MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

CURRICULUM & TERM WORK:

ADVANCE DIPLOMA IN TOOL

&

DIE MAKING

W. E. F. 2020-21

CONTENTS

Sr. No	Particulars	Page No.
1.	Introduction	1
2.	Program Educational Objectives	2
3.	Program Outcomes	2
4.	Sample Attributes Of Tool & Die Engineer	3
5.	Tool & Die Making Training Program Includes	3
6.	Core Curriculum Areas	4
7.	Curriculum Structure	4
8.	Teaching & Examination Scheme	7

FIRST SEMESTER

A1-01	COMMUNICATION SKIL	16
A1-02	ENGINEERING MATHEMATICS - I	19
A1-03	APPLIED SCIENCE - I	23
A1-04	ENGINEERING DRAWING - I	28
A1-05	WORKSHOP PRACTICE - I	34
A1-06	WORKSHOP TECHNOLOGY - I	39
A1-07	ELECTRICAL & ELECTRONICS	43
A1-08	COMPUTER APPLICATIONS	47

SECOND SEMESTER

A2-01	ELECTRICAL & ELECTRONICS (WORKSHOP)	53
A2-01	ENGINEERING MATHEMATICS-II	58
A2-03	APPLIED CHEMISTRY	61
A2-04	MACHINE DRAWING	65
A2-05	APPLIED MECHANICS	71
A2-06	WORKSHOP PRACTICE – II	76
A2-07	WORKSHOP TECHNOLOGY & METROLOGY	80

THIRD SEMESTER

A3-01	THEORY OF MACHINES & MECHANISMS	87
A3-02	STRNGTH OF MATERIALS	92
A3-03	ADVANCE MANUFACTURING PROCESSES	96
A3-04	TOOL & DIE MAKING – PRACTICE-I	100
A3-05	TOOL & DIE MAKING TECHNOLOGY	103
A3-06	ENGINEERING MATERIAL & PROCESS	107
A3-06	COMPUTER AIDED DRAFTING (AUTOCAD)	110

FOURTH SEMESTER

A4-01	CNC TECHNOLOGY & PROGRAMMING	115
A4-02	TOOL & DIE MAKING PRACTICE - II	121
A4-03	DESIGN OF JIGS AND FIXTURES - I	123
A4-04	DESIGN OF PRESS TOOLS - I	128
A4-01	DESIGN OF MOULDS - I	132
A4-06	C PROGRAMMING	139
A4-07	DESIGN OF CUTTING TOOLS	148

FIFTH SEMESTER

A5-01	CNC MACHINING	152
A5-02	TOOL & DIE MAKING PRACTICE - III	157
A5-03	DESIGN OF JIGS AND FIXTURES - II	160
A5-04	DESIGN OF PRESS TOOLS - II	165
A5-05	DESIGN OF MOULD - II	170
A5-06	MACHINE DESIGN WITH ADVANCE CAD	177
A5-07	INDUSTRIAL ENGINEERING & QUALITY SYSTEMS	181

SIXTH SEMESTER

A6-01	ENTREPRENEURSHIP DEVELOPMENT	186
A6-02	CNC MACHINING & AUTOMATION	190
A6-03	COMPUTER AIDED MANUFACTURING	194
A6-04	TOOL & DIE MAKING	198
A6-05	DESIGN OF MOULD - III	200
A6-06	DESIGN OF DIE CASTING DIES	205
A6-07	DESIGN OF FORGING DIES	212
A6-08	PRODUCATION PLANNING, ESTIMATING & COSTING	217

MSME TECHNOLOGY CENTRE, BHOPAL

OUTCOME BASED CURRICULUM: ADTDM

I. INTRODUCTION

This course focuses on tool & die technology by emphasizing mechanical engineering, production engineering and computing. Conceiving, utilizing, maintaining and upgrading tool & die techniques, machineries, equipment, tooling's and systems will require this knowledge. Also required will be an understanding of the synergies and trade-offs at the interfaces between the tool & die techniques in system and subsystem level that the devices and systems contain. Design projects at levels I & II of the course facilitate integration of knowledge gained in the three years for the projects during last year.

MISSION:

a. Providing consultancy to industrial units for effective use of tools, jigs, fixtures & gauges and guidance regarding their procurement or manufacturing.
b. Designing & manufacturing of tools, jigs, fixtures, moulds, dies and dies and gauges based on drawing prepared by Tool Room or made available by the customer.
c. Carrying out individual machining jobs (job orders) relating to tools, jigs, fixtures, moulds, dies and gauges etc. manufactured by customers or private Tool Rooms themselves, as well as related technical services (e.g. testing of materials, inspection and overhauling of tools, gauges etc)
d. Long term training of tool and die makers, machine tool operator as well as medium & short term training programmer for entrepreneurs and employees of the Micro, Small & Medium Enterprises.

II. PROGRAM EDUCATIONAL OBJECTIVES:

The Tool & Die Making Diploma Technician after completion of Four year education & training will be able to function in and an as-

A. A Tool & Die Making Technician / Engineer to work on shop floor
B. An Entrepreneur
C. A life-long learner of Higher Education leading to undergraduate & post-graduate program
D. A Technician / Engineer as Leader

III. PROGRAM OUTCOMES

P1. An ability to apply knowledge of mathematics, science, and engineering

P2. an ability to conduct experiments, as well as to analyze and interpret data

P3. an ability to design a system component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

P4. an ability to function as individual and a member of multidisciplinary teams

P5. an ability to identify, formulate, and solve engineering problems

P6. an understanding of professional and ethical responsibility

P7. an ability to communicate effectively

P8. a recognition of the need for, and an ability to engage in life-long learning

P9. a knowledge of contemporary issues

P10. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

P11. An ability to work on project and apply financial concept in project.

IV. SAMPLE ATTRIBUTES OF TOOL & DIE ENGINEER

GENERAL

1. Evaluate Personnel Appraisal
2. Conduct Mechatronic Product process study
3. Conduct Departmental Meeting
4. Working in multi-disciplinary team

PERFORM SHOP FLOOR FUNCTION

1. Tool & Die Production
2. Tool & Die Design
3. Maintenance Programme Activities
4. Die Reliability and Maintenance
5. System/Process Design

MANAGE PROJECT

- Perform Tool & Die manufacturing Activities Improvement

V. TOOL & DIE MAKING TRAINING PROGRAM INCLUDES

- Workshop Practice
- Workshop Technology
- Tool & Die Technology
- Tool & Die Practice
- Design of jigs fixtures & gauges
- Design of Moulds
- Design of Cutting Tools
- Design of Forging Dies
- Design of Die Casting Dies
    - Advance Manufacturing Technologies
    - Have strong team skills to solve complex problems that cross disciplinary boundaries.
    - Preform design and implementation of intelligent engineered products and processes enabled by the integration of mechanical, electronic, computer and software engineering technologies.

VI. CORE CURRICULUM AREAS

Mechanical Engineering Courses

- Engineering Graphics
- Mathematics
- Engineering Mechanics
- Strength of Materials & Engineering Materials
- Production Planning, Estimating & Costing
- Industrial Engineering & Quality Systems
- Additive Manufacturing

Tool & Die Engineering Courses

- Design of Press Tools
- Design of jigs & fixtures
- Design of Moulds
- Design of Cutting Tools
- Design of Forging Dies
- Design of Die Casting Dies

VII. CURRICULUM STRUCTURE

- Programme Duration: Eight Semester (4 Years)
- Hours Per Semester: 40 Hours/Week
- No. of Weeks per semester/term: 20
- No. of courses /Semester: Approximately 6 to 7

BASIC SCIENCE

a. Understand and proficiently apply the relevant sciences and scientific methods to mechatronics engineering, to design solutions to complex problems
b. Identify, interpret and critically appraise current developments and advanced technologies and apply them to mechatronics engineering

1. Communication Skills
2. Mathematics I
3. Mathematics II
4. Applied Science I
5. Life Skills (Professional Practice)

ENGINEERING SCIENCE

a. Understand and proficiently apply the relevant sciences and scientific methods to mechatronics engineering, to design solutions to complex problems

b. Identify, interpret and critically appraise current developments and advanced technologies and apply them to mechatronics engineering

6. AUTOCAD for Engineering
7. Engineering Mechanics
8. Basics of Electrical Engineering
9. Mechanical Workshop
10. Hydraulics & Pneumatics
11. Industrial Automation
12. Engineering Materials & Heat Treatment

CORE TECHNOLOGY

a. Identify and synthesize the constraints posed by economic factors, safety considerations, environment impacts and professional standards on Tool & Die engineering practice and use them to inform professional judgments
b. Determine, analyses and proficiently apply theoretical and numerical analysis of phenomena to Conceive, control and optimize the performance of Tool & Die engineering systems
c. Identify and critically evaluate the performance of a Tool & Die engineering system in terms of economics, safety and the social and physical environment, and implement approaches to minimize any adverse impact leading to sustainable development.
d. Understand and proficiently apply a systems approach to the design cycle, addressing the broad contextual constraints, leading to sustainable development
e. Communicate effectively on both technical and general issues with peers, associates, clients and the general public

a. Design of Press Tools
b. Design of jigs & fixtures
c. Design of Moulds
d. Design of Cutting Tools
e. Design of Forging Dies
f. Design of Die Casting Dies

APPLIED TECHNOLOGY

a. Plan, organize and use resources efficiently
b. Demonstrate the highest standards of personal performance
c. Demonstrate commitment to lifelong learning and professional development
d. Understand the responsibilities of mechatronics engineers to the community, the engineering profession and the industrial and business world
e. Demonstrate commitment to ethical standards and legal responsibilities to the community and the profession

    a. Manufacturing
    b. CNC Programming
    c. CNC Machine
    d. Project I
    e. Project II

DIVERSIFIED TECHNOLOGY

a. Plan, organize and use resources efficiently
b. Demonstrate the highest standards of personal performance
c. Demonstrate commitment to lifelong learning and professional development
d. Understand the responsibilities of mechatronics engineers to the community, the engineering profession and the industrial and business world
e. Demonstrate commitment to ethical standards and legal responsibilities to the community and the profession

    I. Additive Manufacturing
    II. Industrial Automation

VIII TEACHING & EXAMINATION SCHEME

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- I st Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)			Examination Scheme								
						Theory				Practice				
						Sessional		Semester Exam		Sessional		Semester Exam		Total Marks
			Theory (per week)	Practice (per week)	TOTAL (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A1-01	COMMUNICATION SKILLS	2	1	3	40	20	60	30	NA	NA	NA	NA	100
2	A1-02	APPLIED MATHEMATICS-I	2	1	3	40	20	60	30	NA	NA	NA	NA	100
3	A1-03	APPLIED SCIENCE-I	2	2	4	40	20	60	30	50	25	NA	NA	150
4	A1-04	ENGINEERING DRAWING	2	6	8	NA	NA	NA	NA	40	20	60	30	100
5	A1-05	WORKSHOP PRACTICE-I	0	12	12	NA	NA	NA	NA	160	80	240	120	400
6	A1-06	WORKSHOP TECHNOLOGY-I	4	0	4	40	20	60	30	NA	NA	NA	NA	100
7	A1-07	ELECTRICAL & ELECTRONICS	2	0	2	40	20	60	30	NA	NA	NA	NA	100
8	A1-08	COMPUTER APPLICATIONS	1	3	4	NA	NA	NA	NA	40	20	60	30	100
		Total Teaching Hours	15	25	40								Total Marks	1150

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- IInd Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)			Examination Scheme								
						Theory				Practice				
						Sessional		Semester Exam		Sessional		Semester Exam		Total Marks
			Theory (per week)	Practice (per week)	TOTAL (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A2-01	ELECTRICAL & ELECTRONICS(WORKSHOP)	0	3	3	NA	NA	NA	NA	40	20	60	30	100
2	A2-02	APPLIED MATHEMATICS-II	2	1	3	40	20	60	30	NA	NA	NA	NA	100
3	A2-03	APPLIED CHEMISTRY	2	2	4	40	20	60	30	50	25	NA	NA	150
4	A2-04	MACHINE DRAWING	2	6	8	NA	NA	NA	NA	40	20	60	30	100
5	A2-05	APPLIED MECHANICS	2	2	4	40	20	60	30	NA	NA	NA	NA	100
6	A2-06	WORKSHOP PRACTICE-II	0	14	14	NA	NA	NA	NA	160	80	240	120	400
7	A2-07	WORKSHOP TECHNOLOGY & METROLOGY	4	0	4	40	20	60	30	NA	NA	NA	NA	100
		Total Teaching Hours	12	28	40								Total Marks	1050

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- III[rd] Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)			Examination Scheme								
						Theory				Practice				
						Sessional		Semester Exam		Sessional		Semester Exam		Total Marks
			Theory (per week)	Practice (per week)	TOTAL (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A3-01	THEORY OF MACHINE & MECHANISMS	2	1	3	40	20	60	30	NA	NA	NA	NA	100
2	A3-02	STRENGTH OF MATERIALS	3	1	4	40	20	60	30	NA	NA	NA	NA	100
3	A3-03	ADVANCE MANUFACTURINGPROCESSES	2	0	2	40	20	60	30	NA	NA	NA	NA	100
4	A3-04	TOOL & DIE MAKING PRACTICE	0	20	20	NA	NA	NA	NA	160	80	240	120	400
5	A3-05	TOOL & DIE MAKING TECHNOLOGY	4	0	4	40	20	60	30	NA	NA	NA	NA	100
6	A3-06	ENGINEERING MATERIAL AND PROCESS	2	0	2	40	20	60	30	NA	NA	NA	NA	100
7	A3-07	COMPUTER AIDED DRAFTING (AUTOCAD)	2	3	5	NA	NA	NA	NA	40	20	60	30	100
		Total Teaching Hours	**15**	**25**	**40**								**Total Marks**	**1000**

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- IVth Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)			Examination Scheme								
						Theory				Practice				
						Sessional		Semester Exam		Sessional		Semester Exam		Total Marks
			Theory (per week)	Practice (per week)	TOTAL (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A4-01	CNC TECHNOLOGY & PROGRAMMING	2	4	6	40	20	60	30	40	20	60	30	200
2	A4-02	TOOL & DIE MAKING PRACTICE - II	0	16	16	NA	NA	NA	NA	160	80	240	120	400
3	A4-03	DESIGN OF JIG, FIXTURES & GAUGES - I	1	3	4	40	20	60	30	40	20	60	30	200
4	A4-04	DEIGN OF PRESS TOOLS - I	1	3	4	40	20	60	30	60	30	90	45	250
5	A4-05	DEIGN OF MOULDS - I	1	3	4	40	20	60	30	60	30	90	45	250
6	A4-06	C PROGRAMMING	1	3	4	NA	NA	NA	NA	40	20	60	30	100
7	A4-07	DESIGN OF CUTTING TOOLS	2	0	2	40	20	60	30	NA	NA	NA	NA	100
		Total Teaching Hours	**8**	**32**	**40**								**Total Marks**	**1500**

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- Vth Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)			Examination Scheme								
						Theory				Practice				
						Sessional		Semester Exam		Sessional		Semester Exam		Total Marks
			Theory (per week)	Practice (per week)	TOTAL (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A5-01	CNC MACHINING	2	10	12	NA	NA	NA	NA	160	80	240	120	**400**
2	A5-02	TOOL & DIE MAKING PRACTICE - III	0	8	8	NA	NA	NA	NA	160	80	240	120	**400**
3	A5-03	DESIGN OF JIG & FIXTURES - II	1	3	4	40	20	60	30	40	20	60	30	**200**
4	A5-04	DEIGN OF PRESS TOOLS - II	1	3	4	40	20	60	30	60	30	90	45	**250**
5	A5-05	DEIGN OF MOULDS - II	1	3	4	40	20	60	30	60	30	90	45	**250**
6	A5-06	MACHINE DESIGN WITH ADVANCE CAD	3	3	6	NA	NA	NA	NA	40	20	60	30	**100**
7	A5-07	INDUSTRIAL ENGG. & QUALITY SYSTEMS	2	0	2	40	20	60	30	NA	NA	NA	NA	**100**
Total Teaching Hours			**10**	**30**	**40**	**Total Marks**								**1700**

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- VIth Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)			Examination Scheme								
						Theory				Practice				
						Sessional		Semester Exam		Sessional		Semester Exam		Total Marks
			Theory (per week)	Practice (per week)	TOTAL (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A6-01	ENTERPRENEURSHIP DEVELOPMENT	2	0	2	NA	NA	NA	NA	50	25	NA	NA	**50**
2	A6-02	CNC MACHINING & AUTOMATION	2	8	10	NA	NA	NA	NA	160	80	240	120	**400**
4	A6-04	COMPUTER ADIED MANUFACTURING	1	3	4	NA	NA	NA	NA	40	20	60	30	**100**
5	A6-05	TOOL & DIE MAKING	0	10	10	NA	NA	NA	NA	160	80	240	120	**400**
6	A6-06	DESIGN OF MOULDS - III	1	3	4	40	20	60	30	60	30	90	45	**250**
7	A6-07	DESIGN OF DIE CASTING DIES	1	3	4	40	20	60	30	40	20	60	30	**200**
8	A6-08	DESIGN OF FORGING DIES	1	3	4	40	20	60	30	40	20	60	30	**200**
9	A6-09	PRODUCATION PLANNING, ESTIMATING & COSTING	2	0	2	40	20	60	30	NA	NA	NA	NA	**100**
Total Teaching Hours			**10**	**30**	**40**	**Total Marks**								**1700**

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- VIIth Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)		Examination Scheme								
					Theory				Practice				Total Marks
					Sessional		Semester Exam		Sessional		Semester Exam		
			Theory (per week)	Practice (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A7-01	PROJECT- LIVE PRODUCATION JOBS	NA	48	NA	NA	NA	NA	325	163	275	137	600
Total Teaching Hours			NA	48	Total Marks								600
			48										

ADVANCE DIPLOMA IN TOOL & DIE MAKING CURRICULUM- VIIIth Semester

Sr. No.	Subject Code	Subject Name	Teaching Scheme/ No. of Hours(per week)		Examination Scheme								
					Theory				Practice				Total Marks
					Sessional		Semester Exam		Sessional		Semester Exam		
			Theory (per week)	Practice (per week)	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	Max. Marks	Min. to pass	
1	A8-01	PROJECT- LIVE PRODUCATION JOBS	NA	48	NA	NA	NA	NA	325	163	275	137	600
Total Teaching Hours			NA	48	Total Marks								600
			48										

MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

FIRST SEMESTER: COURSE DETAILS

ADVANCE DIPLOMA IN TOOL & DIE MAKING

A1-01: COMMUNICATION SKIL

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL	TOTAL MARKS
2	1	3	60	00	40	-	-	100

II. RATIONALE: (NEED AND IMPORTANCE OF THE SUBJECT)

- English has become the language of Governments, Education, advancement, jobs and a symbol of self-
- Improvement. The new ideas about language, the dimensions of usage and the new development in educational technology have given rise to branches in the use of English.
- It occupies the position of associate official language. It is used widely as a link language in offices and among the educated people. It is not only a compulsory subject at school, college and university but is also the medium of instruction to the large extent. It is the language of science and technology. English language has been assigned the role of library language.
- It is up to the teacher to make the student realize that gaining competence in English he shall hold the master-key to success in the contemporary world.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVE.

Students will be able to:

- Understand grammatical rules
- Use rules and formulate the problem/resolve the problem
- Use rules in business communication/communication
- Apply principles or techniques of reading/writing/listening through examples/exercises
- Write/develop essay
- Summarize the events

IV. COURSE OUTCOMES

- Students will be able to construct the sentence in English. Students can apply grammar rules in sentence building.
- Understand the different types of paragraph. Comprehend main ideas and reproduce them. Describe an object, process or procedure.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1.	UNDERSTANDING GRAMMATICAL CONCEPTS	Student Should be able to :- • Identify the part of speech • Know about noun, pronoun, verb, adverb, adjective • Evaluate the different types of Preposition, Conjunction, Interjection, Articles	Part of speech, Noun, Pronoun, Verb, Adverb, Adjective, Preposition, Conjunction, Interjection, Articles	12	18
2	TENSES	Student Should be able to :- • Construct the sentence in present, past, future tens forms	Present Tense and Its forms, Past tense and its forms, Future Tests and its forms	10	15
3	INTRODUCTION TO COMPONENTS OF GRAMMAR	Student Should be able to :- • Apply grammar rules in sentence building by help of active voice, passive voice, direct speech and indirect speech	Active Voice, Passive voice, Direct Speech Indirect Speech	8	12
4	TYPES OF SENTENCES AND THEIR CONSTRUCTION	Student Should be able to :- • Comprehend main ideas about sentence construction, sentence patterns	Sentence construction, Sentence patterns	6	9
5	SYNONYMS AND ANTONYMS	Student Should be able to :- • Process or procedure in synonyms, antonyms, homonyms, commonly confusing words	Synonyms, Antonyms, Homonyms Commonly confusing words	4	6

VI. LIST OF TUTORIAL (Total Hours:- 20 Hrs.)

1.	Describe an object, process or procedure. Prepare list of various communication activities carried out in your institute.
2.	Study of word formation.
3.	Identify sentence elements.
4.	Draw the diagram of communication cycle for given situation. State the type and elements of communication involved in it.
5.	Role play: Teacher should form the group of students based on no. of characters in the situation. Students should develop the conversation and act out their roles.

6.	Collect five pictures depicting aspects of body language from different sources such as magazines, newspapers, internet etc. State the type and meaning of the pictures.

VII. REFERENCE BOOKS

1. Effective Communication – Raju Shetty
2. Communication Skills – B. V. Pathak
3. Written & Spoken Communication in English – Board of Editors

A1-02: ENGINEERING MATHEMATICS - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS TUTORIAL	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK	ORAL	TOTAL MARKS
2	1	3	60	-	40		100

II. COURSE RATIONALE

Mathematics is the foundation of science and technology. The study of basic mathematics is helpful to understand concepts of Engineering. This subject enhances logical thinking capability. It also improves the systematic approach in solving engineering problem.
Algebra provides the language and abstract symbols of mathematics. It also helps to use that Language in real-life applications.
Matrix and Determinant topics are helpful for finding optimum solution of system of
Simultaneous equations which are formed in the various branches of engineering using different parameters.
Trigonometry is the study of triangles and angles.
Geometry gives emphasis on understanding the deductive reasoning process. It includes writing derivations of theorems and giving geometric relationships by reasoning. Co- ordinate geometry plays an important role in Animation, AutoCAD, Computer graphics etc. Contents of this subject will form foundation for further study in mathematics.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVES

- Apply Cramer's rule and matrix method to solve simultaneous equations in three Variables.
- Use concept of allied angle, compound angle, multiple and sub-multiple angles to
- Solve engineering problems.
- Use factorization and de-factorization formulae to solve examples.
- Understand the relationship of two variables.

IV. COURSE OUTCOMES

Student will be able to solve simultaneous equations in three variables, Use concept of allied angle, compound angle, multiple and sub-multiple angles to solve engineering problems, Use factorization and de-factorization formulae to solve example

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1 Algebra	LOGARITHM	Student will able to :- • Understand concept of logarithms • Explain logarithms & power function • Solve logarithms numerical	Definition of logarithm, Laws of logarithms, Common logarithms & Napier logarithms (only definition) Use of calculator for engineering calculations.	4	6
	DETERMINANTS	Student will able to :- • Define determinant • Explain Order of determinants • Solve Solution of simultaneous equations	Definition of determinant, Order of determinants, Solution of simultaneous equations (Cramer's rule)	4	6
	PARTIAL FRACTIONS	Student will able to :- • Understand partial fraction • Resole the Rational Fractions • Evaluate Integral of Rational Fractions by partial fraction • Convert improper fraction into proper fraction • Classify factorization & DE factorization Formulae	Rational Fractions, To resolve given rational fraction into partial fractions	4	6
	BINOMIAL THEOREM	Student will able to :- • Understand Binomial theorem • Classify Permutation & combinations • Evaluate Factorial notation • Understand Importance & application of Binomial theorem • Apply Algebraic Express to solve Trade Related Problems.	Definition of permutation and combinations, Factorial notation Application of Binomial theorem for approximate values, Application of algebraic expression to solve trade related.	4	6

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
2 Trigonometry	TRIGONOMETRIC RATIO	Student will able to :- • Understand Addition, Double Angle Formulae For Trigonometric Ratios. • Classify Odd, Even Function • Understand Sign of Trigonometric ratio	Trigonometric ratios of any angle Relation between Trigonometric ratios Relation between Trigonometric ratios Fundamental Identities, Trigonometric ratios of standard angles, Signs of Trigonometric ratios, Trigonometric ratios of negative angles	8	12
	TRIGONOMETRIC RATIOS OF ALLIED, COMPOUND, MULTIPLEANGLES	Student will able to :- • Define allied angles, compound angles, multiple and submultiple angles • Evaluate Product Sum- Difference formulae	Trigonometric ratios of allied angles Trigonometric ratios of compound angles, Trigonometric ratios of multiple and submultiple angles Product, Sum-Difference formulae	6	9
	INVERSE CIRCULAR FUNCTIONS	Student will able to :- • Understand Principle value of inverse circular functions	Product, Sum-Difference formulae Definition, Principle value of inverse circular functions, Simple problems	6	9
	PROPERTIES & SOLUTION OF TRIANGLE	Student will able to :- • Define properties of Sine Rule, Cosine Rule, Tangent Rule Etc.	Sine Rule, Cosine Rule, Tangent Rule Half angle formulae, Application of trigonometry for trade related problems	4	6

VI. TUTORIALS: (Total Hours: - 20 Hrs.)

List of tutorial:

Sr. No.	Topic for tutorial
1	Logarithm
2	Determinants
3	Binomial Expansion
4.	Partial fraction.
5	Trigonometric ratio of allied, compound, multiple and sub-multiple angles.
6	Factorization and de- factorization formulae.
7	Inverse trigonometric ratios.
8	Straight line.

VII. REFERENCE BOOKS

Sr. No	Title	Authors	Publication
1	Mathematics for Polytechnic	S.P. Deshpande	Pune Vidyarthi Griha.
2	Trigonometry	S. L. Loney	S. Chand Publication
3	Matrices	Ayres	Schuam series McGraw Hill
4	Higher Engineering Mathematics	B. S. Grewal	Khanna publication
5	Engineering Mathematics	S. S. Sastry	Prentice Hall of India

A1-03: APPLIED SCIENCE - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	2	3	60	00	40	50	150

II. COURSE RATIONALE

The subject is classified under basic sciences and intends to teach students Basic facts, concepts and principles of applied science, as a tool to analyze Engineering problems. Applied science lays down the foundation to understand Core technology subjects.

Applied science is the foundation of science and technology. The study of basic applied science is helpful to understand concepts of Engineering. This subject enhances logical thinking capability. It also improves the systematic approach in solving engineering problem. For sustainable socio-economic development of the country, comprehensive research techniques in science and engineering are required. Regarding any problem to identify, understand and solve, the decision based on scientific facts and results is must.

Engineering, being the science of measurement and design, has been offspring of physics that plays the primary role in all professional disciplines of engineering. The different streams of physics like optics, Acoustics, Dynamics, Semiconductor physics, surface physics, Nuclear physics, Energy studies, Materials science, etc provide fundamental facts, principles, Laws, and proper sequence of events to streamline engineering problems.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

The student should be able to

Engineering is entirely meant for comfort of mankind. The overall growth of engineering discipline is based on developments in fundamental sciences and their conceptual learning too.

Solve problems by using analytical and systematic approach

Measure given dimensions by using appropriate instruments accurately.

Select proper measuring instrument on the basis of range, least count and precision required for measurement.

Select proper material for intended purpose by studying properties of materials.

Identity good and bad conductors of heat.

Analyze relation among pressure, volume and temperature of gas and to interpret the results identity the effect of interference of interference between light waves. Identity properties and photo electric effect for engineering application. Identify, analyze, discriminate and interpret logical sequence of field problems with the study of physics.

IV. COURSE OUTCOMES

Student will be able to:

- Describe the properties of solids.
- List the different properties of liquids.
- Explain the atomic structure of materials.
- Define & explain thermal properties of materials.
- Demonstrate the use of basic measuring instruments.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1.	PROPERTIES OF SOLIDS.	Student Should be able to :- • Define Unit • Describe need for Measurement • Differentiate between types of stress & strain • Explain characteristics of material under stress and strain	Units and measurements, Introduction Need for measurement, system of units, fundamental and derived units. Accuracy and precision of measuring instruments. Errors in measurements. Dimensional analysis and its applications.	2	6
			Properties of bulk matter Introduction, Definition of Deforming force, elasticity plasticity. Stresses-tensile, volumetric and shear stress Strains- tensile, volumetric and Shear strain, Elastic limit, Hook's law. Elastic coefficients- Young's modulus, bulk modulus, modulus of rigidity Stress- strain diagram, behaviour of wire under continuously Increasing load, Poisson's ratio, compressibility.	6	6
2	PROPERTIES OF LIQUIDS.	Student Should be able to :- • Understand behaviour of pressure in the liquid • Describe the viscosity and its applications	Fluid friction, Introduction, Pressure, pressure-depth relation, atmospheric pressure, Pascal's law Viscous force, definition of viscosity velocity gradient, Newton's law of viscosity, coefficient of viscosity and its SI unit. Streamline and turbulent flow with examples, critical velocity,	4	6

		• List different flow conditions of liquid • Explain concept of surface tension	Reynolds's number and its significance. Up thrust force, terminal velocity, Stokes law, and derivation of coefficient of viscosity by Stoke's method. Effect of temperature and adulteration on Viscosity of liquid.		
			Surface tension, Introduction, Cohesive and adhesive force, Definition and unit of surface tension, Laplace's molecular theory of surface tension. Effect of temperature on surface tension. Derivation of expression for surface tension. Angle of contact, Capillarity and examples of capillary action.	4	4
3	ATOMIC STRUCTURE.	Student Should be able to :- • Understand structure of atom and its orbital configuration • Explain isobar and isotopes • Explain theory of atom	Atomic structure, Introduction, Bohr's Atomic Model, structure of an atom. Atomic number and Atomic mass number. Orbital electronic configuration of atom Valences, concept of stable configuration, Electrovalence and covalence. Isotopes and isobars.	2	4
		Student Should be able to :- • Define faraday's laws of electrolysis • Explain applications of electrolysis	Electrochemistry, Introduction, Arrhenius theory of electrolytic dissociation, Degree of ionization, electrode potential, Faraday's laws of electrolysis, applications of electrolysis	4	4
4	THERMAL PROPERTIES OF MATTER.	Student Should be able to :- • Describe heat conduction through material • Explain different gas laws • Difference between isothermal process and adiabatic process. • Define specific heat, its SI units • Draw Graph for laws • Describe relation between Cp and Cv.	Modes of transfer of heat, Introduction, Definition of calorie, Absolute zero, units of temperature. Conduction, convection, radiation. Coefficient of thermal conductivity, good conductors of heat. Insulators with suitable examples.	2	6
			Introduction Gas laws; Boyle's law, Charles law, Gay - Lussa's law. Perfect gas equation Specific heat of a substance, SI unit, specific heat of gas at constant volume. Specific heat of gas at constant pressure, ratio of specific heat. Mayer's relation between Cp and Cv. Isothermal process, adiabatic process. Difference between isothermal process and adiabatic process.	4	6

5	BASIC MEASURING TECHNIQUE.	Student Should be able to :- • Demonstrate use of steel rule, calliper v block, angel plate • Explain application of radius gauge, fillar gauge , pitch screw gauge • Describe use of try square • Use surface plate • Differentiate between cast iron & Granite surface plate	Steel Rule - Introduction Concept, Application & Procedure Callipers - Introduction, Types of Callipers Description , application & Procedure Surface plate - Introduction Material of Surface plate - Cast Iron & Granite, Sizes and Accuracy, Care, Use of surface plate & Procedure , Angle plate - Introduction, Sizes and Accuracy, Care, Use of angle plate & Procedure 'V' Block-Introduction, Care, Use of V blocks & Procedure Try square-Introduction, Care, Use of square & Procedure.	4	6
		• Describe types of micrometre bevel protector, combination set • Calculate least count of vernier calliper, micrometre • Demonstrate use of vernier Height Gauge	Straight edge, Introduction Classification, their use & Procedure Radius Gauge Introduction, Use & Procedure. Feeler Gauge Introduction, Use & Procedure, Pitch screw Gauge Introduction, Use & Procedure, Vernier calliper Introduction, Reading the Vernier scale, Types of Verviers, Least Count - Calculation, Errors observed in Vernier, Precautions in the use of Vernier & Procedure Vernier Height Gauge Introduction, Description of their parts & requirement, Precautions in the use of Height Gauge, Test for Accuracy & Procedure Micrometre Introduction Description of their parts, Reading the Micrometre Ratchet stop mechanism, Types of micrometre, Precaution, use of micrometre & Procedure, possible error, Bevel protector Introduction, Description of various parts, Application Combination set introduction Application.	4	8
6	ERRORS & GEOMETRICAL DIMENSIONING SYMBOLS.	Student Should be able to :- • Explain types of errors • Describe straightness, flatness, parallelism, circularity, cylinder city, concentricity, co-axiality, ovality, Angularity, Roundness	ERRORS, introduction- Types of errors, Static Errors. Controllable Errors, Random Errors, Concept of precision & accuracy water, acid, alkali. Applications of aluminium. Geometrical Dimensioning Symbols. Definitions, Symbols of Straightness, Flatness, Parallelism, Circularity, cylinder city, Concentricity, Co-axiality, Ovality, Angularity, Roundness.	4	4

VI. LIST OF PRACTICAL EXPERIENCES (Total Hours:- 40 Hrs.)

Knowledge, skills, attitudes to be developed (Laboratory objectives)

Detailed list of laboratory experiences

1. Know your Physics Laboratory, measuring instruments and interpretation of graph,
2. Measure the dimensions of given objects using Vernier calliper.
3. Measure the dimensions of given objects using micrometre screw gauge.
4. Determine Young's modulus of elasticity of metal wire by using Searle's apparatus.
5. Determine coefficient of viscosity of given liquid using Stoke's Method
6. Determine surface tension of liquid by capillary rise method using travelling microscope.
7. Determine the coefficient of thermal conductivity of copper by Searle's method.
8. Determine refractive index of liquid by concave mirror.
9. Determine stiffness constant 'K' of a helical spring.

VII. REFERENCE BOOKS

Sr. No.	Title	Author	Publisher
01	Engineering Physics	B.L. Theraja	S. Chand Publishers -New Delhi
02	Concepts of Modern Physics	Beiser Arthur	McGraw-Hill Education New Delhi
03	A text book of chemistry for e engineers	Wiley India	Wiley New Delhi
04	A text book of engineering chemistry	Dr. S S Dara	McGraw-Hill Education New Delhi
05	Basic science Physics	Pawar M S	Nirali Publication pune
06	Applied science	S N Narkhede	Nirali Publication pune
07	Conceptual Physics	H.C Verma	Bharati Bhawan New delhi year

A1-04: ENGINEERING DRAWING - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL	TOTAL MARKS
2	6	-	-	60	-	40	-	100

II. COURSE RATIONALE

Engineering Drawing is the language of engineers. The concepts of Engineering Drawing are used to develop, express the ideas, and convey the instructions which are used to carry out jobs in the field Engineering. The course illustrates the techniques of graphics in actual practice. This preliminary course aims at building a foundation for the further course in drawing and other allied subjects. This subject is useful in developing drafting and sketching skills of students.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVES

The student after studying this subject will be able to:

- Draw different engineering curves and know their applications.
- Draw orthographic projections of different objects.
- Visualize three dimensional objects and draw Isometric Projections.
- Draw simple geometrical figures using CAD package.

IV. COURSE OUTCOMES

After completion of this course students will be

- Able to draw Orthographic Projections of line, planes and solids with given orientation.
- Draw different engineering curves and know their applications.
- Develop ability to draw sectional views and missing view from given orthographic views
- Visualize three dimensional objects and draw Isometric Projections.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION	Student Should be able to :- • Define drawing • List type of drawing • Differentiate artistic drawing and technical drawing • State the difference between artistic drawings. • Types of drafting processes • Understand the advance drafting processes • Understand the latest CAD software • Understand the ISO • Draw the flow chart of engineering drawing in tool room	Introduction and observation of engineering drawing practices in the Tool Room environment and manufacturing industry. Definition of sketches, mechanical and computer generated drawings. Classification of drawing set and related information. The industrial drafting process from product conception to production. Procedure – To read link diagram and subject objective. To integrate the flow of engineering drawing Tool Room. To select reference material and ISO norms. To sketch flow charts of engineering drawing process of Tool Room. Exercise – Sketch the flow chart of engineering drawing observed in the Tool Room. List reference material and tools needed.	2	0
2	MEDIA USED FOR ENGINEERING DRAWING	Student Should be able to :- • List the drawing instruments • Illustrate different size of standard drawing sheets. • Draw the layout of drawing sheets using drawing instruments & equipment's on the drawing sheet. • Understand the latest drawing media	Introduction to drawing instruments, machines, complete conventional and latest working stations, Definition, principles, procedures and exercise of media, Standard drawing sheets, Conventional drawing instruments accessories and aids, Reproduction, storage, retrieval, Definition and principles of latest drawing media, CAD station components, CAD software, Plotter	2	0
3	SCALES, LINES & LETTERING	Student Should be able to :- • Stand the importance of lines • Describe Types of lines and Factors for selecting type of lines • Draw different types of lines and their applications.	Scales, Introduction, Definition of drawing to scale, Full, Reduced, Enlarged, Factors for choice of scale, Purpose, actual size, size of sheet, BIS norms, Procedure for drawing to scale, Exercise for "Drawing to Scale"	2	6

		• Understand the importance of different types of scale ratios and as per BIS norms. • Describe factors for choice of scale. • Define full scale, Reduced, Enlarged scale on drawing sheet/Sketch book. • Described the relationship between size of letter and space between them • Write the sentences by using single stroke letters • Write the title by using single stroke and gothic letters and numbers.	Lines – Introduction to lines, Types of lines, Application of line, Factors for selecting type of line, Purpose of line ,BIS norms, Exercises Lettering, Introduction to lettering, Types of lettering Relationship between size of letter and space between letters. Factors for selection type and size of letters, Purpose of lettering, BIS norms, Exercises		
4	GEOMETRIC CONSTRUCTIONS	Student Should be able to :- • Understand the definition, principle and Procedure for drafting of simple geometrical construction straight lines and perpendiculars to line from different points. • Understand drafting procedures to bisect, trisect the angles. • Demonstrate drafting procedure of construction of angles and polygons on drawing sheet / sketch book • Understand drafting procedure for construction of inscribe and describe the circles. • Understand definition, principle, procedures of conic sections. • Understand the different methods used for construction of ellipse, parabola, hyperbola and other curves on drawing sheet/ sketch book.	Introduction to examples of simple and advanced geometrical construction, Definition, principles, procedures, exercise of simple geometrical construction, Straight lines, Angles, Polygons, Circle/ Arcs, Definition, principles, procedures, exercise of advance geometrical construction Conic Section : Ellipse, Parabola, Hyperbola, Helix, Cycloid, Involute	6	9
5	ORTHOGRAPHIC PROJECTIONS	Student Should be able to :-	Introduction to orthographic projections, Definition of orthographic projections, Points,		

		• Understand the definition, importance and principle of projection • List types of projections and orthographic projection. • Understand Principles of quadrants. • Understand drafting procedures of and Principles of Horizontal Plane and Vertical Planes. • Understand Procedure for drawing orthographic projection of points, lines and planes in 1st & 3rd quadrants. • Understand Principles of First angle projection methods. • Understand Principles of Third angle projection methods. • Draw the different views of three dimensional objects by Third angle projection methods on drawing sheet/sketch book.	Lines, Planes, Solids, Principles of quadrants and planes, Principles of different views, Procedure for drawing different views of points, lines, planes and solids (in 1st and 3rd quadrants) Exercise on orthographic projection of (in 1st and 3rd quadrants), Points, Lines in different positions to planes, Planes in different positions to planes, Solids in different positions to planes, Exercises of missing lines and views	8	6
6	IS CODE OF PRACTICE	Student Should be able to :- • Demonstrate the drafting procedure of First angle and Third angle projection methods • Understand draw the orthographic views by using IS code of practice. • Draw the different views of three dimensional objects by Third angle projection methods by IS norms on drawing sheet / sketch book.	ORTHOGRAPHIC PROJECTIONS OF OBJECTS USING IS CODE OF PRACTICE Introduction to 1st angle and 3rd angle projections. Definition of orthographic projections, 1st angle and 3 angle. Principles of 1st angle and 3rd angle projections according to BIS norms. Procedure for drawing different views of an object in 1st angle and 3rd angle. Exercises on 1st angle and 3rd angle projections of different objects.	8	12
7	DIMENSIONING	Student Should be able to :- • Understand the Principles of dimensioning.	Introduction to dimension, Definition of dimension, Functional dimension, Non-functional dimension, Auxiliary dimension Principles of		

		• Identify the size and location dimensions. • Indicate the dimensions different methods. • Understand the Rules of dimensioning. • Demonstrate correct the dimensions to the views on drawing sheet/sketch book	dimensioning Rules of dimensioning, Method of dimensioning, Indication of dimensioning, BIS norms Procedure of dimensioning Exercise on dimensioning (linear, circular, angular	4	6
8	ISOMETRIC PROJECTIONS	Student Should be able to :- • Understand Definition and Principle of isometric projection. • Understand the Definition and • Principle of isometric axis, isometric lines and isometric planes. • Construct an isometric scale. • Define Isometric projections and Isometric views. • Demonstrate the concept of orthographic projection & isometric views. • Differentiate between Isometric projections and Isometric views	Introduction to isometric projection. Definition of isometric projections (axes, lines, planes) Principles of co-ordinates (x, y, z), Principles of isometric projections of planes, prisms, pyramids, cylinders, cones, irregular objects. Principles of dimensioning isometric projections, Procedure for drawing isometric views of regular solids and irregular objects. Exercises on drawing isometric views of regular solids and irregular objects.	4	9
9	CONVERSION OF ISOMETRIC VIEWS TO ORTHOGRAPHIC PROJECTIONS & VISA-VERSA	Student Should be able to :- • Understand the principle for Conversion of isometric views from orthographic projection. • Demonstrate Procedure for Conversion of isometric views to orthographic projection & visa- versa. • To draw Isometric projections and Isometric views from orthographic projection on drawing sheet / sketch book & visa-versa.	Introduction to conversion of orthographic projections to isometric view and vice versa. Recall the concepts of orthographic projections and isometric view. Principles of conversion of orthographic views to isometric and vice versa. Procedure of drawing orthographic views from isometric view and isometric view from orthographic views. Exercise on drawing orthographic views from the given isometric view and isometric view from the given orthographic views.	4	12

VI. LIST OF PRACTICAL EXERCISE (Total Hours: - 120 Hrs.)

Minimum 10 Practical exercise to be completed

01	Drawing instrument practice.
02	Types of line and conventional representation of materials.
03	Scales, lettering and numbering.
04	Plane and advanced geometrical constructions.
05	Dimensioning.
06	Projection of points and lines.
07	Orthographic projection of solids (first angle projection method).
08	Orthographic projection of solids (first angle projection method).
09	Orthographic projection of solids (third angle projection method).
10	Orthographic projection of solids (third angle projection method).
11	Conversion of orthographic view in to isometric views visa-versa.
12	Conversion of orthographic view in to isometric views and visa-versa.

VII. REFERENCE BOOKS

Sr. No.	Author	Title	Publication
1	N. D. Bhatt	Engineering Drawing	Charotar Publishing House 2010
2	Amar Pathak	Engineering Drawing	Dreamtech Press, 2010
3	DJolhe	Engineering Drawing	TataMcGraw Hill Edu., 2010
4	MB.Shah, B.C.Ranas	Engineering Drawing	Pearson, 2010
5	R. K. Dhawan	Engineering Drawing	S. Chand Co., Reprint 2010
6	K. L. Narayan, P.	Text Book on Engineering Drawing	Scitech Publications, 24th Reprint August 2011
7	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age Publication, Reprint 2006

A1-05: WORKSHOP PRACTICE - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL
-	12	-	-	240	-	160	3	400

II. COURSE RATIONALE

Tool & die Makers are expected to know basic workshop practice like wood working, sheet metal, fitting. This subject will develop skills in handling various mechanical, tools.
The students are required to select and use various tools & equipment's related to wood working, sheet metal process.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVES

- Read and interpret the drawing.
- Draw sketch for given job.
- Use specification tables.
- Decide Sequence of procedure.
- Recognize, identify and use of various tools used in Workshop.
- Use of Technical skills for efficient repair work..

IV. COURSE OUTCOMES

Student will be

- Able to read job drawing.
- Able to identify and select proper material, tools, equipment's and machine.
- Able to select proper parameters (like cutting speed, feed, depth cut use of lubricants) in Machine.
- Able to select proper material, tools and techniques used in soldering.

V. CONTENT

UNIT NO.	TOPIC/SUB TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	MSME TC BHOPAL & ENVIROMENT		Description of various courses. MSME environment, Housekeeping, Functioning of Store & Procedure followed.	240	400
2	BENCH WORK	Student Should be able to :- • List Hand Tools • List types of Files. • Identify the File for different operation. • Explain different parts of files. • Difference between types of Files. • Demonstrate Methods of filling. • Identify Special purpose file and needle files. • Explain Construction, parts and specification of vice. • Take Care of vices • List measuring Instrument. • Describe Parts of different measuring instrument. • Demonstrate How to measure. • Draw different measuring tool. • Read the measured dimension. • Understand Proper way of marking • List Different types of cutting tool • Understand Selection of cutting tool for different material. • List Types of frames • Explain Parts of a blades • List types of blades • Explain the working of Power hacksaw	Introduction to hand tools (Hand Cutting Tools), Measuring tool, Equipment's & their uses & applications. Basic metal cutting operations using hand tools, Sheet metal work , Manufacturing useful products		

		• List Properties of sheet metal. • Understand how sheet metals component formed.			
3	MATERIAL PREPARATION	Student Should be able to :- • Cut the material in the required size as per the specification given in the drawing. • Write Process planning • Drawing reading • Select a material for the desired operation	Planning &cutting raw material as per requirement.		
4	BASIC TOOL GRINDING	Student Should be able to :- • Explain pedestal grinding machine • Operate pedestal grinding machine • Explain single point cutting tool • Nomenclature of single point cutting tool • Follow safety	Sharpening of Single point cutting tool for their basic geometrical knowledge & skill.		
5	TURNING	Student Should be able to :- • Explain lathe machine • Explain lathe machine accessories • Explain lathe machine attachments • List Different types of turning tools • Perform lathe operations • List Different types of taper turning methods • Thread cutting techniques on lathe machine • Do Gear setting, Inch conversion • Draw Diagram of lathe machine. • Perform Calculation of R.P.M Feeds • Understand Tables depth of cut • Calculate various parameters of turning operation • Calculate machining time , Setting time, Machining time, Auxiliary time, Delay time, Total time	Basic knowledge of working principle of Lathe machine, various parts of machine & their functioning, use of various accessories & attachments for work holding & tool holding. Knowledge & Basic skills for various turning operations. Knowledge of calculating metal cutting parameters.		

6	MILLING	Student Should be able to :- • Explain Working principle of a milling machine. • Explain different parts of a milling a machine • Explain different types of milling S machine • Describe working principle of a milling cutters. • List different types of milling cutters • Different parts of a milling cutters and their specifications • Understand the working principle of a milling machine accessories and attachments • Understand and explain indexing principles and methods different • Perform milling operations. • Calculate various parameters of milling operation • Explain various milling surface finish	Basic knowledge of working principle of Milling machine, various parts of machine & their functioning, use of various accessories & attachments for work holding & tool holding. Knowledge & Basic skills for various Milling operations. Knowledge of calculating metal cutting parameters.		

VI. LIST OF PRACTICAL EXPERINC (Total Hours: - 240 Hrs.)

TURNING			MILLING		FITTING
Sr. No.	**Title of Exercise**	**Sr. No.**	**Title of Exercise**	**Sr. No.**	**Title of Exercise**
1	U-Channel	1	Tap Wrench Body	1	Screw Jack Body
2	Name Plate-Marking & Punching	2	Parallel Block	2	Centre Punch
3	Angle Plate	3	Straight Clamp	3	Chamfer Tool
4	S-Plate	4	Tap Wrench Jaw	4	C-Clamp Screw
5	C-Clamp	5	Strap Clamp	5	Screw Jack Screw
6	Open Fitting			6	Rest Button for Screw Jack
7	Book Supporter				

A1-06: WORKSHOP TECHNOLOGY - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL
4	-	3	60	-	40	-	100

II. COURSE RATIONALE

Tool & die Makers are expected to know basic workshop practice like wood working, sheet metal, fitting. This subject will develop skills in handling various mechanical, tools.
The students are required to select and use various tools & equipment's related to wood working, sheet metal process.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVES

- Read and interpret the drawing.
- Draw sketch for given job.
- Use specification tables.
- Decide Sequence of procedure.
- Recognize, identify and use of various tools used in Workshop.
- Use of technical skills for efficient repair work.

IV. COURSE OUTCOMES

Student will be

- Understand & Follow safety in the workshop.
- Explain basic metal cutting technique.
- Operate Drilling, Lathe and Milling Machines.
- Calculate the parameters like rpm, speed, feed, depth of cut.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION & SAFETY	Student Should be able to :- • Explain workshop technology • Explain the importance of workshop technology • List the safety precautions for working in workshop • Define manufacturing • List to do & not to do in workshop	Introduction to workshop Technology Safety Precautions	6	6
2	BASIC METAL WORKING TECHNIQUE	Student Should be able to :- • Define vice & Types of vices. • Define hand tools • List types of hand tools are there • Discuss metal working techniques • Describe metal working done by joining process • List the different types of metal joining process • Define is welding, types of welding • Explain metal working takes place by hot forming process • Describe the different hot forming processes	Metal working technique using hand tools Metal working technique - joining Metal working technique - hot forming	12	6
3	BASIC METAL WORKING TECHNIQUE WITH GENERAL MACHINE TOOLS	Student should able to • Define machine tools • List the types of machine tools • Define drilling machine • List are the parts of drilling machine • list are the types drilling machine • Working principle of drilling machine	Drilling operations & drilling machines Level-I (bench, pedestal, portable)	8	6
			Drilling operations and drilling machines Level-II (Column and Radial Drilling Machines)	6	3
			Drilling operations and drilling machines Level-III(Gang Drills & Special Drilling Machines)	4	3

		• work holding devices in drilling machine • Tool holding devices in drilling machine • Define portable drilling machine, describe its operations • Define pedestal drilling machine, describe its operation • Explain column& radial drilling machine, Discuss its operation • Define gang drilling machine & explain its operation • Define special drilling machine & explain its operation • Differentiate gang drill, special drill • Explain shaper machine • List different type of shaper • List the different parts of shaper • Elaborate the parts of shaper with their function • Explain the mechanism of shaper • Discuss the various shaping operation • Define sawing machine • List different types of metal cutting saws • Elaborate power hacksaw • Discuss the main parts of power hacksaw machine • Describe the operation of power hacksaw • Explain band saw • List the different parts of band saw machine	Shaping operations and shaper	2	3
			Sawing operation and power hacksaw	2	3
			Sawing operation and band saw	2	3
			Hand grinding operations and pedestal grinder	2	3
			Turning operation and lathe Level-I (Center Lathe)	18	12
			Milling operations and milling machine Level-I (Column Knee type [vertical and Horizontal] Milling Machine)	18	12

		• Describe sawing operation of band saw machine • List types of band saw machine • Define hand grinding • Discuss the advantages of hand grinding • Explain the operation of hand grinding • Discuss the different types of lathe machine • Explain centre lathe • Demonstrate the working principle of centre lathe • Discuss the operation of centre lathe • Parts of milling machine • List diff. Types of milling machine • Explain & demonstrate working of column and knee type milling machine			

VI. REFERENCE BOOKS

Sr. No	Title	Authors	Publication
1	WORKSHOP TECHNOLOGY : AN INTRODUCTORY COURSE PART 1	CHAPMAN,W.A.J.	EDWARD ARNOLD PUBLISHERS LTD.
2	WORKSHOP TECHNOLOGY PART 2 : MACHINE TOOLS	CHAUDHARY,TIKAMLAL	KHANNA PUBLISHERS,
3	WORKSHOP TECHNOLOGY VOL 1	ARORA,B.D.	SATYA PRAKASHAN
4	WORKSHOP TECHNOLOGY	GUPTA, R.B.	SATYA PRAKASHAN.

A1-07: ELECTRICAL & ELECTRONICS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL
2	-	3	60	-	40	-	100

II. RATIONALE: (NEED AND IMPORTANCE OF THE SUBJECT)

Study of Magnetic and Electric Circuits are essential in study of Electrical Engineering, study of elements of electrical engineering constitutes the basic and fundamental aspect of the functioning and analysis of Electrical network, instruments and machineries and also to integrate the basic knowledge to make the base of understanding electronics technology. The basic principles involve in understanding and working is included in the syllabus. This concept will help the students to pick up the higher knowledge which is to be imparted in the following years. The faculty may give some assignments and arrange for industrial trips.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVE

The student should be able to.

- Understand the electrical engineering concepts such as current, voltage, frequency, resistance, electro-magnetic induction, Capacitance, Electrostatics.
- Understand electrical engineering principles and rules.
- Apply principles in solving electrical engineering problems.
- Understand principles and construction of transformer.
- Understand AC &DC source of energy.
- Student will be able to identify different components used in electronics circuits.
- Student will know the basic concept of components used and their practical application.
- To develop the concept on Electrical and electronic circuit parameters and laws.

IV. COURSE OUTCOMES

- Student will be able to identify different components used in electronics circuits.

- Student will know the basic concept of components used and their practical application.
- Students will able to do understand and explain the working principles of operation of various components.
- Conceptual understanding.
- Application of knowledge in solving problem.
- Solving the numerical problems related to electrical power system.
- Circuit development/Problem solving.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	ELECTROMAGNETIC INDUCTION	Student Should be able to :- • Understand the concept of electromagnetic indication. • Explain various electromagnetic laws. • Understand mutually induces EMF • State Flemings left hand rule • State faradays law	Electromagnetic Induction Contents: Relation between Magnetism and Electricity, Production of Induced E.M.F. and Current, Faraday's Laws of Electromagnetic Induction, Fleming's Right Hand Rule, Lenz's Law Induced E.M.F: Self Induced E.M.F., Mutually Induced E.M.F., direction of Induced E.M.F. and currents, Energy Stored in Magnetic Field.	8	12
2	SINGLE PHASE TRANSFORMER	Student Should be able to :- • Describe construction & working of single phase transformer. • Explain working principle of transformer • List the parts of single phase transformer	Single Phase Transformer Construction and working of transformer, classification , brief description of each part, its function (power transformer, audio frequency transformer, frequency transformer, transformer, pulse intermediate frequency transformer) Significance of EMF equation (no derivation) Voltage ratio, current Transformation ratio.	8	12
3	THREE PHASE INDUCTION MOTOR	Student Should be able to :- • Understand three phase induction motor	Three Phase Induction Motor Construction and principle of working Types - Squirrel cage and. slip ring	8	12

	AND FRACTIONAL HORSE POWER MOTORS	• Explain the construction & working of Universal motor, Stepper motor, Servo motors. • Understand necessity of starter	Torque - speed characteristics Necessity of starter Basic concepts of speed control method Using Thyristor. Universal motor - Schematic Representation, principle of operation, reversal of rotation and applications. Stepper motor - Schematic representation, types, principle of working and applications. Servo motor - Schematic representation Types, principle of working and applications.		
4	SEMICONDUCTOR DIODES.	Student Should be able to :- • Understand concept of DIODE • List types of diode. • Describe PN junction diode • Draw symbols for various diodes • Explain working principle of diode	P.N. Junction Diodes Working principle &circuit diagram of Characteristic of PN junction diode, Static & dynamic resistance, specification, forward voltage drop, maximum forward current, power dissipation. Zener diode Constructional diagram, symbol, circuit diagram and characteristics of Zener diode Specification: Zener voltage, power dissipation, dynamic resistance Special Diodes Construction, symbol & applications of PIN diode, Schottky diode, Tunnel diode	6	9
5	DC circuits and Network Theorems	Student Should be able to :- • Understand fundamentals of DC circuits. • Analyze various network laws. • Define Ohm's law. • State Kirchhoff's current & voltage law. • Analyze source conversation • Explain STAR/DELTA & DELTA/ STAR • Understand various network theorem with its application	Fundamental of DC circuit Ohm's law: Concept of open &short circuit, Kirchhoff's current, Maxwell's loop analysis, Concept of ideal &practical current, and voltage sources source conversion. Star/Delta &Delta /Star conversion (no derivations) Voltage divider and Current divider Network theorem Statement, explanation & applications of following Super position theorem Thevenin's Theorem Maximum theorem Numerical examples on above topic.	10	15

VI. REFERENCE BOOKS

Sr. No	Title	Authors	Publication
1	BASIC ELECTRICALS	B.L. THARTEJA	S. CHAND
2	PRINCIPLES OF ELECTRONICS	V.K MEHTA	S. CHAND
3	BASIC ELECTRONICS	GROB BERNARD	Mc GRAW-HILL
4	A TEXTBOOK OF APPLIED ELECTRONICS	R.S. SEDHA	S. CHAND

A1-08: COMPUTER APPLICATIONS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORLA/PRACTICE	TOTAL
1	3	--	-	60	-	40	3	100

II. RATIONALE: (NEED AND IMPORTANCE OF THE SUBJECT)

The primary purpose of using a computer is to make life easier. Profession, role of computer in general and hardware &software becomes very vital. Computers have established an indispensable part in a business, academics, research, engineering, medicine, space. The subject introduces the fundamentals of computer system focusing various hardware and software components. It also requires Computer Networking

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVE

The student should be able to.

- Understand a Computer system that has hardware and software components, which controls and makes them useful.
- Understand the operating system as the interface to the computer system.
- Understand application of software in mechatronics.
- Have hands on experience on operating system and different application software.
- Use the Internet to send mail and surf the World Wide Web.
- Setup of local Network (Wire &Wireless).
- Understand different hardware components/elements for networking.
- Use of MS-Office (Word, Excel &PowerPoint).

IV. COURSE OUTCOMES

After completion of this course students will be

- Computer operation process/function
- Able to select software/hardware.
- Identify Need & nature of networking.
- Searching of information.

- Computer operation and handling.
- Develop a peer to peer networking.
- Developing output based on MS office/use tools.
- Develop skill to handle and use Internet.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	Introduction	Student Should be able to :- • Define Computer • Classify types of computers • Explain block diagram of computer • Convert Binary decimal hexadecimal • Describe bit Byte concept • Draw flow chart • Understand the algorithm	Computer Fundamental: Definition of Computer, Hardware & Software, Classification Generations, characteristics & History of computers, Block diagram of computer, Area of applications, Computer Programming Languages, Components of IT Data Representation: Number system, converting between Binary Decimal & Hexadecimal number system, Basic definition Bits, Byte, Word & Double Word, Memory unit, ASCII code. Flowchart &Algorithm: Algorithm Definition, Characteristics, Advantages and disadvantages, Examples Flowchart: Definition, Define symbols of Flowchart, Advantages and disadvantages, Examples.	4	12
2	Operating System & I/0 Devices.	Student Should be able to :- • Understand the concept of Operating • List types of Operating system • Use applications like paint, calculator, notepad	Operating System: Meaning and Definition, Structure of O.S., Types of O.S., Functions of O.S., DOS - Internal & External commands, Batch files. Windows Operating system: Components of window desktop, windows explorer, control panel, Managing the files	4	12

		• List the input & output devices of computer • Explain the function of each input & output device	and folders, Accessories: Paint, calculator and notepad. I/0 Devices: Input Devices Keying: Keyboard, Touch screen, Pointing Mouse, digitizer, Joystick and scanning devices: Scanner, OMR, OCR, and MICR. Output Devices Monitors (CRT, TFT, LCD, Plasma), Screen Image Projector, Printers &its types, Plotters. Memory Devices: Primary Memory &its types (RAM, ROM,CMOS), Secondary memory &its types (Hard Disk, Flash Drives, Magnetic Tape, Optical Discs- CD, DVD, Blue-Ray).		
3	MS OFFICE	Student Should be able to :- • Demonstrate the use of MS word • Perform various tasks on MS Excel • Create a power point presentation	MS-Word: Moving through a Word document menu bar and drop down menus toolbars, Entering text into a document, deleting text, Font formatting keyboard shortcuts, Paragraph formatting, Bullets and numbering, Page formatting, Headers and footers, Introducing tables and columns, printing within Word, Development of application using mail merge, Creating and using macros in a document MS-Excel2013: Creating and opening workbooks & entering data, navigating in the worksheet, Selecting items, Inserting and deleting cells, rows and column, Moving between worksheets, Formatting and customizing data, Formulas, functions and named ranges, creating, manipulating & changing the chart type, Printing, Page setup, MS-PowerPoint: Introduction to Power Point, Toolbars, Creating a Simple Presentation, Additional Features in PowerPoint, Creating Slide Show, Navigating through a slide show,	8	24

			Slide show transitions, Slide show timings, Animation effects Printing a Presentation.		
4	Networking& Internet.	Student Should be able to :- • List components of a communication • List types of networks • Differentiate between various types of networks • Explain network devices • Use internet • Create Email account	Data Communication: Components of communication system, Computer network advantages and applications. Types of Network LAN MAN WAN, Peer to Peer and Client Server Network. Parallel and Serial Synchronous and Asynchronous transmission, Transmission Mode, Network Topologies, Transmission Media , Networking Devices, OSI Model, TCP/IP Protocols. Internet: History of Internet, requirement for connecting Internet, Sending & receiving e-mails, browsing the WWW Creating own Email Account, Searching	4	12

VI. **LIST OF PRACTICAL EXERCISES (Total Hours: - 60 Hrs.)**

01	Identification of the peripherals of a computer, components in a CPU and its functions.
02	Installation of operating System (win XP7 /8) and Device Drivers.
03	Study & Executing of Internal &External MS DOS command.
04	Write a leave letter to the Principal using different alignments, &formats in MS-Word.
05	Development of application using mail merge.
06	To create a cover page of a project report in MS Word.
07	Create your class time table by using different formatting styles in MS- Excel.
08	Create a marks sheet for 10 students using EXCEL.
09	To create simple bar chart using Excel.
10	To create a simple presentation in PowerPoint.
11	To create animation and sound effects using MS PowerPoint.
12	Practical setup of Lab Intra-Network.
13	Configuration of wireless Router and setup of Wi-Fi network.
14	Web Browsers, Surfing the Web customize their web browsers with the LAN.
15	To access the websites and email & Search Engines.

VII. REFERENCE BOOKS

Sr. No	Title	Authors	Publication
1	Chetan Srivastava	Fundamental of Information.	Kalyani Publisher.
2	V. Rajaraman	Fundamentals of Computers.	PHI Publication, IVth Edition.
3	B. Ram	Computer Fundamental.	PHI Publication, IVth Edition.
4	E Balagurusamy	Fundamentals of Computers.	Tata Mcgraw Hill Publication.
5	Behrouz A. Forouzan	Data communications.	McGraw-Hill.
6	Dr. P. MOHAN	Fundamentals Of Computers.	Himalaya publishing House.

MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

SECOND SEMESTER: COURSE DETAILS

ADVANCE DIPLOMA IN TOOL & DIE MAKING

A2-01: ELECTRICAL & ELECTRONICS (WORKSHOP)

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
0	3	-	-	60	-	40	3	100

II. COURSE RATIONALE

Study of Electrical & Electronics (Workshop) are essential in study of Electrical Engineering, study of elements of electrical engineering constitutes the basic and fundamental aspect of the functioning and analysis of Electrical network, instruments and machineries and also to integrate the basic knowledge to make the base of understanding electronics technology. The basic principles involve in understanding and working is included in the syllabus. This concept will help the students to pick up the higher knowledge which is to be imparted in the following years. The faculty may give some assignments and arrange for industrial trips Symbol, Specification and Approximate Cost. Phase Tester, Series Test Lamp, Tong Teste Study.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVE.

Students will be able to:

- Understand the electrical engineering concepts such as current, voltage, frequency, resistance, electro-magnetic induction, Capacitance, Electrostatics.
- Understand electrical engineering principles and rules.
- Apply Safety Precautions & use of Fire Fighting Equipment's
- Understand principles of Switches and Study of their Working Mechanism
- Understand Identification of Resistors and finding their Values
- Student will be able to identify different components used in electronics circuits.
- Student will know the basic concept of components used and their practical application.
- To develop the concept on Electrical and electronic circuit parameters and laws.

IV. COURSE OUTCOMES

- Student will be able to identify different components used in electronics & Electrical circuits.
- Student will know the basic concept of components used and their practical application.
- Students will able to do understand and explain the working principles of operation of various components. Conceptual understanding.
- Application of knowledge in solving problem.

- Solving the numerical problems related to electrical & electronic power system.
- Circuit development/Problem solve Student will be able to identify different components used in electronics circuits.
- Student will know the basic concept of components used and their practical application.
- Students will able to do understand and explain the working principles of operation of various components.
- Application of knowledge in solving problem.
- Circuit development/Problem solving

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1 ELECTRICAL	Introduction to Electrical workshop	Student Should be able to:- • Understand the Symbols used in electrical workshop • Understand the concept of Measurement • Understand the Prepare one Switch Board • Study & Functioning Domestic Appliances	Study of Symbol, Specification and Approximate Cost of Common Electrical Accessories, Tools and Wires & Cables Required for Domestic Installation Basic Electricity Rules for a Domestic Consumer Safety Precautions & use of Fire Fighting Equipment' Use of series of Phase Tester, Series Test Lamp, Tong Tester and Megger in Testing of Electrical Installation	30	30
	Measurement		**Measurement** Prepare a Potential Divider and Measure Resistance of a Filament Lamp Using Voltmeter and Ammeter. Measurement of Power and Energy Consumption by an Electric Heater using Watt Meter and Energy Meter.		
	Preparation & Functions		**Prepare one Switch Board as per Institutional Requirement** (Using Flush type Switches, Sockets, MCB, Etc.) Study, Connecting, Testing and Fault Finding of Fluorescent Tube and its Accessories Ceiling Fan with resistance type and Electronic Regulator **Study & Functioning, of following Domestic Appliances** Automatic Electric Iron, Air Cooler, Electric Water Pump Design Draw and Estimate the Material required for Installation For a small Residential Building / Office / Hall.		

2 ELECTRONICS	Identification	Student Should be able to:- • Understand the building Resistors • Identify the capacitor • Understand the Switches Working Mechanism • Study of Tools used in Electronic • Understand the Measurement of Amplitude • Understand the general purpose of PCB	**Identification of following Resistors and finding their Values:** Fixed Resistor Variable Resistance Semi Variable Preset.	30	30
	Working Mechanism		**Identification of following Capacitor and finding their Values:** Ceramic, Polystyrene, Electrolytic, Tantalum **Identification of following Switches and Study of their Working Mechanism:** Toggle switch, Slide switch , Rotary switch, Push to on Push to off, Momentary Switch, Electromagnetic Switch SPST, SPDT, DPST, DPDT		
	Tools used in Electronic Workshop		**Identification and Testing of following type of Connectors:** Printed Circuit Edge, Coaxial, Tape & Ribbon, Plug and Socket connector, USB connector, Power connector, Radio Frequency connector **Study of following Tools used in Electronic Workshop**: Component Lead Cutter, Wire Strippers, Soldering Iron & Soldering Station, De-Solder Pump, Tweezers, Noise Pliers, Screw Driver, LCR meter, Power Supply, Signal Generator Measurement of Voltage, Current and Resistance using Analog & Digital Multi-meter. Testing of Electronic, Component such as Capacitor, Inductor, Diode and Transistor. Measurement of Amplitude & Frequency of a Signal using CRO. Verification of Ohm's law using Resistive Circuit and Analog/ Digital Meters.		

			Soldering of different passive component combination on general purpose PCB Sketching of different Electronic Components Symbol on Drawing Sheet.		

VI. LIST OF PRACTICLES

SR. NO.	TITLE OF EXPERIMENT(ELECTRONICS)
1	Study various measuring instruments like Voltmeter, Ammeter & Multimeter
2	Study different types of resistors, capacitors & inductors.
3	To find the value of resistor by color coding method & verify it using multimeter.
4	To study forward characteristics of PN junction diode.
5	To study reverse characteristics of PN junction diode.
6	To study forward characteristics of Zener junction diode.
7	To study reverse characteristics of Zener junction diode.
8	To study operation & understand applications of LED & photo diode.
9	To study the operation of Half wave rectifier & verify its I/O waveforms.
10	To study the operation of Full wave Centre tap rectifier & verify its I/O waveforms.
11	To study the operation of Full wave Bridge rectifier & verify its I/O waveforms.
12	To study the operation of Inductor Filter & verify its I/O waveforms.
13	To study the operation of Capacitor Filter & verify its I/O waveforms.
14	To study the operation of Inductor-Capacitor Filter & verify its I/O waveforms.

SR. NO.	TITLE OF EXPERIMENT(ELECTRICAL)
1	a. Know your electrical laboratory b. learn the safety Precautions to be followed in the laboratory.
2	To determine Impedance, resistance & reactance of CHOKE Coil (Ballast).
3	To determine current drawn and Power factor of a series R-L-C Circuit and to draw a Phasor diagram.
4	To Verify Line and Phase relationship between voltage and current phase balanced star and delta circuit.
5	To find transformation ratio of single phase transformer.
6	To determine efficiency of a single phase transformer at half load, ¾ load and full load.
7	To determine Slip of a three phase induction motor.
8	To reverse direction of rotation of a three phase induction motor.
9	To measure insulation resistance of a motor winding.
10	To study different types of wires/cables and switches.
11	Mini project on wiring(inter connection of switch, holder, fuse, plug socket indicator)

VII. REFERENCE BOOKS

Sr. No.	Author	Title	Publisher
1	M.L. Gupta	Electrical Workshop	
2	K.B. Bhatia	Domestic Devices & Appliances	
3	S.L. Uppal	Electrical Workshop	
4	K.R. Nahar	Electrical Component & Shop Practice	
5	K. S. Janwal	Maintenance of Electrical Equipments	Danpat rai & Co. (P)
6	Ritu Sahdev	Basic Electrical Engineering	Khanna Publishing House, 2018

A2-02: ENGINEERING MATHEMATICS - II

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS TUTORIAL	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK	ORAL	TOTAL MARKS
2	1	3	60	-	40	-	100

II. COURSE RATIONALE

Mathematics is the foundation of science and technology. The study of basic mathematics is helpful to understand concepts of Engineering. This subject enhances logical thinking capability. It also improves the systematic approach in solving engineering problem.
Algebra provides the language and abstract symbols of mathematics. It also helps to use that Language in real-life applications.
Matrix and Determinant topics are helpful for finding optimum solution of system of
Simultaneous equations which are formed in the various branches of engineering using different parameters.
Trigonometry is the study of triangles and angles.
Geometry gives emphasis on understanding the deductive reasoning process. It includes writing derivations of theorems and giving geometric relationships by reasoning. Co- ordinate geometry plays an important role in Animation, AutoCAD, Computer graphics etc. Contents of this subject will form foundation for further study in mathematics.

III. COURSE OBJECTIVES/INSTRUCTIONAL OBJECTIVES

- Apply Cramer's rule and matrix method to solve simultaneous equations in three Variables.
- Use concept of allied angle, compound angle, multiple and sub-multiple angles to
- Solve engineering problems.
- Use factorization and de-factorization formulae to solve examples.
- Understand the relationship of two variables.

IV. COURSE OUTCOMES

Student will be able to:

- Solve point & distance numerical
- Solve the line equation using different forms
- Elaborate the circle equation
- Numerical on functions & limits

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1 COORDINATE GEOMETRY	POINT & DISTANCE	Student Should be able to :- • Solve Point & Distance Numerical • Understand Section Formulae • Solve Centroid of Triangle, • Area Of Angle & Co linearity of Point	Distance between two points, Section formula, Centroid of the triangle, Area of a triangle, Collinearity of the points	6	9
	STRAIGHT LINE	Student Should be able to :- • Solve Line Equation Using Different Forms • Classify Slop & Intercept of Line • Calculate Parallel & Perpendicular Line • Understand Slope Point Form, Two Intercept Form, general Equation of Straight Line • Solve Slope & Intersection of The Line, Perpendicular Distance of Point Form A Straight Line	Slope and Intercepts of a line, Angle between two lines, Parallel and perpendicular lines, Various forms of the straight lines, Slope - point form, Equation of the straight line through the point of intersection of two line, Two points form , Slope-point form, Two intercepts form, General equation of the straight line, To find slope & intercepts of the line Ax + By + C = 0, Perpendicular distance of point form a straight lines, Distance between two parallel lines	14	15
	CIRCLE	Student Should be able to :- • Elaborate Equation of Circle • Calculate Centre & radius of Circle • Evaluate General Equation of Circle	Equation of circle, Equation of circle with Centre at (h,k) and radius r Education of circle with Centre at origin and radius r General equation of circle Centre and radius of circle $x2+y2+2gx + 2fy +c =0$	8	12
2 FUNCTIONS & LIMITS	FUNCTIONS & LIMITS	Student Should be able to :- • Solve Engineering Numerical on Function & Limit • Calculate Limits By Substitutions & By Elimination Zero Denominators	Definition of Constant and Variable, Definition of Function of Notation, Value of a function. Different types of Functions (Illustration by examples) Algebraic functions, Rational	12	24

		• Calculate Limit At Infinity of Rational Function • Calculate Limit in Determinant Form by Repeated Used of L Hospital Rule • Classify Odd, Even Function	functions. Trigonometric and Inverse trigonometric functions. Logarithmic and Exponential functions Parametric functions, Implicit functions. Even and odd functions **Concept of limit** Algebra of limits, Methods of finding limit, Limit of Algebraic functions by factorization, rationalization, etc. Limit of Trigonometric functions Limit of Exponential functions.		

VI. Tutorials: (Total Hours:- 20 Hrs.)

1) Tutorials are to be used to get enough practice.

2) Make group of 20 students and for each group minimum 10 problems are to be given.Knowledge, skills, and attitudes to be developed (Laboratory objectives)

List of tutorial:

Sr. No.	Topic for tutorial
1	Forms of line equations
2	Point & distance formula
3	Equation of circle
4.	Functions
5	Limits

VII. REFERENCE BOOKS

Sr. No	Title	Authors	Publication
1	Mathematics for Polytechnic	S.P. Deshpande	Pune Vidyarthi Griha.
2	Trigonometry	S. L. Loney	S. Chand Publication
3	Matrices	Ayres	Schuam series McGraw Hill
4	Higher Engineering Mathematics	B. S. Grewal	Khanna publication
5	Engineering Mathematics	S. S. Sastry	Prentice Hall of India

A2-03: APPLIED CHEMISTRY

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTCE	TOTAL MARKS
2	2	3	60	-	40	50	3	150

II. COURSE RATIONALE

Chemistry is a foundation of all core technology subjects. Study of science and technology goes hand in hand. Technical knowledge can be gained more effectively using concepts of chemistry. Curriculum of Applied Chemistry includes fundamental concepts used in industrial applications.

Definition of Atom, Atomic number atomic mass, Bohr's Atomic theory its postulates, explanations, Quantum numbers, Principal, Azimuthal, Magnetic and Spin Quantum numbers, Orbit and sub orbit and number of electronic & their distribution, Orbitals Sipete

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

The student should be able to

- Understand method of selection of material for intended purpose.
- Apply knowledge of good and bad conductors of heat in various engineering concepts.
- Know the effect of interference between light waves.

IV. COURSE OUTCOMES

Student will be able to:

- Understand ATOMIC STRUCTURE
- Understand ELECTRO CHEMISTRY.
- Know the Water Treatment.

V. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	ATOMIC STRUCTURE	Student Should be able to :- • Describe Application of X-rays • List Properties of X-rays • Explain Laser generation	Definition of Atom, Atomic number atomic mass, Bohr's Atomic theory its postulates, explanations, Quantum numbers, Principal, Azimuthal, Magnetic and Spin Quantum numbers, Orbit and sub-orbit and number of electronic & their distribution, Orbitals Sipete. Pauling Exclusion principle, Hand's Rule, its explanation, Filling of the orbits, Orbital electronic configuration of the atoms having atomic number 11 to 20, Nuclear Stability, Mass defect Periodic table, Modern Periodic Law, Long form of Periodic Table	6	10
2	KINETIC THEORY OF GASES & METALS, ALLOYS NON- METALS	Student Should be able to:- • Classify engineering materials • List properties of metals • Explain applications of metals • List types of plastics • Properties & applications of plastics • List Types of rubber. Properties and applications of rubber	**Kinetic Theory of Gases** **Ideal Gas Equation, Vender Walls Equation** **Liquification of Gases, Critical Pressure and Critical Temperature for Liquification** **Metals and alloys** Characteristics of metals, occurrence of metals Physical properties and applications of metals. Alloys, preparation of alloys, purposes of making alloys. **Non-metallic engineering materials** Definition of plastics, types of plastics. Properties and applications of plastics. Types of rubber. Properties and applications of rubber.	6	10
3	FUELS AND LUBRICANT	Student Should be able to:- • Define lubricant • List functions of lubricants • Classify lubricants • Explain various characteristics of lubricants • Explain various characteristics of Fuels	**Fuels & Lubricant** Definition of lubricant, functions of lubricants. Classification of lubricants. Physical characteristics of lubricants, viscosity, viscosity index, oiliness, volatility, flash and fire point, Cloud and pour point, Chemical characteristics of lubricants value **Fuels**	8	10

			Definition, Classification, Calorific Value (HCV and LCV), Solid Fuels, Coal and Coke, Liquid Fuels, Petroleum and its Distillation, Cracking, Octane and Cetane Values of Liquid Fuels, Synthetic Petrol, Power Alcohol, Bio-Gas		
4	ELECTROCHEMICAL CELLS/BATTERIES / POLYMERS, INSULATORS, DIELECTRICS AND ADHESIVES	Student Should be able to:- • Define Electrochemical cells • Classify electrochemical cells • Explain construction and working of Primary cells and secondary cell • Define Polymers • Classify Characteristics of polymers	**Electrochemical cells/batteries** Definition of electrolyte. Conductivity of electrolytes. Specific conductance, cell, battery. Classification of electrochemical cells: Primary cells and secondary cell, its construction and working **Polymers, Insulators, Dielectrics and adhesives:** Definition, examples and applications of electrically conducting polymers. Definition of dielectrics and insulator. Properties of gaseous, liquid and solid insulators, their examples. Definition, Characteristics, advantages of adhesives.	8	10
5	WATER & CORROSION	Student Should be able to • List types of Impurities in nature / water • Explain Physical & chemical characteristics • Explain use of Water Treatment by washing Soda • Process of removal hardness • Define Corrosion • Protection from Corrosion by method	Impurities in nature / water, Physical & chemical characteristics of water, Types, Hard water & Soft water, Disadvantages of Hard water in domestic use & in industrial use, Boiler troubles Scale and sludge formation in boiler , Water Treatment by washing Soda, Permutit Process and Ion exchange process of removal hardness, Limesoda Process, Treatment of drinking water coagulations, Sedimentation, Filtration, Chlorination, PH Value & Its Engineering Applications Definition of Corrosion Theories of Corrosion Acid Theory (Rusting), Direct Chemical Corrosion or Dry Corrosion, Wet Corrosion or Electro-Chemical Corrosion (Galvanic and Concentration Cell Corrosion), Protection from corrosion by Galvanisation , Tinning	12	20

VI. LIST OF PRACTICLES: (Total Hours:- 40 Hrs.)

- Determination of Percentage Purity of an Acid by Titration with Standard Acid.
- Identification of Acid and Basic Radicals in a Salt
- Characteristic tests of carbohydrates, fats and proteins in pure sample and their detection in given food stuffs.
- Determination of Percentage Purity of a Base by Titration with Standard Alkali Solution.

- Determination of the Strength of Ferrous Sulphate using Standard Ferrous Ammonium Sulphate and Potassium Dichromate as Intermediate Solution.
- Determination of melting point and boiling point of Compounds
- Determination of Heat of neutralisation between Acid and Base.
- Determination of pH Values of Given Samples.
- Determination of Hardness of Water by EDTA Method.
- Estimation of Free Chlorine in Water.
- Determination of Acid Value of Oil.
- Preparation of Soap.

VII. REFERENCE BOOKS

Sr. No.	Title	Author	Publisher
1	Chemistry of Engineering Materials	C.V. Agarwal	
2	Engineering Chemistry	P.C. Jain and Monika	
3	Engineering Chemistry	M.M. Uppal	
4	Engineering Chemistry	V.P.Mehta Jain Bros. Jodhpur	
5	Practical Chemistry for Engineers	Virendra Singh	

A2-04: MACHINE DRAWING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
2	6	-	-	60	-	40	3	100

II. COURSE RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation.

The course of study for comprises both practical and theoretical activities that respond to the interests, skills and disposition of students within a wide range of abilities. This subject stimulates an interest in drafting and engineering as career options for students.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

- Appreciate the need for sectional view and types of sections.
- Draw sectional views using different types of sections.
- Explain the use of threaded fasteners and the types of threads.
- Compare hole basis system with shaft basis system.
- Select different types of fits and tolerance for various types of mating parts.
- Appreciate the importance of fits and tolerance.

IV. COURSE OUTCOMES:

- Understand Importance of engineering drawing; Drawing techniques.
- Understand the concept of developing cross sections.
- Develop the ability to draw the isometric view from the orthographic views.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	TOLERANCES, LIMITS, FITS AND SURFACE TEXTURE	Student Should be able to :- • State what is Limits, Fits, Tolerances and Surface Texture? • Importance of Limits, Fits, Tolerances and Surface Texture. • State types of Limits. • Indicate the Tolerances on drawing. • Define the Fits. • Types of Fits. • Explain Need of Fits. • Define Clearance fit, Transition fit and Interference fit. • Define Tolerance. • Importance of tolerances on drawing. • State Types of Tolerances. • Method indicate tolerances individual parts. • State Importance of surface texture. • Identify the surface roughness and machining symbols. • Explain interpret the meaning of machining symbols.	Exercises on surface texture symbol & values/ specifications. Roughness value Ra, roughness grade numbers. Production methods, coating, machine allowance. Factors for choice of symbols, value and location. Drafting of symbol. Indicating specifications. Placing/ location of symbol. Exercises on Part drawing indicating production, process surface value Ra or grade. Indication of tolerances, limits, fits. Introduction to examples of lines and angular tolerancing on technical drawings. Limits of tolerancing. Tolerancing of lines and angular. Order of deviations and limits. Types of fits. Rules for tolerancing of parts and mating parts and their representation as per BIS norms. Procedure for indicating tolerances on drawing of parts and mating parts. Exercises Tolerancing lines and angular dimensions on drawings of parts and mating parts.	2	3

2	GEOMETRIC TOLERANCING SYMBOLS AND CHARACTERISTICSGEOMETRIC TOLERANCING SYMBOLS AND CHARACTERISTICS	student will be able to: • Understand concept of Geometric tolerance symbol. • Importance of geometric tolerances on drawing. • Types of Geometric tolerances. • Concept of Datum, Feature control frame • Identify form and position tolerances • Apply the different geometric tolerances on drawing. • Interpret the meaning of geometric tolerance symbols	Exercises on single and related features. Form tolerance (Straightness, flatness, circularity, cylindricity, profile of line and profile of surface).Orientation tolerances (Parallelism, Perpendiculars siting and angularity) Location tolerances (Position, coaxially, symmetry).Run-out tolerances (Circular run-out, total run-out).Rules of geometrical tolerancing. Relationship of individual features from its ideal feature form. Procedure of drafting symbols. Procedure of indicating tolerances and characteristics. Procedure of interpreting symbols and indications. Exercise on drafting and writing lead line, arrow, datum letter, tolerance value and symbols and features. Exercise on interpreting symbols and indications.	4	3
3	SECTIONAL VIEWS	student will be able to: • Define Sectional views. • Principle of sectional views. • Understand the importance of Sectional views. • To describe the types of Sectional views • To draw different sectional views according to applications. • Draw the different types of sectional views on drawing sheet/sketch book	Exercises on types of sectional views. Sectional lines & sectioning. Principles of sectioning & BIS norms. Procedure for selecting and drawing of section views. Exercises on single object sectioning and sectioning on simple assemblies.	4	15
4	DEVELOPMENT OF SURFACES	student will be able to: • Understand the Definition, principle and procedure for Surface development. • State the types of methods used to draw surface developments. • State the importance and applications of Developments of surfaces. • To understand drafting procedures of parallel	Exercises on types of development of surfaces (Ruled, Plane surfaces, Single curved, Warped, Double curved surfaces). Parallel line development. Radial line development. Triangular development. Approximate development. Procedure for development of surfaces by orthographic projection method. Rectangular truncated prism. Cylinder with inclined. Pyramid and truncated	6	6

		development, Radial line development • To understand drafting procedures of construction development of surfaces on drawing sheet/sketch book	pyramid. Cone and truncated cone. Exercise on development of surfaces of solids as indicated above.		
5	INTERPENETRATION OF SOLIDS	student will be able to: • To understand the Definition, and principle of interpenetrations of solids., • State types of interpenetrations of solids. • To understand uses of interpenetrations of solids. • To understand drafting procedures and Principles of interpenetrations of plane surfaces and curved surfaces. • To draw the different Interpenetration curves of cylinder, prism and pyramids in to each other on drawing sheet/ sketch book	Introduction to interpenetration of solids. Definition of interpenetration of solids. Intersection of two plane surfaces. Intersection of two curved surfaces. Intersection of plane surface and curved surface. Principles of generating curves of intersection by line method and cutting plane method. Procedure for construction of intersection of Prism and prism. Cylinder and cylinder. Cone and cylinder. Cylinder and prism. Exercises with Tool Room applications.	6	6
6	ELEMENTS OF ASSEMBLY	student will be able to: • Define the temporary joint and permanent joints. • Define the screw threads and their importance. • State types of screw threads. • State the types of nuts, bolts, screws and washers. • To draw the different views assembly elements on drawing sheet / sketch book.	Introduction to Elements of assembly. Temporary joints: Screw threads. Bolts. Nuts. Dowels. Washers Springs. Permanent joints. Representation norms as per BIS to represent the elements being used for assembly. Selection and representation of different elements in engineering drawing used in assembly. Exercise on selection and representation of different elements temporary joints on drawing.	2	3
7	ELEMENTS OF JOINTS	student will be able to: • To understand the different types of joints. • Explain Rivet and Riveting. • State types of Riveted joints, & types • Explain the methods used to make riveted joints air tight. • Explain the Welding processes. • Types of welded joints.	Exercises on rivet joints, welded joints and pipe joints. Temporary joints. Permanent joints. Rivet joints and types. Welded joints and types. Pipe joints and types. Principles of representation of different types of joints as per BIS norms. Drawing and dimensioning of different joints. Exercise for practice of different joints used in Tool Design.	4	3

		• Draw different types of welding symbols on drawing sheet			
8	ASSEMBLY AND DETAIL DRAWINGS	student will be able to: • Define Assembly drawing. • Explain different types of assembly drawings • To draw Bill of Material block. • Know the procedure of drafting of different views of assembly drawing. • Know the procedure of drafting of detailed drawing. • To draw the simple assembly drawings and details of the same on drawing sheet.	Exercises on assembly drawing and detail drawings. Title block. Bill of material block. Modification block. Relationship of assembly drawing, detail drawing and bill of material. Procedures for drawing of assembly drawing and detail drawing and with bill of material etc. for the following simple jobs Jig. Fixture. Press tool (Single operation).Injection mould (Single cavity).Exercises on developing assembly drawing and detail drawing for the above specified Tools.	6	18
9	MACHINE ELEMENTS	student will be able to: • To understand the principles for drawing conventional representations of machine elements. • To Procedure for conventional representations of gears and springs. • Identify the different types of keys and cotters, their applications. • Identify the different types of Circlips and, their applications. • Identify the different types of O-rings and their applications. • To draw the different types of machine elements on drawing sheets	Conventional representation of Gears and types. Bearings and types. Cotter joints and types. Shaft couplings and types Keys and types. Circlips. Pins. O-rings Principles of representation of different machine elements as stated above as per BIS norms. Procedures for representation of different machine elements and dimensioning. Exercises on drawing of different machine elements as per norms and dimensioning it.	6	3

VI. LIST OF PRACTICALE EXPRINCES: (Total Hours:- 120 Hrs.)

01	Sectional views
02	Sectional views
03	Geometrical tolerance
04	Development of surfaces and intersection of surfaces
05	Keys and cotter joints
06	Screw threads
07	Riveted joints and welded joints
08	Assembly and detail drawing screw jack
09	Assembly and detail drawing- knuckle joint
10	Assembly and detail drawing -square tool post
11	Assembly and detail drawing - revolving centre
12	Assembly and detail drawing - (simple jig and press tool)

VII. REFERENCE BOOKS

Sr. No.	Author	Title	Publication
1	N. D. Bhatt	Engineering Drawing	Charotar Publishing House 2010
2	R. K. Dhawan	Engineering Drawing	S. Chand Co., Reprint 2010
3	K. L. Narayan, P.	Text Book on Engineering Drawing	Scitech Publications, 24th Reprint August 2011
4	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age Publication, Reprint 2006

A2-05: APPLIED MECHANICS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	2	3	60	-	40	-	100

II. COURSE RATIONALE

Study of science and technology goes hand in hand. The study of mechanics is helpful for understanding the concepts of engineering. Curriculum of Applied Mechanics includes fundamental concepts used in industrial applications.

Study of various forces is helpful in the selection of Material. It helps in analysis of real world engineering structures. It helps in the modelling and analysis of static equilibrium problems with an emphasis on real world engineering systems and problem solving. The topics like friction, equilibrium are helpful to learn the applications of the equations of static equilibrium to interacting bodies or parts of a structure. The topics like centre of gravity & machines give knowledge about systems containing multi-force members, frames, and machines.

The subject in all gives brief knowledge about how to Formulate static equilibrium equations for a rigid body and evaluate member forces in frames, machines, both plane and space trusses, and structures supported by cable systems.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Draw Shear Force and Bending Moment Diagrams for multi-force members.
- To apply Coulomb's dry friction laws to engineering problems.
- To draw free body diagrams in analyzing static equilibrium engineering problems.

IV. COURSE OUTCOMES

Student will be able to:

- Relative motion. Inertial and non-inertial reference frames.
- Newton's laws of motion and conservation principles.
- Application of the vector theorems of mechanics and interpretation of their result

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HRS	MARKS
1	**SIMPLE MACHINES**	At the end student should be able to • Define different type of machines and term used in it. • Explain law of machine and solve numerical based on it. • Understand the working of simple machine. • Calculate efficiency of simple machines.	**Definitions :-** Simple machine, compound machine , load, effort, mechanical advantage , velocity ratio , input of a machine .output of a machine efficiency of a machine , ideal machine, ideal effort and ideal load, load lost in friction, effort lost in friction. **Analysis: -** Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self-locking machine. Simple numerical problems. **Velocity Ratio for simple machines :** - Simple axle and wheel, differential axle and wheel, Weston's differential pulley block, single purchase crab, double purchase crab, worm and worm wheel, geared pulley block, screw jack, calculation of mechanical advantage, efficiency, identification of type such as reversible or not etc.	**8**	**12**
2	**FORCE SYSTEMS**	At the end student should be able to • Define the fundamentals of force systems. • Classify force system. • Explain characteristics and principal of force. • Define moment and couple and explain its properties and characteristics.	**Fundamentals and Force systems:-** Definitions of mechanics, Engineering mechanics, statics, dynamics, Kinetics, Kinematics, rigid body. Classification of force system according to plane coplanar and non-coplanar, sub classification of coplanar force system-collinear, concurrent, non-concurrent, parallel, like parallel, unlike parallel, general etc. Definition of a force, S.I. unit of a force, representation of a force by vector and by Bow's notation method. Characteristics of a force, effects of a force, principle of transmissibility. **Resolution of a force and Moment of a force: -** Definition, Method of resolution, along mutually perpendicular direction and along two given direction. Definition of moment, S.I. unit, classifications of moments, sign convention, law of moments Varignon's theorem of moment and its use. Definition of couple, S.I. unit, properties of couple with example.	6	6
3	**COMPOSITION OF FORCES**	At the end student should be able to	**Analytical method: -**		

		• Understand different types of analytical methods to find the resultant force. • Understand different types of graphical methods to solve resultant force of a system.	Definition of Resultant force, methods of composition offerees, Law Of parallelogram offerees, Algebraic method for determination of resultant for concurrent and non-concurrent, parallel coplanar force system. **Graphical method:-** Space diagram, vector diagram, polar diagram, and funicular:- polygon. Resultant of concurrent and parallel force system only.	6	12
4	**EQUILIBRIUM SPECIFIC**	At the end student should be able to • Define the equilibrant and state relation between resultant and equilibrant. • Explained Lami's theorem and solved problems on it. • Define beam and its types. • Classify the load and calculate reaction on different types of beams.	**Equilibrant and Lami's Theorem:-** Definition of equilibrant, relation between resultant and equilibrant, equilibrant of concurrent and non- concurrent force system. Statement and explanation of Lami's theorem, Application of Lami's theorem for solving various engineering problems. **Beams :-** Definition, Types of beams (cantilever, simply supported, overhanging, fixed, continuous), Types of end supports (simple support, hinged, roller), classification of loads, point load, inclined point load, uniformly distributed load. Analytical method to determine reactions of simply supported, cantilever and over hanging beam subjected to point loads and UDL	8	12
5	**FRICTION**	At the end student should be able to • Define friction and explain types of force acting on it. • Understand law of friction and its advantages and disadvantages. • Get the concept of equilibrium of a body on horizontal and inclined plane due to force applied on it.	**Definition :-** Friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction, angle of repose and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages. **Equilibrium of body on Horizontal and inclined plane :-** Equilibrium of body on horizontal plane subjected to horizontal and inclined force. Equilibrium of body on inclined plane subjected to forces applied parallel to the plane only. Concept of ladder fraction.	4	6
6	**CENTROID AND CENTRE OF GRAVITY**	At the end student should be able to • Define centroid.	**Centroid :-** Definition of centroid. Moment of an area about an axis. Centroid of basic geometrical figures such as square, rectangle, triangle, circle,		

		• Find centroid of different geometrical figures and composite figures. • Define centre of gravity and its effect on simple solids.	semicircle and quarter circle. Centroid of composite figure with not more than three geometrical figures. **Centre of gravity : -** Definition, centre of gravity of simple solids such as cylinder, sphere, hemisphere, cone, cube, and rectangular block. Centre of gravity of composite solids with not more than Two simple solids. (Hollow solids are not expected.)	8	12

I. LIST OF PRACTICAL EXERCISES: (Total Hours: - 40 Hrs.)

I. To find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine. Calculate maximum efficiency and also check the reversibility of machines (Sr no. 1 to 4):-

1) Differential axle and wheel.

2) Single purchase crab or Double purchase crab

3) Weston's differential pulley block or worm geared pulley block

4) Simple Screw jack.

5) Verify law of moments

6) Verify law of polygon of forces.

7) Verify of Lami's theorem.

8) Verify the Equilibrium of parallel forces - simply supported beam reactions.

9) Compare coefficient of friction on horizontal plane and inclined plane for the same surface.

II. Graphical solutions for the following on A4 Size Graph Paper:-

1) Concurrent force system : Two problems

2) Parallel force system : Two problems

3) Reactions of beam : Two problems

II. REFERENCES

Sr. No.	Author	Title	Publication
1	Malhotra,D.R.	Engineering Mechanics And Strength Of Materials	Satya Prakashan
2	Khurmi,R.S.	A Text Book Of Engineering Mechanics (Applied Mechanics)	S. Chand & Co Ltd.
3	Chapman,W.A.J.	A Text Book Of Engineering Mechanics	S. Chand & Co.
4	Ranmamrutham.S.	Engineering Mechanics: A Text Book Of Applied Mechanics	Dhanpat Rai & Sons

A2-06: WORKSHOP PRACTICE – II

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
-	14	-	-	240	40	160	400

II. COURSE RATIONALE

The knowledge of manufacturing practices is highly essential for all engineers and technocrats for familiarizing themselves with modern concepts of manufacturing technologies.

The goal of workshop technology is to explore trends in the use of and development of different machines. The subject gives an idea of modern concepts of manufacturing technology needed for the competitive industrial environment. It helps in the analysis of the necessary details of plant and shop layouts. General industrial safety measures to be followed in various manufacturing shops are described in the subject.

The subject gives details regarding fundamental properties and testing of engineering materials and heat treatment of metals and alloys. It helps in the study of various tools, equipment and processes used in various shops such as carpentry, pattern making, mould and core making, foundry shop. The study of special casting methods and casting defects are useful for understanding the process of casting.

The subject helps in understanding & provides basic knowledge of mechanical working of metals. Fundamental concepts related to forging work and other mechanical working processes (hot and cold working).

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- To gain theoretical and practical knowledge of manufacturing processes and workshop technology.
- To get exposed to hand tools, equipment's, machines and manufacturing setups.
- To understanding the working of various machines on shop floor.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the working of a manufacturing unit.
- Understand the safety measures to be taken while working in workshop.
- Applications of various machines in industries.

V. CONTENT:

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	MSME TC & ENVIROMENT		Description of various courses. MSME TC environment, Housekeeping, Functioning of Store & Procedure followed.	280	400
2	BENCH WORK	Student Should be able to :- • List of hand tools • Types of file and how to filing • Types of hammer and its work • How to use spanner • How to use tap, die and reamer • Types of measuring instrument • How to proper used of measuring instrument • Identify the name of measuring instrument and denote their parts	Introduction to hand tools (Hand Cutting Tools), Measuring tool, Equipment's & their uses & applications.		
3	FITTING & ASSEMBLY	Student Should be able to :- • Procedure of fitting • Types of fitting • Condition of fitting in different situation • Using hand tool and equipment's	Produce & fit together the parts made on bench Introduction to hand tools & equipment's.		
4	SHEET METAL	Student Should be able to :- • Manufacturing of useful product by using sheet metal • Safety precautions while working	Manufacturing of sheet metal enclosures (useful products).		
5	TURNING	Student Should be able to :- • operate the machine • List Types of lathe machine • Know about its parts • List tool holders • Safely handle the machine	Knowledge & skills for turning operations Application of various tools & tool holders Calculating cutting parameters		

		• Use proper tool for cutting the material • Types of tools • How to make the tools • Classification of tools • To calculate the cutting • speed • To select the proper R.P.M • To select the proper feed			
6	MILLING	Student Should be able to :- • How to operate the machine • Types of milling machine • Known about its parts • How to mounting the tools • safety of machine • Classification of tools • Types of tools • How to make the tools • Use proper tool for cutting the material • To calculate the cutting Speed • To select the proper R.P.M • To select the proper feed	Knowledge & skills for milling operations Application of various tools & tool holders Calculating cutting parameters.		
7	SURFACE GRINDING	Student Should be able to :- • How to operate the machine • Types of grinding machine • Know about its parts • How to mounting the wheel • How to safety from machine • How to holding the job • Classification of wheels • Types of wheels • Use proper wheel for grinding	Knowledge & skills for surface grinding operations Application of various tools & tool holders Calculating cutting parameters		

8	BASIC CYLINDRICAL GRINDING	Student Should be able to :- • How to operate the machine • Types of grinding machine • Known about its parts • How to mounting the tools • safety of machine	Knowledge & skills for cylindrical grinding operations Application of various tools & tool holders Calculating cutting parameters		
9	BASIC TOOL & CUTTER GRINDING	Student Should be able to :- • How to operate the machine • To know grinding method • Known about its parts • safety of machine	Knowledge & skills for cutter resharpening operations Application of various tools & tool holders Setting for cutter regrinding		

VIII. LIST OF PRACTICAL EXPERIENCES (Total Hours: - 280 Hrs.)

Bench Fitting:	
Sr. No.	Title of Exercise
1	C-Clamp
2	Open Fitting (Radius)
3	Close Fitting (Square)
4	Close Fitting (T)
5	Tap Wrench Assembly

Milling	
Sr. No.	Title of Exercise
1	V-Block
2	Tap wrench body
3	Chamfer Tool
4	Multiple Operations
5	Straight edge

Turning	
Sr. No.	Title of Exercise
1	Guide Pillar
2	Guide Bush
3	Clamping Button
4	Screw Jack Body
5	Screw Jack Screw
6	Tap Wrench Handle

IX. REFERENCE BOOK

Sr.No	**Author**	**Title**	**Publisher / Edition**
1	WORKSHOP TECHNOLOGY : AN INTRODUCTORY COURSE PART 1	CHAPMAN,W.A.J.	EDWARD ARNOLD PUBLISHERS LTD.
2	WORKSHOP TECHNOLOGY PART 2 : MACHINE TOOLS	CHAUDHARY,TIKAMLAL	KHANNA PUBLISHERS,
3	WORKSHOP TECHNOLOGY VOL 1	ARORA,B.D.	SATYA PRAKASHAN
4	WORKSHOP TECHNOLOGY	GUPTA,R.B.	SATYA PRAKASHAN
5	WORKSHOP TECHNOLOGY PART -3	CHAPMAN,W.A.J.	ARNOLD PUBLISHERS (INDIA) LTD.

A2-07: WORKSHOP TECHNOLOGY & METROLOGY

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
4	-	3	60	-	40	-	100

II. COURSE RATIONALE

The knowledge of manufacturing practices is highly essential for all engineers and technocrats for familiarizing themselves with modern concepts of manufacturing technologies.

The goal of workshop technology is to explore trends in the use of and development of different machines. The subject gives an idea of modern concepts of manufacturing technology needed for the competitive industrial environment. It helps in the analysis of the necessary details of plant and shop layouts. General industrial safety measures to be followed in various manufacturing shops are described in the subject.

The subject gives details regarding fundamental properties and testing of engineering materials and heat treatment of metals and alloys. It helps in the study of various tools, equipments and processes used in various shops such as carpentry, pattern making, mould and core making, foundry shop. The study of special casting methods and casting defects are useful for understanding the process of casting.

The subject helps in understanding & provides basic knowledge of mechanical working of metals. Fundamental concepts related to forging work and other mechanical working processes (hot and cold working).

Tool and die makers are expected to know Engineering metrology concepts. This subject will develop skills in handling various measuring instruments and their uses.

The students are required to select and use various tools & equipment's related in project work.

Basic measuring instruments used in technical practices are must be known to tool and die maker and this subject plays vital role in it.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- To gain theoretical and practical knowledge of manufacturing processes and workshop technology.
- To get exposed to hand tools, equipment's, machines and manufacturing setups.
- To understanding the working of various machines on shop floor.
- Read and interpret the drawing.
- Understands working principle of measuring instrument.
- Use specification tables.
- Decide Sequence of procedure.

- Recognize, identify and use of various measurement tools used in technical practice.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the working of a manufacturing unit.
- Understand the safety measures to be taken while working in workshop.
- Applications of various machines in industries.
- Student will be Able to read job drawing.
- Able to identify and select proper measuring instruments.
- Able to select proper parameters in Machine by using appropriate measuring instrument.

V. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	WORKSHOP TECHNOLOGY : AN INTRODUCTORY COURSE PART 1	CHAPMAN,W.A.J.	EDWARD ARNOLD PUBLISHERS LTD.
2	WORKSHOP TECHNOLOGY PART 2 : MACHINE TOOLS	CHAUDHARY,TIKAMLAL	KHANNA PUBLISHERS,
3	WORKSHOP TECHNOLOGY VOL 1	ARORA,B.D.	SATYA PRAKASHAN
4	WORKSHOP TECHNOLOGY	GUPTA,R.B.	SATYA PRAKASHAN
5	WORKSHOP TECHNOLOGY PART -3	CHAPMAN,W.A.J.	ARNOLD PUBLISHERS (INDIA) LTD.
6	WORKSHOP TECHNOLOGY PART I	CHAPMAN,W.A.J.	CBS PUBLISHERS
7	WORKSHOP TECHNOLOGY PART II	CHAPMAN,W.A.J.	CBS PUBLISHERS
8	ENGINEERING METROLOGY	JAIN,R.K.	KHANNA PUBLISHERS
9	FUNDAMENTALS OF DIMENSIONAL METROLOGY	DOTSON, CONNIE	THOMSON

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION TO SUBJECT	Student Should be able to :- • Define is tool • Define is the use of tool • Define is machine tool • Classification of machine tool • Define is workshop technology • Importance of workshop technology	Review of previous semester, Machine tool, Classification of machine tool, Syllabus of subject i.e. workshop technology Marking criteria for the subject, Reference book	10	-
2	LATHE MACHINE	Student Should be able to :- • Define is lathe machine • Working principle of lathe machine • Types of lathe machine • Difference between capstan & turret lathe • The lathe accessories • The lathe attachments • Different cutting tools used in lathe • Different lathe operations • Calculation of speed and feed of lathe machine • Define is the mechanism of lathe machine • Specification of lathe machine • Calculation related to lathe operation • Safety precaution while working on lathe machine	Classification of lathe machine, Capstan and turret lathe, Lathe accessories, Lathe attachments, Lathe cutting tool and metal cutting , Speed and feed , mechanism of lathe machine, Specification of lathe machine, Precaution while working on lathe machine	10	15
3	MILLING MACHINE	Student Should be able to :- • Define is milling machine • Working principle of milling machine • Different parts of milling machine and their uses • Different milling operation • Classification of milling machine and their use • Attachment used in milling machine • Work holding devices in milling machine • Cutter holding devices in milling machine • Different types of cutter use functions and their • Define are the specification of cutting tools • Define are the safety rules while using cutters	Calculation related to lathe operation , such as Speed, Feed, Depth of cut, Introduction to milling machine, Working principle of milling machine Main parts of milling machine and their function, Milling operation, Classification of milling machine, Types of milling machine and their used, Milling accessories, Milling attachment, Speed and feed mechanism of milling machine, Milling cutter geometry and metal cutting, Classification of milling cutter and their used, Precaution while using milling cutter, Calculation related to milling operations, Machining time and gear cutting method, Precaution while working on milling machine	14	15

		• Calculation of speed and feed mechanism of milling machine • Define is machining time • Explain gear cutting take place in milling machine • Precaution to avoid accident in milling machine			
4	GRINDING MACHINE	Student Should be able to :- • Define is grinding machine • Name and classification of grinding machine • Different parts of grinding machine and their use • Different types of grinding • Define is jig grinder machine & its use • List of work holding attachments • Cutting tools used in grinding machine • Specification of grinding wheel • Cutting tool holders • Define are the cutting tool operation • Allowances and tolerance for grinding • Machine setting for operation • Define is profile grinding • Describe the use of profile grinding • Size and shape of grinding wheel	Introduction :Selection and used of jig grinder, machine and jig grinding , Work holding attachment ,cutting tools ,Cutting tool holder ,operation, Setting up the machine for operation Selection and used of profile grinder machine and profile grinding, Work holding attachment ,cutting tools ,Cutting tool holder ,operation, Setting up the machine for operation	12	9
5	PANTOGRAPH	Student Should be able to :- • Define is pantograph • Selection and use of pantograph • Different work holding devices used in pantograph • Different cutting tools used in pantograph • Define are the cutter holding devices used in pantograph • Operation take place in pantograph • Machine set up for pantograph	Introduction :Selection and used of pantograph Work holding attachment ,cutting tools ,Cutting tool holder ,operation, Setting up the machine for operation	10	6

6	SLOTTING MACHINE & PLANNING MACHINE	Student Should be able to :- • Define is slotting machine • Explain the slotting machine works • Types of slotting machine • Define are the size of slotter • Different parts of slotting machine and their use • Name of the slotting cutting tools • Define are the work holding and tool holding devices • Setting of machine parameters for working • Calculation of speed, feed& depth of cut • Define are the precaution while working on slotting machine • Define is planning machine • Define is the use of planning machine	Introduction to slotting machine, Working principle of slotting machine, Shaper cutting tools main parts of slotting machine and their function Slotting machine , Slotting cutting tools Work holding and tool holding device for slotting machine, Selection of machining parameters Precautions while working on slotting machine Introduction to planning machine, Working principle of planning machine, Main parts of planning machine and their function, Planning operation , Classification of planning machine. Quick return mechanism of planning machine, Planning cutting tool, Work holding and tool holding device for planning machine, Selection of machining parameters, Precaution while working on planning machine	10	6
7	METROLOGY	Student Should be able to :- • Explain the use of metrology • Need of symbols • Metrology instruments • Measuring techniques • Working principle of Radius gauge • Working principle of Feeler Gauge, Pitch screw Gauge, Vernier caliper • Working principle of Vernier Height Gauge, Micrometer • Use of Machine tool metrology	Definitions, Symbols of Straightness, Flatness, Parallelism, Circularity, cylindercity, Concentricity, Co-axiality, Ovality, Angularity, Roundness Measurement of Surface Finish, Limits, Fits and Tolerance, Linear and Angular Measurement, Comparators, Gear and Screw Measurement **Calipers** - Introduction, Types of Calipers Description , application & Procedure **Surface plate** - Introduction Material of Surface plate -Cast Iron & Granite, Sizes and Accuracy, Care, Use of surface plate & Procedure **Angle plate** Introduction, Sizes and Accuracy, Care, Use of angle plate & Procedure **'V' Block** Introduction, Care, Use of Vee blocks & Procedure **Try square** Introduction , Care, Use of square & Procedure **Straight edge**, Introduction Classification ,their use & Procedure **Radius Gauge** Introduction, Use & Procedure	14	9

			Feeler Gauge Introduction, Use & Procedure **Pitch screw Gauge** Introduction, Use & Procedure, **Vernier caliper** Introduction, Reading the Vernier scale, Types of Verviers, Least Count – Calculation, Errors observed in verniers, Precautions in the use of Vernier & Procedure **Vernier Height Gauge** Introduction, Description of their parts & requirement, Precautions in the use of Height Gauge, Test for Accuracy & Procedure **Micrometer** Introduction Description of their parts, Reading the Micrometer Ratchet stop mechanism, Types of micrometer, Precaution, use of micrometer & Procedure, possible error **Bevel protector** Introduction, Description of various parts, Application **Combination set** Introduction, Application		

MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

THIRD SEMESTER: COURSE DETAILS

ADVANCE DIPLOMA IN TOOL & DIE MAKING

A3-01: THEORY OF MACHINES & MECHANISMS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	1	3	60	-	40	-	100

II. COURSE RATIONALE

It is a core technology subject in Mechanical Engineering Discipline. Mechanical Engineers often come across various machines in practice. They should be able to identify and interpret various elements of machines in day to day life. In maintaining various machines, a diploma engineer should have sound knowledge of fundamentals of machine and mechanism. It will be helpful for them to understand the mechanisms from operational point of view in a better way. This subject imparts the kinematics involved in different machine elements and mechanisms like gear, Cam-follower, follower, belt-pulley, flywheel, brake, dynamometer, clutch, etc.

Detailed knowledge of these aspects with deep insight into the practical applications develops a professional confidence in them to become successful Engineer.

This subject serves as a prerequisite for subjects like Machine Design to be learned in higher semester

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

1. Understand different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Draw cam profile suitable to various displacement diagram.
4. Select Suitable Drives and Mechanisms for a particular application
5. Understand the function, operation and application of flywheel and governor.
6. Understand the function, operation and application of brake, dynamometer, clutch and bearing
7. Find magnitude and plane of unbalanced forces.

IV. COURSE OUTCOMES

After studied about TOM a student should be able to identify and interpret various elements of machines in day to day life. TOM is a core technology subject in Mechanical Engineering Discipline. Detailed knowledge of these aspects with deep insight into the practical applications develops a professional confidence in them to become successful Engineer.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.		CONTENTS	TEACHING HRS/UNIT	MARKS
1	**Fundamentals and type of Mechanisms**	Students should be able to :- • Understand Kinematics, Dynamics, Statics. • Describe Kinematics pair & its type. • Understand inversion of four bar chain • Define inversion • Understand Oldham 'S coupling	**Kinematics of Machines:-** Definition of Kinematics, Dynamics, statics, Kinetics, Kinematics link, Kinematics pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. **Inversion of Kinematic Chain:-** Inversion of four bar chain, coupled wheels of Locomotive, Beam engine, Pantograph. Inversion of single slider Crank chain -Pendulum pump, Rotary I. C. Engines mechanism, Oscillating cylinder engine, Introduction & Definition Inversion Whitworth mechanism. Quick return mechanism of shaper, Inversion of Double Slider Crank Chain- Scotch Yoke Mechanism Elliptical trammel, Oldham's Coupling.	12	12
2	**Velocity and Acceleration in Mechanisms**	Students should be able to :- • Understand Kinematics, Dynamics, Statics. • Analyse the velocity and acceleration of mechanisms Describe Kinematics pair & its type. • Differentiate between velocity & acceleration • Understand velocity and acceleration diagram	Concept of relative velocity and relative acceleration of a point on a link, angular acceleration, inter-relation between linear and angular velocity and acceleration. Difference between Velocity & acceleration **Drawing** of velocity and acceleration diagram of a given configuration, diagrams of simple Mechanism. Determination of velocity and acceleration of point on link by relative velocity method.	6	15

3	**Cams and Followers**	Students should be able to :- • Understand Kinematics, Dynamics, Statics. • List application of Cams and Followers • Classify Cams and Followers • Understand simple harmonic motion • Draw profile of radial cam with Knife-edge and roller follower	Concept, definition and applications of Cams and Followers. Cam terminology, Classification of Cams and Followers. Different follower motions and their displacement diagrams -Uniform velocity, Simple harmonic motion, Uniform acceleration and Retardation. Drawing of profile of radial cam with knife-edge and roller follower.	4	10
4	**Power Transmission**	Students should be able to :- • Describe power transmission systems. • Understand types of belt drive • Determine velocity ratio • Describe centrifugal tension and initial tension • Understand types of chain drive • Understand types of gear drive.	**Belt Drives**- flat belt, V-belt & its applications, Material for flat and V-belt.. Selection of belts, angle lap, Length of belt, Slip and creep. Determination of velocity ratio, of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numerical). **Chain Drives**- Types of chains and sprockets, velocity ratio. Advantages & Disadvantages of chain drive over other drives, Selection of Chain & Sprocket wheels, methods of lubrication. **Gear Drives** - Classification of gears, Law of gearing, gear terminology. Types of gear trains, their selection for different applications. Train value velocity ratio for simple, compound, reverted and epicyclical gear trains.	5	9
5	**Flywheel and Governors**	Students should be able to :- • Describe the operation and perform basic analysis of flywheel and governors.	Flywheel -Concept, function and application Governors- Types, concept, function Comparison between Flywheel and Governor.	4	3

		• Differentiate between flywheel and governor.			
6	**Brakes and Dynamometers**	Students should be able to :- • Describe the function of break and dynamometers • Understand types of brakes and dynamometers • Understand construction and working of rope brake dynamometer.	Function of 'brakes and Dynamometers, Type of brakes & Dynamometers, comparison between brakes & Dynamometer. Construction and working- shoe brake, Band brake, Internal expending shoe brake, Disc Brake Construction and working of Rope brake Dynamometer, Hydraulic Dynamometer, and Eddy current Dynamometer.	6	6
7	**FRICTION & VIBRATION**	Students should be able to :- • Describe the Friction • Understand types of Friction • Understand the vibration concept • Type of vibrations and uses	Friction: Friction of collars and pivots, Friction clutches-plate clutch and centrifugal clutch, Friction in journal bearings, Rolling friction Vibration: Causes of vibrations in machine, their effects and method of reducing them, Free or natural vibration, Forced vibration, Damped vibration	3	5

VI. LIST OF Tutorial (Total Hours: - 20 Hrs.)

Sketch and describe Working of quick return mechanism for a shaper. Find the ratio of time of cutting stroke to the time of return stroke for the same

Sketch and explain the working of the following mechanisms

a) Bicycle free wheel sprocket mechanism

b) Geneva mechanism

c) Ackerman's steering gear mechanism

d) Foot operated air pump mechanism (Evaluate the effort at pedal for a given pump pressure)

3) Determine velocity and acceleration of various links of the given two mechanisms, by relative velocity method. (Any two mechanism)

4) Determine velocity and acceleration of piston of an I. C. engine's Slider Crank mechanism by Klein's construction

5) Describe the working and function of flywheel. Determine the coefficient of fluctuation of speed for a given turning moment diagram.

6) Draw a schematic diagram of Hartnell governer (or any other governer) and describe its working. Draw a graph between radius of rotation versus speed of the governor.

Sketch the two wheeler braking system and identify the functions of various components. Dismantle and assemble mechanically operated braking mechanism of two wheelers.

Dismantle and assemble multi-plate clutch of two-wheeler. Draw neat sketch and state the functions of various components

Determine graphically counterbalance mass and its direction for completely balancing a system of several masses rotating in a single plane

VII. REFERENCE BOOK

Sr. No.	Author	Title	Publication
1	R.S. Khurmi	Theory Of Machines	S.Chand
2	Singhal, B.L.	A Text Book Of Mechanisms (Theory Of Machines)	Nirali Prakashan
3	Rattan, S.S.	Theory Of Machines	Tata McGraw Hill
4	Rattan,S.S.	Theory Of Machines	Tata McGraw Hill
5	Ambatkar, S.D.	Theory Of Machines And Mechanisms	Tech-Max Publication Tech-Max Publication
6	Bevan, Thomas	Theory Of Machines	Pearson
7	Singh, Sadhu	Theory Of Machines :Kinematics And Dynamics	Pearson
8	Bevan, Thomas	Theory Of Machines	Pearson

A3-02: STRNGTH OF MATERIALS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
3	1	3	60	00	40	-	100

II. COURSE RATIONALE

All engineers are required to analyses reasons for failure of different components and select the required materials for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. Hence this subject has been introduced. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles to the solution of applied problems to develop the required competencies.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- To understand the concept of strength of material.
- To study the concepts of shear force & bending moment.
- To understand the types of materials depending upon their physical properties.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the Principle of superposition.
- Understand the Applications of definite integrals.
- Applications of Shear force & bending moment.

V. CONTENT

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	STRESS & STRAIN	Student Should be able to :- • Understand what is stress &its type • What is strain & its type • Define concept of strength of material • Explain the properties of isotropic material • Describe Hook's law • Describe YOUNG'S modulus • Explain Stress -strain diagram • Describe principle of superposition	Introduction to subject, objectives, concept of strength of material. Stress & strain types, definition, explanation, calculations. Hook's law, Young's modulus, Stress-strain diagram. Principle of superposition. Elasticity, Plasticity, Ductility, Brittleness, Toughness Hardness	12	12
2	SHEAR FORCE & BENDING MOMENT	Student Should be able to :- • Define force • Define shear force • Describe the sign convention • Describe the bending moment • Explain the shear force & bending moment diagram for cantilever beam • Explain the shear force & bending moment diagram for simply supported beam	Shear force & bending moment. Sign convection. Exercises on cantilever, shear force and bending moment. Exercises on simply supported beam. Mohr's circle: For like direct stresses, For unlike direct stresses, for two perpendiculars direct stresses with state of simple shear	12	12
3	BENDING STRESSES IN BEAMS	Student Should be able to :- • Define beam and types • Define bending stress • Describe the stress in beam • Explain bending equation ,notations • Explain bending stress for four standard beam conditions • Explain bending stress for cantilever with point load at free end. • Explain bending stress for cantilever with UDL over complete span.	Assumptions in theory of bending. Stresses in beams. Bending equation, notations. Bending stresses for four standard beam conditions, Cantilever with point load ate free end. Cantilever with UDL over complete span, simply supported beam with central point load, simply supported beam with UDL over complete span.	8	9

		• Explain bending stress for simply supported beam with central point load • Explain bending stress for simply supported beam with UDL over complete span			
4	TORSION OF CIRCULAR SHAFTS	Student Should be able to :- • Define the TORISION formula • Explain the standard of shaft size and materials • Describe the power transmission by shaft • How to replace solid shaft to hollow shaft • Describe the angle of twist • Explain strength of ratio • Explain power ratio	Torsion formula, Shaft std. Sizes & materials, Power transmitted by shaft, replacing solid shaft with hollow Shaft. Angle of twist, Strength ratio, power ratio.	10	9
5	COLUMN & STRUT	Student Should be able to :- • Define column • Describe long column • Describe short column • Define strut • Define crippling load • Define critical load • Explain Eulet"s formula.	Definition of long column, short column, strut, crippling load, critical load. Euler's formula	10	9
6	DEFLECTION OF BEAMS MOMENT OF INERTIA	Student Should be able to :- • Explain deflection • Describe deflection on simply supported beam • Describe deflection on cantilever beam • Types of loading beams.	Simply supported beam, cantilever. Exercises. Types of loading, beams. Calculations. Moment of Inertia, Thin Cylindrical Shells, Combined Direct and Bending Stress	8	9

VI. LIST OF Tutorial (Total Hours: - 20 Hrs.)

Sr. No.	Topic For Tutorial
1	Solve numerical on principle of superposition
2	Draw shear force & bending moment diagrams for the beams
3	Derive the torsion equation & solve numerical
4	Draw the deflection curves for the different beams
5	Solve numerical based on Euler's formula

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	THE STRENGTH OF MATERIALS (SI UNITS)	MALHOTRA,D.R.	SATYA PRAKASHAN
2	ELEMENTS OF STRENGTH OF MATERIALS (SI & MKS UNITS)	MALHOTRA,D.R.	SATYA PRAKASHAN
3	APPLIED MECHANICS AND STRENGTH OF MATERIALS	MALHOTRA,D.R.	SATYA PRAKASHAN
4	ENGINEERING MECHANICS AND STRENGTH OF MATERIALS	MALHOTRA,D.R.	SATYA PRAKASHAN
5	STRENGTH OF MATERIALS	RAMAMRUTHAM,S	DHANPAT RAI & SONS

A3-03: ADVANCE MANUFACTURING PROCESSES

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	-	3	60	00	40	-	100

II. COURSE RATIONALE

The subject Provides students with the opportunity to improve and build on current skills and knowledge of Non-conventional machining. Students receive training on the latest equipment used in the modern business environment, and successful students have the opportunity to develop an advanced-level of proficiency in the use and application of Non-conventional machining.

The Machine Tool Technology subject is designed to prepare students to enter the machine tool trade. Machine Tool Technology training is used to explain the nature and purpose of the machine trade. It also explains use and applications of machines like jig boring & jig grinding. The student is introduced to tools, materials, equipment's and trade terms and develop the skills to handle the machine.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Practice safe work habits in an industrial manufacturing environment.
- To study the Working Principle & Application of Polishing.
- To understand the working of jig boring & jig grinding machine.

IV. COURSE OUTCOMES

Student will be able to:

- Utilize quality control concepts to identify root cause part discrepancies.
- Understand the Applications of different machines used in industries.
- Synthesize information to complete the manufacture of parts on boring & grinding machines.

V. CONTENT

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	JIG BORING	Student Should be able to :- • Elaborate Jig Boring Operation & Its Functions Along With Its Constructions Working. • Draw Neat Sketch of Jig Boring Machine • Apply Various Laws Principle Related With Machining • Calculate Machining Parameter Like Speed, Feed, etc. • Convert Parameter of Machining into Numerical Value • Differentiate Various Cutting Tool & Holding Devices • Design Machine Tool Parameter its • Specifications • Give Importance of Handling & Safety Measures.	Introduction To Jig Boring Operation& Machine Construction & Description Of The Machine & Its Parts, Classification Of The Machine: Vertical & Horizontal, Working Of The Machine Various Types Of Operations Jig Boring, Reaming, Counter Boring, Angular hole Drilling & Boring. Machine Setting (Straight, Parallel, Angular) Job Setting (Support, Clamping, References) Machine Parameters & Calculations (Speed, Feed, Depth Of Cut, Angular Setting Work Holding Devices Description & Construction Of The Work Holding Device, Cutting Tool Holders Types Of Cutting Tool Holders, Functions & Working Of Tool Holders, Selection & Their Use Handling & Safety Measures	8	12
2	JIG GRINDING	Student Should be able to :- • Understand The Fundamental of Jig Grinding • Draw neat sketch of Jig Grinding & its Various Parts • Describe Operation & Principle of Jig Grinding • Calculate Machining Parameter & its Calculations	Introduction To Jig Grinding Operation& Machine Construction & Description Of The Machine & Its Parts Classification Of The Machine Working Of The Machine Operations Introduction To Various Types Of Operations On Jig Grinding Machine Setting Job Se Machine Parameters & Calculations (Speed, Feed, Depth Of Cut, Angular Setting)	4	6

3	PROFILE GRINDER	Student Should be able to :- • Sketch Profile Grinding along with Its Parameter • Describe Operation & Working Principle of Profile Grinder • Summarize Setting of Profile Grinding • Compare Profile Grinding with Conventional Grinding	Introduction To Profile Grinding Operation & Machine, Construction & Description Of The Machine & Its Parts, Classification Of The Machine Working Of The Machine Operations Introduction To Various Types Of Operations Profile Grinding Job Setting Machine Setting Handling & Safety Measures	4	6
4	NON CONVENTIONAL MACHINING	Student Should be able to :- • Understand the Basic Principle of Various • Machining Process Like lector chemical, Plasma Arc Machining, • Differentiate Conventional & Non-Conventional Machining Process • Describe Rapid Prototype Concept	Introduction, Working Principle & Application of following processes – Electrochemical machining, Ultrasonic Machining, Abrasive Jet Machining, Electron Beam Machining, Chemical Machining, Laser Beam Machining, Plasma Arc Machining, Rapid prototyping.	12	18
5	SURFACE FINISH TECHNIQUES	Student Should be able to :- • Analyze Finishing Process of Metal • Differentiate Various Finishing Process • Elaborate Principle & Working of Lapping, Honing, Polishing	Introduction, Working Principle & Application of Polishing, Lapping, Honing	4	6
6	GEAR CUTTING	Student Should be able to :- • Describe Gear Terminology • Draw Nomenclature of Gears • Classify Different Types of Gears • Calculate Gear Getting Calculations.	Introduction To Gear & Their Use, Nomenclature Of Gears, Classification Of Different Types Of Gears, Cutting Tools, Types Of Gear Cutting Tools Machine Set Up, Gear Cutting Methods, Machine Set Up & Calculations.	8	12

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	ADVANCE MACHINING PROCESS	VIJAY L JAIN	ALLI8ED PUBLICATION
2	MACHINE TOOL TECHNOLOGY	BHATTACHARYA	NEW CENTRAL BOOK AGENCY
3	ADVANCE MACHING TECHNIQUES	WINSTOON	SATYA PRAKASHAN
4	ADVANCE MANUFACTURING PROCESS	M.S. MAHAJAN	VRINDA
5	MANUFACTURING TECHNOLOGY	M ADITHAN	NEW EDGE PUBLICATION

A3-04: TOOL & DIE MAKING – PRACTICE

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
-	20	-	-	240	-	160	3	400

II. COURSE RATIONALE

The subject is the mother of all manufacturing technics and deals with moulds, jigs & fixtures, plastics, die casting, dies. The practical subject introduces the Numbering & lettering as per specified dimensions with maintaining quality criteria.

A brief idea about the Grinding of single lip cutters as per specified in drawing with maintaining quality criteria is included in the course. The operation to re sharp the drills to require angle is performed which helps the students to understand the maintenance of the tools.

The later part of the course helps in understanding the operation of turning & milling. The course is helpful to make standard parts of press tool, jigs, fixtures & gauges, plastic mould.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Understand Numbering & lettering as per specified dimensions with maintaining quality criteria.
- To re sharp the drills to required angle.
- Make standard parts of press tool.

IV. COURSE OUTCOMES

Student will be able to:

- Operate the pantograph machine.
- Manufacture the single lip cutter.
- Re-sharp the drill angles.
- Manufacture the parts of standard press tool.
- Manufacture the parts of standard jigs and fixtures.
- Manufacture the parts of standard single cavity mould.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	PANTOGRAPH (NUMBERING & LETTERING)	Student Should be able to :- • Numbering & lettering • as per specified by using pantograph machine	Numbering & lettering as per specified dimensions with maintaining quality criteria.	400	400
2	SINGLE LIP CUTTER GRINDING.	Student Should be able to :- • Manufacture single lip Grindir cutter and grind the angle of single lip cutter	Grinding of single lip cutters as per specified in drawing with maintaining quality criteria.		
3	RESHARPENING OF DRILLS	Student Should be able to :- • Student will be able to grind the drills and To resh maintain the required the drill angles	To resharp the drills to required angle.		
4	TURNING	Student Should be able to :- • Guide pillar • plastic • Guide bush • Shank • Drill bush • Locating pins • Resister ring • Rest buttons • Ejector pin • Core	Make standard parts of press tool, jigs, fixtures & gauges, plastic mould.		
5	MILLING	Student Should be able to :- • Top plate • bottom plate • plastic • core plate • core back plate • cavity plate • spacers • ejector plate • ejector back plate • thrust plate	Make standard parts of press tool, jigs, fixtures & gauges, plastic mould.		

		• punch holder plate			
6	SURFACE GRINDING	Student Should be able to :- • The grinding operation on the manufactured on milling machine	Preparations of grinding wheels for grinding & use of special devices. Grinding of standard parts of press tool, jigs, fixtures & gauges, plastic mould.		
7	CYLINDRICAL GRINDING	Student Should be able to :- • Perform the grinding operation manufactured on milling machine.			

VI. LIST OF EXERCISES (Total Hours: - 400 Hrs.)

Sr. No	Name of Exercise
1	Single Lip cutter
2	Engraving on pantograph machine using single lip cutter
3	Eccentric Turning
4	Resharpening of twist Drill
5	Manufacture Drill chuck key
6	Manufacture & assemble Die Set
7	Manufacture & assemble Drill Jig
8	Manufacture & assemble Hand Mould

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	TOOL & DIE MAKERS : DIES & MOULDS IST YR FUNDAMENTAL DESIGN CONCEPT OF PRESS TOOLS		NTTF
2	TOOL MAKING (MT P5) : PRESS TOOL FOR HINGE COMPONENTS	ATI	ATI
3	TOOL MAKING (MT P5) : PRESS TOOL FOR SLOTTED PLATE	ATI	ATI
4	SHEET METAL PRESS TOOLS DESIGN AND MAKING : A PRACTICAL APPROCH	LUQMAN, MIDHAT	CBS PUBLICATION

A3-05: TOOL & DIE MAKING TECHNOLOGY

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
4	-	3	60	-	40	-	100

II. COURSE RATIONALE

The course gives a detailed definition of jigs and fixtures, and also identified the numerous advantages that are associated with the use of jigs and fixtures in manufacturing to include: production increase, cost reduction, interchangeability and high accuracy of parts, reduction of the need for inspection and quality control expenses, reduction of accident as safety is improved, automation of machine tool to an appreciable extent, easy machining of complex and heavy components, as well as low variability in dimension which leads to consistent quality of manufactured products.

The work also explained that since the design is dependent on numerous factors which are analyzed to achieve an optimum output, that jigs and fixtures should be made of rigid light materials to facilitate easy handling.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Describe elements of jigs & fixtures.
- Explain Basic principle & rules of clamping.
- Selection of proper sheet material, sheet material components & their applications.
- Understand the process of moulding & its types.
- Classify the cutting tools.
- Understand the process of cutting tools & tools used.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of limit fit & tolerance.
- Understand the concept of limit fit & tolerance.
- Understand standard & non-standard clamping.
- Classification of clamping methods common types of clamps.

- Understand the concept of press tools.
- Understand the applications of press tools.
- Understand the concept of molding.
- Understand elements of Moulds their function
- Understand the concept of & applications of cutting tool.
- Understand the Properties of cutting fluid

V. CONTENT

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	JIGS & FIXTURES	Students should be able to:- • List Various Types of Tools used in Mass Production System • Define Tools like Jigs Fixtures, Press Tool, Mould, • Describe Various Locating Elements Used in Production System. • Understand Principle o f Locating, Clamping Along with its Rules. • Classify Various Types of Locating & Guiding Elements • Design Standard Bushingsits Formula • Analysis of Material Used For Manufacturing Tools • List Various Types of Fastening Devices Used in Production. • Explain Concept of Limit, Fit & Tolerance.	Introduction of tools used in mass production, Jigs, Fixtures, Gauges, Press Tools, Moulds ,Purpose & advantages of Jigs & Fixtures **Locating elements**, Introduction, Principle of location, Guide lines for selection of location surfaces / plane, Classification of location & commonly used locating, methods & devices, Indexing devices, Type of location & their brief description, Nesting locators, Profile locators, Adjustable locators **Clamping elements** Introduction to clamp, Basic principles & rules of clamping, Classification of clamping methods & common types of, clamps Non mechanical clamps, Non-standard clamps Clamping methods & their description **Guiding elements** Introduction to Tool Guiding elements, Classification of tool guiding elements & common types of bushings, Special bushings, Clamp locks for bushings, Jig bushings, Design of standard bushings and empherical formulas Standard bushings & their description **Tool Bodies (Jig & Fixture)** Introduction, Types of tool bodies, Preformed materials **Fasteners (Jig & Fixture)** Introduction to fasteners, Types of fastening devices, Fastening devices & their applications	20	15

			Recommended materials & heat treatment for jig & fixture elements **LIMIT FIT & TOLERANCE** Introduction, Advantages & disadvantages, Tolerances, Limits, Fits, Allowances, Deviation, Max. & Min. material condition, Shaft basis & hole basis system		
2	Press Tools	Students should be able to:- • Defne Press Tool Terminology • Design Press Tool to Produce Desired Components from Sheet Metal • Understand Sheet Material used in Press Tool • Understand Press Tool Operation Along With its Principle • Elaborate Relation Between Pierce Part & Shearing Operation. • List various Cutting & Non-Cutting Operations • List Various Types of Dies Used in Press Tool • State Principle of Strip Layout	**Introduction:** Use of Press tools, Presses and Tool drawings to produce, Components from sheet material for mass production. Video Cassette, Definition: Sheet material, Sheet material components & application, Press tools. Presses. **Press Tools Cutting Operations** Use and application of Press Tool cutting operations to produce sheet material components, Principle of shearing, Principle of Cutting clearance, Relation between pierce part / slug and Shearing operation, Classification of shearing operations, Angular clearance, Land, Classification of shearing operations, Principle of strip layout, progressive dies, combination dies **Press Tool and Parts** Introduction: Use and application of different elements in a Typical Press Tool. Typical Press Tools & their parts. -Cutting operations, Non-cutting operations	20	15
3	Moulds	Students should be able to:- • Defne Mould & Its Use • Understand Concept of Moulding of Components Produce From Plastics • List Industrial Applications of Plastics • Classify Plastic Material &Mould Material • Classify Moulding Machine & Equipment Along With Its Use & Applications. • Describe Various Parts of Mould & Material Used For It. • State Principle of Injection moulding • Elaborate Feeding System & Cooling System Used In Moulding operation.	Introduction: An Overview of Use of plastic moulds, moulding machine & equipment and Tool drawings to produce Plastic Components for mass production, Classification of industrial application of plastics, Classification of plastics material & mould material, Classification of application of moulding machine & equipment, Classification of application of moulds. Use and Application of moulding machine Introduction: Use and application of different elements in a typical INJECTION MOULD, CORE AND CAVITY Classification, Functions and ,Materials used for core & cavity, MOULD BASE & PARTS: Mould base housing parts with classification, Sprue bush, Locating ring, Types of Bolsters, Types of Ejection guides,	20	15

		• State Principle of Alignment & Guidance, Mounting & Ejection System Used In Moulding	Guide pillars & Bushes Locators & grids, FEEDING SYSTEM: Elements & functions of feed systems, a) Sprue b) Runner c) Cold Slug d) Gate, Classification of various feed systems and Balancing feed system COOLING SYSTEM: Elements and functions of cooling systems, Classification of various cooling system and Balanced circuits, EJECTION SYSTEM Parts & function of ejector elements with classification, Ejection Grid, Ejector Plate Assembly, Ejector Plate, Retaining Plate, Ejector Rod & Bush, Ejector Pin, Sprue Puller etc, CORE & CAVITY RETAINER PARTS: Principle of alignment and guidance, clearance, mounting and ejection, parting surfaces and cooling, Material used for different elements.		
4	Cutting Tools	Students should be able to:- • Define Various Types of Cutting Tools Used in Production System • Draw Nomenclature of Various Cutting Tool like Drill, SPCT, • Calculate Tool Life of Various Tools Like SPCT, Drill, Reamer, Cutter, • Understand Heat Generation in Metal Cutting • Select Various Types of Cutting Fluid Used While Machining	Introduction, Definition of cutting tool, Different types of cutting tool, Single point cutting tool, Nomenclature of single point cutting tool , Tool signature, Multi point cutting tool, Nomenclature of multi point cutting tool - Drill, Tap, Die , Reamer, Milling cutter, Hob, Broach. Methods of metal cutting, Orthogonal cutting, Oblique cutting, Mechanics of metal cutting, Chip formation, Chip breakers, Tool life & Tool wear, Face wear, Flank wear, Nose wear, Machinability, Heat generation in metal cutting, Cutting tool materials, Characteristics of cutting tool material, Types of cutting tool material, Cutting fluids, Purpose of cutting fluid, Properties of cutting fluid, Selection of cutting fluid	20	15

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	Design of Jigs & Fixtures	P.H. Joshi	Macgrall Hills
2	Design of press tools	P.H. Joshi	S. Chand
3	Design of Modules.	RJW Pie	E-w P Ltd.
4	Design of cutting tools	P.K. Roy	Nirali Publication.

A3-06: ENGINEERING MATERIAL & PROCESS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	-	3	60	-	40	-	100

II. COURSE RATIONALE

Materials are probably more deep-seated in our culture than most of us realize. The need to study Material Science and Engineering as well as take a look at classification of Engineering Materials and their importance in various live endeavors.

Sometimes the discipline of Materials Science and Engineering can be sub-divided into materials science and materials engineering sub disciplines. Strictly speaking, materials science involves investigating the relationships that exist between the structures and properties of materials.

The role of a materials scientist is to develop or synthesize new materials, whereas a materials engineer is called upon to create new products or systems using existing materials and/or to develop techniques for processing materials.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Understand meaning of engineering material used in industry.
- Understand materials used in labs & in metallurgy.
- Understand the Properties of material.
- Understand heat treatment and other process

IV. COURSE OUTCOMES

Student will be able to:

- List types of steels & cast irons
- Define mechanical properties of materials
- Describe importance of heat treatment process
- Describe heat treatment process

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION TO ENGINEERING MATERIALS & CRYSTAL SYSTEM IMPERFECTIONS	Students should be able to:- • Understand Classification and Properties of Material • Apply the Concept of Crystal Structure • Get The Meaning of Different Types Of Structure • Classify Geometry of Crystal & Its Principle • Apply Core Concept of Material Science To	Classification and Properties of Material Introduction to engineering materials, Classification of materials, Thermal, chemical, electrical, mechanical properties of various materials, Selection criteria for use in industry Introduction: Types of crystal systems, Definition : Concept of classification of crystal system. Concept of classification of Bravis lattice. Geometry of crystals. Geometry of crystal systems. Introduction Definition- Concept of classification of imperfections, Principles - Principle of point imperfection, surface imperfection	6	6
2	MECHANICAL PROPERTIES	Students should be able to:- • Define Different Properties of Material • Explain Concept of Stress Strain • Understand Related To Material Science & Its Properties	Mechanical Properties of materials, Concept of Stress & strain, Hooke's law, stress strain diagram for ductile material.	4	6
3	ELASTIC DEFORMATION & PLASTIC DEFORMATION	Students should be able to:- • Analyze Deformation of Material Related To Various Types Of Plastics • Concept of Elastic & Plastic Deformation • Understand The Recrystallization Phase	Introduction: Definition - Concept of classification of deformation, Principles: Principle of elastic deformation, plastic, deformation, Procedure: Study of elastic deformation & plastic deformation. Concept of deformation, work hardening or strain hardening, Recovery, recrystallization & grain growth.	6	9
4	PROPERTIES & APPLICATION OF STEEL & CAST IRON	Students should be able to:- • Differentiate Various Types of Steels Cast Iron • Understand Importance of Carbon Content In Material • Present Specifications of Steels. • Define Designation & Standards of Steel	Cast iron & alloy cast Iron, Concept of machinability, Cast ability & formability, plain carbon steel, alloy steel & tool steels, plain carbon, medium carbon, High carbon steels, specification of steels, designation standards for the steel.	6	9

5	PHASE DIAGRAM & TESTING OF MATERIALS	Students should be able to:- • Define Heat Treatment. • Draw & Explain iron-Carbon Equilibrium Diagram • Differentiate Various Phases of Equilibrium • Present Importance of Carbon & Other impurities In Material • Explain Meaning of Allotropy of Iron	Definition, Description & Application of heat treatment, Description & application of iron- carbon diagram. Definition, Description of Testing of metals and alloys	8	12
6	FUNDANMENTAL OF HEAT TREATMENT PROCESSES	Students should be able to • Describe Process of Heat Treatment • Give Applications Limitations of Heat Treatment Along With Its Effect • Classify Various Types of Heat Treatment • Understand The Effect of Heat Treatment on Material • Understand Concept of Surface & induction Hardening.	Description & application of different process of heat Treatment, Description of effects of annealing, normalizing, hardening, tempering, etc. Use application & types of appropriate quenching media. Description & application of thermos chemical treatment – nitriding, carburzing, carbonitriding, cyaniding etc. Use & application of surface & induction hardening	6	15
7	OTHER PROCESSES	Students should be able to • Describe Process of Heat WELDING TYPES & PROCESS	Welding Types & Process, Gas Welding , Electric Arc Welding , Other Welding Processes, Modern Welding Methods and processes	4	03

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	MATERIAL SCEIENCE AND HEAT TREATMENT SEM III	V.D KODGIRE	EVEREST
2	MATERIAL SCEIENCE	R.K RAJPUT	S.K KATARIA PUBLICATION
3	ENGINEERING MATERIAL	B.K AGARWAL	
4	HEAT TREATMENT FOR STEELS	VIJENDRA SINGH	STANDARD
5	HEAT TREATMENT	C.P SHARMA	PRENTICE HALL OF INDIA

A3-07: COMPUTER AIDED DRAFTING (AUTOCAD)

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
2	3	-	--	60	--	40	3	100

II. COURSE RATIONALE

In the engineering world, CAD is extremely important and widely used to design and develop products to be used by consumers. This knowledge is a hot commodity for those employing engineers, because of its benefits in the engineering workplace. AutoCAD is a computer-aided software drafting program. It is used for a number of applications like creating blueprints for buildings, bridges and computer chips to name a few. AutoCAD is 2D and 3D computer aided drafting software application.

AutoCAD is a 2-D and 3-D computer-aided drafting software application used in architecture, construction, and manufacturing to assist in the preparation of blueprints and other engineering plans.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- To obtain products at a much lower manufacturing cost, compared to the one resulted from conventional applications.
- AutoCAD applications, by their complexity, allow the obtaining of much more reduced manufacturing times, compared to the conventional ones.
- In its industry, it has a good population of AutoCAD installed for execution of precision engineering works.
- Which can proficiently carryout work using CAD software, and subsequently use it for production.

IV. COURSE OUTCOMES

Student will be able to:

- Drawing in AutoCAD.
- Different modes of AutoCAD.
- Execute different commands in AutoCAD.

V. CONTENT:

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION TO AUTO CAD	Students should be able to:- • Definition of Auto cad • Concept of Auto cad • Concept of hard ware and software • Capability of Auto cad	Introduction & Review of Previous knowledge, Introduction & Objective of Syllabus, Introduction to – AUTO CAD, Capability of Auto Cad, Documentation Quick tour, Accessing documentation, Concept of hardware & software	4	3
2	GETTING STARTED (PRINCIPLE & CONCEPT)	Students should be able to:- • How to starting & setup new drawing • What are the command • What are the key specification • What are the mouse function • Design the templates • How to correct mistakes • How to refreshing screen display • Opening band saving new file • Setting the display	Starting AUTOCAD Setting up new drawing, Templates, Getting help , AUTOCAD & interface, Accessing command, Correcting mistakes, Refreshing screen display, Opening & saving existing file & function keys, Setting new drawing	4	3
3	CREATING OBJECTS (CO ORDINATE SYSTEM)	Students should be able to:- • Describe coordinate system • Define Cartesian coordinate system • Define polar coordinate system • Define absolute coordinate system • Define incremental coordinate system • How to create drawing line objects using command-line, poly lines multi lines • Explain about curves • How to create solid filled areas -region • What is hatching • What is hatching & its type • What is the command of Nut	Co-ordinates system - Cartesian, Polar, Absolute & Incremental co-ordinate system, Drawing line objects - Line, Poly line, Multi line, Rectangle & Polygons, Drawing curve objects – Circle, Arc, Ellipse, Creating solid filled areas- Regions, Hatch, Dot-nut, DD type	4	9

4	EDITING METHODS	Students should be able to:- • How to editing the object • What are the object properties • Explain matching properties • Explain mirror ,move • How to pattern • How trim ,resize, Insert breaks ,rotate ,chamfer, fillet, offset, align, extend ,array, mirror, stretch, grip, length	Working with named objects - Selecting objects, Editing objects, Using the object properties - Matching properties, Copy, Move, Erase, Resize, Insert breaks, Oops, Rotate, Chamfer, Fillet, Offset, Align, Trim, Extend, Array, Mirror, Stretch, Grip, Lengthen, Scale	4	9
5	DRAWING WITH PRECISION	Students should be able to:- • What are the snap & grid & Ortho mode • How to adjust the snap & grid alignment using Ortho mode • What is point filter • What is construction line • Using tracking specify the measurement & division • Wgat is arial 7 DD view	Adjusting snap & Grid alignment using ortho mode, Snapping geometric points, Using point filters, Using tracking specifying the measurement & division, Drawing construction lines, calculating points and values Zoom & Pan, Arial 7 DD view	6	9
6	LAYER MANAGEMENT (LAYERS, COLOURS & LINE TYPE)	Students should be able to:- • How to create layer • How to manage layer • how to assigning color in a line • How to change the properties of layer line types to layer • what is matching properties	Creating & managing layers, Assigning colour, Line types to layers, Changing properties , Matching properties	4	3
7	ADDITING TEXT TO DRAWINGS	Students should be able to:- • what are the text style • how to create D text & G text • what is multi line text • How to create multi line text • How to mirror a text • How to edit & modify DD	Text styles Text, D Text & G Text, Multiline Text, Mirror Text, Arc Text , DD edit, DD modify	4	3
8	DIMENSIONING & TOLERANCING	Students should be able to:- • Dimension concept about generating dimension • How to edit dimensions • Different types of dimension style	Dimensioning concepts Creating dimensions , Editing dimensions, Creating dimension styles, Adding geometric tolerances	4	9

		• What Is tolerance • How to generate tolerance			
9	USING BLOCKS ATTRIBUTES , X-REF	Students should be able to:- • What Is attribute • How to edit the DD block • What is the command of attribute • How to insert & modify in word block	Attribute definition DD attribute, DD edit block, Word block, Insert, Modify insert	1	3
10	LAYOUT & PLOTTING	Students should be able to:- • How to create a lay out • what are dimensioning space in a paper • How to set up plot • What is my set up plot	Paper space Model space, View ports, MV setup plot, Configuration, Customizing Auto Cad	1	3
11	WORKING IN 3D SPACE	Students should be able to:- • How to enter in work space of auto-cad • Explain co-ordinate system • Define a co-ordinate system • How to create a solid object • How to editing and modify solid objects	Specifying 3D co-ordinates, Defining a user co-ordinate system , Viewing in 3D, Creating 3D objects, Editing in 3D, Editing in 3D solids	4	6

VI. LIST OF EXERCIES: (Total Hours: - 60 Hrs.)

Student should individually perform the CAD exercises in the lab as per the exercises prescribed

VII. REFERENCE BOOK

SR. NO.	TITLE	AUTHORS	PUBLICATION
1	ENGINEERING DRAWING WITH A PRIMER ON AUTOCAD	SIDDIQUEE,ARSHAD N	PRENTIC HALL OF INDIA LTD.
2	ENGINEERING DRAWING WITH AN INTRODUCTION TO AUTO CAD	JOLHE DHANANJAY A.	TMH
3	ENGINEERING DRAWING : PLANE AND SOLID GEOMETRY	BHATT N.D.	CHAROTAR PUBLISING HOUSE
4	ENGINEERING GRAPHICS WITH AUTOCAD	GOEL,B.K.	S.K.KATARIA & SONS

MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

FOURTH SEMESTER: COURSE DETAILS

ADVANCE DIPLOMA IN TOOL & DIE MAKING

A4-01: CNC TECHNOLOGY & PROGRAMMING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
2	4	3	60	60	40	40	3	200

II. COURSE RATIONALE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

General Objectives: Student will be able to:

- To obtain products at a much lower manufacturing cost, compared to the one resulted from conventional applications.
- CNC applications, by their complexity, allow the obtaining of much more reduced manufacturing times, compared to the conventional ones.
- In its industry, it has a good population of CNC machines installed for execution of precision engineering works.
- Which can proficiently carryout work using CAD software, and subsequently use it for production through CNC machines.

IV. COURSE OUTCOMES

Student will be able to:

- Switching ON & OFF CNC machines.
- Job setup on CNC Machines.
- Machine setup for different modes.
- Prepare part programme by using G & M codes.
- Execute part programme block for different modes.
- Trouble shooting Different errors while programming & machining.
- Switching ON & OFF machines.
- Job setup on EDM Machines.
- Prepare programme for different machining.
- Configuration pre-defined parts on CAM CT.

V. CONTENT: THEORY

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	CNC introduction	Student Should be able to :- • Define NC & CNC. • Write about Historical development of CNC technology & classification. • Explain uses of CNC machine tool. • Write down Advantages & Disadvantages of conventional, NC & CNC. Identification Axis & Classification of NC system.	Introduction to NC & CNC, Terminology Historical development of CNC technology, Classification, Selection and use of CNC machines tool, Advantage & disadvantages of conventional, NC & CNC, NC is automatic control operation of NC machine tool, Axis identification & classification of NC system	6	9
2	CNC LATHE	Student Should be able to :- • Explain about CNC lathe & identification of various types. • Explain main parts & features of CNC lathe machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters. • Different operations & operational principle of various operations. • Write Calculation of machine parameters & tool geometry selection for operation. • Write safety precaution for operate Machine	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories. Cutting and material removal. Calculation of machine parameter and tool geometry selection. Safety and maintenance of machine, work place and cutting tools and accessories, Identify CNC LATHE machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.	6	9
3	CNC MILLING	Student Should be able to :- • Explain about CNC milling & identification of various types. • Explain main parts & features of CNC milling machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters.	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories. Cutting and material removal. Calculation of machine parameter and tool geometry selection. Safety and maintenance of machine, work place and cutting tools and	6	9

		• Different operations & operational principle of various operations. • Write Calculation of machine parameters & tool geometry selection for operation. • Write safety precaution for operate machine.	accessories, Identify CNC MILLING machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.		
4	CNC WIRECUT	Student Should be able to :- • Explain about CNC WIRECUT &identification of various types. • Explain main parts & features of CNC WIRECUT machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters • Different operations & operational principle of various operations. • Write Calculation of machine parameters & tool geometry selection for operation. • Write safety precaution for operate machine.	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories, Cutting and material removal. Calculation of machine parameter and tool geometry selection, Safety and maintenance of machine, work place and cutting tools and accessories Identify CNC WIRECUT machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.	4	6
5	CNC EDM - DIE SINKING	Student Should be able to :- • Explain about CNC EDM DIE SINKING machine & identification of various types. • Explain main parts & features of CNC DIE SINKING machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters. • Different operations & operational principle of various operations. • Write Calculation of machine parameters & tool geometry selection for operation. • Write safety precaution for operate machine.	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories, Cutting and material removal, Calculation of machine parameter and tool geometry selection. Safety and maintenance of machine, work place and cutting tools and accessories, Identify CNC EDM-DIE SHINKING machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.	4	6

6	HIGH SPEED MILLING	Student Should be able to :- • Explain about CNC HIGH SPEED MILLING machine & identification of various types. • Explain main parts & features of CNC HIGH SPEED MILLING machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters. • Different operations & operational various operations. • Write Calculation of machine parameters & tool geometry selection for operation. • Write safety precaution for operate machine	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories. Cutting and material removal. Calculation of machine parameter and tool geometry selection, Safety and maintenance of machine, work place and cutting tools and accessories, Identify HIGH SPEED MILLING machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.	4	7
7	CNC GRINDING	Student Should be able to :- • Explain about CNC GRINDING machine & identification of various types. • Explain main parts & features of CNC GRINDING machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters. • Different operations & operational various operations. • Write Calculation of machine parameters & tool principle of geometry selection for operation. • Write safety precaution for operate machine	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories. Cutting and material removal .Calculation of machine parameter and tool geometry selection. Safety and maintenance of machine, work place and cutting tools and accessories, Identify CNC grinding machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.	4	6

8	CNC MACHINING CENTRE	Student Should be able to :- • Explain about CNC MACHINING CENTRE machine & identification of various types. • Explain main parts & features of CNC MACHINING CENTRE machine. • Define work holding devices & its selection. • Write about cutting tools, cutting tools holders & various cutting parameters. • Different operations & operational principle of various operations. • Write Calculation of machine parameters & tool geometry selection for operation. • Write safety precaution for operate machine.	Description of main parts and features of, Machine, Work holding devices, Cutting tools, Cutting tool holders, Cutting parameters, Operations, Operational principles of machines and accessories. Cutting and material removal. Calculation of machine parameter and tool geometry selection. Safety and maintenance of machine, work place and cutting tools and accessories, Identify CNC MACHINING CENTRE machine, work holding devices, cutting tools and holders for operation by applying the standard practice and norms with respect to safety and maintenance.	6	8

VI. CONTENT : CNC PROGRAMMING (PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	Codes & Cycles for CNC Lathe & Milling programming	Student Should be able to :- • Describe the G code & M code. • Explain the various cycles in lathe & milling machine. • Describe the NC programme.	Codes & Cycles for CNC Lathe Programming, Preparatory commands (G - Codes), Miscellaneous commands (M – Codes), Cycles used in CNC Lathe Programming, Codes & Cycles for CNC Milling Programming, Preparatory commands (G - Codes), Miscellaneous commands (M – Codes), Cycles used in CNC Lathe Programming, Workshop & Demo on CNC Lathe & Milling simulator	**30**	**15**
2	Introduction to NC Programming	Student Should be able to :- • Describe the G code & M code. • Explain the various cycles in lathe & milling machine. • Describe the CNC programme.	Work organisation and flows of manual NC programming, NC programming basics, Introduction into manual NC programming, NC programming, Workshop & Demo on CNC Lathe & Milling simulator, Manual NC programming Turning, CNC programming Turning	**10**	**15**

3	Introduction to CNC programming	Student Should be able to :- • Describe the G code & M code. • Explain the various cycles in lathe milling machine. • Describe the CNC programme.	CNC Programming for CNC Lathe, CNC Programming for CNC Milling, Workshop & Demo on CNC Lathe & Milling simulator, Programming for CNC Lathe & Milling Exercises, Programming and machining on CNC Lathe & Milling for any one exercise from programmed one.	**40**	**30**

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	CNC TECHNOLOGY AND PROGRAMMING	KRAR,STEVE	MCGRAW-HILL INC.
2	CNC TECHNOLOGY (BASIC COURSE)	BISWAS,P.K.	ALL INDIA COUNCIL OF TECH. EDUCATION
3	CNC TECHNOLOGY (LATHE & MILLING)	IGTR	IGTR
4	CNC TECHNOLOGY : LATHE AND MILLING	IGTR,AHM	INDO-GERMAN TOOL ROOM
5	CNC TECHNOLOGY PROGRAMMING AND OPERATING (M)	DHOTRE,MAHESH	SAITECH, AHMEDNAGAR

A4-02: TOOL & DIE MAKING PRACTICE - II

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
-	16	-	-	240	-	160	3	400

II. COURSE RATIONALE

The subject is the mother of all manufacturing technics and deals with moulds, jigs & fixtures, plastics, die casting, dies. The practical subject introduces the Numbering & lettering as per specified dimensions with maintaining quality criteria.

A brief idea about the Grinding of single lip cutters as per specified in drawing with maintaining quality criteria is included in the course. The operation To resharp the drills to required angle is performed which helps the students to understand the maintenance of the tools.

The later part of the course helps in understanding the operation of turning & milling. The course is helpful to make standard parts of press tool, jigs, fixtures & gauges, plastic mould.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Understand Numbering & lettering as per specified dimensions with maintaining quality criteria.
- To reshape the drills to required angle.
- Make standard parts of press tool.

IV. COURSE OUTCOMES

Student will be able to:

- Manufacture and assemble the parts of standard press tool.
- Manufacture and assemble the parts of standard jigs and fixtures.
- Manufacture and assemble the parts of standard single cavity Mould.
- Manufacture and the standard parts of production order.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	TURNING	Student Should be able to :- • Manufacture and assemble the parts of standard press tool. • Manufacture and assemble the parts of standard jigs and fixtures. • Manufacture and assemble the parts of standard single cavity mould. • Manufacture and the standard parts of production order.	Make standard parts of press tool, jigs, fixtures & gauges, plastic mould.	320	400
2	MILLING		Make standard parts of press tool, jigs, fixtures & gauges, plastic mould.		
3	SURFACE GRINDING		Preparations of grinding wheels for grinding & use of special devices.		
4	CYLINDRICAL GRINDING		Grinding of standard parts of press tool, jigs, fixtures & gauges, plastic mould.		

VI. LIST OF EXPERIENCES (Total Hours: - 320 Hrs.)

Sr. No.	Name of Exercise
1	Manufacturing & assembly of blanking tool
2	Manufacturing & assembly of V bending tool
3	Manufacturing & assembly of mould base

VII. REFERENCE BOOK

SR. NO.	TITLE	AUTHORS	PUBLICATION
1	PRESS TOOLS : DESIGN & CONSTRUCTION	JOSHI, PRAKASH H.	A.H.WHEELER PUBLISHING
2	TOOL MAKING (MT P5) : PRESS TOOL FOR HINGE COMPONENTS	ATI	ATI
3	TOOL MAKING (MT P5) : PRESS TOOL FOR SLOTTED PLATE	ATI	ATI
4	SHEET METAL PRESS TOOLS DESIGN AND MAKING : A PRACTICAL APPROCH	LUQMAN, MIDHAT	CBS PUBLICATION

A4-03: DESIGN OF JIGS AND FIXTURES - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	60	40	40	200

II. COURSE RATIONALE

The course gives a detailed definition of jigs and fixtures, and also identified the numerous advantages that are associated with the use of jigs and fixtures in manufacturing to include: production increase, cost reduction, interchangeability and high accuracy of parts, reduction of the need for inspection and quality control expenses, reduction of accident as safety is improved, automation of machine tool to an appreciable extent, easy machining of complex and heavy components, as well as low variability in dimension which leads to consistent quality of manufactured products.

The work also explained that since the design is dependent on numerous factors which are analyzed to achieve an optimum output, that jigs and fixtures should be made of rigid light materials to facilitate easy handling.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Locate elements of jigs & fixtures.
- Basic principles & rules of clamping
- Design standard bushings.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of limit fit & tolerance.
- Understand standard & non-standard clamping.
- Classification of clamping methods & common types of clamps.
- Design a jig for specific application
- Design a fixtures for specific application

V. CONTENT:

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION	Student Should be able to :- • Understand the tools used in mass production. • List of the different types of jigs & fixtures. • Understand the basic information of the press • tools, moulds & gauges • Define press tools, moulds & gauges.	Introduction Tool used in mass production, jigs, fixtures, Gauges, Press Tools, Moulds	2	-
2	JIGS & FIXTURES	Student Should be able to :- • Define jigs and fixtures. • Differentiate between the jigs & fixtures. • Understand the purpose of jigs & fixtures. • List of the advantages of jigs & fixtures.	Introduction Purpose & advantages of jigs & fixtures	2	3
3	ELEMENTS OF JIGS & FIXTURES	Student Should be able to :- • Define locating elements used in jigs & fixture. • Understand the principle of location. • Classification of location and commonly used locating. • Explain the locating methods & devices. • List of the locating devices. • Elaborate the indexing methods • Explain the nesting locators, profile locators adjustable locators. • Design the different types of locators. • Understand the basic principle and rules of clamping. • Classification of clamping methods & common types of clamps. • Understand the standard and non- standard clamps. • Describe the damping methods • Define no mechanical clamps • Explain no standard clamps	**Locating elements,** Introduction, Principle of location, Guide Lines for selection of location surfaces / plane, classification of location & commonly used location, methods & devices, Indexing devices, Type of location & their brief description, Nesting locators, Profile locators, Adjustable locators	6	15
			Clamping elements introduction to clamp, basic principles & rules of clamping, classification of clamping methods & common types of clamps non mechanical clamps Clamping methods & their description	6	12
			Guiding elements Introduction to Tool Guiding elements, Classification of tool guiding elements& common types of bushings, Special bushings, Clamp locks for bushings, Jig bushings, Design of standard bushings and empherical formulas Standard bushings & their description	6	15

		• Define tool guiding elements • Classification to guiding elements • List of the common types of bushings. • Design she special bushings & standard bushings • List of the tool bodies • Define the tool bodies • Understand the materials used for the tool bodies • Define and list of different types fastening devices. • Explain the different types of fastening devices • Understand the recommended material and heat treatment for jigs and fixtures elements.	**Tool Bodies (Jig & Fixture)** Introduction, Types of tool bodies, Preformed materials	2	3
			Fasteners (jig & fixture) Introduction to fasteners, Types of fastening devices, Fastening devices & their applications Recommended materials & heat treatment for jig & fixture elements	2	6
4	LIMIT FIT & TOLERANCE	Student Should be able to :- • Define limits, fits, tolerance. • List of different types of limits, fits, tolerance. • Differentiate between hole basis system and shaft basis system. • Explain max. & min, material condition. • Explain the hole basis system. • Explain shaft basis system	Introduction, Advantages & disadvantages, Tolerances, Limits Fits, Allowances, Deviation, Max. & Min. material condition Shaft basis & hole basis system.	4	6

I. **CONTENT (PRACTICE)**

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION		Geometrical dimensioning & tolerance system practice: Geometrical characteristics, Geometrical tolerances, Dimensioning methods	6	4
2	ELEMENTS OF JIGS & FIXTURES	Student Should be able to :- • Define locating elements used in jigs & fixture • Understand the principle of location • Classification of location and 6ommonly use • locating • Explain the locating methods & devices, • List of the locating devices. • Elaborate the indexing methods • Explain the nesting locators, profile locators adjustable locators. • Design the different types of locators. • Understand the basic principle and rules clamping. • Classification of clamping methods & common types of clamps. • Understand the standard and non- standard clamp	Locators, Locating methods & devices: Pins & Buttons, Two pin location, Diamond locators, Rest Pads, V locators, Profile locators, Adjustable locators	12	20
			Indexing devices: Linear indexing, Rotating indexing Clamps, Clamping methods & Devices: Strap clamps, Screw clamps, Quick acting clamps, Power clamping, Non mechanical clamp & Non-standard clamping elements	10	12
			Guiding elements- (Bushings): Press fit bushes, Linear & wearing, Renewable bushes, Slip bushes, Threaded bushes, Special bushes Clamp locks for bushings	10	15
			Types of tool bodies, Types of fastening devices	4	3
3	LIMIT FIT & TOLERANCE	Student will be able to- • Define limits, fits, tolerance. • List of different types of limits, fits, tolerance. • Differentiate between hole basis system and shaft basis system. • Explain max. & min. material condition. • Explain the hole basis system. • Explain the shaft basis system.	Tolerances, Limits, Fits, Allowances, Deviation	8	6

VI. LIST OF PRACTICAL EXPERIENCES

Sr. No	Title of Sheet
1	Geometrical dimensioning & tolerance system
2	Locators
3	Indexing devices
4	Clamping methods & devices.
5	Types of bushes

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	JIGS AND FIXTURES	JOSHI P. H	NEW DELHI:TMH
2	JIGS AND FIXTURE DESIGN	HOFFMAN, EDWARDG	CENGAGE LEARNING INDIA PRIVATE LIMITED
3	JIGS AND FIXTURES : NON-STANDARD CLAMPING	GRANT , HIRAM E.	NEW DELHI : TMH
4	DESIGN OF JIGS AND FIXTURES & PRESS TOOL	VIJAYA RAMNATH B.	ESWAR PRESS
5	INTRODUCTION TO JIGS & TOOL DESIGN	KEMPSTER MLHA	NEW DELHI,VIVA BOOKS PRIVATE LIMITED

A4-04: DESIGN OF PRESS TOOLS - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	90	40	60	250

II. COURSE RATIONALE

Press tools are commonly used in hydraulic, pneumatic, and mechanical presses to produce components at high volumes. Generally press tools are categorized by the types of operation performed using the tool, such as blanking, piercing, bending, forming, forging, trimming etc. The press tool will also be specified as a blanking tool, piercing tool, bending tool etc.

Use and application of Press Tool cutting operations to produce sheet material components helps in industrial applications. Use and application of different elements in a Typical Press Tool is helpful in the manufacturing of a component.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Mounting, stripping and ejection Material used for different elements.
- Selection of proper Sheet material, Sheet material components & their applications.
- Understand the Effect of shear angle.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of press tools.
- Understand the applications of press tools.
- Classification of press tools & understands the design parameters.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	OVERVIEW OF MASS PRODUCTIN OF SHEET MATERIAL COMPONENT	At the end of this unit student should be able to: • Understand about press tool, use of press tool • Understand function & parts of press tool • Understand application of press tool • To know about different types of sheet materials • used in press tools • To know about different types of sheet materials	Introduction: Use of Press tools, Presses and Tool drawings to produce, Components from sheet material for mass production. Video Cassette, Definition: Sheet material, Sheet material components & application, Press tools. Presses.	1	-
2	PRESS TOOLS CUTTING OPERATIONS	At the end of this unit student should be able to: • Understand different types of press operations • Understand term like land, angular clearance, cutting clearance etc. • Understand component strip layout • To know relation between pierce part & cutting operation • To know different types of cutting operations	Use and application of Press Tool cutting operations to produce sheet material components, Principle of shearing, Principle of Cutting clearance, Relation between pierce part / slug and Shearing operation, Classification of shearing operations, Angular clearance, Land, Classification of shearing operations, Principle of strip layout,	2	10
3	PRESS TOOLS INTEGRATED OPERATIONS	At the end of this unit student should be able to: • Understand about different types of integrated operations & it's used. • Understand about different types of strip layout for integrated dies. • Understand about progressive tool, compound tool its parts & use • Calculation of clearance, forces in progressive & compound tool	Introduction: Use and application of Press Tool integrated operations to produce sheet material components, Classification of integrated operations, Strip layout. Concept of classification of integrated dies a) Progressive dies b) Combination dies, Principle of blank though, Chop off, parting.	2	10
4	TYPICAL PRESS TOOL AND PARTS	At the end of this unit student should be able to: • Understand types of typical press tool & its parts. • Understand of typical press tool • Understand cutting & non-cutting operation in typical press tool	Introduction: Use and application of different elements in a Typical Press Tool. Typical Press Tools & their parts. -Cutting operations, Non-cutting operations Relationship among different elements Principle of alignment and guidance, clearance.	2	9

		• Understand material feeding process • Understand about fitment for alignment & guidance of parts	Principle of mounting, stripping and ejection Material used for different elements.		
5	CLASSIFICATION OF PRESS TOOLS- CUTTING DIES	At the end of this unit student should be able to: • Explain and Classify different types of cutting dies • Explain use & its application • Understand principle of cutting dies, inverted dies, compound dies. • Understand relation between cutting clearance & burr side.	Introduction: Use and application of types of cutting dies. Classification of cutting dies Principle of Inverted dies. Principle of Compound dies Burr side relationship and differential cutting Clearance in a Compound die.	3	9
6	DESIGN PARAMETERS FOR SHEARING	• Understand basic design parameters in tool design • Understand use & application of design parameters • Understand shear angle effects on cutting forces • explain & calculate term like cutting force, land, angular clearance, shear angle	Introduction: Use and application of design parameters in Tool Design, Principles of shearing & stripping forces, Effect of shear angle, Calculate shear force, stripping force for the given samples of different thickness and materials using data sheets, tables, formulae etc. Principle of design parameters such as cutting clearance, angular clearance, land with respect to quantity & quality requirements, Geometrical relationship between components, Punch & Die, Principle of design parameters such as cutting clearance, angular clearance, land with respect to quantity & quality requirements, Principles of shearing & stripping forces. Effect of shear angle,	4	10
7	DESIGN PARAMETERS FOR STRIP - LAYOUT	• Understand basic design parameters for strip layout • Understand sheet material utilization • Explain use of strip layout • Explain application of strip layout	Use and application of different design parameters for Strip, Layouts for optimum press tool design and material utilization, Strip layout. Classification of Strip Layouts. Piloting and Stopping. Strip guiding Material condition. Economy factor, Material condition	2	-
8	DESIGN PARAMETERS FOR ELEMENTS OF	• Understand concept of press tool. • Understand different design parameters. • Explain classification of element of press tool	Introduction:Use and application of different Design Parameters for Elements of Press Tool for Cutting Operations, Concept of construction of Press Tool.	4	12

	PRESS TOOL FOR CUTTING OPERATIONS	• Explain different types of dies used. • Explain factors affecting for selection of dies • Explain different types of guiding elements & locating elements • Explain different types of plates used in press tool & its function • understand selection of material of different parts of press tool	Classification of the elements of Press tools. Functional elements, Dies, Solid Die vs. Split Die, Factors effecting selection of splits mounting of splits, Punches, Categories, Mounting of Punches, Guiding & locating elements, Pilots, Stoppers, Stock Guides. Classification of Die sets. Ejecting elements. . Strippers, Shedders, Knockouts. Supporting & clamping elements. Back plate, Punch plate, Top plate, Concept of material selection and Heat treatment		

VI. LIST OF PRACTICAL EXPERIENCES

UNIT NO.	CONTENTS	TEACHING/ PRACTICAL HOURS	MARKS
1	DESIGN OF PIERCING TOOL PART DETAIL & STANDARD ELEMENTS	6	05
2	DESIGN OF PIERCING TOOL ASSEMBLY & STANDARD ELEMENTS	6	10
3	DESIGN OF BLANKING TOOL PART DETAIL & STANDARD ELEMENTS	9	15
4	DESIGN OF BLANKING TOOL ASSEMBLY & STANDARD ELEMENTS	9	15
5	DESIGN OF PROGRESSIVE TOOL PART DETAIL & STANDARD ELEMENTS	9	15
6	DESIGN OF PROGRESSIVE TOOL ASSEMBLY & STANDARD ELEMENTS	6	10
7	DESIGN OF COMPOUND TOOL PART DETAIL & STANDARD ELEMENTS	6	10
8	DESIGN OF COMPOUND TOOL ASSEMBLY &STANDARD ELEMENTS	9	10

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	ADVANCED TOOL DESIGN PRINCIPLES (PRESS TOOLS)	NUTTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
2	FUNDAMENTAL DESIGN CONCEPT OF PRESS TOOLS	NETTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
3	PRESS TOOLS PART-I (1081) TP		EDUCATION & TRG CONSULTANTS
4	PRESS TOOLS PART-II (1082)TP		EDUCATION & TRG CONSULTANTS
5	PRESS TOOLS PART-III (1083) TP		EDUCATION & TRG CONSULTANTS
6	PRESS TOOLS : DESIGN & CONSTRUCTION	JOSHI, PRAKASH H.	A.H.WHEELER PUBLISHING

A4-05: DESIGN OF MOULDS - I

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	90	40	60	250

II. COURSE RATIONALE

The course offers knowledge of plastic moulds, moulding machine & equipment. The course gives knowledge of applications of moulds in the industries. The knowledge of Classification, Functions and, Materials used for core & cavity is helpful for working in industry.

Different parts like Mould base housing parts with classification, Spruce bush, Locating ring, Types of Bolsters, Types of Ejection guides, Guide pillars & Bushes Locators & grids are important from the course point of view.

The course gives idea about Injection moulding, which is a manufacturing process for producing parts by injecting material into a mould. Injection moulding can be performed with a host of materials mainly including metals, (for which the process is called die casting), glasses, elastomers, confections & most commonly thermoplastic & thermosetting polymers.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Classify industrial applications of plastics.
- Understand the process of moulding & its types.
- Understand the design parameters related to mould, material & machine - injection moulds.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of moulding.
- Understand the specification of mould, material & machine – injection mould.
- Understand elements of moulds & their function.

V. CONTENT (THEORY)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1 INTRO DUC TION	OVERVIEW OF MASS PRODUCTION OF PLASTIC COMPONENTS	After studying this unit student will able to: • Use of plastic mould, moulding machine & equipment • Classification & application of plastic • material & mould material • Classification of moulding machine • Classification of mould	Introduction: An Overview of Use of plastic moulds, moulding machine& equipment and Tool drawings to produce Plastic Components for mass production, Classification of industrial application of plastics, Classification of plastics material & mould material, Classification of application of moulding machine & equipment, Classification of application of moulds	2	3
2 MOULDING OPERATIONS	MOULDING OPERATIONS INJECTION, COMPRESSION,TR ANSFER, BLOW,ROTATION AL,THERMO FORMING MOULDING	After studying this unit student will able to: • Use & application of moulding machine & injection moulding process • Moulding process elements machine, material & mould parts & function • Classification of injection moulding machine • Process set up data	Introduction: Use and Application of moulding Machine and further injection moulding processes, Injection moulding process elements - Machine, Material and Mould, Parts & Function of injection moulding machine (Clamping, Heating & Feeding, and Ejection), Classification of injection moulding machines, Process set up data	2	15
3 ELEMENTS OF MOULD& MOULD & THEIR FUNCTION	ELEMENTS OF MOULD & THEIR FUNCTION-INJECTION MOULD	Student will able to: • Use & application of different element of injection mould • Mould base & base parts • Elements use in the mould base • Feeding system of mould • Cooling system of mould • Ejection system of mould • Core &cavity retainer parts	ntroduction: Use and application of different elements in a typical INJECTION MOULD, CORE AND CAVITY: Classification, Functions Materials used for core & cavity, MOULD BASE & PARTS: Mould base housing parts With classification, Sprue bush, Locating ring, Types of Bolsters, Types of Ejection guides, Guide pillars & Bushes Locators & grids, FEEDING SYSTEM: Elements & functions of feed systems, a) Sprue b) Runner c) Cold Slug d) Gate,	6	15

			Classification of various feed systems and Balancing feed system COOLING SYSTEM: Elements and functions of Cooling systems, Classification of various cooling system and Balanced circuits, EJECTION SYSTEM: Parts & function of ejector elements with classification, Ejection Assembly, Ejector Plate, Retaining Plate, Ejector Rod & Bush, Ejector Pin, Sprue Puller etc, CORE& CAVITY RETAINER PARTS: Principle of alignment Grid, Ejector Plate and guidance, clearance, mounting and ejection, parting surfaces and cooling, Material used for different elements.		
4 CLASSIFICATION OF MOULDS	CLASSIFICATION OF MOULDS- MOULDS INJECTION MOULDS	Student will able to: • Use & application of multi daylight mould • Classification of mould two plate mould, three plate mould & stripper plate mould • Principal & extraction of the parting surface • Classification of mould based ejection • Classification of mould based on feed system • Layout of runner & gate	Introduction: Use and application of multi day light moulds, BASED ON DAY LIGHT: Two plate mould, Three plate mould, Stripper plate mould and Stack mould, Principles of parting surface, multi day light, injection moulding process, BASED ON EJECTION: Classification of moulds ejection, Principle of undercuts & threads, BASED ON FEED SYSTEM: Classification of moulds based on feed system, based ejection, Principles of feed systems, layout of runner, gates, spure bush	4	12
5 DESIGN PARAMETERS RELATED TO MOULD, MATERIAL & MACHINE	DESIGN PARAMETERS RELATED TO MOULD, MATERIAL & MACHINE- INJECTION MOULDS	After studding this unit student will able to: • Use & application of design parameter in injection mould • Concept of design parameter pertaining to mould, machine & material • Construction of mould with respective machine • Concept of quality & quantity • Properties of plastic material	Introduction: Use and application of Design parameters in injection mould, Concept of design parameters pertaining to mould, machine and material. (Refer list of Design Parameters), Concept of quality and quantity required, Construction of mould with respective machine, Properties of plastic material	4	12

6 SPECIFICATION	SPECIFICATION OF MOULD, MATERIAL & MACHINE	Student will able to: • Use & application of the specification pertaining to mould, material & machine • Mould & tool design data • Classification of tool material • Process & work sheet of mould	Introduction : Use and application of the specification pertaining to mould, material and machine for tool design data, material composition and specification, classification of tool material, treatment, work sheet	2	3

VI. CONTENT (Practice)

UNIT NO.	TOPIC/SUB-TOPIC NO.		CONTENTS	TEACHING HOURS	MARKS
1	COMPONENT DRAWING	Student will able: • Study the component • Analyse customer need • Determine the dimension shrinkage with allowance.	Introduction: Use and application of allowances for component drawing, Study the component / sample, Study & analyse customer needs, Determine the dimensions with allowances and shrinkages, Draw component drawing.	10	20
	RUNNER LAYOUT	Student will able: • Use & application of runner layout • Selection of impression according • requirement • Draw the typical runner layout	Introduction: Use and application of the typical runner layout, Study the component drawing / sample, Study & select the impression according to requirement, Draw the typical runner layout.		
	COOLING / HEATING LAYOUT	Student will able: • Use of cooling & heating circuit in mould • Typical circuit layout per heating/cooling in mould	Introduction: Use of cooling & heating circuit in moulds, Draw a typical circuit layout per heating / cooling in mould, (Simple circuit, 'O' circuit, Z circuit, Heat pipes, insert cooling, integer core cooling, Baffled cooling.		
2	CALCULATE DESIGN PARAMETERS WITH RESPECT TO	Student will able: • Use of design parameter for optimum mould design	Introduction: Use of design parameters for optimum mould design, Study the component specification and customer requirement, Study & use the design	8	16

	MOULD, MATERIAL & MACHINE	• Study the component specification & customer requirement • Design parameter with respect to mould material & machine • Calculation & verification of design parameter according to requirement of mould	parameters with respect to mould, material and machine, Use the data book, standards for optimum selection of design parameters, Calculate & verify the design parameter according to requirement of mould.		
	PREPARATION OF WORK / DATA SHEET OF MOULD, MATERIAL & MACHINE	Student will able: • Use of work sheet for mould design • Use the information data preparation of work • Data sheet for mould design in relevant format	Introduction: Use of work sheet for mould design, Use the information data Prepare the work / data sheet for mould design in relevant format.		
3	SKETCHING CONCEPTUAL DESIGNS	Student will able: • Development of conceptual design. • Study the component drawing /sample • Selection of optimal design.	Introduction: Use and application of alternative conceptual design, Refer (List of exercises for design practice & Flow Chart), Study the component drawing / sample, Develop conceptual design using data sheet. Develop alternative conceptual designs, Develop alternative conceptual designs, and Select the optimal design.	14	12
4	DRAW THE ASSEMBLY AND DETAIL DRAWINGS OF MOULD	Student will able: • Use of assembly & detail drawing for manufacturing of mould • Process sheet & work sheet from design parameter • Draw the assembly & detailed drawing of the mould as per norm	Introduction: Use of Assembly and detailed drawings for manufacturing of mould, Refer (List of exercises for design practice Chapter 6.1 & Flow Chart), Refer the process sheet & worksheet from the design parameters for the selected optimal design, Use the concept drawing, Draw the assembly and detailed drawings of mould as per norms.	8	28

5	BILL OF MATERIALS	Student will able: • Preparation of bill of material • Mass production of the component • Use of bill of material in mould manufacturing	Introduction: Use of Bill of Material in mould manufacturing and mass production of component, Study the data sheet & work sheet, Prepare bill of material.	10	14
	MOULD DATA	Student will able: • Use of mould data in the production component • Preparation of mould data for machine set up	Introduction: Use of mould data in the production of components, Study the standards, norms & prepare data for machine set up, Prepare processing data & mould data.		

I. LIST OF PRACTICAL EXPERIENCES (Total Hours:- 60 Hrs.)

1	Design of hand mould
2	Mould base design
3	Design of mould base part & elements
4	Design of single impression two plate mould
5	Design of two impression two plate mould
6	Design of four impression two plate mould with proper design of ejection & cooling system
7	Design of multi impression mould with proper design of ejection & cooling system
8	Design of single impression mould by using finger cam actuation method
9	Design of two impression mould by using dog-leg cam actuation method
10	Design of two impression mould by using cam-track actuation method
11	Design of two impression mould by using spring actuation method

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	TOOL AND DIE MAKER (PRESS TOOLS; JIGS AND FIXTURES AND DIES AND MOULDS) FIRST YEAR TRADE PRACTICALS	CIMI	CENTRAL INSTRUCTIONAL MEDIA INSTITUTE
2	ADVNACED DESIGN ELEMENTS OF DIES AND MOULDS AND RELATED TOOLINGS	NUTTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
3	INJECTION MOULDING	ATHALYE,A.S.	MULTI-TECH PUBLISHING CO
4	MOULDING OF PLASTICS	ATHALYE,A.S.	MULTI-TECH PUBLISHING CO
5	INJECTION MOULDS : 108 PROVEN DESIGNS	GASTROW,HANS	HANSER PUBLICATION
6	THEORY DIES AND MOULDS 1ST YEAR : FUNDAMENTAL DESIGN CONCEPTS OF DIES & MOULDS	NETTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
7	HANDBOOK OF THERMOEST PLASTICS INJECTION MOULD DESIGN	CRACKNELL,P.S.	BLACKIE ACADEMIC & PROFESSIONAL
8	INJECTION MOULDING	PYE R.G.W	AFFILIATED EAST WEST PRESS
9	DESIGN MANUAL PLASTIC INJECTION MOULD VOL-1 & 2	CTTC	CTTC KOLKATA
10	HOW TO MAKE AN INJECTION MOULD	MENGHES/MOHRAN	HANSER PUBLICATION
11	INJECTION MOULDING	ROSATO	CBS PUBLICATION

A4-06: C PROGRAMMING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	-	-	60	-	40	100

II. COURSE RATIONALE

C Programming is basic computer programming. It includes the topics Operators, if statement, Loop Control, Arrays, string, Basics of a function, Structures, Graphics introduction. C's compactness and coherence is mainly due to the fact that it's a one man language. C's known as middle level language .It was designed to have both: a relatively good programming efficiency (as compared to Machine oriented languages) and a relatively good machine efficiency (as compared to problem oriented languages).

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Learn programming concepts and methodology
- Learn standard, sequential, decision and iterative structures of programming language
- Write, debug, compile and execute the programs -
- Write programs for hardware interfacing.
- Design graphics using standard geometrical shapes and graphic functions
- Handle text and binary files for real life applications

IV. COURSE OUTCOMES

Students will able to learn programming concepts and methodology of C programming. Learn standard, sequential, decision and iterative structures of programming language. Also learn how to debug, compile and execute the programs write programs for hardware interfacing. Design graphics using standard geometrical shapes and graphic functions & handle text and binary files for real life applications.

I. CONTENTS

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOME	CONTENTS	TEACHING HOURS	MARKS
1	**Getting Started with C**	Student should be able to :- • Understand history of c language. • Describe the concept of Keywords, constant, • Variable & character set. • Describe Concept of Operators. • Learn programming concept and methodology of C programming.	**History of C,** Features of 'C', advantages of 'C', assembler, compiler, interpreter, structure of' C' program **Character set, keywords**, **constants, variables**, rules of variables, data type-declarations, initializations, assignments, memory sizes, formatting characters and minimum/maximum values for each data types, type modifiers, type conversion **Operators** (arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special operators) precedence, expressions, formatted input and output statements.	3	15
2	**The Decision Control Structure**	Student should be able to :- • Describe function of loops & decision making statements. • Choose the loops and decision making statements to solve the problems.	**Decision making and branching: if statement** (if, if-else, if-else-if ladder, nested if-else), switch statement. **Loop Control**: What is loop, why to use loops, pre-test and post-test loops, while, do-while and for loops, nested loops, break and continue statement	3	10
3	**Arrays & Strings**	Student should be able to :- • Explain Declaration of array, size of array. • Describe initialization one dimensional, two dimensional array. • Implement different operation on array. • Describe string initialization functions &implement • Different standard library of strings function	**Arrays:** Declaration, initialization of one dimensional, two dimensional arrays, size of array, memory allocation of array, accessing array elements using index. Operations such as searching and sorting of array. **Declaration and initialization of string variables**, string handling functions from standard library (strlen (), strcpy (), strcat (), strcmp ()).	4	10

4	**Function & Structures**	Student should be able to :- • Explain Function definition, uses of functions & variables. • Describe function definition call, passing arguments to functions, different between call by & call by reference. • Use function to solve the given problems. • Describe pointer, Structures & unions.	**Basics of a function**, Need of functions, How function works, Function definition, internal and external variables, scope and lifetime of variables, function call, passing arguments to functions (call by value, call by reference), return values, storage classes, category of function , Library functions Introduction to pointer, Pointer notation. Recursion, recursion and stack, Programs on pointers **Structures**: Defining structure, declaring and accessing structure members, initialization of structure, arrays of structure.	6	10
5	**Graphics & files**	Student should be able to :- • Describe initialization of graphics, Basic graphic function • Describe fonts, patterns, colures & styles of graphics. • Use graphics function solve the given problems. • Explain types of files – text and binary, flies operations – read, write, open, close. • Implement file operations in c programming for a given application.	**Graphics introduction**, Initialization of graphics, using fonts, patterns, colours, styles, filling. Basic graphic functions **Why to use file**, file types-text and binary, file handling-sequential and random, file operations- read, write, open, close, append, basic file functions	4	15

V. LIST OF PRACTICAL: (ANY TEN FORM FOLLOWING) (Total Hours:- 60 Hrs.)

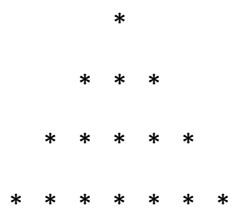
EXPERIMENT-1:- Write a C program to print your Name at Screen.

EXPERIMENT-2:- Write a C program to display ”MSME TECHNOLOGY CENTRE” at first line and “BHOPAL” at second line of output screen.

EXPERIMENT-3:- Write a program to display Yours Name in double inverted comma.

EXPERIMENT-4:- Print the following output in the middle of the screen.

(Use only \n and \t in printf statement don't use spaces)



EXPERIMENT-5:- Write a program addition of two numbers.

EXPERIMENT-6:- Take two variables and swap their contents using third temporary variable.

EXPERIMENT-7:- Take two variables and swap their contents without using third temporary variable

EXPERIMENT-8:- Take a four digit number from the user print its reverse

EXPERIMENT-9:- Take a four digit number from the user and print the sum of the digits.

EXPERIMENT-10:- Take a three digit number from the user and print the sum of first and last digit.

EXPERIMENT-11:- Take the marks of five subjects and calculate the total and the average and print it.

EXPERIMENT-12:- Take the radius of the circle and calculate the area of the circle.

EXPERIMENT-13:- Write a C program to check whether given number is even or odd.

EXPERIMENT-14:- Write a C program to check whether given number is positive or negative.

EXPERIMENT-15:- Find out the Largest among three numbers without using the logical operators.

EXPERIMENT-16:- Find out the largest among three numbers using the logical operator.

EXPERIMENT-17:- Take number of items and the price per item from the user and calculate the bill, if total amount is more than 1000 then give 10% discount else no discount, Display the bill.

EXPERIMENT-18:- Take the character from the user and print whether the entered character is vowel or consonant. (Program should be Applicable for both the cases i.e. Upper and Lower case);

EXPERIMENT-19:- Take the basic salary from the user if basic salary is less than or equal to 2000 then

DA=40% and HRA is 20%

if basic salary is greater than 2000 then

DA=60% and HRA is 40%,

Calculate the gross salary.

EXPERIMENT-20:- Take the number from the user up to 10 and print it in words.

EXPERIMENT-21:- Take two numbers from the user and show him the menu of the operations to be performed on these two numbers and ask his choice, operate and display the result. Which has following options:

1. Addition.
2. Subtraction.
3. Average
4. Exit

EXPERIMENT-22:- Calculate the total electricity bill Take number of units consumed from the user.

UNITS	RATE
0-100	2.25
101-500	5.65
501-1000	7.85
1001 onwards	9.30

EXPERIMENT-23:- write a c program for the display first 10 natural numbers using while loop.

EXPERIMENT-24:- Print the sum of first 10 natural numbers.

EXPERIMENT-25:- Take the number from the user and generate the table of given number.

EXPERIMENT-26:- Take the number from the user and print the sum of the digits.

EXPERIMENT-27:- Take the number from the user and print it in reverse order.

EXPERIMENT-28:- write a program to print the all even numbers from 0 to 30.

EXPERIMENT-29:- Print the sum of first 100 even numbers.

EXPERIMENT-30:- Take the number from the user and check whether the entered number is prime or not.

EXPERIMENT-31:- Print the Fibonacci series.

EXPERIMENT-32:- Take the number from the user and reverse it and check whether it is same as the number.

EXPERIMENT-33:- Print the series of numbers up to 10000 whose sum and the product of the digits is same.

EXPERIMENT-34:- Take the input of 10 numbers from the user and print those numbers in the reverse order.

EXPERIMENT-35:- Take the input of 10 numbers from the user and print square of the numbers in the same array.

EXPERIMENT-36:- Take the input of 10 numbers from the user finds the smallest and the largest number among these numbers.

EXPERIMENT-37:- Take the input of 10 numbers from the user and print how many positive, negative, even and odd numbers are present in the given array.

EXPERIMENT-38:- Take the input of 10 numbers from the user and print those numbers in the ascending order.

EXPERIMENT-39:- write a program to enter elements for 3x3 matrix and display them.

EXPERIMENT-40:- Take two 2D-arrays from the user and subtract them and store the result in the third array.

EXPERIMENT-41:- Take two 2D-arrays from the user and add them and store the result in the third array.

EXPERIMENT-42:- write a program for calculating the multiplication of 2 dimensional Array.

EXPERIMENT-43:- Take two matrices of 3 x 3 order and multiply them and store in the third matrix.

EXPERIMENT-44:- Take one matrix of 3 x 3 order and print it in the ascending order.

EXPERIMENT-45:- write a c program to enter roll number and total mark of 5 students and on the basis of roll number of any student print mark of respective entered roll number student (by using 2 Dimensional Array)

EXPERIMENT-46:- Write a program to find the frequency of characters in a string. (Enter any string and checks how many times a character is repeated in the string)

EXPERIMENT-47:-Write a program that converts all lowercase characters in a given string to its equivalent uppercase character.

EXPERIMENT-48:- Write a program to determine the length of string enter though keyboard.

EXPERIMENT-49:- Write a program to exchange the content of two strings.

EXPERIMENT-50:- take two strings from keyboard and copy second string at the end of first string.

EXPERIMENT-51:- Take one string from the user and check whether the given string is palindrome or not.

EXPERIMENT-52:- Take two strings and check whether they are of equal length or not.

EXPERIMENT-53:- Send the number into the function and print the Cube of a number in the function itself.

EXPERIMENT-54:- Send the number into the function and print the Cube of a number in the main function.

EXPERIMENT-55:- A four digit positive integer is entered through keyboard, write a function to calculate sum of the digit.

EXPERIMENT-56:- Write a function to calculate factorial of a number.

EXPERIMENT-57:- Send the radius of 5 circles in the function and print the area of those circle in the main function.

EXPERIMENT-58:- Create a variable and assign it some value then print the value address of that variable and the value at that address.

EXPERIMENT-59:- Take two numbers from the user and add them using the pointers and print the result. (Don't use name of variables even in scanf and printf statements only use pointers.)

EXPERIMENT-60:- Take two numbers from the user and swap them using the pointers.

EXPERIMENT-61:- write a program to generate the table of any given number by using function call by reference.

EXPERIMENT-62:-write a program for swapping the contents of two variable by using function call by reference.

EXPERIMENT-63:- take 5 number from keyboard and calculate the square of those number.

EXPERIMENT-64:- take any two number from keyboard and display the GCD number of those number.

EXPERIMENT-65:- take any digit number form keyboard and display the reverse number of entered number.

EXPERIMENT-66:- Create a structure of an employee having the name, code, designation and the basic salary.

EXPERIMENT-67:- In the above program list all the employees whose basic salary is more than 5000.

EXPERIMENT-68:- For the above program take the name of employee from the user and check whether the given employee is present in the list or not, if present display all the details, else give message employee not present.

EXPERIMENT-69:- Create a structure to specify data on students given below:

Roll number, Name, Year of joining

Assume that there are not more than 8 students in the class.

(a) Write a function to print names of all students.

(b) Write a function to print the data of a student whose roll number is given.

EXPERIMENT-70:- Create a structure to specify data of customers in a bank.

The data to be stored is:

Account number, Name, Balance in account.

Assume maximum of 10 customers in the bank.

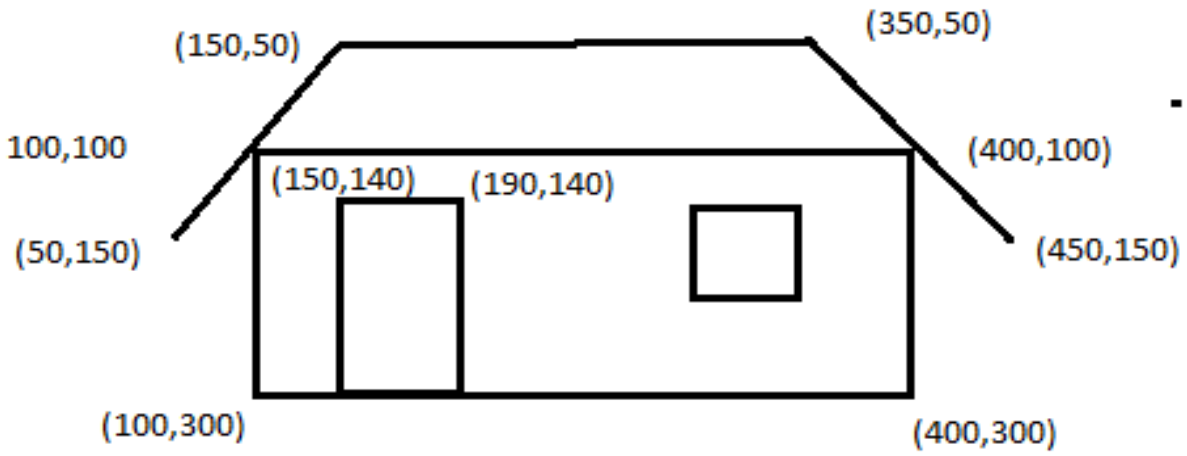
Write a function to print the Account number and name of each customer with balance below Rs. 100.

EXPERIMENT-71:- write a C program to draw a line parallel to x-axis.

EXPERIMENT-72:- write a C program to draw circle with center coordinates (100,100) and radius 80.

EXPERIMENT-73:- write a C program to draw cylinder at output screen.

EXPERIMENT-74:- write a C program to draw following graph at output screen.



EXPERIMENT-75:- Create a file on the DOS using dos commands and write few lines in that file. Read the file through a C program.

EXPERIMENT-76:- Create a file with the C program and read the contents with the help of C program.

EXPERIMENT-77:- Create a file, write few lines in the file and the contents into another file.

EXPERIMENT-78:- Generate a table of the given number and store it in the file and read it with the help of C program.

VI. REFERENCE BOOKS

Sr.No.	Author	Title	Publication
1	Amdani, Salim Y	C Programming	University Science Press
2	Pandey, Hari Mohan	Trouble Free C (Book For C Programming)	University Science Press
3	Dixit, J.B.	Mastering C Programs	Fire Wall Media
4	Patil,B.M	Concepts Of C Programming	Shri Laxmi Prakashan
5	Arora, Ashok	Unix And C Programming	Fire Wall Media

A4-07: DESIGN OF CUTTING TOOLS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	-	3	60	-	40	-	100

II. COURSE RATIONALE

Cutting-tool design requires an understanding of the application difficulties that a tool may encounter in the machining process, and then factoring them into the tool design or changing certain process conditions or both. The course is helpful in understanding Cutting tool materials, Characteristics of cutting tool material, Types of cutting tool material, Cutting fluids, Purpose of cutting fluid, Properties of cutting fluid, Selection of cutting fluid.

The Re-sharpening of cutting tool, Storage of cutting tool, Precautions of cutting tool is useful in cutting tool industries. The tools cutting theory & Tool geometry is useful in industry. The practical knowledge includes handling of tools which is helpful for tool design.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Classify cutting tools.
- Understand the process of cutting tools & tools used.
- Understand the Properties of cutting fluid.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of & applications of cutting tool.
- Understand the Properties of cutting fluid.
- Understand practical use of cutting tools

V. CONTENT

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INTRODUCTION CUTTING TOOL	Student will be able to- • Define the cutting tool. • List the different types of cutting tool. • Understand the cutting tool.	Introduction, Definition of cutting tool, Different types of cutting tool	4	3
2	TOOL GEOMETRY	Student will be able to- • Differentiate between single & multi point cutting tool. • Explain the single point cutting tool with nomenclature. • Explain the multipoint cutting tool with nomenclature. • Understand the nomenclature of drill, tap, die, reamer, milling cutter, hob, broach	Single point cutting tool, Nomenclature of single point cutting tool , Tool signature, Multi point cutting tool, Nomenclature of multi point cutting tool - Drill, Tap, Die , Reamer, Milling cutter, Hob, Broach.	10	12
3	METAL CUTTING THEORY	Student will be able to - • List the methods of metal cutting. • Elaborate the orthogonal and oblique cutting. • Differentiate between the orthogonal and oblique cutting. • Understand the mechanics of metal cutting. • Understand the chip formation process. • Explain chip breakers.	Methods of metal cutting, Orthogonal cutting, Oblique cutting, Mechanics of metal cutting, Chip formation, Chip breakers	6	12
4	CUTTING TOOL LIFE	Student will be able to - • Understand the tool life and tool wear. • List of different types of tool wear. • Understand the materials of cutting tool. • List the different types of cutting tool materials. • Explain the importance of cutting fluid machining. • Explain the properties and purposes of cutting fluid. • Elaborate the selection procedure of cutting fluid. • Understand the characteristics of cutting tool materials.	Tool life & Tool wear, Face wear, Flank wear, Nose wear, Machinability, Heat generation in metal cutting, Cutting tool materials, Characteristics of cutting tool material, Types of cutting tool material, Cutting fluids, Purpose of cutting fluid, Properties of cutting fluid, Selection of cutting fluid	10	15

5	DESIGN OF CUTTING TOOL	Student will be able to - • Calculate the metal cutting parameters & cutting forces. • Calculate the shear plane angle. • Understand the concept of merchant circle diagram. • Design the single point cutting tool. • Design the multipoint cutting tool	Metal cutting parameters, Cutting forces, Determination of shear plane angle, Design of single point cutting tool, Design of multi point cutting tool	6	12
6	MAINTENANCE OF CUTTING TOOL	Student will be able to- • Understand the process of re-sharpening of cutting tool. • Understand the storage of cutting tool. • Understand the precautions of cutting tool while using.	Re-sharpening of cutting tool, Storage of cutting tool, Precautions of cutting tool	4	6

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	METAL CUTTING	TRENT,M.EDWRD	ELSEVIER
2	CUTTING TOOLS	JOSHI,PRAKASH H	WHEELER PUBLISHING
3	METAL CUTTING THEORY AND CUTTING TOOL DESIGN	ARSHINOV,V.	MIR PUBLISHER,MOSCOW
4	CUTTING TOOLS	EDWARDS,R.	THE INSTITUTE OF MATERIALS
5	CUTTING TOOL TECHNOLOGY	ROY,P.K.BAGCHI,H	NIRALI PRAKASHAN

MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

FIFTH SEMESTER: COURSE DETAILS

ADVANCE DIPLOMA IN TOOL & DIE MAKING

A5-01: CNC MACHINING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE TEST	TOTAL MARKS
2	10	-	-	240	-	160	3	400

II. COURSE RATIONALE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- To obtain products at a much lower manufacturing cost, compared to the one resulted from conventional applications.
- CNC applications, by their complexity, allow the obtaining of much more reduced manufacturing times, compared to the conventional ones.
- In its industry, it has a good population of CNC machines installed for execution of precision engineering works.
- Which can proficiently carryout work using CAD software, and subsequently use it for production through CNC machines.

IV. COURSE OUTCOMES

Student will be able to:

- Switching ON & OFF CNC machines.
- Job setup on CNC Machines.
- Machine setup for different modes.
- Prepare part programme by using G & M codes.
- Execute part programme block for different modes.
- Trouble shooting Different errors while programming & machining.
- Switching ON & OFF EDM machines.
- Job setup on EDM Machines.
- Prepare programme for different machining.
- Configuration pre-defined parts on CAM CT.
-

V. CONTENT (THEORY & PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1 CNC LATHE	INTRODUCTION	Student will able to know :- • Write the procedure to start the machine. • Explain about the control panel. • Define the axis principle of the lathe machine • Propose of using hand wheel function. • Write down the procedure of work holding device work piece reference. • What do you understand homing process. • Describe the homing process in different mode. • Understand the tool selection & how to set the tool. • Need of cutter compensation. • Prepare part programing by using G & M code. • Different type of cycle. • Calculate the RPM for various material. • Different errors while programing and machining. • Write safety preparation for machine.	Switching ON & OFF machines , Axes principle, Introduction to control panel, Hand wheel functions	60	60
	JOB SETUP		Work holding devices, Tool holding devices, Work piece References		
	MACHINE SETUP		Machine referencing , Different modes, manual, Auto, full auto mode, editing mode, Tool selection & tool setting, Cutter compensation, X-axis, Z-axis setting		
	PREPARATION OF PART PROGRAM		Study of part drawing, Prepare part programme by using G & M codes, Simulate part programme on screen, Add labels, Cycle definition		
	TURNING A PART		Execute part programme block by block mode, Execute part programme full sequence mode, Feed selection & speed selection for various material like MS, BSK, OHNS, HcHcR, Cutting coolant for turning machine (Water soluble, oil base, air cooled)		
	PART MANUFACTURING		Produce part by using program, Inspection of part by using cycle on or manual measuring instrument, Report generations		
	TROUBLE SHOOTING		Different errors while programming & machining, Causes & remedies		
	SAFETY		Safety precautions while stating machine, While machining, Power off while Auto machining		

2 CNC MILLING	INTRODUCTION	Student will able to know :- • Write the procedure to start the machine. • Explain about the control panel. • Define the axis principle of the milling machine. • Propose of using remote control function. • Write down the procedure of work holding device work piece reference. • What do you understand homing Process. • Describe the homing process in Different mode. • Understand the tool selection & how to set the tool. • Need of cutter compensation. • Prepare part programing by using G &M code. • Different type of cycle. • Calculate the RPM for various material. • Different errors while programing and machining. • Write safety preparation for machine.	Switching ON & OFF machines, Axes principle, Introduction to control panel, Remote control functions	60	60
	JOB SETUP		Work holding devices, Tool holding devices, Auto tool changer , Work piece References		
	MACHINE SETUP		Machine referencing, Different modes, manual, Auto, full auto mode, editing mode, Tool selection & tool setting, Cutter compensation, Z-axis setting		
	PREPARATION OF PART PROGRAM		Study of part drawing, Prepare part programme by using G & M codes, Simulate part programme on screen, Take dry run with Z axis upward direction, Add labels, Cycle definition		
	MILLING A PART		Execute part programme block by block mode, Execute part programme full sequence mode, Feed selection & speed selection for various material like MS, BSK, OHNS, HcHcR, Cutting coolant for milling machine (Water soluble, oil base, air cooled)		
	PART MANUFACTURING		Produce part by using program, Inspection of part by using cycle on or manual measuring instrument, Report generations.		
	TROUBLE SHOOTING		Different errors while programming & machining, Causes & remedies		
	SAFETY		Safety precautions while stating machine, While machining, Power off while Auto machining		
3 CNC EDM	INTRODUCTION	Student will able to know :- • Write the procedure to start the machine. • Explain about the control panel.	Working principle of EDM, Main parts, Control panel	60	60
	JOB SETUP		Different work holding devices, Alignment of the parts		
	MACHINE SETUP		Dielectric level maintaining, Electrode holding devices, Electrode alignment , Generator settings, Flushing functions		

	MACHINING	• Define the axis principle of the milling machine. • Propose of using remote control function. • Write down the procedure of work holding device work piece reference. • What do you understand homing process. • Describe the homing process in different mode. • Understand the tool selection & how to set the tool. • Need of cutter compensation. • Prepare part programing by using G &M code. • Different type of cycle. • Calculate the RPM for various material. • Different errors while programing and machining. • Write safety preparation for machine.	Electrode material & spark gap considerations, Rough machining with different electrodes, Finish machining with different electrodes		
	ADVANCED MACHINING		Introduction to advanced machining, Referencing & different measuring cycles, Concept of down, orbit, expand, cone, helix, Vector programming, Contouring (with C axis), Different surface finishing & surface texture, Auto electrode changer, Command programming		
	INSPECTION		Inspection of part, Making inspection report		
	TROUBLE SHOOTING		Different errors while machining, programming, dry run and verifying , Causes & remedies		
	SAFETY		Safety precautions while stating machine, While machining, Power off while Auto machining		
4 CNC WIREC UT	INTRODUCTION	Student will able to know :- • Write the procedure to start the machine. • Explain about the control panel. • Define the axis principle • Propose of using remote control function. • Write down the procedure of work holding device work piece reference.	Switching ON & OFF the machine, Working principle of EDM, Classification of machine, Introduction to main parts, Deionisation bottle / chiller	60	60
	ABOUT THE MACHINE		Driving mechanism, Introduction to manual remote control, Main Modes of machine, Movement in absolute & relative system, Introduction to machine & part system of axes		
	JOB SETUP		Work holding devices, Job alignment		
	MACHINE SETUP		Referencing , Technology selection, Manual cutting by commands		

	PREPARATION OF PART PROGRAMME	• What do you understand homing process. • Describe the homing process in different mode. • Understand the tool selection & how to set the tool. • Need of cutter compensation. • Prepare part programing by using G & M code. • Different type of cycle. • Calculate the RPM for various material. • Different errors while programing and machining. • Write safety preparation for machine	Introduction G & M functions, Making ISO part programmes in editor using lines, Making ISO part programmes in editor using arcs, Making ISO part programmes in editor using lines and arcs, Preparation of technology & command files in CT Experts		
	MACHINING		Execution of a part programme, Different user parameters, Different generator parameters		
	Introduction to CAM		Segment geometry (Lines & Arcs), Configuration pre-defined parts , Transform contours options		
	EXECUTION		Execution of programmed contour, Z setting with respective nozzle, Taper machining with sharp edges & with lands		

VI . REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	CNC TECHNOLOGY AND PROGRAMMING	KRAR,STEVE	MCGRAW-HILL INC.
2	CNC TECHNOLOGY (BASIC COURSE)	BISWAS,P.K.	ALL INDIA COUNCIL OF TECH. EDUCATION
3	CNC TECHNOLOGY (LATHE & MILLING)	IGTR	IGTR
4	CNC TECHNOLOGY : LATHE AND MILLING	IGTR,AHM	INDO-GERMAN TOOL ROOM
5	CNC TECHNOLOGY PROGRAMMING AND OPERATING (M)	DHOTRE,MAHESH	SAITECH, AHMEDNAGAR

A5-02: TOOL & DIE MAKING PRACTICE - III

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE TEST	TOTAL MARKS
-	8	-	-	240	-	160	3	400

II. COURSE RATIONALE

The subject is the mother of all manufacturing technics and deals with moulds, jigs & fixtures, plastics, die casting, dies. The practical subject introduces the Numbering & lettering as per specified dimensions with maintaining quality criteria.

A brief idea about the Grinding of single lip cutters as per specified in drawing with maintaining quality criteria is included in the course. The operation To reshape the drills to required angle is performed which helps the students to understand the maintenance of the tools.

The later part of the course helps in understanding the operation of turning & milling. The course is helpful to make standard parts of press tool, jigs, fixtures & gauges, plastic mould.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Understand Numbering & lettering as per specified dimensions with maintaining quality criteria.
- To resharp the drills to required angle.
- Make standard parts of press tool.

IV. COURSE OUTCOMES

Student will be able to:

- Make standard parts of jigs.
- Make standard parts of fixtures & gauges.
- Make standard parts of plastic mould.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	PRACTICE HOURS	MARKS
1	TURNING	Student Should be able to :- • Understand pre machine the standard parts of production orders	Make standard parts of press tool, jigs, fixtures & gauges, plastic mould.	160	400
2	MILLING		Make standard parts of press tool, jigs, fixtures & gauges, plastic mould.		
3	SURFACE GRINDING		Preparations of grinding wheels for grinding & use of special devices.		
4	CYLINDRICAL GRINDING		Grinding of standard parts of press tool, jigs, fixtures & gauges, plastic mould.		

VI. LIST OF PRACTICAL EXERCISES (Total Hours: - 160 Hrs.)

Students have to manufacture the parts of press tools, moulds, die casting dies supplied by production centre.

VII. REFERENCE BOOK

SR. NO.	TITLE	AUTHORS	PUBLICATION
1	TOOL & DIE MAKERS : DIES & MOULDS IST YR FUNDAMENTAL DESIGN CONCEPT OF PRESS TOOLS		NTTF

2	TOOL MAKING (MT P5) : PRESS TOOL FOR HINGE COMPONENTS	ATI	ATI
3	TOOL MAKING (MT P5) : PRESS TOOL FOR SLOTTED PLATE	ATI	ATI
4	SHEET METAL PRESS TOOLS DESIGN AND MAKING : A PRACTICAL APPROCH	LUQMAN, MIDHAT	CBS PUBLICATION

A5-03: DESIGN OF JIGS AND FIXTURES - II

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	60	40	40	200

II. COURSE RATIONALE

The course gives a detailed definition of jigs and fixtures, and also identified the numerous advantages that are associated with the use of jigs and fixtures in manufacturing to include: production increase, cost reduction, interchangeability and high accuracy of parts, reduction of the need for inspection and quality control expenses, reduction of accident as safety is improved, automation of machine tool to an appreciable extent, easy machining of complex and heavy components, as well as low variability in dimension which leads to consistent quality of manufactured products.

The work also explained that since the design is dependent on numerous factors which are analyzed to achieve an optimum output, that jigs and fixtures should be made of rigid light materials to facilitate easy handling.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Locate elements of jigs & fixtures.
- Basic principles & rules of clamping
- Design standard bushings.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of limit fit & tolerance.
- Understand standard & non-standard clamping.
- Classification of clamping methods & common types of clamps.

V. CONTENT:

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	DESIGN	Student Should be able to :- • Understand deign principle of jig & fixtures • Understand flow chart of jigs & fixtures • Understand design elements of jigs & fixtures • Analyze check list for jigs & fixtures	Introduction Tool design objectives, Planning for design, Major factors in design, Economy & cost, Materials for Jigs & Fixtures, Accuracy, and Elements of design.	4	12
2	JIGS	Student should be able to: • Understand deign of jigs • Design procedure for different jigs • Select material in Jig design • Analyze economic justification of use of jigs and fixture	Introduction Classification of Jigs, Leaf jigs, Template jig, Box jigs, Channel jig, Plate jig, Indexing jig, Universal jig, General consideration of design of a jig, Introduction, Rigidity, Location & clamping, Chip formation & chip control, Jig bushings (J & F), Jig supports , maintenance, storage and safety of jigs.	4	12
3	FIXTURES	Student should be able to: • Understand deign of fixture • Design procedure for different fixture • Select material in fixture design • Maintenance of Fixture • Use of CAD/CAM in Jigs and Fixture Design	Introduction Classification & Design of Turning & boring Fixture, Milling Fixture, Grinding Fixture, Welding Fixture, Assembly, Inspection Fixture, Tool setting elements & General consideration of design of a jig, Maintenance, safety & storage of fixtures	4	12
4	ESTIMATIO N	Student should be able to: • Explain and Classify Estimation • Understand costing • Understand types of cost • Understand types of expenses	Introduction: Cost –Estimation Use and application of Estimation Methods in Tool Design, Concept of estimation, Tool material, Machine hours, Process, Principles: Principle of weight, volume, Principles of estimation of machine hours through process planning. Principles of process estimation.	4	6
5	GAUGES	At the end of this unit student should be able to: • Explain and Classify Gauges • Understand deign of gauges • Design procedure for different gauges	Classification of gauges Fixed gauges, Ring gauges, Pin gauges, Plug gauges, Snap gauges, Receiving gauges, Design of gauges, Taylor's principles, Manufacturing tolerances, Wear allowances, Steps in gauge design, Materials for gauges, Hardness required for gauges, Maintenance, safety & storage of gauges.	4	18

VI. CONTENT (PRACTICE)

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	SKETCHING CONCEPTUAL DESIGNS	student should be able to: • Understand deign principle of jig & fixtures • Understand flow chart of jigs & fixtures • Understand design elements of jigs &fixtures • Analyze check list for jigs & fixtures	Concept of conceptual design.(Flow chart), Concept of analysis.(Mechanical & economic), Concept of materials, Concept of elements of jig., Concept of safety & maintenance, Principles of development of a conceptual design of jig with respect to part, operation, equipment & operator criteria. (Ref. flow chart), Principles of development of alternatives, Principles of analysis & selection, Principles of material selection, Principles of safety & maintenance. Study the product requirement, production rate & equipment.(Machine, cutting Tool etc.), Study the classification of jigs & select the type, Select the locating, clamping, guiding, supporting elements & body of jig, Prepare conceptual design using standard parts(Ref. Flow chart for development of design solutions & objectives of list of exercise)	15	10
2	DRAWING THE ASSEMBLY & DETAIL DRAWINGS	student should be able to: • Understand deign of jigs • Design procedure for different jigs • Select material in Jig design • Analyze economic justification of use of jigs and fixture	Concept of use of work sheet & process sheet, Concept of drawing & layout for assembly & detail, Concept of verification of design, Principles of selection of optimal design, Principles of drawing layout for Jig, Principles of drawing norms & practices, Draw the component drawing, Prepare the process sheet, Draw the assembly drawing for the optimal design, Draw the detail drawings with geometric dimensioning, tolerancing, surface roughness symbols & material.	15	15
3	SKETCHING CONCEPTUAL DESIGNS	student should be able to: • Understand deign of fixture • Design procedure for different fixture • Select material in fixture design • Maintenance of Fixture • Use of CAD/CAM in Jigs and Fixture Design	Concept of conceptual design. (Flow chart), Concept of analysis. (Mechanical & economic), Concept of materials, Concept of elements of jig, Concept of safety & maintenance. Principles of development of a conceptual design of Fixture with respect to part, operation, equipment & operator criteria, Principles of development of alternatives, Principles of analysis & selection, Principles of material selection, Principles of safety & maintenance, Study the product requirement, production rate & equipment.(Machine, cutting Tool etc.), Study the classification of Fixtures & select the type, Select the locating, clamping, Tool setting, supporting elements & body of Fixture.14 Prepare conceptual design using standard	10	10

			parts.(Ref. Flow chart for development of design solutions & objectives for list of exercises), Analyse the alternatives, Select the optimal design, Select & specify the material for all elements.		
4	DRAWING THE ASSEMBLY & DETAIL DRAWINGS	student should be able to: • Explain and Classify Estimation • Understand costing • Understand types of cost • Understand types of expenses	Concept of use of work sheet & process sheet. Concept of drawing & layout for assembly & detail, Concept of verification of design, Principles of selection of optimal design, Principles of drawing layout for Fixture, Principles of drawing norms & practices, Draw the component drawing, Prepare the process sheet, Draw the assembly drawing for the optimal design. Draw the detail drawings with geometric dimensioning, tolerance, surface roughness symbols & material.	10	15
5	DESIGN OF GAUGE (Plug, ring & Snap Gauges)	At the end of this unit student should be able to: • Explain and Classify Gauges • Understand deign of gauges • Design procedure for different gauges	Design & calculation of design parameters, Drawing norms & practices for different Gauge.	10	10

VII. LIST OF EXERCISES (Total Hours:- 60 Hrs.)

1	Typical jig /fixtures
2	Elements of jig / fixture (locating elements, clamping elements, guiding elements, supporting elements)
3	1. Plate jig 2. Channel jig 3. Indexing jig 4. Leaf jig 5. Box jig (minimum three jigs)
4	1. Turning fixture 2. Milling fixture 3. Grinding fixture 4. Welding fixture / assembly fixture 5. Inspection fixture (minimum three fixtures)
5	Checking Of Design, Assembly & Detail Drawing

VIII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	Jig & Fixtures Non-Standard Clamping Devices	Grant E. Hiram	Tata Mc Graw Hill Publication Co. Ltd., New Delhi
2	Jig & Fixture Design Manual	Henriksen, K. Erik	Industrial Press Inc New York
3	Advanced Design Elements of Jigs, Fixtures, Cutting Tools & Guages	NTTF	
4	Hand Book of Jig & Fixture Design	William E. Boyes	SME, Michigan - USA
5	Tool Design Draftsman 1st Year Fundamental of Tool Design Principles	NTTF	
6	Tool Design	Donalson	

A5-04: DESIGN OF PRESS TOOLS - II

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	90	40	60	250

II. COURSE RATIONALE

Press tools are commonly used in hydraulic, pneumatic, and mechanical presses to produce components at high volumes. Generally press tools are categorized by the types of operation performed using the tool, such as blanking, piercing, bending, forming, forging, trimming etc. The press tool will also be specified as a blanking tool, piercing tool, bending tool etc.

Use and application of Press Tool cutting operations to produce sheet material components helps in industrial applications. Use and application of different elements in a Typical Press Tool is helpful in the manufacturing of a component.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Mounting, stripping and ejection Material used for different elements.
- Selection of proper Sheet material, Sheet material components & their applications.
- Understand the Effect of shear angle.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of press tools.
- Understand the applications of press tools.
- Classification of press tools & understands the design parameters.

V. CONTENT

UNIT NO.	TOPIC/SUB -TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	CLASSIFICATION OF PRESS TOOLS	At the end of this unit student should be able to: • Understand about press tool, use of press tool • Understand classification of press tool • Understand application of fine blanking operation • Explain about process of fine blanking operation To know about different types of sheet materials used in press tools	Fine blanking tolerance, tools required, fine blanking pressure, V' ring pressure, press used.	2	6
2	CLASSIFICATION OF PRESS TOOLS NON CUTTING DIES - BENDING	At the end of this unit student should be able to: • Explain and Classify different types of non-cutting dies. • Explain use & its application • Understand principle of non-cutting dies. • Explain use & its application • Explain types of bending dies. • understand term like spring back, blank development, Clearance on die	Application and use of Press Tool non-cutting Dies to produce sheet material component, Concept of classification of non-cutting die, Bending dies, Types of Bending Dies, Stripping in Bending Dies, Concept of spring back, Methods of preventing Spring Back, Blank development, Concept of applying clearances, Design parameters for elements of press tool for bending operations. 'V', 'U', 'Z', 'L' type of components.	3	6
3	CLASSIFICATION OF PRESS TOOLS OF NON CUTTING DIES - DRAWING	At the end of this unit student should be able to: • Understand about different types of non-cutting dies & it's used. • Understand about different types of drawing operation • Understand classification of drawing operation. • Understand calculation of no. of draws for given component	Drawing & its classification. Process and metal flow, spring back. Die, Drawing force, Blank holding force, Stripping force, Calculate the number of draws for the given components. (2 draws, 4 draws & 6 draws), Blank development - Develop the Blank for the given components, (2 draws, 4 draws & 6 draws) and develop the Blank.	3	6
4	DESIGN PARAMETERS FOR BENDING	At the end of this unit student should be able to • Understand design parameters for bending operations • Understand factor of geometrical dimensional tolerance	DESIGN PARAMETERS FOR ELEMENTS OF PRESS TOOL FOR BENDING OPERATIONS - Derive the geometrical & dimensional tolerances for the following elements for a given component ('V', 'U', 'Z', 'L' type of components). Die Plate, Punch,	3	9

		• Explain & calculate bending force • Understand develop blank length & set back method.	Stripper / ejector, Punch plate, Calculate the bending force, stripping force, spring back for the given samples. Develop the blank length using elementary method and set back method for the given components of different thicknesses.		
5	DESIGN PARAMETERS FOR ELEMENTS OF PRESS TOOL FOR DRAWING OPERATIONS	At the end of this unit student should be able to: • Understand basic design parameters in tool design for drawing operation. • Understand use & application of design parameters • Understand geometrical & dimensional tolerances for draw, deep draw. • Explain & calculate term like draw force, blank holding force, stripping force	Derive the geometrical & dimensional tolerances for the following elements for a given component (draw, deep draw, Reverse draw, Sizing draw) as Punch, Die. Blank Holder, Stripper, (Components of drawing, deep drawing, and Reverse drawing). Identify & specify the materials used for all the elements, Calculate the drawing force, blank holding force, stripping force, spring back for the given samples with different materials & thickness.	6	9
6	CLASSIFICATION OF PRESSES	At the end of this unit student should be able to: • Explain use & classification of presses. • Explain concept of shut height. • Explain concept of Centre of pressure. • Explain concept of die cushion.	Use and application of presses for Press Tool operation, constructional features of press for using Press Tools, Concept of shut height, Centre of pressure, Die Cushion.	2	6
7	MATERIAL FEEDING AND SCRAP HANDLING	At the end of this unit student should be able to: • Explain use & application of material feeding & scrap handling equipment. • Explain Classification of material handling equipment. • Explain Classification of scrap handling equipment.	Use and application of material feeding & scrap handling equipment in press operation. Classification of material handling equipment & scrap handling equipment.	5	6
8	MATERIAL MACHINE TIME AND PROCESS	At the end of this unit student should be able to: • Explain features of feeding. • Explain features of scrap handling equipment. • Explain schematic layout of feeding, scrap handling	Constructional features of the feeding & scrap handling equipment through schematic layout, Constructional features of the feeding & scrap handling equipment through schematic layout.	3	6

9	DIE MAINTENANCE, SAFETY & STORAGE	At the end of this unit student should be able to: • Explain types of process. • Explain concept of safety. • Explain storage of press tool	Machine hours, Process, Estimation of process, Estimation of weight, Concept of safety, storage of press tool, machine & its maintenance	3	6

VI. LIST OF EXERCISES (Total Hours:- 60 Hrs.)

UNIT NO.	CONTENTS	TEACHING / PRACTICAL HOURS	MARKS
1	DESIGN OF DRAW TOOL PART DETAIL &STANDARD ELEMENTS	4	5
2	DESIGN OF DRAW TOOL ASSEMBLY &STANDARD ELEMENTS	8	10
3	DESIGN OF "V"BENDING TOOL PART DETAIL & STANDARD ELEMENTS	8	10
4	DESIGN OF "V"BENDING TOOL ASSEMBLY & STANDARD ELEMENTS	8	15
5	DESIGN OF "U"BENDING TOOL PART DETAIL &STANDARD ELEMENTS	8	10
6	DESIGN OF "U"BENDING TOOL ASSEMBLY &STANDARD ELEMENTS	8	10
7	DESIGN OF "L"BENDING TOOL PART DETAIL & STANDARD ELEMENTS	8	15
8	DESIGN OF "L"BENDING TOOL ASSEMBLY &STANDARD ELEMENTS	8	15

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	ADVANCED TOOL DESIGN PRINCIPLES (PRESS TOOLS)	NUTTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
2	FUNDAMENTAL DESIGN CONCEPT OF PRESS TOOLS	NETTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
3	PRESS TOOLS PART-I (1081) TP		EDUCATION & TRG CONSULTANTS
4	PRESS TOOLS PART-II (1082)TP		EDUCATION & TRG CONSULTANTS
5	PRESS TOOLS PART-III (1083) TP		EDUCATION & TRG CONSULTANTS
6	PRESS TOOLS : DESIGN & CONSTRUCTION	JOSHI, PRAKASH H.	A.H.WHEELER PUBLISHING
7	TOOL AND DIE MAKER (PRESS TOOLS; JIGS AND FIXTURES AND DIES AND MOULDS) FIRST YEAR TRADE PRACTICALS	CIMI	CENTRAL INSTRUCTIONAL MEDIA INSTITUTE
8	PRESS TOOLS	DANGE,R.K.	ALL INDIA COUNCIL OF TECH. EDUCATION
9	PRESS TOOLS : DESIGN & CONSTRUCTION	JOSHI, PRAKASH H.	A. H. WHEELER & CO. LTD.
10	PRESS TOOLS	KYAK,P.K.	
11	DESIGN OF JIGS,FIXTURES AND PRESS TOOLS	RAMNATH, VIJAYA	ESWAR PRESS
12	PRESS TOOL PART III (TP)	TETCOS	TETCOS

A5-05: DESIGN OF MOULD - II

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	90	40	60	250

II. COURSE RATIONALE

The course offers knowledge of plastic moulds, moulding machine & equipment. The course gives knowledge of applications of moulds in the industries. The knowledge of Classification, Functions and, Materials used for core & cavity is helpful for working in industry.

Different parts like Mould base housing parts with classification, Spruce bush, Locating ring, Types of Bolsters, Types of Ejection guides, Guide pillars & Bushes Locators & grids are important from the course point of view.

The course gives idea about Injection moulding, which is a manufacturing process for producing parts by injecting material into a mould.

Injection moulding can be performed with a host of materials mainly including metals, (for which the process is called die casting), glasses, elastomers confections & most commonly thermoplastic & thermosetting polymers.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Classify industrial applications of plastics.
- Understand the process of moulding & its types.
- Understand the design parameters related to mould, material & machine -injection moulds.

IV. COURSE OUTCOMES

Student will be able to:

- Understand the concept of moulding.
- Understand the specification of mould, material & machine injection mould.
- Understand elements of moulds & their function.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	OVERVIEW OF MASS PRODUCTION OF PLASTIC COMPONENT	After studying of this unit student will able to: • Plastic mould • Plastic injection molding machine • Plastic component produce from mould • Definition and classification of plastic	Introduction: An Overview of Use of plastic moulds, moulding machine& equipment and Tool drawings To produce plastics Components for mass production, Classification of plastic materials, Types of plastic material with examples, Definition of polymer, Abbreviations, Properties , Material Characteristics & Uses, Identification & Testing of plastics, Classification of industrial application of Automotive, Consumer Electronics Aeronautics, Heavy Engineering, Bio-Medical.	1	5
2	MOULDING OPERATIONS-COMPRESSION	Student will able to: • Compression moulding process • Classification of moulding process for thermoset material • Use & application of moulding machine	Introduction: Use and Application of moulding further Compression moulding processes, Classification of moulding processes for Thermosets, Compression MOULDING Define & Illustrate.	2	10
3	OPERATIONS TRANSFER	Student will able to: • Transfer moulding process • classification of moulding process • Use & application of moulding machine	Introduction: Use and Application of moulding machine and further TRANSFER moulding processes, Classification of moulding processes for Thermosets, TRANSFER MOULDING-Define & Illustrate.	1	
4	ELEMENTS OF MOULD & THEIR FUNCTION-INJECTION, COMPRESSION MOULD & TRANSFER MOULD	After studying this unit student will able to: • Injection, compression & transfer mould • Feeding system of mould • Cooling system of mould • Ejection system of mould Extraction of core cavity design of	Introduction: Use and application of different elements in a typical INJECTION, COMPRESSION MOULD &TRANSFER MOULD, FEEDING SYSTEM: Elements & function of feed system and it's layout, Principles of parting surfaces, Classification of Gates, Types of Runners and their selection Criteria, Advantages and Disadvantages, Classification of various feed systems (Runner Layouts),Balancing of HEATING/COOLING feed system, SYSTEM:	4	25

		injection, compression & transfer mould • Core & cavity retainer parts • Mould base & elements of mould	Classification of various heating systems, Elements & functions of heating system, Balanced circuits, EJECTION SYSTEM: Parts& function of ejector elements with classification, Elements - Ejection Grid, Ejector Plate Assembly, Ejector Rod & Bush, Ejector Pin, Sprue Puller etc, Ejection methods from Fixed half & Moving half, Ejection force Calculation, Principles of parting surfaces, alignment, guidance and clearance, mounting and ejection. CORE AND CAVITY Classification, Functions used for core & cavity, Shrinkage, Draft & Venting, Principles of parting surfaces, alignment, guidance and clearance, mounting and ejection, Types of Parting Surfaces, CORE & CAVITY RETAINER PARTS: Principle of alignment and guidance, clearance, Principles of parting surfaces, alignment, guidance and clearance, mounting and ejection, MOULD BASE & PARTS: Mould base housing parts with classification, Elements, Principles of alignment, guidance and clearance, mounting and ejection, and Materials Material used for different elements.		
5	CLASSIFICATION OF MOULDS INJECTION MOULDS	Student will able to: • Based on ejection classification of mould • Multiday light mould • Split cavity, side core & side cavity of mould • Undercut & screwing, unscrewing mould • Hot runner & runner less mould • Principal of feed system, layout of runner & gate	Introduction: Use and application of multi day light moulds BASED ON EJECTION: Classification of moulds based on ejection, Principle of ejection, Split Cavity Mould, Side Core and Side Cavity Moulds, undercuts & threads, Unscrewing Moulds, Principles of feed systems, layout of runner, gates, spure bush etc., Cold Runner moulds, Insulated Runner Moulds, Hot Runner	2	15
6	CLASSIFICATION OF MOULDS COMPRESSION	After studying this unit student will able to:	Introduction: Use, application of classified compression moulds, Principles of compression moulding process, heating system, temperature control, feeding & ejection,	1	

		• Principal of compression moulding process • Classification of compression mould • Heating system & temperature control • Feeding & ejection system	Classification: Positive mould, Semi Positive mould, Flash mould : a) Open flash mould b) Closed flash mould , c) Inclined flash mould and Landed positive type		
7	CLASSIFICATION OF MOULDS TRANSFER MOULDS	Student will able to: • Principal of transfer moulding process Classification of transfer mould • Heating system & temperature control • Feeding & ejection system of transfer mould	Introduction: Use and application of classified Transfer moulds, Classification: Pot type transfer mould, Plunger type transfer mould : a) Top plunger type b) Bottom plunger type c) Side plunger type and Screw type transfer mould, Principles of transfer moulding process, heating system, temperature control, feeding & ejection	2	
8	DESIGN PARAMETERS RELATED TO MOULD, MATERIAL & MACHINE - INJECTION MOULDS	After studying this unit student will able to: • Design parameter of injection mould based on day light, based on ejection & based on feed system • Concept of design parameter pertaining to mould • Construction of mould with respective machine • Concept of quality & quantity • Properties of plastic material & mould material	Introduction: Use and application of Design parameters in injection mould - BASED ON DAY LIGHT, BASED ON EJECTION & BASED ON FEED SYSTEM , Concept of design parameters pertaining to mould, machine and material. (Refer list of Design Parameters), Concept of quality and quantity required, Construction of mould with respective machine, Hot runner system, properties of plastic material Composition, Properties and Heat treatment of Mould material	3	3
9	DESIGN PARAMETERS RELATED TO MOULD, MATERIAL & MACHINE – COMPRESSION MOULDS & TRANSFER MOULDS	Student will able to: • Design parameter of compression & transfer mould • Concept of design parameter pertaining to mould • Construction of mould with respective machine • Concept of quality & quantity Properties of plastic material & mould material	Introduction: Use and application of Design parameters - COMPRESSION MOULDS & TRANSFER MOULD, Concept of design parameters pertaining to mould, machine and material. (Refer list of Design Parameters), Concept of quality and quantity required, Construction of mould with respective machine. Properties of plastic material, Composition, Properties and Heat treatment of Mould material	2	

10	SPECIFICATION OF MOULD, MATERIAL & MACHINE – COMPRESSION & TRANSFER MOULD	Student will able to: • Specification of mould, material & machine tool design data • Classification of mould material, tool material & their application • Composition, Properties & heat treatment of material	Introduction: Use and application of the specification pertaining to mould, material and machine for Tool Design data, Classification of mould material, Tool material & their applications, Composition, Properties and Heat treatment, Machine specification.	2	2

VI. CONTENT (PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	COMPONENT DRAWING	Student will able to: • Study the component • Analyse customer need • Determine the dimension with shrinkage allowance	Introduction: Use and application of allowances for component drawing, Study the component / sample, Study & analyse customer needs, Determine the dimensions with allowances and shrinkages, Draw component drawing.	12	18
2	RUNNER LAYOUT	Student will able to: • Use & application of runner layout • Selection of impression according to requirement • Draw the typical runner layout	Introduction: Use and application of the typical runner layout, Study the component drawing / sample, Study & select the impression according to requirement, Draw the typical runner layout.		
3	COOLING / HEATING LAYOUT	Student will able to: • Use of cooling & heating circuit in mould • Typical circuit layout per heating/cooling in mould	Introduction: Use of cooling & heating circuit in moulds, Draw a typical circuit layout per heating / cooling in mould, (Simple circuit, 'O' circuit, Z circuit, Heat pipes, insert cooling, integer core cooling, Baffled cooling.		
4	CALCULATE DESIGN PARAMETERS WITH RESPECT TO MOULD, MATERIAL & MACHINE	student will able to: • Use of design parameter for optimum mould design • Study the component specification & customer requirement	Introduction: Use of design parameters for optimum mould design, Study the component specification and customer requirement, Study & use the design parameters with respect to mould, material and machine, Use the data book, standards for optimum selection of design parameters,	12	18

		• Design parameter with respect to mould material & machine • Calculation & verification of design parameter according to requirement of mould	Calculate & verify the design parameter according to requirement of mould.		
5	PREPARATION OF WORK / DATA SHEET OF MOULD, MATERIAL & MACHINE	Student will able to: • Use of work sheet for mould design • Use the information data preparation of work • Data sheet for mould design in relevant format	Introduction: Use of work sheet for mould design, Use the information data Prepare the work / data sheet for mould design in relevant format.		
6	SKETCHING CONCEPTUAL DESIGNS	Student will able to: • Development of conceptual design • Study the component drawing/sample • Selections of optimal design	Introduction: Use and application of alternative conceptual design, Refer (List of exercises for design practice & Flow Chart), Study the component drawing / sample, Develop conceptual design using data sheet. Develop alternative conceptual designs, Develop alternative conceptual designs, and Select the optimal design.	12	22
7	DRAW THE ASSEMBLY AND DETAIL DRAWINGS OF MOULD	Student will able to: • Use of assembly & detail drawing for manufacturing of mould • Process sheet &work sheet from design parameter • Draw the assembly & detailed drawing of the mould as per norm	Introduction: Use of Assembly and detailed drawings for manufacturing of mould, Refer (List of exercises for design practice Chapter 6.1 & Flow Chart), Refer the process sheet & worksheet from the design parameters for the selected optimal design, Use the concept drawing, Draw the assembly and detailed drawings of mould as per norms.	12	27
8	BILL OF MATERIALS	Student will able to: • Preparation of bill of material • Mass production of the component • Use of bill of material in mould manufacturing	Introduction: Use of Bill of Material in mould manufacturing and mass production of component, Study the data sheet & work sheet, Prepare bill of material.	12	5
9	MOULD DATA	Student willable to: • Use of mould data in the production component • Preparation of mould data for machine	Introduction: Use of mould data in the production of components, Study the standards, norms & prepare data for machine set up, Prepare processing data & mould data.		

VII. LIST OF PRACTICAL EXPERIENCES (Total Hours:- 60 Hrs.)

1	Design of two impression underfeed mould
2	Design of single impression hot runner mould
3	Design of four or multi impression runner less mould using multi nozzle manifold
4	Design of single or two impression compression mould for thermoset material
5	Design of two impression transfer mould for thermoset material
6	Design of single impression blow mould
7	Design of multi impression thermoforming or vacuum forming mould
8	Design of single impression mould for ejection from fixed half
9	Design of single impression mould using hydraulic actuation method
10	Design of manually chain rotation gear mould
11	Design of multi impression gear mould automatic removing of component using rack & pinion method

VIII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	TOOL AND DIE MAKER (PRESS TOOLS; JIGS AND FIXTURES AND DIES AND MOULDS) FIRST YEAR TRADE PRACTICALS	CIMI	CENTRAL INSTRUCTIONAL MEDIA INSTITUTE
2	ADVNACED DESIGN ELEMENTS OF DIES AND MOULDS AND RELATED TOOLINGS	NUTTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
3	INJECTION MOULDING	ATHALYE,A.S.	MULTI-TECH PUBLISHING CO
4	MOULDING OF PLASTICS	ATHALYE,A.S.	MULTI-TECH PUBLISHING CO
5	INJECTION MOULDS : 108 PROVEN DESIGNS	GASTROW,HANS	HANSER PUBLICATION
6	DIES & MOULDS I (1084) TP		EDUCATION & TRG CONSULTANTS
7	THEORY DIES AND MOULDS 1ST YEAR : FUNDAMENTAL DESIGN CONCEPTS OF DIES & MOULDS	NETTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
8	INJECTION MOULDING	ATHALYE,A.S.	MULTI TECH PUBLISHING CO.
9	TRAINING IN INJECTION MOULDING : A TEXT AND WORKBOOK	MICHAELI,WALTER	HANSER PUBLICATION

A5-06: MACHINE DESIGN WITH ADVANCE CAD

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/ PRACTICE	TOTAL MARKS
3	3	-	-	60	-	40	3	100

II. COURSE RATIONALE

The subject is the Overview of MACHINE DESIGN With ADVANCE CAD essentials Getting started in Solid works Command Manager. Dimensioning standards and units for dimensioning. Important terms and their definitions. Creating and Modifying solid base and thin extruded features Creating and Modifying solid base and thin revolved features Overview of assemblies, the assembly command manager. Bottom-up assemblies, reference sets Bottom-down assemblies, filtering, mating conditions Component pattern, exploding views and components Assembly drawings, assembly projects, Simulation setting

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Understand Introduction to Solid works
- Sketcher & Modification of Sketches
- Solid Modelling & Editing
- Surface Modelling & Editing

IV. COURSE OUTCOMES

Student will be able to know:

- Understand Introduction to Machine
- Sketcher & Modification of Sketches
- Solid Modelling & Editing
- Surface Modelling & Editing

V. CONTENT (THEORY & PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	PRACTICE HOURS	MARKS
1	MACHINE DESIGN	Student will be able to know • About machine design • Definition of Design of machine • What are the advantage	General consideration and procedure in machine design, Selection of material, Working stress and factor of safety, selection of factor of safety Stress concentration, stress concentration factor and methods of reducing stress concentration, Fatigue and endurance limit, Effect of load, surface finish and size on endurance limit, Preferred number Design of Welding Joints : Types of welded joint and Design of lap joint and butt joint Strength of transverse and parallel fillet welded joints in axial loading, Basic welding symbols	30	5
2	Introduction to Solid works	Student will be able to know • About cad software • Definition of solid works • What are the advantage of cad software	Overview of Solid works essentials Getting started in Solid works Command Manager. Dimensioning standards and units for dimensioning. Important terms and their definitions. Open a new part document.	10	10
3	Sketcher & Modification of Sketches	Student will know: • The sketcher work benches and the environment • How to create sketch • What are the sketcher tool • How to modification of sketch • How to generate the dimension& modification in the sketch • What are the relation of sketch (symmetricity, concentricity, parallel, angularity, etc) • How to fully constrain the sketch	Understand the requirement of the sketching environment Open a new part document. Understand the various terms used in sketching environment. Work with various sketching tools. Use the drawing display tools. Delete the sketched entities. Sketching in Solidworks, creating & constraining a sketch Edit the sketches using various editing tools. Creating and Modifying the rectangular patterns of the sketched entities. Creating and Modifying the circular patterns of the sketched entities. Creating and Modifying the circular patterns of the sketched entities. Add geometric relations to the sketch. Dimension the	10	

		• What are the concept of fully define sketch • Explain What are the features of sketch (mirror ,pattern ,etc)	sketches. Modifying the dimensions of the sketch. Understand the concept of fully defined sketch. View and examine the relations applied to the sketches.		
4	Solid Modeling & Editing	Student will know: • What is solid modelling • Explain the features of solid modelling • Explain the orientation of solid view • How to modify the orientation view • How to create extrude ,pocketing ,revolve • Explain Features about hole ,shell warp, draft • Explain what is fillet, chamfer, mirror , pattern • what are the geometric plane and axis • what is co-ordinate system & describe	Creating and Modifying solid base and thin extruded features Creating and Modifying solid base and thin revolved features. Dynamically rotate the view to display the model from all directions. Modifying the orientation of the view. Change the display modes of the solid model. Apply material and textures to the models. Creating and Modifying Features-Holes, Draft, Shell, Wrap, Pre-form Features. Creating and Modifying Linear and circular Patterns/Mirror Apply simple and advanced fillets. Chamfer the edges and vertices of the model Faces and bodies. Creating and Modifying Curves Creating and Modifying reference Geometry - Plane, Axis, Co-ordinate System, Point. Creating and Modifying model using the contour selection technique.	10	10
5	Assembly Modeling	Student will know: • What is assembly • Explain types of assembly • What is top down assembly • Explain bottom up assembly • What are the features of assembly • How to assembly all parts • How to generate simulation of all parts	Overview of assemblies, the assembly command manager. Bottom-up assemblies, reference sets Bottom-down assemblies, filtering, mating conditions Component pattern , exploding views and components Assembly drawings, assembly projects, Simulation setting	10	10
6	Drafting	Student will know • What is drafting • How to enter in to drafting work bench	Generate standard three views, Model view, and predefined view, standard section views Crafting drawings, Creating dimensions, Annotations, Notes and Surface Finish Symbols Add Geometric	10	

		• What are the standard view • What are the model view & pre define view • Generate the dimension in sketch • Describe about GD & T symbols • Discuss about generate GD& T symbols in the sketch • What is tolerance • Elaborate hatching line • How to edit the hatching line	Tolerance to the Drawing Views. Add Center Marks and Center Lines to the Drawing Views Add Center Marks and Center Lines to the Drawing Views		10
7	Designing	Student will know • What is cotter joints • Define knuckle joints • Discuss & drawing Couplings • Define & design Keys and Couplings • Explain Lever Design	Design of simple cotter joints Design of knuckle joints Design of Keys and Couplings Design of Shaft Design of Components Lever Design Design of Cast Iron pulley, Flywheel, Helical spring, Leaf spring	40	15

VI. REFERENCE BOOK:

SR. NO.	TITLE	AUTHORS	PUBLICATION
1	ENGINEERING DRAWING : PLANE AND SOLID GEOMETRY	BHATT N.D.	CHAROTAR PUBLISING HOUSE
2	ENGINEERING DRAWING : PLANE AND SOLID GEOMETRY	BHATT N.D.	CHAROTAR PUBLISING HOUSE
3	STRENGTH OF MATERIALS (MECHANICS OF SOLIDS)	KHURMI R.S	S. CHAND PUBLICATION

A5-07: INDUSTRIAL ENGINEERING & QUALITY SYSTEMS

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
3	-	3	60	-	40	-	100

II.COURSE RATIONALE

This course is designed to help student's Overview of Industrial Engineering and its application. Concept of Industrial Engineering Concept of system Concept of Resources Various Industrial Engineering activities (works study, plant layout & material handling, inventory control etc) Role of Industrial Engineer Relation between Productivity & IE. Overview of plant layout, Overview of value analysis & its application. Network construction concept Classification of Network techniques Key terms for Network techniques (Event, Activity, critical path, duration EST, EFT, LST, LFT) Network Diagram for C.
Concept & Principles of Quality Management Total Quality Management philosophy Concept & Principles of Quality circles Tools for Total Quality Management TQM Structure

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to understand,

- Industrial Engineering & Its Application
- Methods & Procedures Of Plant Layout
- Method Study
- Value Analysis Process

IV.COURSE OUTCOMES

Student will be able to understand,

- Concept Of Industrial Engineering Concept Of System Concept Of Resources Various Industrial Engineering Activities
- Concept Of Work Study Concept & Principles Of Method Study Symbols
- Overview Of Work Measurement
- Overview Of Value Analysis & Its Application
- Overview of Network Techniques, CPM & PERT

I. **CONTENT**

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INDUSTRIAL ENGINEERING & ITS APPLICATION	Student should be able to: • Understand industrial engineering and its application. • Explain different methods and procedure of plant layout. • Understand work study concept and principle of method study. • Define value analysis and its application. • Describe network techniques, CPM & PERT.	Introduction: Overview of Industrial Engineering and its application Definition Concept of Industrial Engineering Concept of system Concept of Resources Various Industrial Engineering activities (works study, plant layout & material handling, inventory control etc) Role of Industrial Engineer Relation between Productivity & IE.	6	8
2	METHODS & PROCEDURES OF PLANT LAYOUT	Student should be able to: • Define plant layout, type and principle • Factors require for installation of plant. • Describe procedure for making plant layout.	Introduction Overview of plant layout Definition Concept & Principles of plant, plant location Factors governing Plant Location Concept & Principles of plant layout Classification of plant layout Concept of work station Storage space requirements Procedure for making plant Layout	6	8
3	PRODUCTIVITY	Student should be able to: • Introduce productivity. • Factors affecting productivity. • Define productivity measuring Techniques.	Introduction Overview of Productivity Techniques Definition Productivity concept Productivity measurement techniques Factors affecting Productivity	4	6
4	METHOD STUDY	Student should be able to: • Describe Method study & its principle. • Define symbols used in method study various flow process.	Introduction Overview of Method Study Definition Concept of work study Concept & Principles of method study Symbols used in Method Study Various flow process charts & Diagrams Concept & Principles of motion economy	8	10

	WORK MEASUREMENT	Student should be able to: • Define work measurement. • Explain time study • Understand principle of work sampling.	Introduction Overview of Work Measurement Definition Concept of work measurement Uses of time study Various time study methods Data recording in Time Study Methods of rating Allowances & standard data in work measurement Concept & Principles of work sampling		
5	VALUE ANALYSIS PROCESS	Student should be able to: • Understand value analysis and its application. • Classification procedure for value analysis.	Introduction Overview of value analysis & its application Definition Approach of value Analysis Concept of function / utility Value & its classification Procedure for Value Analysis	2	4
6	NETWORK TECHNIQUES, CPM & PERT	Student should be able to: • Describe network techniques, CPM&PERT. • Classification of network techniques. • Define terms related to network techniques. • Limitation of network techniques	Introduction Overview of Network Techniques, CPM & PERT Definition Network construction concept Classification of Network techniques Key terms for Network techniques (Event, Activity, critical path, duration EST, EFT, LST, LFT) Network Diagram for CPM Three time Estimates in PERT Advantages & Limitations of Network Techniques.	4	6
7	TOTAL QUALITY MANAGEMENT	Student should be able to: • Describe total quality Management. • Define principle of TQM. • EXPLAIN TQM structure. • Principle of quality circle.	Introduction Overview of Total Quality Management Definition Concept & Principles of Quality Management Total Quality Management philosophy Concept & Principles of Quality circles Tools for Total Quality Management TQM Structure	10	18
	ISO 9000 QUALITY SYSTEM	Student should be able to: • Understand ISO 9000 Quality system. • Understand all content of ISO 9000	Introduction Overview of ISO 9000 Quality system Definition Inspection, Quality Control & Quality Assurance Concept of Quality system standards ISO 9000 Quality system documentation structure Crucial Terminology (Quality, Quality Policy, Planning & Audit etc)		

	INSPECTION	Student should be able to: • Understand inspection. Classification of inspection.	Introduction Overview of Inspection & Inspection department Definition Concept of inspection Classification of inspection Incoming inspection In process inspection Finished goods inspection Process of Inspection in Tool Room		
	STATISTICAL QUALITY CONTROL	Student should be able to: • Describe Statistical quality control. • Understand various control chart	Introduction Overview of Statistical Quality Control Definition Standard deviation concept of Statistical Quality Control Various control charts		
	DEPRECIATION	Student should be able to: • Describe Depreciation • Different methods of calculating depreciation	Definition, Obsolescence and amortization, Different methods of calculating depreciation, Numerical problems.		
	LINEAR PROGRAMMING	Student should be able to: • Describe L.P • Different methods of optimal solution	Formulation L.P. problem, Graphical method for optimal solution, Simplex method for optimal solution		

II. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	INDUSTRIAL ENGINEERING	GUPTA,R.B.	SATYA PRAKASHAN
2	INDUSTRIAL ENGINEERING AND MANAGEMENT	KHAQNNAQ,O.P.	DHANPAT RAI & SONS
3	INDUSTRIAL ENGINEERING	SAHU,SADANANDA	ALL INDIA COUNCIL OF TECH. EDUCATION
4	INDUSTRIAL ENGINEERING AND MANAGEMENT	BANGA, T. R.	KHANNA PUBLISHERS
5	INDUSTRIAL ENGINEERING AND MANAGEMENT	KHANNA, O.P.	DHANPAT RAI & SONS
6	INDUSTRIAL ENGINEERING AND PRODUCTION AND OPERTIONS MANAGEMENT	PATIL SANJAY S	ELECTRO TECH.PUBLICATION
7	INDUSTRIAL ENGINEERING AND PRODUCTION MANAGEMENT	TELSANG MARTAND	S.CHAND

MSME TECHNOLOGY CENTRE BHOPAL

(A Government of India Society under Ministry of Micro, small and medium enterprises)

SIXTH SEMESTER: COURSE DETAILS

ADVANCE DIPLOMA IN TOOL & DIE MAKING

A6-01: ENTREPRENEURSHIP DEVELOPMENT

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	-	-	50	_	-	-	50

II. COURSE RATIONALE

Entrepreneurs are the innovators that stimulate job growth, economic growth and development that allows any country to compete with and in the global economy. India, being far more developed and forward looking country than some of the third world countries, can provide lead to entrepreneurial development activities. The purpose of exposing the students to entrepreneurship is to motivate them to look at entrepreneurship as a viable, lucrative and preferred career. Entrepreneurs require a foundation in several key areas in order to be successful. This course will focus on multiple topics including: opportunities and challenges for new ventures, benefits/drawbacks of entrepreneurship, strategic management and forms of business ownership, marketing strategies, venture finance and human resource management.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- Primary objective of the course is to expose the students of Business Management to appreciate and understand the concepts and fundamentals of Entrepreneurship and to make them understand the process of business idea generation and converting the idea into a business model.
- Primary objective of the course is to expose the students of Business Management to appreciate and understand the concepts and fundamentals of Entrepreneurship and to make them understand the process of business idea generation and converting the idea into a business model

IV. COURSE OUTCOMES

Student will be able to know:

- Have the ability to discern distinct entrepreneurial traits.
- Know the parameters to assess opportunities and constraints for new business ideas.
- Understand the systematic process to select and screen a business idea.
- Design strategies for successful implementation of ideas.
- Write a business plan.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	INFORMATION GATHERING FOR IDENTIFICATION OF OPPORTUNITY	Student will able to know :- • Entrepreneurship • Explain Entrepreneur • Differentiate between businessman & Entrepreneur • The Opportunity and in Innovations of Entrepreneurship • Characteristics and function of entrepreneurs • Have knowledge about scientific and non- scientific discussion for sources • Explain demography, mood and means • Discuss the incongruity, innovations based on process need • Discuss the change in industry structure and market structure. • Describe the information gathering technique identification of product or service for getting business • Explain the principle of market survey	Entrepreneurship, Entrepreneur, Opportunity, Innovations, Characteristics of Entrepreneurs. The unexpected Success Failure, The incongruity, Innovations based on Process need, Change in Industrial Structure or Market Structure, Demographics, Changes in perception mood and means, New knowledge scientific and non-scientific, Discussion for sources. Information Gathering Techniques Identification of Product or services for Getting Business. Industries to be Surveyed Principles of Market Survey	6	50
2	product and services specifications	Student will able to know :- • Define product identification and its concept and nature • Discuss the product life cycle management	Analysis of Survey Data & Product Service Design	10	

		• Demonstrate strategies for better analysis of survey data • Understand the product service design			
3	Project formulation	Student will able to know :- • Understand better the system concept and project formats • Explain the process to create the service for any manufacturing product • Design strategies for successful implementation of idea • Describe project planning and the scope of project planning	System Concept and project format. Based on job Design for Manufacturing Product or Creating Service Capability, System Concept, Project formats, Job Design	10	
4	Estimation of Resources & Tax System and Insurance	Student will able to know :- • Discuss the equipment need for project • Understand the financial resources or cost estimation for any project • Have ability to know about the human resources need for the project	Space, Equipment's, Human Resources, Financial Resources, Entrepreneurship Support System, ISO : 9000 Series of Quality System	6	
5	Management	Student will able to know :- • Understanding the dynamic role of management • Understand the management skill and requirements	Marketing Management, Pricing policy Distribution channels and methods of marketing, Financial Management, Function and duties of finance departments Brief idea of journal, ledger, trial balance, trading account, profit and loss account, balance sheet making, Material Management, Store and store keeping, Principles of Management	4	
6	The procedure of project report writing	Student will able to know :- • Describe the process to write a project report • Understand procedure for submitting project report to the firm	Project Report Writing, Procedure for submitting project Report to the Firm.	4	

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	ENTEREPRENEURSHIP DEVELOPMENT HAND BOOK (H)	HARCUT, O.P.	SCIENTIFIC PUBLISHERS
2	THE START-UP OWNER'S MANUAL: THE STEP BY STEP GUIDE FOR BUILDING A GREAT COMPANY	STEVEN BLANK AND BOB DORF	K & S Ranch ISBN-987-0984999392

A6-02: CNC MACHINING & AUTOMATION

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE TEST	TOTAL MARKS
2	8	-	-	240	-	160	3	400

II. COURSE RATIONALE

In recent years the manufacturing environment has undergone dramatic change. For achieving market goals it is essential to produce quality parts in less time. Evolution of information technology, variety manufacturing concepts with zero lead time demand and quality consciousness have supported fast adaption of computerized numerical control (CNC) machines. As in human beings mental ability is becoming more important than physical ability to do the manual work, similarly CNC programming in the same way has more importance along with selection and use of CNC tooling. In this course therefore an attempt has been made to develop skills required for programming, tooling etc. for CNC machine. CNC machines normally are not limited to machine tools only but realm of CNC has widened in almost all areas of manufacturing, processes and support activities. It is therefore very important for mechatronics engineers to master CNC technology.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- To obtain products at a much lower manufacturing cost, compared to the one resulted from conventional applications.
- CNC applications, by their complexity, allow the obtaining of much more reduced manufacturing times, compared to the conventional ones.
- In its industry, it has a good population of CNC machines installed for execution of precision engineering works.
- Which can proficiently carryout work using CAD software, and subsequently use it for production through CNC machines.

IV. COURSE OUTCOMES

Student will be able to:

- Switching ON & OFF CNC machines.
- Job setup on CNC Machines.
- Machine setup for different modes.
- Prepare part programme by using G & M codes.
- Execute part programme block for different modes.
- Trouble shooting Different errors while programming & machining.

- Switching ON & OFF EDM machines.
- Job setup on EDM Machines.
- Prepare programme for different machining.
- Configuration pre-defined parts on CAM CT.

V. CONTENT (THEORY & PARCTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1 CNC LATHE	INTRODUCTION	Student Should be able to :- • Write the procedure to start the machine. • Explain about the control panel. • Define the axis principle of the lathe machine. • Propose of using hand wheel function. • Write down the procedure of work holding device work piece reference. • What do you understand homing process. • Describe the homing process in different mode. • Understand the tool selection & how to set the tool. • Need of cutter compensation. • Prepare part programing by using G & M code. • Different type of cycle. • Calculation the RPM for various material. • Different errors while programing and machining.	Switching ON & OFF machines , Axes principle, Introduction to control panel, Hand wheel functions	80	100
	JOB SETUP		Work holding devices, Tool holding devices, Work piece References		
	MACHINE SETUP		Machine referencing , Different modes, manual, Auto, full auto mode, editing mode, Tool selection & tool setting, Cutter compensation, X-axis, Z-axis setting		
	PREPARATION OF PART PROGRAM		Study of part drawing, Prepare part programme by using G & M codes, Simulate part programme on screen, Add labels, Cycle definition		
	TURNING A PART		Execute part programme block by block mode, Execute part programme full sequence mode, Feed selection & speed selection for various material like MS, BSK, OHNS, HcHcR, Cutting coolant for turning machine (Water soluble, oil base, air cooled)		
	PART MANUFACTURING		Produce part by using program, Inspection of part by using cycle on or manual measuring instrument, Report generations		
	TROUBLE SHOOTING		Different errors while programming & machining, Causes & remedies		
	SAFETY		Safety precautions while stating machine, While machining, Power off while Auto machining		

		• Write safety preparation for machine.			
2 CNC MILLING	INTRODUCTION	Student Should be able to :- • Write the procedure to start the machine. • Explain about the control panel. • Define the axis principle of the milling machine. • Propose of using remote control function. • Write down the procedure of work holding device work piece reference. • What do you understand homing process. • Describe the homing process in different mode. • Understand the tool selection & how to set the tool. • Need of cutter compensation. • Prepare part programing by using G & M code. • Different type of cycle. • Calculate the RPM for various material. • Different errors while programing and machining. Write safety preparation for machine.	Switching ON & OFF machines, Axes principle, Introduction to control panel, Remote control functions	80	100
	JOB SETUP		Work holding devices, Tool holding devices, Auto tool changer , Work piece References		
	MACHINE SETUP		Machine referencing, Different modes, manual, Auto, full auto mode, editing mode, Tool selection & tool setting, Cutter compensation, Z-axis setting		
	PREPARATION OF PART PROGRAM		Study of part drawing, Prepare part programme by using G & M codes, Simulate part programme on screen, Take dry run with Z axis upward direction, Add labels, Cycle definition		
	MILLING A PART		Execute part programme block by block mode, Execute part programme full sequence mode, Feed selection & speed selection for various material like MS, BSK, OHNS, HcHcR, Cutting coolant for milling machine (Water soluble, oil base, air cooled)		
	PART MANUFACTURING		Produce part by using program, Inspection of part by using cycle on or manual measuring instrument, Report generations.		
	TROUBLE SHOOTING		Different errors while programming & machining, Causes & remedies		
	SAFETY		Safety precautions while stating machine, While machining, Power off while Auto machining		
3 AUTOMATION	ROBOTICS	Student Should be able to :- • Write the Advantages of robot • Propose of using Robots • Application of robots • Different control loops	Introduction, Advantages of a robot, Robot terminology, Major Features of a robot, Manipulator, Controller, Sensors, Power supply unit, Types of Robots, According to the structure of Manipulator, According to type of system, According to type of control loops, Application of robots.	40	40

	AUTOMATION IN MANUFACTURING		Introduction to machining centre, Introduction to computer Integrated manufacturing (CIM), Introduction to flexible manufacturing system (FMS), Introduction to group technology (GT), Introduction to computer process planning (CAPP)		

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	CNC TECHNOLOGY AND PROGRAMMING	KRAR,STEVE	MCGRAW-HILL INC.
2	CNC TECHNOLOGY (BASIC COURSE)	BISWAS,P.K.	ALL INDIA COUNCIL OF TECH. EDUCATION
3	CNC TECHNOLOGY (LATHE & MILLING)	IGTR	IGTR
4	CNC TECHNOLOGY : LATHE AND MILLING	IGTR,AHM	INDO-GERMAN TOOL ROOM
5	CNC TECHNOLOGY PROGRAMMING AND OPERATING (M)	DHOTRE,MAHESH	SAITECH, AHMEDNAGAR

A6-03: COMPUTER AIDED MANUFACTURING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE TEST	TOTAL MARKS
1	3	-	-	60	-	40	3	100

II.COURSE RATIONALE

The subject is the Introduction to CAD/CAM , Scope of MASTERCAM Requirement of hardware and software High end and low end software's Introduction to MASTERCAM Graphical interface Overview of file management Creation of basic various geometrical entities Drawing of simple 2d drawings. Editing and modification technique of 2D drawings Selection methods by Grouping / Masking of entities / Assigning / Changing coolers for transformation. Working with level Transformation technique of 2D drawings dimensioning and tolerance method.

III.COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- 2 D MODELLING.
- 3 D WIREFRAME AND SURFACE MODELLING
- SOLID MODELLING
- TOOL PATH GENERATION

IV. COURSE OUTCOMES

Students will be able to:

- 2 D MODELLING.
- 3 D WIREFRAME AND SURFACE MODELLING
- SOLID MODELLING
- TOOL PATH GENERATION
- 2D-toolpath generation
- 3D-tool path generation for rough machining
- 3D-toolpath generation for finish machining

- Program post processing(G and M code generation

V. CONTENT (THEORY & PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	THEORY & PRACTICE HOURS	MARKS
1	2 D MODELLING	Students should be able to • Define CAD & CAM. • Explain the uses of CAD & CAM. • Define master CAM. • Explain about the history of master CAM. • Differentiate between low end & High end software. • Understand the graphical interface & file management of master CAM. • Understand, why uses of master CAM in manufacturing field.	**INTRODUCTION** Introduction to CAD/CAM, Scope of MASTERCAM Requirement of hardware and software High end and low end software's Introduction to MASTERCAM Graphical interface Overview of file management.	8	15
2			**2D DRAWING** Creation of basic various geometrical entities Drawing of simple 2d drawings. Editing and modification technique of 2D drawings Selection methods by Grouping / Masking of entities / Assigning / Changing coolers for transformation. Working with level Transformation technique of 2D drawings Dimensioning and tolerance method its editing method Adding text to drawing and its modification	16	
3	3 D WIREFRAME AND SURFACE MODELLING	Student should be able to • Define 2D modelling. • Understand the co- ordinate system & its types. • Difference between drawing & modelling. • Create the 2D model. • Explain about uses of various geometrical entities in 2D model. • Understand how to modification of a 2D model in Master cam. • Define dimension. • Understand how to dimensioning of a drawing.	**WIREFRAME MODELLING** Plan concept 3D construction plane. Misc. planes	12	15
4			**SURFACE MODELLING** Surface terminology Creating surfaces Modification of surfaces Converting wire frame models into surface model	12	

		• Define tolerance. • Differentiate between tolerance & dimensioning. • Understand how to write tolerance value of a drawing.			
5	SOLID MODELLING	Student should be able to • Define solid modelling. • Create solid modelling. • Understand the file extension of solid modelling. • Understand the use solid modelling tool. • Understand the why use of solid model. • Define Drafting. • Explain the projection view. • Create the different views of solid model.	**SOLID MODELLING** Solid terminology creation of solids Modification of solid Drafting of solid	16	15
6	TOOL PATH GENERATION	Students should be able to • Define tool path in master CAM. • Define 2D tool path & how to create the 2D tool path generation. • Define 3D tool path. • Define roughing operation. • Define allowance. • Define depth per cut. • Describe the procedure of 3D tool path generation for rough machining. • Define finishing operation. • Describe the procedure of 3D tool path generation for finish machining. • Define G & M code. • Define simulation of a program. • Describe the different cam operations used in master CAM. • Explain how to generate the code of operation. • Understand the procedure of program post processing in master CAM.	**6. TOOL PATH GENERATION AND POST PROCESSING** 2D-toolpath generation 3D-tool path generation for rough machining 3D-toolpath generation for Finnish machining Program post processing(G and M code generation) programmer simulation and verification	16	15

		• Understand the procedure of program simulation & verification.			

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	CAD/CAM: COMPUTER-AIDED DESIGN AND MANUFACTURING	Mikell P. Groover	MCGRAW-HILL INC.
2	CAD/CAM : COMPUTER-AIDED DESIGN AND MANUFACTURING	M. GROOVER	PEARSON
3	LEARNING MASTERCAM MILL: STEP BY STEP	JAMES VALENTINO , JOSEPH GOLDENBERG	

A6-04: TOOL & DIE MAKING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	ORAL/PRACTICE	TOTAL MARKS
-	10	-	-	240	-	160	3	400

II. COURSE RATIONALE

The subject is the mother of all manufacturing technics and deals with moulds, jigs & fixtures, plastics, die casting, dies. The practical subject introduces the Numbering & lettering as per specified dimensions with maintaining quality criteria.

A brief idea about the Grinding of single lip cutters as per specified in drawing with maintaining quality criteria is included in the course. The operation to reshape the drills to require angle is performed which helps the students to understand the maintenance of the tools.

The later part of the course helps in understanding the operation of turning & milling. The course is helpful to make standard parts of press tool, jigs, fixtures & gauges, plastic mould.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Students will be able to:

- Understand Numbering & lettering as per specified dimensions with maintaining quality criteria.
- To reshape the drills to required angle.
- Make standard parts of press tool.

IV. COURSE OUTCOMES

Student will be able to:

- Make standard parts of jigs.
- Make standard parts of fixtures & gauges.
- Make standard parts of plastic mould.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	PRACTICE HOURS	MARKS
1	Manufacture of tools ordered by internal or external customers.	Student will be able to design & manufacture the press tool, jigs, fixtures & gauges moulds parts	Manufacturing independently press tool, jigs, fixtures & gauges, moulds parts with the help of all conventional machine design / part design of press tool, mould, jigs & fixture parts. Planning of production of press tool, mould jigs & fixture parts, produce & test function of press tool, mould, jigs & fixture parts.	200	400

A6-05: DESIGN OF MOULD - III

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	-	90	-	60	250

II. COURSE RATIONALE

The course will cover the fundamentals of injection moulds design and give the student and understanding of moulds design and function. Topics include: shrinkage allowances, gate locations, cooling, runner balancing, stripper plates slide moulds, two and three plate designs as well as moulding machine considerations. Over the semester, the students will have the experience of collaborating to develop a complete mould design from scratch. Hands-on examination of parts, moulds, and drawings are featured as well as CAD demos and a plant tour.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- Analyse mould cooling systems and components, and identify ways to improve the uniformity and efficiency of removing heat from the moulded part.
- Recognize the primary mould components, and recall key considerations, for ejecting plastic parts and runner systems.
- Analyse and solve engineering, strength of material, problems related to the structural integrity of injection mould plates and components.
- Evaluate if an injection mould is a good match for an injection moulding machine.

IV. COURSE OUTCOMES

Student will be able to know:

- Different transfer moulding processes and operations.
- Different Process elements and Process Setup for transfer moulding.
- Brief description of mould parts/ elements, feeding system, Function, different lay outs of transfer moulding.
- Design parameters related to transfer moulds.
- Different Blow moulding processes and operations.
- Different Process elements and Process Setup for Blow moulding.
- Brief description of mould parts/ elements of Blow moulding.
- Design parameters related to Blow moulding.
- Rotational moulding processes and operations.

- Mould polishing & surface treatment.
- Material handling, storage & disposal.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	CONTENTS	TEACHING HOURS	MARKS
1	MOULDING PROCESSES & OPERATIONS (TRANSFER MOULDING)	Introduction to the process, use & application, Transfer moulding process, Need of Transfer moulding process & its application, classification of transfer moulding process, Definition & process of pot type Transfer moulding, Definition & process of Plunger type Transfer moulding, Advantages & Limitations of the process	2	6
2	PROCESS ELEMENTS (TRANSFER MOULDING)	Process elements, Machine (its parts & function) & materials, Mould (Specifications).		
3	PROCESS SET UP (TRANSFER MOULDING)	Process set up sheet, Bullk factor, injecting pressure (Applied Pressure), Heating & curing, Press speed, Transfer moulding check list, Common problems & their remedies.		
4	ELEMENTS & THEIR FUNCTION (TRANSFER MOULD)	Introduction, Introduction & brief description of mould parts/ elements, feeding system, Function, different lay outs, Principle of parting surfaces, Classification of Gates & their design features (Design considerations - Edge, top, bottom, depression, ring, disc, spoke gate & fan gate), EJECTION SYSTEM: Parts & function of ejector elements (ejector grid, ejector plate assembly, ejector rod & bush, ejector pin), CORE & CAVITY, Function & classification, Material used, Draft & venting, Principle of parting surface & mounting methods, RETAINERS FOR CORE & CAVITIES, Principle of alignment , guidance & clearance, MOULD BASES & PARTS, Mould base elements- (bolsters, ejectors, aligning elements, principle of aligning, guidance & clearance)	2	8
5	DESIGN PARAMETERS RELATED TO TRANSFER MOULDS	Introduction use & application of design parameters, Use of standard tables & selection of parameters for appropriate requirements, concept of design parameters to mould with respective machine & material, Minimum moulding pressure, Moulding Mass ,Total Volume of Loose powder, Depth of cavity , Loading space, Transfer pot calculations, Minimum cross section area of Sprue, Runner & gate dimensions, Runner & gate dimensions, Clamping tonnage, Runner & gate dimensions, Clamping tonnage, Heating calculations	2	8
6	MOULDING PROCESSES & OPERATIONS (BLOW MOULDING)	Introduction to the process, use & application, Blow moulding process, Need of Blow moulding process & its application, classification of blow moulds, Extrusion blow moulding process, Injection blow moulding process, Process elements, Machine (its parts & function),	3	6

		Mould & materials, Nomenclature of blow moulded component, Mandrel & Prison description		
7	ELEMENTS & THEIR FUNCTION (BLOW MOULD)	Introduction, Introduction & brief description of mould parts/ elements, blow mould elements, Neck ring, cavity, Back plate, Inserts, Guide pins, flash pocket relief, Parting line Vents, Mould body.	1	6
8	DESIGN PARAMETERS RELATED TO BLOW MOULDS	Introduction use & application of design parameters, Use of standard tables & selection of parameters for appropriate requirements, concept of design parameters to mould with respective machine & material, Blow pressure, Clamping pressure, Parrison Diameter, Ring Diameter, Mandrel Diameter, Die swell, Blow ratio.	2	6
9	MOULDING PROCESSES, PROCESS ELEMENTS & OPERATIONS (THERMO FORMING)	Introduction to the process, use & application, THERMO FORMING process, advantages & its application, classification of thermo forming moulds, Standard Vacuum forming process, Plug assist Vacuum forming process, process elements, Machine (its parts & function), Mould & materials.	1	6
10	MOULDING PROCESSES, ELEMENTS & OPERATIONS (ROTATIONALMOULDING)	Introduction to the process, use & application, rotational moulding process, advantages, disadvantages & its application, process elements, Process for rotational moulding.	2	5
11	MOULD POLISHING & SURFACE TREATMENT	Introduction to the surface treatment process, Flame treatment, Chemical treatment, Screen printing, Electro plating & hot stamping, requirement & types of surface finishing process, Mould polishing process, Chrome plating, classification of polishing equipment, Manual & power assisted polishing kit.	3	5
12	MATERIAL HANDLING , STORAGE & DISPOSAL	Introduction, use & application & estimation, Methods of storage & disposal of plastic materials with estimation for plastic & mould, cycle time estimation.	2	4

VI. CONTENT (PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	CONTENTS	TEACHING HOURS	MARKS
ELEMENTS OF MOULD & THEIR FUNCTION (COMPONENTS & LAYOUTS)	COMPONENT DRAWING	Introduction: Use and application of allowances for component drawing, Study the component / sample, Study the component / sample, Study the component / sample, Draw component drawing.	15	18
	RUNNER LAYOUT	Introduction: Use and application of the typical runner layout, Study the component drawing / sample, Study & select the impression according to requirement, Draw the typical runner layout.		
	COOLING / HEATING LAYOUT	Introduction: Use of cooling & heating circuit in moulds, Draw a typical circuit layout per heating / cooling in mould, (Simple circuit, 'O' circuit, Z circuit, Heat pipes, insert cooling, integer core cooling, Baffled cooling.		
CLASSIFICATION OF MOULDS (WORK / DATA SHEET	CALCULATE DESIGN PARAMETERS WITH RESPECT TO MOULD, MATERIAL & MACHINE	Introduction: Use of design parameters for optimum mould design, Study the component specification and customer requirement, Study & use the design parameters with respect to mould, material and machine, Use the data book, standards for optimum selection of design parameters, Calculate & verify the design parameter according to requirement of mould.	15	18
	PREPARATION OF WORK / DATA SHEET OF MOULD, MATERIAL & MACHINE	Introduction: Use of work sheet for mould design, Use the information data from chapter 4.1., Prepare the work / data sheet for mould design in relevant format,		
DESIGN PARAMETERS RELATED MOULD, MATERIAL & MACHINE (CONCEPTUAL DESIGNS)	SKETCHING CONCEPTUAL DESIGNS	Introduction: Use and application of alternative conceptual design, Refer (List of exercises for design practice Chapter 6.1 & Flow Chart), Study the component drawing / sample, Develop conceptual design using data sheet. (Refer chapter 4.2), Develop alternative conceptual designs, Evaluate & compare the alternative conceptual design using design parameters, Select the optimal design.	10	22
DESIGN OF MOULDS	DRAW THE ASSEMBLY AND DETAIL DRAWINGS OF MOULD	Introduction: Use of Assembly and detailed drawings for manufacturing of mould, Refer (List of exercises for design practice Chapter 6.1 & Flow Chart), Refer (List of exercises for design practice Chapter 6.1 & Flow Chart), Use the concept drawing, Draw the assembly and detailed drawings of mould as per norms	10	27

SPECIFICATIOPN (MOULD DATA)	BILL OF MATERIALS	Introduction: Use of Bill of Material in mould manufacturing and mass production of component Concept of estimation of, Study the data sheet & work sheet, Prepare bill of material.	10	5
	MOULD DATA	Introduction: Use of mould data in the production of components, Study the standards, norms & prepare data for machine set up, Prepare processing data & mould data.		

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	TOOL AND DIE MAKER (PRESS TOOLS; JIGS AND FIXTURES AND DIES AND MOULDS) FIRST YEAR TRADE PRACTICALS	CIMI	CENTRAL INSTRUCTIONAL MEDIA INSTITUTE
2	ADVNACED DESIGN ELEMENTS OF DIES AND MOULDS AND RELATED TOOLINGS	NUTTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
3	INJECTION MOULDING	ATHALYE,A.S.	MULTI-TECH PUBLISHING CO
4	MOULDING OF PLASTICS	ATHALYE,A.S.	MULTI-TECH PUBLISHING CO
5	INJECTION MOULDS : 108 PROVEN DESIGNS	GASTROW,HANS	HANSER PUBLICATION
6	DIES & MOULDS I (1084) TP		EDUCATION & TRG CONSULTANTS
7	THEORY DIES AND MOULDS 1ST YEAR : FUNDAMENTAL DESIGN CONCEPTS OF DIES & MOULDS	NETTUR TECHNICAL TRG. FOUNDATION	NETTUR TECHNICAL TRG FOUNDATION
8	MOULDER	GUPTA,R.B.	SATYA PRAKASHAN
9	HANDBOOK OF THERMOEST PLASTICS INJECTION MOULD DESIGN	CRACKNELL,P.S.	BLACKIE ACADEMIC & PROFESSIONAL
10	DEVELOPMENTS IN INJECTION MOULDING – 1 TO 5	WHELAN,A.	APPLIED SCIENCE PUBLISHERS LTD.

A6-06: DESIGN OF DIE CASTING DIES

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	60	40	40	200

II. COURSE RATIONALE

The design of die casting die requires considerable skill and expertise. Designer purposes designs of dies employed to cast parts from various alloys and perform a variety of other operations. Every new job requires original thought in its design and the solving of individual problems in its manufacture. Each die cast component, currently in production, presents a challenge for the improvement of its output and quality. The objective here is to design dies to be fit for the purpose, operate at optimum shot rate and is of reasonably simple construction. The main purpose of this subject is to present the systematic design procedure for pressure die casting dies. Die casting dies like any other type of tooling can be very simple and very complex.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- Design and Manufacturing of Quality Press Tools, Die Casting Dies, Moulds, Jigs, Fixtures and Gauges and components as per customer requirements conforming to International Standards.
- In-depth knowledge of the design and manufacture of complex moulds and dies for plastics and metal engineering components.
- Skills in assessing the related performance of tooling and processes;
- Ability to evaluate the effects of tooling design on the quality of finished products.

IV. COURSE OUTCOMES

Student will be able to know:

- Overview of mass production of casted parts.
- Different Die casting operations.

- Application of various feed systems, Cooling systems & Ejection techniques
- Different types of investment casting dies and cold chamber casting dies.
- Design parameters pertaining to mould, machine and material.
- Different types of polishing and surface treatment.
- Different types of plastics processing and pre casting techniques.
- Different types of post casting techniques.
- Understand about material handling – storage & disposal.
- Understand the estimation parameters of die, machine & process.
- Specification of mould, material & machine – cold chamber die casting.
- Application of simulation package.

V. CONTENT(Theory)

UNIT NO.	TOPIC/SUB-TOPIC NO.	OTCOMES	CONTENTS	TEACHING HOURS	MARKS
1	OVERVIEW OF MASS PRODUCTIO N OF CASTED PARTS	Student should able to know :- • Define Die casting • Describe types of metal used for casting. • Explain the types of die casting. • Describe the machine use for die casting • Elaborate die casting process • Explain the application of die casting in industry. • Explain the properties of material used in die casting. • Explain the uses of die cast pasts • Overview of mass production of casted parts.	An Overview of Casting Dies, metals used for casting and casting machine & their relationship, Over view of casting dies, Metal used for casting, Classification of industrial application of metals, Properties of materials.	2	6
2	PRESSURE DIE CASTING (COLD CHAMBER)	Students should able to know :- • Define pressure die casting. • Describe the cold chamber process. • Differentiate between hot chamber and cold chamber process.	Cold chamber process – Parts & function of machine, Process elements- Machine, Material (Metal), castings Dies, Classification of die casting machines, Process set up data sheet.	2	10

		• Explain the parts of cold die chamber. • Elaborate the process of cold die casting. • Describe the classification of die casting machine. • Understand about the material used in die casting operation. • Describe the advantages and disadvantages of cold casting.			
3	ELEMENTS OF DIE CASTING DIES & THEIR FUNCTION - COLD CHAMBER DIE CASTING.	Student should able to know :- • Explain the uses and application of various feed system. • Explain the uses and application of cooling system and ejection techniques. • Understands the classification and elements of feeding system. • Understands the classification of cooling system & ejection system. • Describe the function of cooling system and ejection system. • Describe the elements of cooling system and ejection system	Use and application of various feed systems, Cooling systems & Ejection techniques, Feeding system - Elements, function & Classification, Cooling systems/ Elements - Elements, function & Classification, Ejection System/ Techniques - Elements, function & Classification.	4	12
4	CLASSIFICATION OF COLD CHAMBER DIE CASTING DIES	Students should able to know :- • Define cold chamber die casting • Elaborate the uses of cold chamber die casting dies. • Describe the classification of die casting dies. • Explain the classification of cold chamber die casting dies • Explain the die construction and parts • Explain the function of parts of die.	Use and application of Cold chamber die casting dies, Classification of Cold chamber die casting dies, Classification of die construction & parts & their functions, Classification of feeding & ejection system.	3	12
5	CLASSIFICATION OF INVESTMENT	Student should able to know :- • Define investment casting	Introduction: Use and application of investment casting dies, Classification of investment casting dies, Classification of die		

	CASTING DIES	• Explain the uses and application of investing casting dies • explain the classification of investment die casting dies • Explain the process of investment casting • Explain the classification of die construction and parts. • Explain the function of die parts • Describe the classification of feeding and ejection system of die. • Describe of investment casting process.	construction & parts & their functions, Classification of feeding & ejection system.		
6	DESIGN PARAMETERS RELATED TO MOULD, MATERIAL & MACHINE - COLD CHAMBER DIE CASTING DIES	Students should able to know :- • Describe the parameters and material of die parts. • Describe the application of design parameters. • Explain feeding system. • Define runner velocity and gate velocity and filling rate. • Explain the temperature maintain in the die. • Explain the injection system and its elements. • Describe the properties and heat treatment of mould material. • Explain the composition of material.	Use and application of Design parameters, Concept of design parameters pertaining to mould, machine and material. (Refer list of Design Parameters), Feeding system, Number of cavities, Sprue, Sprue bush, Nozzle, Runner Area, Gate Dimensions(L x b x t), Number of Gates, Cavity balancing, Tie bar loading, Short sleeves(Design & Fitment), Over Flows, Runner Velocity, Gate Velocity, Filling rate, Cooling systems/ Elements - Die Temperature, Temp. of shot cylinder, Cycle Time, Die Heating, Die hardness, Thermal Conductivity, Ejection System/ Techniques, Injection pressure, Injection Time, Ejection Temperature, Push Back Pins, Ejector assembly, Projected area, Surface area of cavity, Variable Clamping Force, Tie Bar Distance (H x V), Registering hole size, Platen sizes, Shut height / Day light, Composition, Properties and Heat treatment of Mould material.	4	6
7	MATERIAL HANDLING – PRE CASTING	Students should able to know :- • Describe the material handling pre-casting.	Introduction: Use and application of pre-casting techniques, Classification of plastics processing., pre casting techniques(Drying,	4	6

		• Explain the use and application pre-casting techniques. • Explain the classification of plastic processing • Elaborate all pre-casting techniques. • Describe about the equipment used in pre-casting techniques • Advantages of pre-casting techniques. • Limitation of pre-casting techniques.	Dehumidifying, Pre forming/ Pallatising, Heating),		
8	MATERIAL HANDLING – POST CASTING	Students should able to know :- • Differentiate between pre-casting and post-casting. • Define the post-casting techniques. • Explain uses and application of post casting techniques. • Classification of the post-casting techniques. • Describe related equipment for post-techniques. • Advantages of post-casting techniques • Limitation of post-casting techniques	Introduction: Use and application of post-casting techniques, Classification of post casting techniques (Trimming, use of fixtures, Coating, Surface decoration), related equipment for the above techniques.		
9	ESTIMATION PARAMETERS OF DIE, MACHINE & PROCESS	Student should able to know:- • Explain the estimation of requirement • Describe the concept of estimation • Explain the material estimation for cast material metal and die • Understand the machine time estimation for die casting and cycle time estimation need of estimation and • Describe the machine hours and processes	Introduction: Estimation of material requirement, machine hours and processes (cycle time), Concept of estimation, Material estimation for Cast metal and Die, Machine time estimation for Die casting, Cycle time estimation.	2	4
10	MAINTENANCE, SAFETY & STORAGE	Student should able to know:- • Understand the standard procedure for maintenance • Explain the steps of safety • Discuss about dos and don'ts during	Introduction: To understand the standard procedures for maintenance, safety, storage of press tool and machine, Concept of safety, maintenance & storage.	2	3

		working • Describe the steps taken during storage of press tool and machine of safety the • Describe the of concept maintenance and storage			

CONTENT (PRACTICE)

UNIT NO.	TOPIC/SUB-TOPIC NO.	CONTENTS	TEACHING HOURS	MARKS
ELEMENTS OF DIE CASTING DIE & THEIR FUNCTION (COMPONENTS & LAYOUTS)	COMPONENT DRAWING	Introduction: Use and application of allowances for component drawing, Study the component / sample, Study the component / sample, Study the component / sample, Draw component drawing as per the shrinkage factor and component ejection.	15	18
	RUNNER LAYOUT	Introduction: Use and application of the typical runner layout, Study the component drawing / sample, Study & select no of cavity according to requirement, Draw the typical runner layout.		
	COOLING LAYOUT	Introduction: Use of cooling circuit in die, Draw a typical circuit layout per cooling in die, (Simple circuit, 'O' circuit, Z circuit, insert cooling, integer core cooling, Baffled cooling.		
CLASSIFICATION OF die (WORK / DATA SHEET	CALCULATE DESIGN PARAMETERS WITH RESPECT TO die, MATERIAL & MACHINE	Introduction: Use of design parameters for optimum die design, Study the component specification and customer requirement, Study & use the design parameters with respect to die, material and machine, Use the data book, standards for optimum selection of design parameters, Calculate & verify the design parameter according to requirement of die.	15	18
	PREPARATION OF WORK / DATA SHEET OF DIE, MATERIAL & MACHINE	Introduction: Use of work sheet for die design, Prepare the work / data sheet for die design in relevant format,		
DESIGN PARAMETERS RELATED DIE,	SKETCHING CONCEPTUAL DESIGNS	Introduction: Use and application of alternative conceptual design, Refer (List of exercises for design practice Flow Chart), Study the component drawing / sample, Develop conceptual design using data sheet. Develop alternative conceptual designs,	10	22

MATERIAL & MACHINE (CONCEPTUAL DESIGNS)		Evaluate & compare the alternative conceptual design using design parameters, Select the optimal design.		
DESIGN OF DIES	DRAW THE ASSEMBLY AND DETAIL DRAWINGS OF DIE	Introduction: Use of Assembly and detailed drawings for manufacturing of die, (List of exercises for design practice & Flow Chart), Refer (List of exercises for design practice & Flow Chart), Use the concept drawing, Draw the assembly and detailed drawings of die as per norms	10	27
SPECIFICATIOPN (DIE DATA)	BILL OF MATERIALS	Introduction: Use of Bill of Material in die manufacturing and mass production of component Concept of estimation of, Study the data sheet & work sheet, Prepare bill of material.	10	5
	DIE DATA	Introduction: Use of die data in the production of components, Study the standards, norms & prepare data for machine set up, Prepare processing data & die data.		

VI. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	A SHORT TERM COURSE ON 'DESIGN OF DIE CASTING DIES"	IDEMI	IDEMI
2	A SHORT TERM COURSE ON 'DESIGN OF DIE CASTING DIES"	TAMBVE, M. J.	IDEMI
3	DIE CASTING EDUCATIONAL PROGRAMME : DIECASTING PRODUCT DESIGN	THE DIE CASTING SOCIETY OF INDIA	THE DIE CASTING SOCIETY OF INDIA
4	PRINCIPLES OF METAL CASTING	RICHARD W.HEINE, CARL R.LOPER,PHILIP C.ROSENTHAL	

A6-07: DESIGN OF FORGING DIES

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
1	3	3	60	60	40	40	200

II. COURSE RATIONALE

In the forging industry today, advanced mathematical techniques such as finite element methods (FEM) are beginning to revolutionize the conventional trial-and-error methods for die design and forging process development. Cost reduction programs are being implemented to enable the forging industry to remain competitive in today's market. Material reduction or weight savings in the quantity of metal required to make the forged part is proving to be a significant factor contributing to cost reduction. Production of ring gear blanks without producing flash reduces the input weight of metal needed to make the gear blank, thus providing cost savings on the forged part.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- Understand Tool Design Parameters
- Understand .Material Handling

IV. COURSE OUTCOMES

Student will be able to:

- Overview of design of component drawing, machining allowances, parting line position.
- Design of fuller and roller.
- Design of bender and mould/blocker.
- Design of finisher, flash & gutter.
- Design of die layout.
- Understand the concept of trim tool, trimming equipment and trimming load.
- Understand the concept of buckling, gripping, heading tool and sliding die.
- Understand the concept of design of cold forging die (warm).
- Understand the concept of handling of dies & materials.
- Understand the concept of estimation.

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
1. TOOL DESIGN PARAMETERS	DESIGN OF COMPONENT DRAWING	Students will be able to • Draw component drawing, • Calculate machining allowance parting line position. • Understand the parting line position and how to use in design forging. • Understand draft angle, web and rib dimensions. • Calculate the forging tolerance.	Introduction, overview of design of component drawing, machining allowances, parting line position, balancing of parting line, draft angle, web dimensions, rib dimensions, corner, fillet & other radii, forging tolerances.	10	30
	DESIGN OF FULLER	Students will be able to • Understand the function of fuller. • Classify the fullers. • Calculate the bite length. • Draw the fuller. • Understand the concept shrinkage.	Introduction, the overview of fuller function, concept of fuller, classification of fullers, concept of gap depth, concept of bite length, concept of shrinkage.		
	DESIGN OF ROLLER	Students will be able to • Explain the function of roller. • Understand the concept of roller. • Describe of gathering material. • Describe the concept of elongation. • Draw the roller. • Calculate the shrinkage.	Introduction, the overview of roller function, concept of roller, concept of gathering material, concept of elongation, concept of shrinkage.		
	DESIGN OF BENDER	Students will be able to • Explain the function of Bender • Understand the concept of Bender. • Understand plan view of component. • Draw the Bender. • Understand the shrinkage	Introduction, the overview of bender function, concept of bending tool, concept of plan view of component, concept of shrinkage		
	DESIGN OF MOULD/BLOCKER	Students will be able to • Describe the function of blocker • Understand the blocker impression. • Calculate the volume of component.	Introduction, the overview of blocker function, concept of blocker impression, concept of volume, concept of shrinkage.		

		• Calculate the shrinkage			
	DESIGN OF FINISHER,FLASH & GUTTER	Students will be able to • Describe the function of finisher, flash &Gutter. • Understand the concept of Finisher, Flash & Gutter. • Draw the Finisher, Flash & Gutter.	Introduction, the overview of finisher, flash & gutter function, concept of finisher, concept of shrinkage, concept of flash, flash land, concept of gutter.		
	DESIGN OF DIE LAYOUT	Students will be able to • Explain the die layout. • Understand the design procedure of finishing impression. • Understand the design procedure of flash and gutter • Draw the forging die layout	Introduction, the overview of die layout function, procedure of design of finisher impression, procedure of designing of flash & gutter.		
2. TOOL DESIGN PARAMETERS	DESIGN OF TRIM TOOLS	Students will be able to • Understand the function of trim tool. • Explain the trim tool parts. • Describe the hot shearing. • Calculate the shear force.	Introduction, the overview of trim tool function, concepts of hot shearing, concept of trim tool, concept of trimming equipment, concept of trimming load.	5	3
	DESIGN OF UPSETTING TOOL (SOLID)	Students will be able to • Understand the function of upsetting tool. • Describe the application of upsetting tool. • Understand the working of upsetting tool. • Define the buckling. • Understand the heading tool. • Understand the main parts of upsetting machine.	Introduction, the overview of upsetting tool function & application, concept of upsetting operation, concept of buckling, concept of gripping, concept of heading tool, concept of sliding die.		
	DESIGN OF COLD FORGING DIE (WARM)	Students will be able to • Describe the cold forging. • List the application of cold forging. • Calculate the shrinkage.	Introduction, the overview of cold forging & application, concept of cold forging, concept of design parameters in cold forging, concept of shrinkage.		

3. MATERIAL HANDLING	HANDLING OF DIES & MATERIALS	Students will be able to • Understand the handling of dies and materials. • Describe the movement die and material. • List the materials handling equipment. • Explain the importance of handling dies and material.	Introduction, overview of handling the dies & material & its importance, concept of die movement, concept of raw material movement, concept of forging movement	3	6
4. ESTIMATION	ESTIMATION OF FORGING DIES & TOOLS	Students will be able to • Understand the purpose of estimation. • Understand the elements of costs. • Define the Estimation of cost elements. • Define the Estimation of tool elements • Understand steps in making of cost estimation • Solve estimated Numerical examples.	Introduction, overview of estimation parameters, estimation of material, machining time.	4	6
5. DIE MAINTENANCE, SAFETY & STORAGE	MAINTENANCE, SAFETY & STORAGE	Students will be able to • Understand the concept of safety. • Describe the concept of maintenance. • Understand the importance of maintenance. • Understand concept of handling & storage	Introduction, to understand the necessity of maintenance, safety & storage of forging dies and tools, concept of safety, concept of maintenance, concept of storage.	4	6
6. SPECIFICATION	SPECIFICATION OF DIES, MATERIAL & MACHINE	Students will be able to • Describe concept of forging die specification • Understand selection of material according to type of process • Understand selection of material according to size • Describe material for forging die • Understand forging material specification	Introduction, use and application of the specification pertaining to forging dies, tools, material and equipment for tool design data, concept offorging dies & tools specification, concept offorging material specification, concept of equipment specification.	4	12

VI. LIST OF EXERCISES

UNIT NO.	CONTENTS
1	Design of FULLER/Roller/Bender/Finisher
2	Design of Die Layout
3	Design of Gear Blank
4	Design of Forging Die

VII. REFERENCE BOOK

SR. NO	TITLE	AUTHORS	PUBLICATION
1	FORGINIG HANDBOOK : DIE DESIGN	THOMAS,A.	DROP FORGING RESEARCH ASSOCIATION
2	ASM HANDBOOK VOL 14 : FORMING AND FORGING	ASM	ASM INTERNATIONAL
3	FORGING DIE DESIGN AND PRACTICE	SHARAN,R	S.CHAND & CO. LTD
4	DESIGN AND MANUFACTURE OF FORGING DIES	MESWANI,N.V.	ALL INDIA COUNCIL OF TECH. EDUCATION
5	FORGING HANDBOOK : DIE DESIGN	THOMAS, A.	DROP FORGING RESEARCH ASS.
6	INDUSTRIESCHMIEDE (FORGING)	NAWROTZKI, VON KLAVS	VERLAG
7	DIE CASTING DIE DESIGN, FORGING DIE DESIGN SEM VI	CTR	CENTRAL TOOL ROOM
8	STEEL FOR DIE BLOCKS FOR DROP FORGING – SPECIFICATION	BIS	BUREAU OF INDIAN STANDARDS

A6-08: PRODUCATION PLANNING, ESTIMATING & COSTING

I. SCHEME OF TEACHING & EVALUATION

THEORY HOURS	PRACTICAL HOURS	PROGRESSIVE TEST	END TERM EXAM. (TH)	END TERM EXAM. (PR)	TERM WORK (TH)	TERM WORK (PR)	TOTAL MARKS
2	-	3	60	00	40	-	100

II. COURSE RATIONALE

This course is designed to help students To understand about production and Methods of production. Concept of production system. Concept of Inputs. Concept of manufacturing process. Concept of output. Overview of productivity & its influence in industry. Overview of productivity & its influence in industry.

III. COURSE OBJECTIVES / INSTRUCTIONAL OBJECTIVES

Student will be able to:

- Concept of production system.
- Concept of Inputs.
- Concept of manufacturing process
- Study of production system. Select the method of production
- Production and Its Methods.
- Material Planning

IV. COURSE OUTCOMES

Student will be able to:

- Understand PRODUCTIVITY
- Understand PROUCTION AND ITS METHODS
- Understand PROCESS PLANNING
- Understand ROUTING AND SCHEDULING

V. CONTENT

UNIT NO.	TOPIC/SUB-TOPIC NO.	OUTCOMES	CONTENTS	TEACHING HOURS	MARKS
Unit I : INTRODUCTION	PROUCTION AND ITS METHODS	Student Should be able to :- • Define concept of production system • Explain manufacturing process. • Write about production system & • Various methods of production. • Point out material planning.	**Introduction :** To understand about production and Methods of production. Definition : Concept of production system. Concept of Inputs, manufacturing process. Concept of output. **Principles :** Principle of production system. Principles of job production. Principles of batch production & mass production. **Procedure :** Study of production system. Select the method of production. Select the inputs, manufacturing process to get desired output. **Exercise :** Describe the production system. Selection of the method of production for a given problem. Select the required inputs & manufacturing process to get desired output.	4	15
	PRODUCTIVITY	Student Should be able to :- • Introduce productivity &factors influencing productivity. • Explain about production and its methods. • Write process planning. • Explain about routing and scheduling.	**Introduction** : Overview of productivity & its influence in industry. **Definition :** Concept of productivity. Concept of factors influencing productivity. **Principles :** Principles of Productivity. Principles of productivity improvement. **Procedure :** Study the difference between production & productivity. Study the factors influencing productivity. **Exercise :** Describe the factors influencing the productivity.		

UNIT II : PRODUCTION PLANNING	MATERIAL PLANNING	Student Should be able to :- • Understand over view of store and inventory control. • Understand Necessity of storage space requirement. • Explain Types and Function of Stores. • Explain about economic order quantity (EOQ) model & its principle. • Draw store layout & store management. • Write about ABC analysis and principle of ABC curve plotting. • Explain Concept of Material requirement Planning and its principle. • Understand Master Schedule • Prepare bill of Material. • Explain principle of operating cycle.	**Introduction :** Overview of stores and inventory control. **Definition :** Concept of storing. Concept of centralize and decentralize store. Concept of economic order quantity.(EOQ) Concept of ABC analysis. Concept of inventory control with respect to cost reduction. Concept of EOQ model. **Principles :** Principle of store layout and store management. Principle of economical inventory. Principle of ABC curve plotting. Principle of EOQ model. **Procedure :** Store and store function. Storing procedure. Documentation of store. Meaning and importance of inventory control. EOQ models. Relationship of different cost and EOQ model. Derive formula and calculate EOQ model. ABC analysis and classification of items. Plotting curve. **Exercise :** Prepare a EOQ model for given data. Prepare a ABC curve for given data.	10	25

	MATERIAL PLANNING	Student Should be able to :- • Write overview of process planning & principles. • Explain economical sequencing. • Define resources. • Explain Quality Control & Principles of • Quality Control. • Write about Optimizing Sequence of • Process Planning. • Prepare working drawing.	**Introduction :** The overview of material planning and its importance. **Definition :** Concept of Material planning. Concept of Master schedule. Concept of Bill of material. Concept of Inventory. **Principles :** Principles of Material Requirement planning. Principles of operating cycle.(Convert cash into inventory. Convert inventory into receivables. Convert receivables into cash.) **Procedure :** Study the importance of material planning. Information required for material planning. Preparation of material requirement schedule. **Exercise :** Prepare one material sheet for given object.		

	PROCESS PLANNING	• Understanding the selection of manufacturing process, select machine, tool requirement for product development. • Select Operation Planning & Tooling	**Introduction :** Overview of process planning and a process sheet. **Definition :** Concept of process planning. Concept of information required for process planning. Concept of economical sequencing. Concept of resources. Concept quality control. **Principles** : Principles of process planning. Principles of optimising sequence of operations. Principles of resources. Principles of quality control. **Procedure :** Preparation of working drawings. Decision to make or buy. Selection of manufacturing process. Machine capacity & machine / equipment selection. Selection of material. Operation planning & Tooling requirement. Preparation of documents such as operation & route sheets. **Exercise :** Prepare one process sheet for given product.		
UNIT III : PRODUCTION CONTROL	ROUTING AND SCHEDULING	Student Should be able to :- • Define production control and its principle. • Explain routing and scheduling. • Understand Principle of routing and scheduling. • Understand critical ratio scheduling. • Explain generation of chart. • Understand analysis of product, number of unit, require material.	**Introduction :** Overview of routing and scheduling phases of production control. **Definition :** Concept of Routing. Concept of scheduling. Concept of critical ratio scheduling. Concept of production control. Concept of charts. **Principles :** Principles of production control. Principles of scheduling. Principles of critical ratio scheduling. Principles of Routing. Principles of generation of charts. **Procedure :** Analyse the product and then decide the number of items to be manufactured. Determine the required material and manufacturing. Verification of planned time and economical lot	6	15

		• Understand importance and objective of scheduling. • Explain use of control chart.	size. Reviewing the scrap factor. Importance and objective of scheduling. Effect of different manufacturing methods on scheduling. Use of control charts in scheduling. **Exercise :** Preparation of route sheet, machine control chart and order control chart.		
	LOADING, DISPATCHING AND FOLLOW UP	Student Should be able to :- • Understand Concept and Principles of Loading. • Requirement of dispatching & follow up. • Explain various chart like job charts, progress chart. • Necessity of audit. • Explain feasibility and production programme. • Understand value analysis. • Need of optimum utilization of man, machine & materials.	**Introduction :** Overview of loading, dispatching and follow up process. **Definition :** Concept of loading, dispatching & follow up. Concept of job cards. Concept of progress card. Concept of auditing .Concept of feasibility and production programme. Concept of value analysis. **Principles :** Principles of loading, dispatching & follow up. Principles of error finding. Principles of planning and re-planning Principles of tooling and gauges. Principles of quality control. Principles of optimum utilization of man, machine & material. Principles of balancing of plant to the existing load. Principles of delivery schedules. **Procedure :** Procedure for loading. Procedure for inspection. Procedure for dispatching. Procedure for follow up. **Exercise :** Prepare a one check list for given object.		
UNIT IV : ELEMENTS OF COST	COST STRUCTURE	Student Should be able to :- • Preparation of cost elements and break even analysis.	**Introduction :** Overview cost elements and break even analysis. **Definition :**	10	20

		• Calculate fixed cost, variable cost, labour cost, material cost, prime cost, factory cost & breakeven analysis. • Explain various cost related factors and draw graphical diagram of cost structure. • Preparation of graphs of breakeven point.	Concept of cost, fixed cost, variable cost, labour cost, material cost, prime cost, factory cost Concept of breakeven analysis. Concept of graphical representation. **Principles :** Principles of cost, fixed cost, variable cost, labour cost, material cost, prime cost, factory cost. Principles of comparison of cost. Principles of breakeven analysis. Principles of graphical representation. **Procedure :** Explain the various elements of cost. Show graphical diagram of cost structure. Show the graphs of Breakeven point. **Exercise :** To prepare a ladder of cost and graph for breakeven analysis.		
	OVERHEADS & DEPRECIATION	Student Should be able to :- • Understand overheads and depreciation. • Define concept of sinking fund method. • Explain straight line method. • Understand principle of allocation of overheads and depreciation & calculation. • Calculation of depreciation cost and overhead cost.	**Introduction :** Overview of allocation of overheads and depreciation. **Definition :** Concept of overheads. Concept of sinking fund method. Concept of depreciation. Concept of straight line method. **Principles :** Principles of allocation of overheads & Depreciation. Principles of calculations overheads & Depreciation. Principles of selection of method. **Procedure :** Procedure for calculating the overheads and procedure of allocation. Procedure for calculating the depreciation cost. **Exercise :** Calculation of depreciation cost and overhead cost.		

UNIT V : COST ESTIMATION	COMPONENTS OF JOB ESTIMATION	Student Should be able to :- • Application of cost estimation. • Define concept of pricing, profit and loss. • Explain realistic estimates. • Describe components of job estimate. • Understand drawing and component of cost with reference.	**Introduction :** Application of cost estimation, Estimation in Machining, Welding, Tool manufacturing, forging cost. **Definition :** Concept of estimate and cost. Concept of pricing. Concept f profit and loss. **Principles :** Principles of realistic estimates. Principles of proper selection of machines & other resources. Principles of cost comparison. Principles of cost. Principles of profit & loss. **Procedure :** Study the drawing. Explain various components of cost with. Reference to drawing. Describe components of job estimate (e.g. Cost of design, drafting, research & development, materials, labour, overheads etc.) **Exercise :** Describe the component of cost with reference to a drawing.	10	25
	ESTIMATING PROCEDURE AND ESTIMATION OF COST OF COMPONENT	Student Should be able to :- • Define estimating procedure and concept of drawing reading. • Estimate time by considering cutting parameters. • Calculate total cost. • Prepare list of elements estimates. • Explain EOQ model for given data. • Prepare a ABC curve for given data.	**Introduction :** Overview of estimating procedure **Definition :** Concept of drawing reading. Concept of manufacturing procedure. Concept of time estimation considering cutting parameters. Concept of estimation of cost, material cost, overhead cost. **Principles :** Principles of estimation. Principles of raw material estimation. Principles of selection of process planning. Principles of time estimation. Principles of overhead expenses. **Procedure :** Study the drawing. List out the elements of estimate. Calculate the material cost. Decide various machining operations. Estimate time for each operation. Add the allowances. Add the overhead expenses. Find out the total estimated cost. **Exercise :**		

			Estimate the cost of given component. (Tooling parts or a simple Tool may be taken)		

VI. REFERENCE BOOK

Sr. No.	Title	Author
1	Production Engineering, Estimating & costing	M. Adithan , B.S. Pale
2	Industrial Engineering & Management Science	T.R. Banga N.K. Agarwal S.C. Sharma
3	Project Management	Rory Burke
4	Industrial Engineering & Management	O.P. Khanna
5	Industrial Organization & Engineering Economics	T.R. Banga S.C. Sharma