production kanban b) Withdrawal kanban		
	Practicals		
	1)Study of kanban		
	SECTION - 2		
07	Setup reduction	18	03
	Introduction to SMED		
	Implementation		
	Tools		
7.1	a)Visual control b) checklist		
	c)Quick fastners d) standaridize Die hight		
	e) locating pins f) Stoppers etc		
7.2	Practicals –		
	Study of SMED		
7.3			
08	Kaizan	16	03
	introduction		
8.1	implementation		

8.2	Practicals 1)Study of kaizen		
09	Six sigma	20	03
9.1			
9.2	Introduction		
9.3	Sigma levels		
	Methods-		
	1)dmaic		
9.4	2)dmadv		
	Implementation		
	Practicals		
	1)Study of six sigma		
10	. Lean simulation	10	02
	Intriduction		
10.1	Benefits		
10.2	Practicals		
	1)Study of Lean simulation		
11	Lean Techniques	22	03
	West indentification		
11.1	Mistake proffing/POKA –YOKE		
11.2	Takt time		
11.3	Visual workplace		
11.4	Practicals		
	1)study of lean techniques		

(6) IMPLEMENTATION STRATEGY (PLANNING)

- (iii) Use of charts,models& transparencies**
- (iv) Teaching Plan**
- (v) Industrial visits**

(7) REFERENCE BOOKS

Sr. No.	Author	Title	Publishers & Address
(i)	Katsundo hitomi	Manufacturing system engg	Viva book pvt ltd pune
(ii)	Jeffery K.Liker David Meier	The Toyota Way field book	Tata Mc Grew Hill Publishing Comp Ltd
(iii)	R C Mishra& k pathak	Maintainance Engineering Management	Prentice Hall of India Private Limited New Delhi 110 001

SUBJECT DETAILS

Course: Mechanical Engineering	Semester: VII
7.3 Subject :- Refrigeration and Air Conditioning	Code :- ME-98
Group : Application (A*)	
	Compulsory

Teaching Scheme		Credits	Examination Scheme and Maximum Marks							
Theory (Hrs Per Week)	Practical (Hrs Per Week)		Paper			Theory	Sessional Marks	Term- Work	Prac- tical/ Oral	Total
			Hrs	No of paper	Marks					
3	2	5	3	1	100	80	20	25	50	175

3) RATIONALE:

RAC is inflect with the process of cooling and heating by removing and adding heat to and from the space. It is a scope of application lies in railways, theaters, hospitals, domestic application, industries, aircraft and rockets etc. Because of ozone depletion, which is global problem, special attention has been given on this subject.

4) OBJECTIVE:

- In refrigeration
- 1) Students will learn about old and CFC free refrigerants along with their properties.
 - 2) Students will well-versed with refrigeration machines- vapour compression and vapour absorption.
 - 3) Students will learn modern refrigeration system and practices
 - 4) Students will be able to calculate the capacity of RAC machine
 - 5) Students will understand basics of liquification of gases

- In Air conditioning**
- 1) Students will learn about psychrometric properties and processes
 - 2) Students will get acquainted with A/C machines like, window A/C, package A/C, central A/C and their application.
 - 3) Students will learn modern A/C systems.
 - 4) Students will be able to design A/C system for rooms or building.

(5) Detailed Contents:

SECTION- I

Sr No	Topic	Marks	Period
(1)	Refrigeration Cycle- (a) Reverse carnot cycle. (b) Reverse Brayton or Bell Coleman cycle. (c) Vapour compression cycle. Air refrigeration system. (d) Vapour absorption cycle. (e) COP, TR, sub cooling, superheating (f) Refrigeration of these cycles on P-V, T-S & P-H diagrams (g) Actual VCR system. (h) Refrigeration plants. (i) CEC & Star Rating of refrigerator (j) Introduction of modern refrigeration system.	36	8
	Practicals: (k) Study of vapour compression refrigeration system (l) Study of vapour absorption refrigeration system (iii) Performance of refrigeration test rig.		
(2)	Refrigerants (a) Primary Refrigerants, CFC free refrigerants, Azeotropes, Properties (b) Secondary Refrigerants NaCl, CaCl ₂ , chilled water. (c) Corrosion inhibitors (d) Eco-friendly Refrigerants (e) Ozone depletion, green house effect.	10	5

(3)	<p>(f) Refrigerant recovery system</p> <p>Component of vapor compression refrigeration system</p> <p>(a) Compressor hermetically sealed reciprocatory, rotary, screw Scroll compressor</p> <p>(b) Capacity control of compressor.</p> <p>(c) Lubricant oil, oil separator.</p> <p>(d) Condenser-types, cooling tower-types</p> <p>(e) Evaporator-types.</p> <p>(f) Expansion devices-capillary tube, automatic expansion valve T.E.V, high and low side float valve.</p> <p>(g) Component selection.</p>	20	5
(4)	<p>Low temperature refrigeration (numerical, no derivation)</p> <p>(a) Cascade refrigeration system</p> <p>(b) Manufacture of dry ice.</p> <p>(c) Liquefactions of gases, hydrogen, helium.</p> <p>(d) Lined system, Claude system.</p>	16	6

SECTION- II

Sr.No.	Topic	Marks	Period
(5)	<p>Air conditioning system.</p> <p>Psychometric properties, process.</p> <p>(a) Factors affecting human comfort.</p> <p>(b) Application of split A/C, package A/C, multisplit A/C , year Round A/C, VRF, chiller system, MAC system, VAV system</p> <p>(c) Heat pump and heat recovery system.</p> <p>(d) Cooling load calculation</p> <p>(e) SHF, BPF.</p> <p>(f) Problems of load calculations of different field.</p> <p>Practicals:</p> <p>(a) Study of window air conditioner</p> <p>(b) Study of package and split A/C.</p> <p>(c) Field load calculation.</p> <p>(d) Study of domestic refrigeration</p> <p>(e) Study of water cooler.</p> <p>(f) Study of ice plant/ cold storage.</p> <p>(g) Performance of heat pump Trainer.</p>	36	11
(6)	<p>Distribution system.</p> <p>(a) AHU, duct system.</p> <p>(b) Air distribution system and air circulation.</p> <p>(c) Pressure in ducts, simple numerical (no derivation)</p>	20	6
(7)	<p>Food preservation</p> <p>(a) Causes of food spoilage</p> <p>(b) Methods of food preservation.</p>	08	02

- (8) **Controls** 10 3
 (a) Electrical and Electronic & digital
 (b) Refrigerant feed control, temperature control.
 (c) Defrosting method.
 Scada -working and application.
- (9) **Air conditioning equipments** 08 2
 (a) Air cleaner, air filter, dehumidifier, humidifier.
 (b) Fans and Blowers, grills and registers.

6) IMPLEMENTATION STRATEGY

- a) Teaching plan
 b) Periodical test
 c) Charts
 d) Continuous assessment of term work

7) Reference books

Sr. No.	Author	Title	Edition	Year of Publication	Publishers & Address
i)	S.C. Arora S. Domkundwar	Refrigeration & A/C	5th	1996	Dhanpatrai & Sons 1682, Nai Sarak, Delhi
ii)	C.P.Arora	Refrigeration & A/C	2 nd	2000	Tata McGraw Hill 4/12 Asat Ali Road New Delhi-02
iii)	P.N.Anantnarayan	Refrigeration & A/C	2 nd	1996	Tata McGraw Hill 4/12 Asat Ali Road New Delhi-02
iv)	R.S.Khurmi	Refrigeration & A/C	2 nd	2000	Tata McGraw Hill 4/12 Asat Ali Road New Delhi-02
v)	W.F. Stoecker & J.W.Jones	Refrigeration & A/C	-	-	Tata McGraw Hill 4/12 Asat Ali Road New Delhi-02
vi)	Norman.C.Harris	Modern Refrigeration & A/C practice	-	-	Wiley Eastern publications
vii)	R.J.Dossat	Principle of Refrigeration	-	-	Wiley Eastern publications

