Curriculum

for

Certificate Programme

In

TOOL AND DIE MAKER

for

Maharaja Ranjit Singh Punjab Technical University,
Bathinda (Punjab)

Prepared By:

Curriculum Development Centre
National Institute of
Technical Teachers Training and Research,
Sector 26, Chandigarh - 160 019

January**, 2017**

FOREWORD

Rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In order to cope with the challenges of handling new materials, machines and technologies, we have to develop human resources having appropriate competencies. There is an increasing demand of skilled workforce in India in particular and the world over in general. Under the new circumstances, India faces a challenging task of meeting the technical manpower requirement, especially in the area of skilled workforce to cater to industrial needs. Efforts have to be made so that pass outs from our technical institutions are acceptable at global level.

Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Technical institutions play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab to start the skill oriented integrated courses at certificate, diploma and degree level, as per the needs of the industry, are laudable.

In order to meet the future requirements of technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of technical programmes at various levels. The curricula for various programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of programme and various courses.

The success of any technical programme depends upon its effective implementation. However best the curriculum document is designed, if it is not implemented properly, the output will not be as per expectations. In addition to acquisition of appropriate physical resources, availability of motivated, competent and qualified faculty is equally essential for effective implementation of the curricula.

It is expected that MRSPTU will carry out curriculum evaluation on a continuous basis to identify the new skill requirements. At the same time, it is expected that innovative methods of course offering will be used to develop desired skills and infuse the much needed dynamism in the system.

Dr. M.P. Poonia
Director
National Institute of
Technical Teachers Training & Research
Chandigarh

PREFACE

Curriculum document is a comprehensive plan of an educational programme. It is through the curriculum that the educational objectives of a programme are achieved. It has to be ensured that the curriculum is dynamic, articulated, balanced, data based, feasible, and as per industrial needs. Curriculum Development Centre at NITTTR, Chandigarh has been extending services to technical education system of the states in northern region in developing and updating their curriculum on regular basis.

Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bathinda, Punjab assigned the project for developing the curriculum of some integrated programmes to this institute in the month of May 2016. A series of curriculum workshops were held during the months of June-July, 2016. This curriculum document is an outcome of the extensive discussions held with the representatives from various organizations, technical institutions and industry during the curriculum workshops. While developing the study and evaluation scheme and detailed contents, the following aspects have been kept in mind:

- Employment Opportunities of Certificate holders
- Job role of certificate holders
- Learning outcome of the Programme
- Mobility of students for their professional growth

We have taken cognizance of recommendation of experts both from industry and academic institutions and have adequately incorporated segments of Industrial Training in the curriculum. Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which units on Communication Skills have been introduced in both the semesters of the certificate course.

We hope that this curriculum document will prove useful in producing skilled manpower at desired level in the state of Punjab. The success of this outcome-based curriculum depends upon its effective implementation and it is expected that MRSPTU will make all efforts to create better facilities, develop linkages with the world-of-work and foster conducive and requisite learning environment as prescribed in the curriculum document.

Professor and Head
Curriculum Development Centre
NITTTR, Chandigarh

ACKNOWLEDGEMENTS

We gratefully acknowledge the assistance and guidance received from the following persons:

i) Vice Chancellor, Maharaja Ranjit Singh Punjab Technical University (MRSPTU), Bhatinda, Punjab for entrusting this project of curriculum design to NITTTR, Chandigarh.
ii) Director, College Development Council MRSPTU for his support and active involvement in the curriculum development.
iii) Director, National Institute of Technical Teachers' Training and Research, Chandigarh for his support and academic freedom provided to Curriculum Development Centre.
iv) All the experts from industry/field organizations, universities, ITIs and other technical institutions for their professional inputs during curriculum workshops.
v) Faculty from different departments of NITTTR, Chandigarh for content updation.
vi) Shri Yogendra Kaushal, Stenographer, Curriculum Development Centre, NITTTR, Chandigarh for processing the document.
vii) Shri Mohan Lal Bindal, Assistant, Curriculum Development Centre for his support and secretarial assistance in the conduct of curriculum design workshops.

Coordinator

1. SALIENT FEATURES OF THE PROGRAMME

1.	Sector	:	Capital Goods
2.	Name of the Certificate Programme	:	Tool and Die Maker
3.	Entry Qualification	:	Matriculation or equivalent NSQF Level as prescribed by MRSPTU, Bathinda
4.	Duration of the Programme	:	One Year
5.	Intake	:	30
6.	Pattern of the Programme	:	Semester Pattern
7.	NSQF Level	:	Level - III

2. JOB ROLE AND JOB OPPORTUNITIES

a) Job Role

A certificate holder in Tool and Die Maker is responsible for manufacturing, repair and maintenance of various types of press tools, jigs and fixtures and plastic moulds.

b) Job Opportunities

On successful completion of this course, the students will be gainfully employed in the following areas:

i) Various production and manufacturing industry.

ii) Maintenance sections of Govt. organizations/private/public sector.

iii) Automobile ancillary units

iv) Plastic process industry

v) Tool rooms

vi) Self employed.

3. LEARNING OUTCOMES OF THE PROGRAMME

After undergoing the programme, students will be able to:

1. Prepare and interpret drawings related to press tools, jigs and fixtures and plastic moulds.
2. Identify and handle different types of tools and instruments
3. Identify and use appropriate engineering materials
4. Follow safety precautions while working
5. Measure different parameters using various measuring instruments
6. Perform various types of bench works and fitting operations
7. Operate various machines like lathe, drilling, milling and grinding machine
8. Manufacture press tools, jigs & fixtures and plastic moulds
9. Repair and maintain various types of press tools, jigs & fixtures and plastic moulds
10. Apply basic principles of maths and physics in solving trade problems
11. Communicate effectively in English with others

4. STUDY AND EVALUATION SCHEME FOR CERTIFICATE PROGRAMME IN TOOL AND DIE MAKER

FIRST SEMESTER

CODE	UNITS	STUDY SCHEME Total Hours		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CMEE2-101	*Communication Skills	8	-	1	25	-	25	25	1	-	-	25	50
CMEE2-101P	*Communication Skills Lab.	-	24	1	-	25	25	-	-	50	3	50	75
CMEE2-102	Engineering Drawing (Tool and Die Maker)	-	-	1	-	-	-	75	3	-	-	75	75
CMEE2-102P	Engineering Drawing (Tool and Die Maker) Lab.	-	64	1	-	50	50	-	-	-	-	-	50
CMEE2-103	Engineering Materials and Heat Treatment	16	-	1	25	-	25	50	2	-	-	50	75
CMEE2-103P	Engineering Materials and Heat Treatment Lab.	-	16	1	-	50	50	-	-	100	4	100	150
CMEE2-104	Press Tools – I	32	-	2	25	-	25	50	2	-	-	50	75
CMEE2-104P	Press Tools – I Lab.	-	64	2	-	50	50	-	-	100	4	100	150
CMEE2-105	Tool Room Practice - I	32	-	2	25	-	25	50	2	-	-	50	75
CMEE2-105P	Tool Room Practice – I Lab.	-	256	8	-	100	100	-	-	100	4	100	200
CMEE2-106P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CMEE2-107P	+4 Weeks Industrial Training (during vacation)	-	-	4	-	-	-	-	-	100	3	100	100
Total		**88**	**472**	**26**	**100**	**300**	**400**	**250**	**-**	**450**	**-**	**700**	**1100**

* Common with other certificate programmes

\# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment and energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

\+ **Industrial Training**

After examination of 1st Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

Total weeks per semester = 16 Total working days per week = 5 Total hours per day = 7

Total Hours in a semester = 16 x 5 x 7 = 560

One credit is defined as one hour of lecture per week or two hours of practicals per week for one semester. Fractions in credits have been rounded to nearest integer.

SECOND SEMESTER

CODE	UNITS	STUDY SCHEME Total Hours		CREDITS	MARKS IN EVALUATION SCHEME								Total Marks
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
CMEE2-208	*Basic Sciences	48	-	3	25	-	25	50	2	-	-	50	75
CMEE2-209	Press Tools – II	24	-	2	25	-	25	50	2	-	-	50	75
CMEE2-209P	Press Tools – II Lab.	-	40	2	-	50	50	-	-	100	4	100	150
CMEE2-210	Jigs and Fixtures	16	-	1	25	-	25	50	2	-	-	50	75
CMEE2-210P	Jigs and Fixtures Lab.	-	32	1	-	50	50	-	-	100	4	100	150
CMEE2-211	Plastic Moulds	16	-	1	25	-	25	50	2	-	-	50	75
CMEE2-211P	Plastic Moulds Lab.	-	32	1	-	50	50	-	-	100	4	100	150
CMEE2-212	Tool Room Practice - II	16	-	1	25	-	25	50	2	-	-	50	75
CMEE2-212P	Tool Room Practice – II Lab.	-	288	9	-	100	100	-	-	100	4	100	200
CMEE2-213P	#Student Centred Activities (SCA)	-	48	2	-	25	25	-	-	-	-	-	25
CMEE2-214P	+4 Weeks Industrial Training	-	-	4	-	-	-	-	-	100	3	100	100
Total		**120**	**440**	**27**	**125**	**275**	**400**	**250**	**-**	**500**	**-**	**750**	**1150**

* Common with other certificate programmes

\# SCA will comprise of co-curricular activities like extension lectures on entrepreneurship, environment and energy conservation, sports, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

\+ **Industrial Training**

After examination of 2nd Semester, the students will go for training during vacation in a relevant industry/field organization for a minimum period of 4 weeks and will prepare a diary. The students will prepare a report at the end of training and will present it in a seminar. This evaluation will be done by concerned instructor in the presence of one industrial representative from the related programme/trade.

5. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 25 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

i. 5 Marks for general behavior and discipline
(by Principal in consultation with all the trainers)

ii. 5 Marks for attendance as per following:
(by the trainers of the department)

a)	75%	Nil
b)	75 - 80%	2 Marks
c)	80 - 85%	3 Marks
d)	Above 85%	5 Marks

iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)

a) 15 - National Level participation or inter-University competition

b) 10 - Participation in two of above activities

c) 5 - Participation in internal sports of the University

Note: There should be no marks for attendance in the internal sessional of different subjects.

UNIT – 1.1
Subject Code: CMEE2-101
COMMUNICATION SKILLS

LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:

- Speak confidently.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper prospective.
- Read various genres adopting different reading techniques.
- Respond to telephone calls effectively.

Practical (24 Hours)	**Theory (08 Hours)**
	Basics of Communication • Process of communication • Types of communication - formal and informal, oral and written, verbal and non-verbal • Objectives of communication • Essentials of communication • Barriers to communication (1 hour)
• Looking up words in a dictionary (meaning and pronunciation) (2 hours)	Functional Grammar and Vocabulary • Parts of speech • Tenses • Correction of incorrect sentences (2 hours)
• Self and peer introduction • Greetings for different occasions (1 hour)	Listening • Meaning and process of listening • Importance of listening • Methods to improve listening skills Speaking • Importance • Methods to improve speaking • Manners and etiquettes (2 hours)
• Newspaper reading (1 hour)	Reading • Meaning • Techniques of reading: skimming, scanning, intensive and extensive reading (1 hour)
• Vocabulary enrichment and grammar exercises • Exercises on sentence framing accurately (6 hours)	Functional Vocabulary - One-word substitution - Commonly used words which are often misspelt - Punctuation - Idioms and phrases (2 hours)

• Reading aloud articles and essays on current and social issues • Comprehension of short paragraph (5 hours)	
• Write a short technical report • Letter writing (3 hours)	
• Participate in oral discussion • Respond to telephonic calls effectively • Mock interview (6 hours)	

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

UNIT - 1.2
Subject Code: CMEE2-102
ENGINEERING DRAWING (TOOL AND DIE MAKER)

LEARNING OUTCOMES:
After undergoing this unit, students will be able to:

- Draw free hand sketches of various objects.
- Read and apply different dimensioning methods on drawing of objects.
- Prepare and read assembly drawings of various tools.

Practical (64 hrs)	**Theory** (Theory part should be covered along with drawing exercises)
• Practical demonstration with the help of blue prints/computer prints. (3 hrs)	Engineering drawing and its importance
• Demonstration of Drawing board, T-square, mini-drafter, set squares, protractor, drawing instrument box, pencils of different grades, erasing shield • Practice on folding of blue print/drawing prints • Identification of various sizes of drawing sheets • Preparation of A2/A1 sheet for preparing drawings. (4 hrs)	Introduction to drawing instruments
• Practice on different types of lines (6 hrs)	• Introduction to various lines
• Practice on writing alphabets and numerals in capital/lower case as per IS: 9609 in vertical and inclined style: (3 hrs)	• Lettering and numbering: Study styles of lettering, spacing of letters, standard heights and widths.
• Practice of free hand sketch of an object in orthographic and isometric views. (6 hrs)	• Introduction to isometric and orthographic views.
• Study and practice of 1st and 3rd angle projections • Practice on drawing of isometric views (6 hrs)	• Introduction to 1st and 3rd angle projections
• Representation of tolerances on engineering drawing (6 hrs)	• Concept of limits, fits and tolerances
• Preparation of fully dimensioned and toleranced drawings (10 hrs)	
• Preparation of detailed drawings and assembly drawings of various tools (10 hrs)	

• Practice on reading drawings of various assemblies of tools (10 hrs)	

Note: There will not be any Theory Examination.

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Sketching
- Drawing

UNIT - 1.3
Subject Code: CMEE2-103
ENGINEERING MATERIALS AND HEAT TREATMENT

LEARNING OUTCOMES:

After undergoing this unit, the students will be able to:

- Select materials as per use/requirement of component.
- Perform various tests of heat treatment.
- Use hardness testing machine.

Practical (16 hours)	**Theory (16 hours)**
	• Basic concept and importance of Engineering materials (1 hr)
• Visual identification of various specimens of metals and alloys (1 hr)	• Properties of materials: Physical and mechanical properties like colour, weight, strength, elasticity, plasticity, ductility, brittleness, hardness, toughness etc. (2 hrs)
• Identification of materials into: ▪ Metal – Non metals ▪ Ferrous – Non Ferrous Metals ▪ Ferrous – Non Ferrous Alloys (1 hrs)	• Types of metals: Ferrous and nonferrous metals, difference between ferrous and nonmetals, difference between metal and nonmetal, ferrous and non-ferrous alloys (2 hrs)
• Study of composition of various types of steels used for tool and die • Market survey on availability of different materials (1 hr)	• Tool and die materials: Introduction to tool and die materials, classification, properties, colour coding and applications (3 hrs)
	• Iron carbon diagram: Introduction, heating and cooling of various phases and their constituents, classifications of iron, steel and cast iron into groups, different structure of steels (4 hrs)
• Hardening of pillars and bushes of die set and their hardness checking • Annealing of die steel (8 hrs)	• Heat Treatment Processes: Annealing, normalizing, hardening, tempering, case hardening and its methods (2 hrs)
	• Furnaces and equipment: Common furnaces used in heat treatment; defects during heat treatment, their causes and prevention (1 hr)
• Hardness testing of various specimens of heat-treated materials (5 hrs)	• Working principle and applications of Rockwell hardness testing machine and different hardness scales (1 hr)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Viva-voce

UNIT - 1.4
Subject Code: CMEE2-104
PRESS TOOLS - I

LEARNING OUTCOME:
After undergoing this unit, the students will be able to:

- Prepare and read drawings of different operations done in press tools
- Identify different components of press tool
- Explain the functions of different parts of press tool

Practical (64 hours)	**Theory (32 hours)**
• Study and demonstrate functions of different types of components used in press tool (4 hours)	Introduction to tooling: • Press tools • Moulds for plastics • Die casting dies • Jigs • Fixtures (3 hours)
• Sketching of press tool operations i.e. blanking, piercing, cutting off, parting off, perforating (24 hours)	• Types of press tools: progressive tool and compound tool; Press tool operations: blanking, piercing, cutting off, parting off, perforating, trimming, notching, shaving, lancing (5 hours)
• Study and demonstrate the functions of embossing, coining, bending, forming drawing, curling, combination tool, bulging, swaging, flaring (12 hours)	• Introduction to embossing, coining, bending, forming drawing, curling, combination tool, bulging, swaging, flaring (3 hours)
• Preparation of drawings showing the alignment of punch and die (12 hours)	Cutting clearance: • Optimum cutting clearance • Excessive cutting clearance • Insufficient cutting clearance • Misalignment between punch and die • Burr side (3 hours)
• Draw and indicate the angular clearance of the die part (4 hours)	Relation of blank size with respect to punch and die: • Worked out examples Land and angular clearance: • Land • Angular clearance • Die with ejector • Grid plate tool (parts and function) (6 hours)
• Draw strip layout and stock of material (4 hours)	Cutting forces: • Methods of reducing cutting forces • Cutting forces worked out examples Stock material: • Strip lay out

	• Punches • Dies (6 hours)
• Draw various types of stoppers and stripper plates (4 hours)	Stoppers: • Function of stoppers • Classification of stoppers • Stop position • Registry position • Types of stops Strippers: • Types of strippers • Stripping force • Stock material • Surface condition of side walls (6 hours

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

UNIT - 1.5
Subject Code: CMEE2-105
TOOL ROOM PRACTICE - I

LEARNING OUTCOMES:

After undergoing this unit, the students will be able to:

- Use lathe machine for turning, taper turning and drilling
- Use tap and die to cut threads
- Use pedestal grinder for grinding angular part
- Use single point cutting tool and twist drill
- Prepare assembly by fitting

Practical (256 hours)	**Theory (32 hours)**
Workshop Safety • Demonstration of safety of equipment and use of fire extinguishers, first aid kit and operation of electrical mains • Practice on use of scale, vernier caliper, micrometer, depth gauge, height gauge, surface plate, angular plate • Practice on use of plug gauge, ring gauge, thread gauge etc. (8 hours)	• Importance of workshop safety and safe procedures • Disposal of workshop waste such as chips, coolant etc. • Introduction to various measuring instruments and tools (2 hours)
Bench Work • Setting of vice height, fixing of the job • Practice on use of aluminium jaws for soft material of work pieces • Practice on use of different files and chisels • Holding of different shapes in bench vice-filing flat surfaces and edges for maintaining 90^0 angle • Checking the dimensions and angles using scale, tri-square, vernier calliper • Use of surface plate, surface gauge, scribers, punches, hammer • Marking out of parallel lines using odd leg calliper and use of centre punch • Filing within accuracy of ± 0.2 mm • Filing 45^0 chamfer on all edges of work piece • Filling external radius and checking with radius gauge (30 hours)	• Bench vices - introduction of bench-vices, types and their uses • Hacksaw – type and use of hacksaw frame and blades • Types of hammers and their applications • Files – types of files, material of files, use of various files (5 hours)
Drilling Machine • Marking on rectangular work pieces • Centre punching • Centre drilling • Through drilling • Counter drilling • Counter sinking • Tapping and reaming (20 hours)	• Types of drilling machines • Selection of cutting parameters for different material and calculation of machining time. • Drills – types, twist drill and its nomenclature (3 hours)

Step Filing • Marking for chiseling • V-shape chiseling • Step filing with specified dimensions and tolerances • Radius filing • Assemble by filing of triangular and square filing (40 hours)	• Types of files and specifications of files • Types of gauges and their applications • Different types of chisels and their uses (5 hours)
Pedestal Grinder • Wheel balancing and mounting • Dressing of grinding wheel • Centre punch grinding • Square shape work piece grinding to demonstrate different tool angles (20 hours)	• Description of pedestal grinder • Balancing and mounting of grinding wheel • Introduction to dressing of grinding wheel • Loading and glazing of grinding wheel (3 hours)
Lathe • Holding of job in three jaw chuck and collets • Holding in 4 jaw chuck and turning • Centering of cutting tool • Step turning • Grooving • Shouldering • Facing • Parting and chamfering • Knurling • Drilling and boring threading • Taper turning • Lathe tool grinding by hand (108 hours) **MILLING**: **Practice on:** • Holding of rectangular job on vice • Holding of cutter i.e. shell and mill • Six sides milling to shape rectangular • Step milling (30 hours)	• Introduction to lathe and its types • Description of different parts of lathe • Selection of RPM, feed, depth of cut and calculation of machining time. • Different types of tool posts • Introduction to single point cutting tool and its geometry • Tool materials • Recommended cutting parameters for different materials • Introduction to threading on lathe • Introduction to taper turning and method for taper turning • Concept of lubrication, lubricant and coolant types and its application. (12 hours) • Introduction to milling machine and its types • Types of milling cutters and its material • Different types of work holding devices • Holding technique of cutters • Different types of milling processes i.e. Up milling and down milling • Calculation of cutting speed and feed (2 hours)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

Subject Code: CMEE2-107
INDUSTRIAL TRAINING – I (4 Weeks)

The purpose of industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through first-hand experience to enable them to use and apply institute based knowledge and skills to perform field activities
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks have been provided in the study and evaluation scheme of 1st semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 20%
b) Industrial training report 50%
c) Presentation and viva-voce 30%

UNIT – 2.1
Subject Code: CMEE2-208
BASIC SCIENCES

LEARNING OUTCOMES:
After undergoing this unit, the students will be able to:

- Apply the basic principles of maths in solving the basic problems of the trade.
- Apply the basic principles of physics in solving the basic problems of the trade.

Practical	Theory (48 Hours)
	Mathematics • Basic Algebra – algebraic formula. Simultaneous equation – quadratic equations (4 hours) • Simultaneous linear equation in two variables (3 hours) • Arithmetic and geometric progression, sum of n-terms, simple calculations. (3 hours) • Mensuration – Find the area of regular objects like triangle, rectangle, square and circle; volumes of cube, cuboid, sphere cylinder (6 hours) • Trigonometry - Concept of angle, measurement of angle in degrees, grades and radians and their conversions, T-Ratios of Allied angles (3 hrs) • Co-ordinate Geometry - Cartesian and polar coordinates, conversion from cartesian to polar coordinates (2 hrs) • Concept of Differentiation and Integration (3 hrs)
	Physics • FPS, CGS, SI units, dimensions and conversions (2 hours) • Force, speed, velocity and acceleration – Definition, units and simple problems (3 hours) • Stress and strain, modulus of elasticity (2 hours) • Heat and temperature, its units and specific heat of solids, liquids and gases (4 hours) • Electricity and its uses, basic electricity terms and their units, D.C. and A.C.,

	positive and negative terminals, use of switches and fuses, conductors and insulators (5 hours) • Work, Power and Energy-Definition, units and simple problems (4 hours) • Concept of force, Inertia, Newton's First law of motion; momentum and Newton's second law of motion; Impulse; Newton's third law of motion. (2 hrs) • Friction and Lubrication (1 hour) • Law of conservation of energy (1 hour)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making

UNIT - 2.2
Subject Code: CMEE2-209
PRESS TOOLS – II

LEARNING OUTCOME:
After undergoing this unit, the students will be able to:

- Prepare and read drawings of different operations done in press tools
- Identify different components of press tools like bending and progressive tool
- Explain the functions of different components used in press tool

Practical (40 hours)	**Theory (24 hours)**
• Preparation of drawings of various pilot profiles (3 hours)	**Pilots:** • Purpose of pilots, size of pilots, length of pilots, pilot opening in the bottom plate, pilot nose profiles, pilots in punches, types of pilots, methods of piloting, direct and indirect piloting (4 hours)
	Side Cutter: • Purpose, advantages of using side cutters (2 hours)
• Preparation of sketches of shanks (2 hours)	**Shanks:** • Types, location of shank on a tool, calculation method and graphical method (polygon systems) (3 hours)
• Preparation of drawings of top plate, bottom plate, guide plate, stripper plate, guide bushes • Position of pillar (10 hours)	**Die Sets:** • Classification material, parts (top and bottom plate, guide pillar and guide bushes), types of die set, standard and non-standard, shut height (3 hours)
• Preparation of sketches of blanking tool and piercing tool (10 hours)	**Blanking Tool:** • Parts and function **Piercing Tools:** • Parts and function (3 hours)
• Preparation of drawings of ejectors and shedders (5 hours)	**Ejectors and shedders:** • Types of shedders, types of ejectors, direct and indirect knock outs (2 hours)
• Preparation of drawings of compound dies (6 hours)	**Compound Dies:** • Construction, parts and their function (2 hours)
	Principles of Bending: • Various elements of bend angles, blank length calculation, plastic deformation and various stress bending formulae • Radius of bend, radius minimum formula and calculation constant and worked examples (3 hours)

• Preparation of drawing of V-bending tool (4 hours)	**V-Bending Tool:** • Construction, parts, bending formula, worked examples (2 hours)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

UNIT - 2.3
Subject Code: CMEE2-210
JIGS AND FIXTURES

LEARNING OUTCOMES

After undergoing this unit, student will be able to:

- Identify different parts of drill jig
- Prepare, read and interpret drawings related to simple plate type drill jig
- Select appropriate material for jigs and fixtures
- Select clamps, locators and ejectors for given applications

Practical (32 hrs)	**Theory (16 hrs)**
• Partwise drawings of drilling jig • Demonstration of drilling jig (4 hrs)	• Jigs and Fixtures - Introduction, types, difference, advantages and disadvantages, economy and cost (2 hrs)
• Drawing of clamping and tool guiding elements • Demonstration of clamps and tool guiding (4 hrs)	• Jigs and fixtures construction, elements of jigs and fixtures and its material. Locating elements, clamping elements, tool guiding element [jigs] and cutter setting element [fixture] (2 hrs)
• Draw detailed drawing of milling fixture (4 hrs)	• Indexing and rotary elements, body, base or frame, fastening parts (2 hrs)
• Preparation of drawing of direction of movements • Preparation of drawing of indexing fixtures (4 hrs)	• Method of restricting the possible movements [principle of 3-2-1 pin method, locating method. Direction of movement (2 hrs)
• Draw drawing of different types of locators (4 hrs)	• Locating devices, its material, types of locator, locator for flat surface (2 hrs)
• Demonstration of various types of ejectors and clamps. (4 hrs)	• Ejectors, clamping devices, types of clamps for jigs and fixtures. Quick clamping material for ejector and clamps. (2 hrs)
• Drawing of different types of bushes (4 hrs)	• Method of removing chip from jigs and fixture. Drill bushes such as fixed bush, liner bush, slip bush. Bush material and its heat treatment. (2 hrs)
• Drawing of different types of jigs and fixture (4 hrs)	• Types of fixtures. Functions and types of cutter guide in a fixture (2 hrs)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

UNIT - 2.4
Subject Code: CMEE2-211
PLASTIC MOULDS

LEARNING OUTCOMES:
After undergoing this unit, students will be able to:

- Read and interpret drawings related to plastic moulds
- Identify different components of injection moulding machine
- Differentiate between working mechanism of different moulding processes
- Select appropriate material for different parts of moulds

Practical (32 hrs)	**Theory (16 hrs)**
• Identification and testing of different types of plastic materials (1 hr)	Introduction to different plastic materials and their properties: • Thermosetting materials and their types • Thermoplastic materials and their types (1 hr)
• Demonstration of various moulding processes on different moulding machines as per availability of machines (2 hrs)	Introduction to moulding processes: • Injection moulding • Blow moulding • Compression moulding • Transfer moulding • Extrusion moulding • Thermoforming process (2 hrs)
Demonstration of "Injection Moulding Machine" i.e. • Working • Parts • Mechanism • Setting of parameters • Moulding cycle (2 hrs)	• Introduction to injection moulding machine, its working, mechanism and specifications • Parts and their functions (1hr)
Hands on practice on "Injection Moulding Machine" i.e. • Moulding cycle • Draw parts of injection moulds (core, cavity, bush, pillers) (6 hrs)	Injection Moulding Process: • Parts of injection mould, material and heat treatment • Principle of injection mould • Moulding defects • Types of injection moulds (single and multi-cavity moulds) (3 hrs)
• Draw register ring, sprue bush and ejection system (6 hrs)	• Introduction and function of feeding system • Sprue, register, ring, runner and gate • Ejection system of injection moulding and its types • Pin ejection • Sleeve ejection • Blade ejection • Air ejection (2 hrs)

• Drawing of different types of runners system (4 hrs)	Types of runner and its design and construction: • Main runner • Sub runner • Cold slug • Runner geometry (full round, half round, trapezoid) (2 hrs)
• Drawing of different types of gates (4 hrs)	Types of gates in Injection Moulding: • Tab gate • Fan gate • Pin gate • Sub gate • Film gate • Edge gate • Submarine gate (2 hrs)
• Draw two plate moulds for simple components (6 hrs)	Introduction to two plate and three plate moulds: • Single cavity moulds • Multi cavity moulds (2 hrs)
• Demonstration on maintenance and restoration of injection moulds (1 hr)	• Maintenance and restoration of injection moulds • Storage, safety and transportation of moulds (1 hr)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

UNIT - 2.5
Subject Code: CMEE2-212
TOOL ROOM PRACTICE – II

LEARNING OUTCOME:
After undergoing this unit, the students will be able to:

- Use milling and grinding machines to produce components for press tool, injection moulds, jigs and fixtures
- Use different types of accessories in milling and grinding operations
- Apply various manufacturing techniques of press tools, hand injection moulds, jigs and fixtures
- Measure precise components by tool maker microscope

Practical **(288 hours)**	**Theory** **(16 hours)**
Milling Practice on: • Angular milling • Dovetail milling • Fixing of rotary table • Radius milling outside and inside • Fixing • Drilling on milling machine techniques • Indexing (72 hours)	• Different types of milling attachment i.e. Vertical milling attachment, rotary table, dividing head (simple and universal) • Indexing methods – direct and compound indexing (2 hours)
Grinding • Procedure for using magnetic table for surface grinding • Procedure for holding job in cylindrical grinding - by collet - by 3-jaw chuck - holding in between centres • Surface grinding of parallel and perpendicular sides of a plate • Setting for external and internal grinding • Uses of universal vice for angular grinding • Achieving interference and sliding fit between pillar & plate and pillar & bush (80 hours)	• Introduction of grinding process • Types of grinder - surface - cylindrical - tool and cutter grinder • Types of grinding wheel, shape and materials • Identification of grinding wheel • Grinding wheels' abrasive, bond and its grade • Introduction to wheel balancing, mounting and tracing of it • Glazing and trucing in grinding wheel • Selection of grinding wheel w.r.t. materials (2 hours)
Die Set Manufacturing • Manufacturing of top and bottom plate • Thrust plate, stripper plate • Pillar and bush • Assembly of die set (20 hours)	• Introduction of die set and its types • Different elements used in die set • Introduction of duel pin and its purpose • Type of fitting allowance in pillar and bush (2 hours)
Jigs and Fixtures • Manufacturing of simple plate type drilling jig • Manufacturing of simple milling fixture	• Introduction of jigs and fixtures • Elements of jigs and fixtures • Types of jigs and fixtures • Introduction and uses of elements such as

(32 hours)	clamping, locating, tool guiding (jigs), cutter setting (fixtures), base plate, body of jigs and fixtures, fastening • Degree of freedom • Uses of ejectors • Different types of drilling bushes (i.e. fixed type, linear type, slip type etc) (4 hours)
Press Tool • Manufacturing of blanking tool or piercing tools (48 hours)	• Introduction of metal cutting and its types i.e. shearing by press tools and shearing machine • Effect of shearing pressure • Effect of burrs and its direction • Introduction of shearing machine and its types • Working principle of shearing machine • Difference between cutting and shearing • Description of blaring tool, compound tool and progressive tool • Strip size calculation • Strip layout • Selection of material for press tool • Importance of clearances and its calculation (3 hours)
Plastic Mould • Manufacturing of hand injection mould (36 hours)	• Introduction of different types of moulds i.e. injection, compression and transfer mould • Different parts of moulds • Effects of runners and gate • Types of runners • Types of gates • Effects of runners on gate (3 hours)

Means of Assessment

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce
- Workshop job

Subject Code: CMEE2-214
INDUSTRIAL TRAINING – II (4 Weeks)

The purpose of industrial training is to:

- Develop understanding regarding the size and scale of operations and nature of industrial/field work in which students are going to play their role after completing the courses of study.
- Develop confidence amongst the students through first-hand experience to enable them to use and apply institute based knowledge and skills to perform field activities
- Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

It is needless to emphasize further the importance of Industrial Training of students during their one-year certificate programme. It is industrial training, which provides an opportunity to students to experience the environment and culture of world of work. It prepares students for their future role as skilled person in the world of work and enables them to integrate theory with practice.

An external assessment of 100 marks have been provided in the study and evaluation scheme of 2nd semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

The instructor along with one industrial representative from the concerned trade will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 20%

b) Industrial training report 50%

c) Presentation and viva-voce 30%

7. RESOURCE REQUIREMENT

7.1 LIST OF TOOLS/EQUIPMENT

a) TRAINEES TOOL KIT FOR 30 TRAINEES +1 INSTRUCTOR

Sr. No.	Names of the Items	Quantity
1.	Steel Rule 150 mm English and Metric combined	31 Nos.
2.	Engineer's Square 150 mm with knife edge	31 Nos.
3.	Hacksaw frame for 200-300 mm blade	31 Nos.
4.	Centre punch 100 mm	31 Nos.
5.	Prick punch 150 mm	31 Nos.
6.	File flat bastard 300 mm	31 Nos.
7.	File flat 2nd cut 250 mm	31 Nos.
8.	File flat safe edge 200 mm	31 Nos.
9.	File triangular smooth 200 mm	31 Nos.
10.	File card	31 Nos.

b) TOOLS AND EQUIPMENTS

Sr. No.	Names of the Items	Quantity
1.	Calliper inside spring type-150 mm	6 Nos.
2.	Calliper outside spring type-150 mm	6 Nos.
3.	Divider spring type – 150 mm	6 Nos.
4.	Odd leg calliper firm joint 0- 150 mm	3 Nos.
5.	Screw driver – 150 mm	4 Nos.
6.	Screw driver – 200 mm	5 Nos.
7.	Centre gauge 55°and 60°	3 Nos.
8.	Oil can 250 ml	6 Nos.
9.	File flat smooth 200 mm	6 Nos.
10.	File flat smooth with safe edge 200 mm	6 Nos.
11.	File half round bastard 300 mm	6 Nos.
12.	File half round smooth 250 mm	6 Nos.
13.	File triangular bastard 250 mm	6 Nos.
14.	File triangular smooth 200 mm	6 Nos.
15.	File round bastard 250 mm	6 Nos.
16.	File square bastard 300 mm	6 Nos.
17.	File square smooth 250 mm	6 Nos.
18.	Knife edge file 150 mm	6 Nos.
19.	Needle file assorted (12 nos.) 150 mm	6 Nos.
20.	Scraper flat 250 mm	6 Nos.
21.	Hammer Ball Peen 0.5 kg with handle	10 Nos.
22.	Hammer Cross Peen 0.75 kg with handle	10 Nos.
23.	Chisel cold flat 18 x 150 mm	10 Nos.
24.	Calliper inside spring type-150 mm	6 Nos.
25.	Chisel Cross Cut 10 x 3 x 200 mm	6 Nos.
26.	Chisel Half Round 10 x 250 mm	6 Nos.
27.	Chisel diamond point 10 x 200 mm	6 Nos.

28.	Scribing block universal 300 mm	6 Nos.
29.	Cast Iron Surface plate 600 x600 mm	1 No.
30.	Granite Surface plate 600 x 600 x 80 mm	1 No.
31.	Tap extractor 3 mm to 12 mm x 1.5 mm (ezzy out)	1 Set
32.	Screw extractor sizes 1 to 8	1 Set
33.	Taps and dies metric 5 mm to 12 mm complete set in a box	4 Sets
34.	Twist Drill with St. Shank Ø 5 to Ø 12 mm in steps of 0.5 mm	4 Sets
35.	Twist Drill St. Shank Ø 8 mm to Ø 12 mm in steps of 1 mm	4 Sets
36.	Taper shank drills Ø 6 mm to Ø 20 mm in steps of 1 mm	2 Sets
37.	D.E spanners 3-4 , 6-8, 10-12, 13-14, 15-16, 18-19, 20-22, 24-26 (8 spanners)	4 Sets
38.	Letter punch 5 mm set	2 Sets
39.	Number punch 5 mm set	2 Sets
40.	Drill chuck 12 mm capacity with key	6 Nos.
41.	Allen key metric 3 to 12 mm set	6 Sets
42.	Centre drills 3, 4,5 mm	6 Each
43.	Parallel hand reamer 6 mm to 12 mm in steps of 1 mm	3 Sets
44.	Star dresser	4 Nos.
45.	Diamond dresser with holder	4 Nos.
46.	Safety goggles (Personal Protective Equipments)	6 Nos.
47.	Demagnetizer	2 Nos.
48.	Snips 200 mm blade	2 Nos.
49.	Workbench 240 cm x 120 cm x 75 cm with 150 mm vice(Each bench fitted with 4 vices)	6 Nos.
50.	Bench Vice 200 mm	4 Nos.
51.	Steel lockers for 31 trainees (Pigeon Cup Board)	2 Nos.
52.	Steel cupboard 180 cm x 60 cm x 45 cm	6 Nos.
53.	Metal rack 180 cm x 60 cm x 45 cm	2 Nos.
54.	Fire extinguisher	2 Nos.
55.	Fire buckets with stand	4 Nos.
56.	Feeler gauge 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm (13 leaves)	2 Sets
57.	Metric Screw pitch gauge-Range 0.4 -6 mm pitch 60° (21 leaves)	2 Sets
58.	Radius gauge 1 - 3 mm by 0. 25 mm and 3.5-7mm by 0.5 mm (34 leaves)	2 Nos.
59.	Vernier height gauge - Range 300 mm, with 0.02 mm least count	2 Nos.
60.	Universal vernier calliper-Range 200 mm, with 0.02 mm least count	2 Nos.
61.	Dial vernier calliper 0-200 mm, with 0.02 mm least count	10 Nos.
62.	Vernier calliper-Range 300 mm Vernier scale 0.02 mm	6 Nos.
63.	Vernier bevel protractor-Blade range 150 and 300 mm, dial 1°, least count 5’ (min.) with head, Acute Angle attachment	6 Nos.
64.	Outside micrometer 0-25 mm, with 0.01 mm least count	2 Nos.
65.	Outside micrometer 25-50 mm, with 0.01 mm least count	4 Nos.
66.	Outside micrometer 50-75mm, with 0.01 mm least count	2 Nos.
67.	Combination square sets-300 mm blade with square head, centre head, protractor head	2 Nos.
68.	Telescopic gauge range 8 -150 mm (6 pcs/set)	2 Nos.

69.	Sine bar 150 mm with stopper plate	2 Nos.
70.	Sine table 200 mm length with magnetic bed	2 Nos.
71.	Slip Gauge Box (workshop grade) -87 pieces per set	2 Nos.
72.	Gauge block accessories consisting holders, half round jaws, scriber point, centre point , triangular straight edge (14 pcs/set)	2 Nos.
73.	Central square – Size 400 x 250 mm blade	2 Nos.
74.	V-Block-Approx. 32 x 32 x 41 mm with clamping capacity of 25 mm with clamps	6 Pairs
75.	V-Block-Approx 65x65x80 mm with clamping capacity of 50 mm with clamps	4 Pairs
76.	Magnetic V-Block 100x100x125 mm	4 Pairs
77.	Angle plate 150 x 150 x 200 mm	2 Nos.
78.	Angle plate-adjustable 250x250x300 mm	2 Nos.
79.	Inside micrometer – Range 50-75mm with std extension rods upto 200mm..	1 Set
80.	Depth micrometer – Range 0-25 mm, accuracy 0.01 mm with std set of extension rods.	1 Set
81.	Magnetic stand with magnetic base 60 x 47.5 mm and with universal swivel clamp, dial holding rod (150 mm) scriber	4 Nos.
82.	Dial test indicator-Lever type- Range 0-0.8 mm –Graduation 0.01mm, reading 0-50-0 with accessories	2 Nos.
83.	Dial test indicator – Plunger type-Range 0-10 mm , Graduation 0.01 mm, Reading 0-100 with revolution counter	2 Nos.
84.	Bore gauge with dial indicator (1 mm range, 0-0.01 mm graduation)-Range of bore gauge 18-150 mm	2 Sets
85.	Straight edge-Single beveled-Size 150 mm and 250 mm	2 each
86.	Tool makers clamp 50 mm & 75 mm	4 Nos. each
87.	C – clamp- 50 mm & 75 mm	10 Nos.each

c) CUTTING TOOLS

Sr. No.	Names of the Items	Quantity
1.	Side and face milling cutter Ø 100 x 10 X Ø 27 mm	4 Nos.
2.	Side and face cutter Ø 80 x 10 X Ø 27 mm	4 Nos.
3.	Cylindrical milling cutter Ø 63 x 70 x Ø 27 mm	4 Nos.
4.	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	3 Nos.
5.	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	3 Nos.
6.	Single angle cutter Ø 75 x 16 x Ø 27mm - 60°	4 Nos.
7.	Single angle cutter Ø 75 x 20 x Ø 27 - 45°	4 Nos.
8.	Equal angle cutter Ø75x 30 x Ø 27 - 90°	4 Nos.
9.	Shell End Mill Ø 50 x 36 x Ø 22 (preferably inserted tip type)	6 Nos.
10.	Shell End Mill Ø 75 mm x 50 x Ø 22 (preferably inserted tip type)	6 Nos.
11.	Parallel shank end mills Ø6, Ø10 and Ø 16 are (double fluted), Ø 20 mm & Ø25mm (four fluted)	10 Nos.each
12.	'T' slot cutter with parallel shank- Ø 17.5 x 8 mm width x dia. of shank 8 mm	3 Nos.
13.	Concave Milling cutter Ø 63 x 6 radius x Ø 27 mm	2 Nos.
14.	Convex Milling cutter Ø 63 x 6 radius x Ø 27 mm	2 Nos.

15.	Disc type form milling cutter (involutes form -2 module, 20° pressure angle)	2 Sets
16.	Tool holder (straight) to suit 6, 8 mm sq. bit size	2 Nos.each
17.	Parting tool holders to suit 3 and 4 mm thick tool blade.	3 Nos.
18.	Boring bars with holders to accommodate 4, 6 and 8 mm HSS tool bits	6 Nos.each
19.	Knurling tool (straight & diamond)	4 Nos.each
20.	Tool bits, inserts, carbide tool bits, reamers, special counter bore, counter sink tools(CNC tooling setup)	as reqd.

d) GENERAL MACHINERY AND INSTALLATION

Sr. No.	Names of the Items	Quantity
1.	Sensitive drilling machine - capacity 12 mm Motorized –with drill chuck and key etc.	2 Nos.
2.	Pillar/column type Drilling machine – 25 mm capacity-motorized with drill chuck & key etc.	2 Nos.
3.	Radial Drill machine to drill up to 32 mm diameter.	1 No.
4.	Power hacksaw machine to accommodate 21” or more length blade.	1 No.
5.	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough wheel)	2 Nos.
6.	SS and SC centre lathe (all geared) with minimum specification as: Centre height 150 mm and centre distance 1500 mm along with 3 & 4 jaw chucks, auto feed system, safety guard, taper turning attachment, motorized coolant system, lighting arrangement & standard accessories.	5 Sets
7.	Shearing machine (lever type)hand operated complete with 300 mm blade length	1 No.
8.	<u>Universal Milling Machine</u> Longitudinal traverse 700 - 800 mm Cross traverse 300 - 400 mm Vertical traverse 200 - 350 mm Swivel of table on either side 45° Speed range rpm 30 to 1800 With universal dividing head, circular table, long arbors, slab arbor, slotting attachment, vertical indexing head, etc.	2 Nos.
9.	<u>Horizontal and Vertical milling machine</u> Vertical Horizontal **Table** Length x width 1350x310 mm Longitudinal traverse 700 - 800 mm Cross traverse 200 - 265 mm Vertical traverse 300 - 400 mm Speed range rpm 20 to 1800	2 Nos. 1 No.

10.	Hydraulic Surface Grinding Machine **Table** Clamping area 600 x 178 mm Grinding area 400 x 200 mm Distance table-centre of spindle 400 - 500 mm Table speed 1-25 m/min. With standard accessories like dust extractor with water separator, balancing device, table-mounted Radius-tangent wheel dresser, wheel flanges, etc.	3 Nos.
11.	Tool and Cutter Grinder Largest diameter of cutter that can be ground 10-100 mm Max. admit between centers 230 mm Max. length of cutting edges ground 120 mm With standard equipment like adaptor bushes, cutter head holder assembly, adaptors, extension spindle, flanges fro grinding wheel, etc.	1 No.
12.	Universal cylindrical Grinding Machine Max. dia ground (effective) 250 mm Max. grinding length 300 mm Height of centre 130 mm Max. distance between centers 340 mm With special accessories like face plate, steady, radius and face dressers, find hand feed attachment etc.	1 No.
13.	Fly press 5 ton capacity	1 No.
14.	Muffle furnace – heating chamber 300 x 300 x 450 mm for 1050^{o}C Quenching tank-600 x600 x 600 mm	1 No.
15.	Rockwell hardness testing machine with standard accessories	1 No.
16.	Hydraulic press 16T with all safety measures	1 No.

7.2 LIST OF CONSUMABLES

1.	Different types of die steel	As required
2.	Different types of blanks	As required
3.	Different types of punches	As required
4.	Different types of milling cutters	As required
5.	Different types of die blocks	As required
6.	Different types of punch plates	As required
7.	Different types of blank punchs	As required
8.	Different types of pierce punchs	As required
9.	Different types of stripper plates	As required
10.	Hydraulic oil	As required

7.3 LIST OF RECOMMENDED BOOKS

1. Engineering Drawing by N.D. Bhatt; Charotar Publishing House Pvt. Ltd., Anand
2. Engineering Drawing by P.S. Gill; SK Kataria and Sons, Delhi
3. Material Science by V.K. Manechanda; India Publishing House, Jalandhar
4. Introduction to Material Science by A.R. Gupta; Satya Prakashan, New Delhi
5. Material Science by G.K. Narula and K.S. Narula; Tata McGraw Hill, New Delhi
6. Material Science by R.K. Rajput; Katson Publishers, Ludhiana
7. Manufacturing Processes (Metal Forming and Machinery) by Dr. Rupinder Gupta; Dhanpat Rai & Co. Pvt. Ltd., Delhi
8. Production Engineering by P.C. Sharma; S Chand and Company Ltd.
9. Tool and Die Maker by Karan Singh; Dhanpat Rai & Co. Pvt. Ltd., Delhi.
10. Tool and Die Maker (Press Tools, Jigs & Fixture) published by National Instructional Media Institute (NIMI), Chennai
11. Basic Tool Die Maker by Karan Singh; Dhanpat Rai & Co. Pvt. Ltd., Delhi.
12. Injection Moulds Design by R.G.W. Pye; Godwin Books
13. Injection Moulding by R.C. Batra; CBS Publishers, Delhi
14. Fundamentals of Tool Design by A. Kumar; Dhanpat Rai & Co. Pvt. Ltd., Delhi.

8. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION AND EVALUATION

Since this skill development course is tailor made i.e. designed to meet the requirement of selected group of students for developing desired competencies in the given trade, it is pertinent for trainers to understand the design philosophy and arrange teaching-learning process using appropriate strategies. The following points may be considered by the trainer at the time of planning the training programme and subsequently during the implementation and evaluation stages:

1. There are multiple competencies in each unit. The course curriculum also includes a core unit on developing effective communication and entrepreneurial qualities. Each unit has specific competencies which trainees are expected to acquire at the end of the each unit. In order to achieve these competencies, the curriculum describes the practice tasks/exercises and related theoretical knowledge. Time has been allocated for both of these components.

2. The curriculum is designed for contact period of 35 hours per week but can be increased/changed as per convenience of the trainees and the trainer.

3. The trainer will assess the attainment of each specific learning outcome of the individual learner and will maintain record whether the trainee has achieved desired level i.e. Yes/No. In case of 'No' the trainee will work further to learn and attain the desired skills till s/he earns 'Yes'.

4. Each learning outcome will be assessed/tested by the trainee as per acceptable norms and record will be maintained for final certification. The final assessment of skills attained through practice jobs and acquisition of relevant knowledge should preferably be carried out appropriately.

5. The examiner will set an objective type question paper for theory examinations of each unit under final assessment. Preferably the question paper should aim at testing the understanding of basic principles and concepts by students and their applications.

6. The final assessment of practical skills development should not be limited to testing a few units, but should spread over to all the acquired skills in an integrated manner. It should ultimately assess the ability of the student to accomplish the desired learning outcomes of the programme.

9. LIST OF EXPERTS/CONTRIBUTORS

a) Following experts participated in the workshop to design curriculum of certificate programme in 'Tool and Die Maker' for MRSPTU, Bathinda on 8-9 September, 2016 at NITTTR, Chandigarh.

1.	Dr. Ashok Kumar Goel, Professor & Head, Electronics and Communication Engineering Department and Director, College Development Council, MRSPTU Campus, Dabwali Road, Bathinda, Punjab
2.	Dr. RK Gupta, Ex-Principal, ISTC-CSIO, Sector 30-C, Chandigarh
3.	Dr. KD Chattopadhyay, Chitkara Institute of Engineering and Technology, Village Jhansla, Rajpura
4.	Shri HS Kalra, Ex-Principal, Govt. Industrial Training Institute, Sector-28, Chandigarh
5.	Shri Jagdeep Singh, Central Tool Room (CTR), A-5, Phase-5, Focal Point, Ludhiana
6.	Shri Sunil Kumar Jain, Manager, ESSEN DEINKI, Industrial Area, Phase-II, Chandigarh
7.	Shri Pirthi Raj, Principal Technical Officer, ISTC-CSIO, Sector 30-C, Chandigarh
8.	Shri Mange Ram, Senior Technical Officer, ISTC-CSIO, Sector 30, Chandigarh
9.	Shri Rahul Kirti, Engineer, Central Tool Room (CTR), A-5, Phase-5, Focal Point, Ludhiana
10.	Shri Inderpreet Singh, Instructor, Govt. Industrial Training Institute, Sector-28, Chandigarh
11.	Shri Rakesh Kumar, Instructor, Tool & Die, Govt. Industrial Training Institute, Patiala
12.	Shri Desh Raj Sharma, Instructor, Govt. Industrial Training Institute, Sector-28, Chandigarh
13.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh
14.	Dr. BS Pabla, Professor & Head, IMCO, NITTTR, Chandigarh
15.	Dr. SS Dhami, Professor, Mechanical Engineering, NITTTR, Chandigarh
16.	Shri P Sudhakar Rao, Assistant Professor, Mech. Engg., NITTTR, Chandigarh
17.	Prof. SK Gupta, Associate Professor, Curriculum Development Centre, NITTTR, Chandigarh **Coordinator**

b) Following experts participated in the workshop to review curriculum of certificate programme in 'Tool and Die Maker' for MRSPTU, Bathinda on 26 December, 2016 at NITTTR, Chandigarh.

1.	Dr. Ashok Kumar Goel, Director, College Development Council, MRSPTU Campus, Bathinda, Punjab
2.	Dr. Balraj Singh, Director, PIT, Rajpura
3.	Shri HS Kalra, Ex-Principal, Govt. Industrial Training Institute, Sector-28, Chandigarh
4.	Shri GS Sethi, Consultant, IndiaCan, A-301, Rishi App, Sector 70, Mohali
5.	Shri Jagdeep Singh, Central Tool Room, A-5, Phase-5, Focal Point, Ludhiana
6.	Shri Sikander Singh Sidhu, Asstt. Professor, CZSCCET, Bathinda
7.	Shri Bhanu Goel, M.D., Apna Mistri, Patiala
8.	Dr. AB Gupta, Professor & Head, Curriculum Development Centre, NITTTR, Chandigarh **Coordinator**