Program Structure

Diploma in Mechanical Engineering (Tool & Die)

Program Outcomes (PO's)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

NBA has defined the following seven POs for an Engineering diploma graduate:

PO1: Basic and Discipline-specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

Credit Distribution

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	8	640	20
Semester III	8	640	21
Semester IV	7	640	20
Semester V	8	640	21
Semester VI	3	630	18
		Total	**120**

I SEMESTER

Sl.No	Course Category	Course Type	Sode	Course Title	L-T-P	Period	Credit	End Exam
1	Humanities & Social Science	Theory	1000231110	Tamil Marabu	2-0-0	30	2	Theory
2	Basic Science	Theory	1000231230	Basic Mathematics	3-1-0	60	4	Theory
3	Basic Science	Practicum	1000231330	Basic Physics	2-0-2	60	3	Theory
4	Basic Science	Practicum	1000231430	Basic Chemistry	2-0-2	60	3	Theory
5	Engineering Science	Practicum	1000231520	Digital Workplace Skills	0-0-4	60	2	Practical
6	Humanities & Social Science	Practicum	1000231640	Communicative English I	1-0-2	45	2	Practical
7	Engineering Science	Practicum	1000231740	Basic Workshop Practices	1-0-2	45	2	Practical
8	Open Elective	Advanced Skill Certification	1000231860	Basic English for Employability	0-0-4	60	2	Practical
9	Humanities & Social Science	Integrated Learning Experience	1000231880	Growth Lab	-	15	0	-
10	Audit Course	Integrated Learning Experience	1000231881	Induction Program - I	-	40	0	-
11	Audit Course	Integrated Learning Experience	1000231882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
12	Audit Course	Integrated Learning Experience	1000231883	Shop floor Immersion	-	8	0	-
13	Audit Course	Integrated Learning Experience	1000231884	Student-Led Initiative	-	22	0	-
14	Audit Course	Integrated Learning Experience	1000231886	Health & Wellness	-	30	0	-
					Test & Revisions	60	-	
					Library	15	-	
					TOTAL	640	20	

II SEMESTER

SL.NO	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Humanities & Social Science	Theory	1000232110	Tamizhar Thozhilnutpam	2-0-0	30	2	Theory
2	Program Core	Theory	1000232210	Basics of Mechanical Engineering	3-0-0	45	3	Theory
3	Engineering Science	Practicum	1000232320	Drafting Practices	0-0-4	60	2	Practical
4	Basic Science	Practicum	1000232440	Applied Mathematics -2	1-0-4	75	3	Practical
5	Basic Science	Practicum	1000232540	Applied Physics - I	2-0-4	90	4	Practical
6	Basic Science	Practicum	1000232640	Applied Chemistry - I	2-0-4	90	4	Practical
7	Engineering Science	Practicum	1000232740	Basic Engineering Practices	0-0-4	60	2	Practical
8	Humanities & Social Science	Practicum	1000232840	Communicative English II	1-0-2	45	2	Practical
9	Open Elective	Advanced Skill Certification	1000232860	Advanced Skills Certification - 2	1-0-2	45	2	NA
10	Humanities & Social Science	Integrated LearningExperience	1000232880	Growth Lab	-	30	0	-
11	Audit Course	Integrated LearningExperience	1000232882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
12	Audit Course	Integrated LearningExperience	1000232883	Shop floor Immersion	-	8	0	-
13	Audit Course	Integrated LearningExperience	1000232884	Student-Led Initiative	-	24	0	-
14	Audit Course	Integrated LearningExperience	1000232885	Emerging Technology Seminars	-	8	0	-
15	Audit Course	Integrated LearningExperience	1000232886	Health & Wellness	-	30	0	-
					Test & Revisions	60	-	
					Library	15	-	
					TOTAL	640	20	

III SEMESTER

Sl. No	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1220233110	Manufacturing Technology	3-0-0	45	3	Theory
2	Program Core	Practicum	1020233230	Strength of Material	3-0-2	75	4	Theory
3	Program Core	Practicum	1220233330	Engineering Materials & Metallurgy	3-0-2	75	4	Theory
4	Program Core	Practicum	1220233440	Engineering Metrology	1-0-4	75	3	Practical
5	Program Core	Practical	1220233520	Computer Aided Machine & Tool Drawing Practical	0-0-4	60	2	Practical
6	Program Core	Practical	1220233620	Manufacturing Technology Practical	0-0-4	60	2	Practical
7	Open Elective	Practical	1220233760	Advanced Skills Certification	1-0-2	45	2	NA
8	Humanities & Social Science	Integrated Learning Experience	1220233880	Growth Lab	-	30	0	NA
9	Audit Course	Integrated Learning Experience	1020233881	Induction Program - II	-	16	0	-
10	Audit Course	Integrated Learning Experience	1220233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	1220233883	Shop floor Immersion	-	8	0	-
12	Audit Course	Integrated Learning Experience	1220233884	Student-Led Initiative	-	22	0	-
13	Audit Course	Integrated Learning Experience	1220233885	Emerging Technology Seminars	-	8	0	-
14	Audit Course	Integrated Learning Experience	1220233886	Health & Wellness	0-0-2	30	1	-
					Test & Revisions	30	-	-
					Library	15	-	-
					Total	625	21	

IV SEMESTER

Sl. No	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1220234110	Tool Room Special Machines	3-0-0	45	3	Theory
2	Program Core	Theory	1220234210	Press Tool	3-0-0	45	3	Theory
3	Program Core	Practicum	1220234340	Fluid Power & Thermal Engineering	2-0-4	75	4	Practical
4	Program Core	Practical	1220234420	Special Machines Practical	0-0-4	60	2	Practical
5	Program Core	Practical	1220234520	Press Tool Making Practical	0-0-6	90	3	Practical
6	Program Elective-I	Practicum	1220234641	1. Industrial Automation	1-0-4	75	3	Practical
			1020234440	2. Sensors & Actuators				
			1020234540	3. Heat Power Engineering				
				4. Inter discipline courses #				
7	Open Elective	Practical	1220234760	Advanced Skills Certification	1-0-2	60	2	NA
8	Audit Course	Integrated Learning Experience	1220234882	I&E/ Club Activity/ Community Initiatives	-	30	0	-
9	Audit Course	Integrated Learning Experience	1220234883	Shop floor Immersion	-	8	0	-
10	Audit Course	Integrated Learning Experience	1220234884	Student-Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience	1220234885	Emerging Technology Seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	1220234886	Health & Wellness	-	30	0	-
13	Audit Course	Integrated Learning Experience	1220234887	Special Interest group(Placement Training)	-	30	0	-
					Test & Revisions	30	-	-
					Library	30	-	-
						640	20	-

Note: # courses from other programmes with the same credits can be considered after proper approval from the Chairman , Board of Examinations.

V SEMESTER

Sl. No	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Practicum	1220235130	Jig, Fixture & Gauges	3-0-2	75	4	Theory
2	Program Core	Theory	1220235210	Plastic Moulding Technology	3-0-0	45	3	Theory
3	Program Core	Practicum	1220235330	Tool Design & Drawing	2-0-2	60	3	Theory
4	Program Core	Practical	1220235420	Plastic Mould Making Practical	0-0-4	60	2	Practical
5	Program Elective-II	Practicum	1020235541	CNC Programming	1-0-4	75	3	Practical
			1020235543	Industrial IoT				
			1020235544	Advanced Welding Technologies				
			1020235545	Industrial Robotics				
			1020235546	HAVC Systems and Components				
6	Hum. Social Science	Practicum	1220235654	Innovation and Startup	1-0-2	45	2	Project
7	Project/Internship	Project/ Internship	1220235773	Industrial Training (Summer Vacation – 90 hours)	-	-	2	Project
8	Open Elective	Practical	1220235860	Advanced Skills Certification	1-0-2	45	2	NA
9	Audit Course	Integrated Learning Experience	1220235981	Induction program III	-	40	0	-
10	Audit Course	Integrated Learning Experience	1220235984	Student-Led Initiative	-	30	0	-
11	Audit Course	Integrated Learning Experience	1220235986	Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience	1220235987	Special Interest Groups (Placement Training)	-	40	0	-
					Test & Revisions	45	-	-
					Library	15	-	-
					Total	580	21	-

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VI SEMESTER

Sl. No	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1220236110	Forging Dies, Die Casting Dies & Die Maintenance	3-0-0	45	3	Theory
2	Program Elective-III *	Theory	1220236211	Industrial Engineering	3-0-0	45	3	Theory
			1220236212	Total Quality Management				
			6000236112	Entrepreneurship				
			6000236113	Project Management				
			1020236115	Industry 4.0				
				Online Elective courses $				
3	Industrial Training/Project	Project/ Internship		In-House ** Project/Internship/Fellowship	-	540	12	Project
					Total	**630**	**18**	
3	Industrial Training/Project	Project/ Internship	1220236351	Internship	-	540	12	Project
3	Industrial Training/Project	Project/ Internship	1220236353	Fellowship	-	540	12	Project
3	Industrial Training/Project	Project/ Internship	1220236374	In-House Project	-	540	12	Project

Note: $ Online courses with the same credits available in AICTE, SWAYAM, NPTEL and reputed institution with proper evaluation system and certification can be considered after proper approval from the Chairman, Board of Examinations.

** Every student should select any one from the In- house Project or Internship or Fellowship. This guidelines have to be followed.

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Introduction:

Use of innovative technologies to create existing products and the creation of new products. Manufacturing technology can include production activities that depend on information, automation, computation, software, sensing, and networking.

Course Objectives:

- To illustrate the working principles of various metal casting processes.
- To learn and apply the working principles of various metal joining processes.
- To study the basic concepts of lathe machine and constructional features of lathe.
- To learn working of basic mechanics of grinding, drilling & broaching machines.
- To learn working of basic mechanics of planner, shaper and slotter.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: The student will be able to recommend the appropriate design of casting process systems and machining (metal cutting) processes.

CO2: To understand the Knowledge & various modern welding techniques such as arc, resistance welding techniques. Atomic hydrogen, TIG, MIG

CO3: To give detailed study of lathes (semi-automatic lathe and conventional lathe).

CO4: The student will have the basic understanding in working principle of grinding, drilling & broaching machines.

CO5: The student will have the basic understanding in working principle of planner, shaper and slotter.

Pre-requisites:

Basic knowledge in Mechanical, materials

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	3	3	-	3	3
CO2	3	-	2	3	2	3	3
CO3	3	-	2	3	2	2	3
CO4	3	-	2	3	-	3	2
CO5	3	-	2	2	2	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online /Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below. Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	Casting Processes	
Patterns: Definition-Pattern materials-factors for selecting pattern materials-single piece solid, split patterns-pattern allowances-core prints. Moulding-definition-moulding boxes, moulding sand-ingredients-silica-clay-moisture and miscellaneous materials-properties of moulding sand-sand additives-moulding sand preparation-mixing-tempering and conditioning- Types of moulding-green and dry sand-machine moulding-top and bottom squeezer machines-jolting machines-sand slinger-CO2 process core making-types of core-core boxes **Casting :** Definition-sand casting using green sand and dry sand-gravity die casting-pressure die casting: Hot and cold chamber processes-centrifugal casting-continuous casting-chilled casting-malleable casting-melting of cast iron-cupola furnace-melting of nonferrous metals-crucible furnace melting of steel-arc furnaces-induction furnaces-instrument for measuring temperature-optical pyrometer-thermo electric pyrometer-cleaning of casting-tumbling, trimming sand and shot blasting-defects in casting causes and their remedies-safety practices in foundry.		9

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Unit II	Metal Joining Processes	
Arc Welding: Definition-Arc welding equipment-arc welding methods-carbon arc, metal arc, Metal Inert Gas (MIG), Tungsten Inert Gas (TIG), Atomic hydrogen, Plasma arc, Submerged arc and Electro slag welding **Gas welding:** Definition-Gas welding equipment-Oxy and acetylene welding-Three types of flame. **Resistance welding:** Classification of resistance welding-butt-spot-seam-projection welding-welding related processes-oxy and acetylene cutting-arc cutting-hand facing bronze welding-soldering and brazing-special welding processes**:** cast iron welding- thermit welding-solid state welding, ultrasonic, diffusion and explosive welding-explosive cladding. **Modern welding:** Electron beam and laser beam welding-types of welded joints-inspection and testing of welded joints-destructive and nondestructive types of tests-safety practices in welding.		9
Unit III	**Centre Lathe, Semi-Automatic and Automatic Lathe**	
Centre Lathe: Theory of Lathes-specifications-simple sketches-principal parts and its functions-tumbler gear mechanism-quick change gear box-apron mechanism-carriage cross slide-automatic, longitudinal and cross feed mechanism-work holding devices : face plate, three jaw chuck, four jaw chuck, catch plate and carrier-types of centres-machining operations done on lathe: facing, plain turning, step turning, taper turning, knurling, thread cutting, boring, chamfering-major machining parameters. **Semi-Automatic Lathe:** Types of Semi-Automatic Lathe – Capstan and turret lathes – difference between turret and capstan – tools and work holding devices – self-opening die head –collapsible tapes **Automatic Lathe:** Classification of single spindle automatic lathe – principle of automatic lathe – automatic screw cutting machine – multi spindle automatic lathes		9

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Unit IV	Drilling, Grinding and Broaching Machine	
Drilling Machines: Drills: Flat drills, twist drills-nomenclature-types of drilling machines: bench type, floor type, radial type, gang drill, multi spindle type- principle of operations in drilling-methods of holding drill bit: drill chucks, socket and sleeve-drilling operation: drilling, boring, reaming, counter sinking, counter boring, spot facing, tapping, deep hole drilling **Grinding Machine**: Types and Classification-specifications-principles of operations-grinding wheels abrasives: natural and artificial-types of bonds-grit, grade and structure of wheels-wheel shapes and sizes-BIS marking systems of grinding wheels-selection of grinding wheels-dressing and truing of wheels-balancing of grinding wheels. **Broaching:** Broaching Machine – Basic Process – Vertical broaching Machine – Horizontal Broaching machine – Double cut broaching – Key way Broaching		**9**
Unit V	**Planner, Shaper and Slotter Machine**	
Planner: Types of Planner-specifications-principles of operation-quick return mechanism-feed mechanism-work holding devices-types of planner operation **Shaper:** Types of Shaper-specifications-principle of operations-quick return mechanism-crank and slotted link mechanism-feed mechanism-work holding devices-types of shaper operations **Slotter: Types** of slotter-specifications-principle of operation-Whitworth quick return mechanism-feed mechanism-work holding devices		9
TOTALHOURS		45
Assessment Test and Revision with Student activity		15*

*** Common Test and Revision periods can be used. 1 Period per week can be used for this subject**

1220233110	MANUFACTURING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Suggested List of Students Activity:

- Prepare the green sand mould for the solid and Spilt pattern
- Practice the basic welding operation
- Prepare a list of work holding devices and tool holding devices used in the workshop

Text and Reference Books:

- R.K. Jain, Production Technology, Edition 1st, Khanna Publishers, 2021.
- P. C. SHARMA, Production Technology, Edn. 10, S.Chand& Co. Ltd., 2010
- P N RAO, manufacturing technology Vol -1, Vol -2, edition5th,Tata McGraw Hill Education Private Limited

Web-based/Online Resources:

- https://youtu.be/OJnWA2DF6jQ?si=JUK0NXnqcqMkrEvf
- https://youtu.be/K4TEuJsUGEM?si=5PYbhvtQE2X6hjeu
- NPTEL (Website): The National Programming Technology Enhanced Learning (NPTEL) offers free online courses on manufacturing processes and other Mechanical Engineering topics. NPTEL Mechanical Engineering.

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer ten questions by selecting two questions from each unit. Each questioncarries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questionsfor 10 marks. The question may have two subdivisions only.

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Introduction:

Strength of materials is a key subject in mechanical engineering that focuses on how solid objects behave when they are put under various forces and pressures. It's vital it helps us understand and predict if a material can handle certain loads without breaking. Strength of materials is the discipline related to calculation of stresses and strains in structures and mechanical components. It helps engineers make informed decisions about material selection,decision and construction.

Course Objectives:

- Acquire knowledge about selection of materials
- Towards developing the theoretical basics about the stress, strain and elastic modulus concepts in various components.
- Understand the mechanical behavior of materials.
- To solve practical problems related to shafts and springs.
  Estimate the stresses induced in thin cylinders.
- Understand the basics of engineering materials and their role in the development of societies and industries.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Discuss various engineering materials and their mechanical properties

CO2: Compute the effects various loads on materials

CO3: Analyses the shaft using the principles of pure torsion

CO4: Analyses the springs in various load conditions

CO5: Determine the various dimensions of thin cylinders under various load conditions

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Pre-requisites:

Knowledge of basic mathematics and Science

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	3				
CO2	2	3	3	2			
CO3	3	3	3				
CO4	3	3	3				
CO5	3	1	3	2			

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- The instructional strategy for teaching strength of materials in polytechnic colleges emphasizes practical application and industry relevance.
- Through a curriculum aligned with the state technical education board, the syllabus is broken down into manageable units, prioritizing topics pertinent to Indian engineering contexts.
- Visual aids, bilingual explanations, and hands-on demonstrations are utilized to accommodate linguistic diversity and enhance understanding.
- Incorporating industry examples and field visit to construction sites and manufacturing facilities fosters experiential learning.
- Assessment methods include practical assessment, written exams, and peer learning initiatives, complemented by career guidance to inform students about opportunities in mechanical engineering.
- Continuous feedback mechanisms ensure the refinement and effectiveness of the instructional approach.

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (First Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks.

  CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any five questions. (5 X 10 Marks = 50 Marks).

  Eight questions will be asked, students should write five questions.

  Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

- **CA 3:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below. Each Exercise observation and calculations should be completed on the day of practice.The same shall be evaluated for 10 marks on the day or next day of practice beforecommencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION - Practical Test

Sl.No.	Description	Marks
A	Aim / Apparatus required	10
B	Procedure / Observation	20
C	Formula / Calculation	20
D	Result / Graph	10
E	Practical document (All Practical’s)	30
F	Viva Voce	10
Total		100

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	SELECTION OF MATERIALS	
Theory: **Engineering materials:** Introduction to engineering materials- Ferrous and Non Ferrous materials - material selection-factors affecting the selection of materials-procedure for materials selection. Advanced materials - smart materials and nanomaterials-classification of nanomaterials – applications. **Hardness test:** Brinell hardness test, Rockwell hardness test, Vickers Hardness test – Shore Hardness Test (Durometer) - Knowledge on Micro Hardness test		9
Practical: **EXPERIMENT : 1.** **Hardness Test:** Determination of Rockwell hardness number for various materials like mild steel, high carbon steel, brass, copper, aluminium and Plastics (Any Two Materials).		3

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Unit II	**DEFORMATION OF METALS**	
Theory: **Simple stresses and strains:** Definition - load, stress and strain - classification of force systems - tensile, compressive and shear force systems– Definition - Hooke's law -Young's modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity - deformation due to tension and compressive forces - simple problems in tension, compression and shear force. **Mechanical testing of materials:** Tensile test of mild steel in UTM - stress strain diagram - limit of proportionality - elastic limit -yield stress - breaking stress - ultimate stress - percentage of an elongation and percentage reduction in area (no problems)- fatigue test - creep test.		9
Practical: **EXPERIMENT : 2.** **Tensile Test on materials :** Determine young's modulus of elasticity, yield stress, ultimate stress, breaking stress, percentage of elongation and percentage of reduction in area of a given specimen (Mild steel, Cast Iron , Aluminum, Brass) (Any one material) and plot stress strain diagram.		4
Unit III	**ELASTIC CONSTANTS AND STRAIN ENERGY**	
Theory: **Elastic constants:** Definition - lateral strain – poison's ratio - volumetric strain - bulk modulus - volumetric strain of rectangular and circular bars (No derivation) - problems connecting linear, lateral and volumetric deformation – Simple problemson elastic constants. **Strain energy:** Definition - proof resilience - modulus of resilience - the expression for strain energy stored in a bar due to axial load - instantaneous stresses due to sudden and impact loads (No derivation) - problems computing instantaneous stress and deformation in sudden and impact loadings.		9

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Practical: **EXPERIMENT : 3.** Impact test : Find the impact strength of the given specimen (Mild steel, Cast Iron, Aluminium and Brass) (Any Two materials) using izod test and Charpy test.		3
Unit IV	**THEORY OF TORSION**	
Theory: Torsion: Theory of torsion - assumptions - torsion equation $\frac{T}{J}=\frac{f_s}{R}=\frac{C\theta}{l}$ (no derivation)- strength of solid and hollow shafts - power transmitted - definition - polar modulus – sectional modulus - torsional rigidity - strength and stiffness of shafts - comparison of hollow and solid shafts in weight and strength considerations - advantages of hollow shafts over solid shafts – shear stress distribution - problems. **Material testing:** Torsion testing machine (Description only).		9
Practical: **EXPERIMENT : 4.** **Torsion test:** Determine the shear stress and modulus of rigidity of the given specimen (Mild steel, Cast Iron, Aluminum and Brass) - (Any two materials) using aTorsion testing machine.		4
Unit V	**SPRINGS AND THIN CYLINDERS**	
Theory: **Springs:** Types of springs - laminated and coiled spring - applications - types of coiled springs - difference between open and closely coiled helical springs - closely coiled helical spring subjected to an axial load (no derivation) - problems to determine shear stress, deflection, stiffness and resilience of closed coil helical springs.		9

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Thin cylinders: Definition - thin cylindrical shell - failure of thin cylindrical shell subjected to internal pressure - hoop and longitudinal stresses causes in thin cylindrical shell subjected to internal pressure (no derivation) - simple problems - change in dimensions of a thin cylindrical shell subjected to internal pressure -problems	
Practical: **EXPERIMENT : 5.** **Test on springs of circular section:** Determine the modulus of rigidity and strainenergy, and stiffness of the open coiled helical springs. **EXPERIMENT : 6.** Determine the modulus of rigidity and strain energy, and stiffness of the closedcoiled helical springs.	6
Revision + Test + Students Activity	10
TOTAL HOURS	75

Suggested List of Students Activity:

Other than the classroom learning, the following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in thiscourse.

- Conduct a survey, specific to properties of various types of materials used in mechanical engineering and prepare a report.
- Compare the strength of the solid shaft with that of hollow shaft for the same power transmission for an automobile and make a report.
- Students can be given practices in the Virtual Labs | Mechanical Engineering (vlab.co.in). This can be given to a team of students and make them prepare a report.

Sample Experiments: Four bar mechanism, Slider crank mechanism, Elliptical Trammel, Cam Mechanism, Linkage Model, Crank and Slotted Mechanism, Whitworth Mechanism, Straight Line Mechanism, Universal Joint etc…

1020233230	STRENGTH OF MATERIALS	L	T	P	C
PRACTICUM		3	0	2	4

Text and Reference books:

1. Dr. P.Purushothama Raj, V. Ramasamy, Strength of Materials, Pearson Edition 2013.
2. Dr. R K Bansal, strength of materials, 5th edition , laxmi publications private limited,2013.
3. R S Khurmi , strength of materials, edition 2019 , s chand publications, 2019.
4. B K Sarkar, strength of materials, 10th edition, tata mcgraw hill education private limited,2012.
5. R K Rajput, materials science and engineering, 5th edition, S K Kataria and sons publications, 2024

Web reference:

- https://youtu.be/GkFgysZC4Vc?si=j-q-9UMmeDg64YNB
- https://youtu.be/uA_HqCGo8Pg?si=q03sPw7010ot0BdT
- https://youtu.be/WERoSRcnafA?si=b7Xv3RI1s8LvSUhw

Equipment / Facilities required to conduct the Practical Portions.

1. Universal testing machine.	01
2. Rockwell's hardness testing machine.	01
3. Impact testing machine.	01
4. Torsion testing machine.	01
5. Spring testing machine	01

Required instruments and consumables.

1020233230	**STRENGTH OF MATERIALS**	L	T	P	C
PRACTICUM		3	0	2	4

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each questioncarries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questionsfor 10 marks. The question may have two subdivisions only.

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		3	0	2	4

Introduction:

Materials are so important in the development of human civilization that the historians have identified early periods of civilization by the name of most significantly used material, e.g.: Stone Age, Bronze Age. This is just an observation made to showcase the importance of materials and their impact on human civilization. It is obvious that materials have affected and controlling a broad range of human activities through thousands of decades.

Metallurgy and Materials engineering involves the engineering principles required to concentrate, extract and refine metals, materials and carbon (coal) materials, as well as to develop new alloys and materials, including ceramics and composites

Materials engineering shows us how to apply knowledge to make better things and to make things better. Materials science and engineering drives innovation in both research and industry in everything from aerospace to medicine. It is fundamental to all other science and engineering disciplines.

Course Objectives

The objective of this course is to enable the student to

1. To know about the different types of material structure.
2. To acquire knowledge on Deformation of Metals.
3. To Understand the Phase Diagrams.
4. To Understand and Use Iron – Carbon Equilibrium Diagram.
5. To Study about various Heat Treatment Process.
6. To Get Knowledge on Thermal & Magnetic properties of Materials.
7. To know about Superconductivity.
8. To study about various Ferrous & Non Ferrous Alloys.
9. To understand the process of Non – Destructive Testing.

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		3	0	2	4

Course Outcomes:

CO1: Explain the basic crystal structure of materials knows as deformation of material behavior.

CO2: Identify the solid solutions & phase diagrams, heat treatment transformation system

CO3: Discuss about the heat treatment of steel & properties of engineering materials

CO4: Describe the properties &composition ferrous &non-ferrous material and its alloys composition

CO5: Explain the modern trends of metallographic & surface treatment and non-destructive testing

Pre-requisites:

Mathematical skills, Mechanics.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	-	2	-	3	2
CO2	3	2	3	-	1	2	3
CO3	2	3	-	3	-	2	3
CO4	3	3	2	3	-	-	3
CO5	3	-	2	2	2	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging
- learning experience. Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (First Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks. CA1 and CA2, Assessment written test should be conducted for two units as below. Answer any Five questions. (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximumtwo subdivisions shall be permitted.

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		3	0	2	4

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

The details of the practical documents to be prepared as per the instruction below.

Each exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice beforecommencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.
The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		3	0	2	4

SCHEME OF EVALUATION - Practical Test

Sl.No.	Description	Marks
A	Aim / Apparatus required	10
B	Procedure / Observation	20
C	Formula / Calculation	20
D	Result / Graph	10
E	Practical document (All Practicals)	30
F	Viva Voce	10
Total		100

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.
Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Syllabus Contents

Unit I	METALLURGY AND MATERIAL STRUCTURE	
Crystalline Structure: Crystallography, crystal, single crystal, crystallization of metals, crystal symmetry, elements of symmetry, space lattice, unit cell, lattice parameters of unit cell, primitive cell, crystal structure, crystal system – cubic system, Tetragonal system, Hexagonal or trigonal system, orthorhombic system, monoclinic system, triclinic system. Miller Indices, Crystal directions, coordinate number, atomic radius, number of atoms per unit cell, density of crystal material. Material structure –Face centered cubic (FCC), Body centered cubic (BCC), Hexagonal close-packed (HCP). **Bonding in solids:** Primary bonds – Metallic bond, Ionic bond, Covalent bond. Imperfections in metal crystals- types of defect- point defect, line defect, surface defect, volume defect, effect of imperfection on metal properties		9
Experiment #1: Study of Metallurgical microscope and grain structures		4
Unit II	**PHASE DIAGRAMS AND IRON CARBON EQUILIBRIUM DIAGRAM**	
Phase Diagrams: Solid solution – types of solid solution- substitutional and interstitial solid solution- solid solution alloy – System, Phase, Component, Degree of freedom or variance of the system. Phase rule, Cooling curves – cooling curve of pure metal, solidification or crystallization of metal, cooling curve of eutectic type alloy. Construction of equilibrium diagrams, Interpretation of equilibrium diagrams. Types of phase diagrams – Eutectic system, Peritectic system, Eutectoid system, Peritectoid system. Iron-Carbon system – allotropy of iron, micro constituents of iron and steel, Iron-iron carbide equilibrium diagram, critical temperatures, effect of alloying elements on Fe-Fe_3C diagram. **Heat Treatment and Transformation Diagram:** Purpose of Heat Treatment, Heat treatment cycle, Time-Temperature-Transformation (TTT) diagram – importance of T.T.T diagram, steps to construct T.T.T diagram,T.T.T diagram and cooling curves.		9
Experiment #2: Preparation of specimen for study of micro structure of ferrousmetals		4

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Unit III	**HEAT TREATMENT, PROPERTIES OF ENGINEERING MATERIALS**	
Heat Treatment of Steel: Annealing – stress relief annealing, Process annealing, spheroidise annealing, Full annealing. Normalizing, Hardening – process, quenching medium, hardenability, end quench hardenability test. Tempering – low temperature tempering, medium temperature tempering, High temperature tempering, Temper brittleness, Austempering, Martempering. Case hardening – carburising – pack carburising, liquid carburising, gas carburising. Nitriding, cyaniding, carbonitriding. Surface hardening – flame hardening, induction hardening. **Properties of Engineering Materials:** Introduction, Mechanical properties of Materials – Strength, Elasticity, Plasticity, Ductility, Malleability, stiffness, toughness, brittleness, hardness, wear resistance, machinability, castability, weldability, fatigue strength, creep. Thermal Properties – Introduction, Heat capacity, Expansion, conductivity, Thermal stress. Magnetic properties		9
Experiment #3: Examine the micro structure of metal samples (i) Ferrous and (ii) Non- Ferrous		4
Unit IV	**FERROUS AND NON – FERROUS METALS AND THEIR ALLOYS**	
Ferrous Metals & its Alloys: Pig Iron – classification, properties and applications, Wrought Iron – composition, properties and uses. Cast Iron – Introduction, classification, effects of alloying elements on the structure of cast iron. Designation system of Cast Iron as per BIS. Composition, Mechanical properties, applications of Grey cast iron, Spheroidal graphite cast iron, Malleable cast iron .Steels – Classification of steel, Effects of alloying elements in steel. Composition, Mechanical properties, applications of low carbon steel, medium carbon steel and high carbon steel. HSS , Tool steel, Stainless steel - Composition ,Mechanical properties and applications Non – Ferrous Metals & its Alloys: Aluminium & its alloys – types, properties and applications. Designation system of aluminium and its alloys as per BIS .Copper & its Alloys – Types , Zinc – Composition , properties & applications.		9
Experiment #4: Detection of Cracks in casting using Detection methods. i. Visual Inspection and ring test ii. Die penetrant test		4

Unit V	Metallography, Surface Treatment and Non Destructive Testing	
Metallography: Metallurgical microscope–Preparation of Specimen, micro and macro examination. Study of micro structure of Ferrous and Non Ferrous metals. Modern techniques of material studies– electron microscope Surface Treatment: Mechanical cleaning and finishing – Vibratory Finishing, wire brush cleaning, buffing and electro polishing. Chemical cleaning – Vapour degreasing, solvent cleaning, alkaline cleaning, Ultrasonic cleaning, acid pickling. Surface coatings – Electroplating, Physical vapour deposition, chemical vapour deposition. Non Destructive Testing: Magnetic particle inspection, X-Ray Inspection, Gamma radiography, Ultrasonic Inspection.		9
Experiment #5: Detection of Cracks in casting using Magnetic particle test		4
Assessment Test, Revision and Students Activity		10
Total		75

Suggested List of Students Activity:

1. Presentation / Seminars by students on any recent technological developments based on the course.
2. Periodic class quizzes conducted on a weekly / fortnightly based on the course

Text Books & Reference Books:

1. Dr. O.P.Khanna, Material science and Metallurgy, Dhanpat Rai & Sons
2. Material Science and Engineering, William .D.Callister JR , Sixth Edition
3. ASM Hand book, Vol.1, ASM International, Materials Park, Ohio, U.S.A,
4. S.K.Hajra Choudhury and A.K.Hajra Choudhury, Elements of Workshop
5. Technology, Media Promoters and publishers pvt. Ltd

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each questioncarries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questionsfor 10 marks. The question may have two subdivisions only.

1220233330	Engineering Materials and Metallurgy	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Introduction:

Introduction to Metrology and Linear Measurement, Angular Measurement, Measurement of Gears and Threads, Measurement of Geometric Parameters and Surface Finish, Comparators and Measurement by Light Wave Interference and Measuring Machines and Recent Trends in Metrology

Course Objectives:

The objective of this course is to enable the student to

- To understand the Needs & Objectives of metrology.
- To understand about the various linear & angular measuring Instruments.
- To Study about the various Measurement Techniques.
- To Calibrate an Instrument.
- To know about various geometric parameters.
- To use Light rays in Measuring an Object.
- To know about the measuring machines.
- To acquire Knowledge about Recent Trends in Metrology.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Select and measure linear measurements using vernier caliper, vernier height gauge and micrometer

CO2: Measure angle of surface using sine bar, slip gauges & angular measuring instruments

CO3: Use dial indicator to measure geometrical parameters

CO4: Explain the usage of Comparators and to check parallelism, squareness, circularity & perpendicularity of a surface

CO5: Understand the working principles of CMM and latest trends in Metrology.

Pre-requisites: Knowledge about accuracy, precision, reliability, and traceability.

1220233440	Engineering Metrology	L	T	P	C
Practicum		**1**	**0**	**4**	**3**

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	2	3	3	1
CO2		2	2	2	2	2	
CO3	2	2	3	2	3	3	1
CO4	3	2	2	2	3	3	
CO5	3	2	3	2	3	3	2

Legend:3-HighCorrelation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implementtask-basedlearningactivitieswherestudentsworkonspecifictasks or projects.
- In corporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporateformativeandsummativeassessmentstogaugestudentprogressandprovidetargeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- Alldemonstrations/Hand-onpracticesmaybefollowedintherealenvironmentasfaras possible.

1220233440	Engineering Metrology	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.
- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.
- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. The marks awarded should be converted to 15 Marks for the internal assessment.Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the schemeof evaluation as below.

1220233440	Engineering Metrology	L	T	P	C
Practicum		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The Readings, Calculations and Graph / Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Observation / Reading	10
B	Tabulation / Formula	20
C	Calculation & Result	20
TOTAL		50
D	Practical Documents (As per the portions)	10
Total Marks		60

1220233440	Engineering Metrology	L	T	P	C
Practicum		1	0	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Observation / Reading	10
B	Tabulation / Formula	20
C	Calculation	20
D	Result	10
E	Viva voce	10
F	Written test	30
		100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1220233440	Engineering Metrology	L	T	P	C
Practicum		**1**	**0**	**4**	**3**

Syllabus Contents

Theory Portion	
UNIT I:Introduction to Metrology and Linear Measurement	**Period**
Introduction: Metrology, objectives of metrology, Precision vs Accuracy. Repeatability, calibration, sensitivity and readability, classification of methods of measurement, general care of equipments. **Non precision Linear Measurements:** Surface plates, Tool maker's flats and high precision surface plates, Angle plates, bench centers, v-blocks, straight edges, Toolmaker's straight edges, using a straight edge, sprit levels,combination set, universal surface gauge, Engineer's square, Engineer's parallel, Radius gauge, feeler gauge, screw pitch gauge, Engineer's taper, wire and thickness gauge. **Precision Linear Measurements:** Characteristics and principles of precision measuring instruments. Vernier instruments, types of vernier calipers, errors in calipers, Vernier height gauge, Vernier depth gauge, digital readout height gauge. Micrometers – Internal micrometers, micrometer depth gauge, thread micrometer, v-anvil micrometer, dial micrometers, digital micrometers, groove micrometer. Telescope internal gauge, Measuring dia of deep holes, slip gauges.	**9**

Practical Exercises:

Ex.No	Name of the Experiment	Period
1.	**Linear Measurements** 1(a). Verniercaliper – Measuring the overall dimensions of a Die plate to an accuracy of 0.02 mm. 1(b). Micrometer – Measuring diameter and thickness of die components to an accuracy of one micron (0.001mm) 2(i). Vernier height gauge:- a) Measurement of height of the given work piece b) Marking the given dimensions on the work piece. c) Transferring measurements from one job to another. 2(ii). Vernier Depth gauge – Measuring the depth of blind holes .	**23**

1220233440	Engineering Metrology	L	T	P	C
Practicum		**1**	**0**	**4**	**3**

Unit II	**Angular Measurement, Measurement of Gears and Threads**	**Period**
Angular Measurement: Instruments for angular measurement- optical bevel protractor, universal bevel protractor, acute angle attachment, optical dividing head, Sine bars, Sine center, angle gauges, clinometers. **Optical instruments for angular measurement**: - Autocollimator – principle of the autocollimator, micro-optic autocollimator, measurement of straightness and flatness. Angle dekkor – working principle, use of angle dekkor in combination with angle gauges. Optical square. **Measurement of Gears:** Gear tooth terminology, Gear tooth verniercaliper. **Thread Measurements**: Screw thread projection, Tool Maker's Microscope, Measurement of Effective Diameter,		**9**
Practical Exercises: 3(a). Screw thread micrometer – Measuring the root dia of the given screw thread 3(b). Measurement of pitch of screw threads using screw pitch gauges. 3(c). Measurement of effective dia of screw thread using three wire method. 4. Measurement of Internal dia of the given die set bush using Inside Micrometer to an accuracy of one micron. 5. Slip Gauges – Building up the given required dimensions and measuring or marking or setting Go and No Go sizes in adjustable gap gauges, to an accuracy of 0.5 micron. 6. Measuring the chordal thickness of the gear teeth using the gear tooth vernier. **Angular Measurements** 7. Measurement of angles using universal bevel protractor to an accuracy of 5'. 8. Using combination set i) Measure angle in the given component with protractor head ii) Find or mark the center of the given cylindrical job using center head. iii) Check and report the squareness of the given specimen using square head. 9.Measure the angle of the surface using Sine bar and Slip Gauges.		**23**

Practical Instructions for Cycle 1 & 2 and Students Activity & Continuous Assessment	**11**
Total Period	**75**

1220233440	**Engineering Metrology**	**L**	**T**	**P**	**C**
Practicum		**1**	**0**	**4**	**3**

Suggested List of Students Activity:

- Each students to write and submit the assignment on the topic Basics of. Exercises.

Text Books:

1. R.K.Jain., Engineering Metrology, Khanna Publishers, Eleventh edition
2. R.Jenkins, Fundamentals of Mechanical Inspection, McGraw Hill Book company.

Reference books:

1. Dr. R. Manikandan, Metrology and Measurements Laboratory Manual,1st edition, Notion Press,2020
2. AnandJayakumarArumugham, Metrology and Measurement : Laboratory Manual,2nd edition, Notion Press,2020
3. Arul R,Metrology and Measurements Lab Manual,1st edition, Notion Press,2020

Web-based/Online Resources:

1. https://youtu.be/NQzX3SAAO_0?si=OQCmDTqZJO8F4sVj
2. https://youtu.be/RYwU769Eny4?si=uVFzbtbUNki8mPpU
3. https://youtu.be/8_wDaFu5yCo?si=TpuNR9WEGmYo0vGT

END SEMESTER EXAMINATIONS – PRACTICAL EXAM.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Observation / Reading	10
B	Tabulation / Formula	20
C	Calculation	20
D	Result	10
E	Viva voce	10
F	Written test	30
		100

Note: For the written test 30 MCQ shall be asked from the theory portions.

Equipment/Facilities required to conduct the Practical Course.

S.NO	LIST OF THE EQUIPMENTS	QUANTITY REQUIRED
1	Vernier caliper 0-150mm	6
2	Micrometer 0-25mm	6
3	Vernier height gauge 0-300mm	2
4	Vernier depth gauge 150mm	2
5	Screw thread micrometer	1
6	Inside micrometer 25-50 mm	6
7	Slip gauges	2
8	Universal bevel protractor	3
9	Combination set	1
10	Sine bar 200mm	1
11	Tool makers straight edge	2
12	Feeler gauge	2
13	Dial test indicator with magnetic stand	3
14	V-block	1
15	Surface plate	1
16	Spirit level	2
17	Go & No Go gauges set	1

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

Introduction:

Introduction to CAD software, drawing aids and editing commands, basic dimensioning, hatching, blocks and views, Isometric drawing, printing and plotting

Course Objectives:

1. Appreciate the need of sectional view and types of sections.
2. Draw sectional views using different types of sections.
3. Explain the use of threaded fasteners and the types of threads.
4. Compare hole basis system with shaft basis system.
5. Select different types of fits and tolerance for various types of mating parts.
6. Practice on CAD commands in making 2D Drawings.
7. Draw assembled drawings of different types of joints and couplings using CAD.
8. Draw assembled drawings of various types of machine elements and Tool assembly using CAD.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Draw sectional views and types of sections

CO2: Select threads fasteners and types of threads

CO3: Compare hole basis system and shaft basis system

CO4: Manipulate fits and tolerance of mating parts

CO5: Construct plan, elevation and side views of different components

CO6: Carry out drawing of a jig, fixture, press tool and plastic moulding tool assembly

Pre-requisites:

Knowledge of Program core.

1. Design the Product.
2. Finalize and Prototype.

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	-	2	1	3	3
CO2	2	3	2	1	2	2	
CO3	3	3	2	2	2	3	1
CO4	3	2	2	3	2	2	
CO5	3	3	-	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle	Second Cycle	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Cycle 1 - Exercises 1, 2, 3, 4 and 5.

  Cycle 2 - Exercises 6, 7, 8, 9 and 10.

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Command Required	10
B	Modelling (2 Views Only)	30
C	Bill of Material & Dimensioning	10
TOTAL		**50**

- **CA 3:** Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

  The details of the documents to be prepared as per the instruction below.

  Each exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

  This documentation can be carried out in a separate notebook or a printed manual or a file with documents..

  The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

- **CA 4:** All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Command Required	10
B	Modeling (2 Views Only)	60
C	Bill of Material & Dimensioning	20
F	Viva Voce	10
	TOTAL MARKS	**100**

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

UNIT-I : INTRODUCTION TO CAD SOFTWARE Introduction – History of CAD – Applications – Advantages over manual drafting – Hardware requirements – Software requirements – Windows desktop – CAD screen interface – menus – Tool bars – How to start CAD – How to execute command – types of co-ordinate systems – Absolute – Relative – Polar.	7
UNIT-II: DRAWING AIDS AND EDITING COMMANDS Creating objects (2D) – Using draw commands – Line, Arc, Circle, Ellipse, Donut, Polygon, Point, Pline, Sketch, Trace – Creating 2D Solid. Creating text – Dtext, Mtext, Text styles – Mline, spline – Drawing with precision – O-snap options – drafting settings –limits – Units – drawing aids – Fill, Snap, Grid, Ortho lines – Function keys - Editing and modify commands – Object selection methods – Erasing object – Oops - Cancelling and undoing a command – Copy – Move – Array – Offset – Scale – Rotate – Mirror – Break – Trim – Extend – Explode. Divide – Measure – stretch – Lengthen – Changing properties – Color – line types –LT scale – Matching properties – Editing with grips – Pedit – Ddedit – Mledit. **BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS** Basic dimensioning – Editing dimensions – Dimension styles – Dimension system variables. Machine drawing with CAD. Creation of blocks – Wblock – inserting a block – Block attributes – Hatching –Pattern types – Boundary hatch – working with layers - Controlling the drawing display – Blipmode – View group commands – Zoom, redraw, regen, regenauto, pan, viewres – Real time zoom. Inquiry groups – calculating area – Distance – Time – Status of drawing – Using calculator. **ISOMETRIC DRAWING, PRINTING AND PLOTTING** Isometric drawing – Isometric projection – drawing iso circles – Dimensioning isometric objects. File commands – File Import and export – plotting drawing – external references – 3D fundamentals – 2D to 3D Conversion 3D Drawing: 3D Primitives-Extrude – Revolve-Slice-Section, Surface 3D Mesh-3D - Surface-3D Operation-Solid Editing.	8

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

MACHINE DRAWING 1. Sleeve & Cotter joint 2. Screw Jack 3. Foot step bearing 4. Plummer Block 5. Universal Coupling 6. Machine Vice	25

TOOL DRAWING 1. Template Drill jig 2. Welding fixture 3. Press tool assembly- Blanking tool **4.** Plastic moulding tool assembly- Injection moulding tool	25
Tests and Model examination	**10**
TOTAL HOURS	**75**

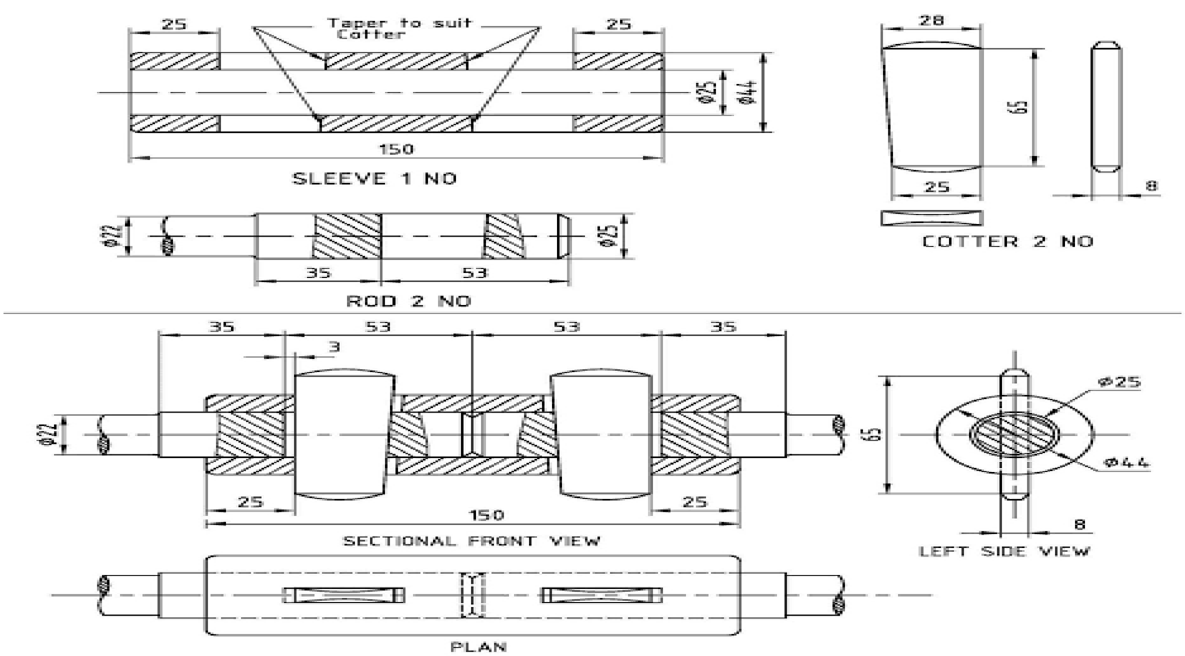
1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

MACHINE DRAWING

Exercise – 1 Sleeve & Cotter Joint

PART & ASSEMBLY DRAWING

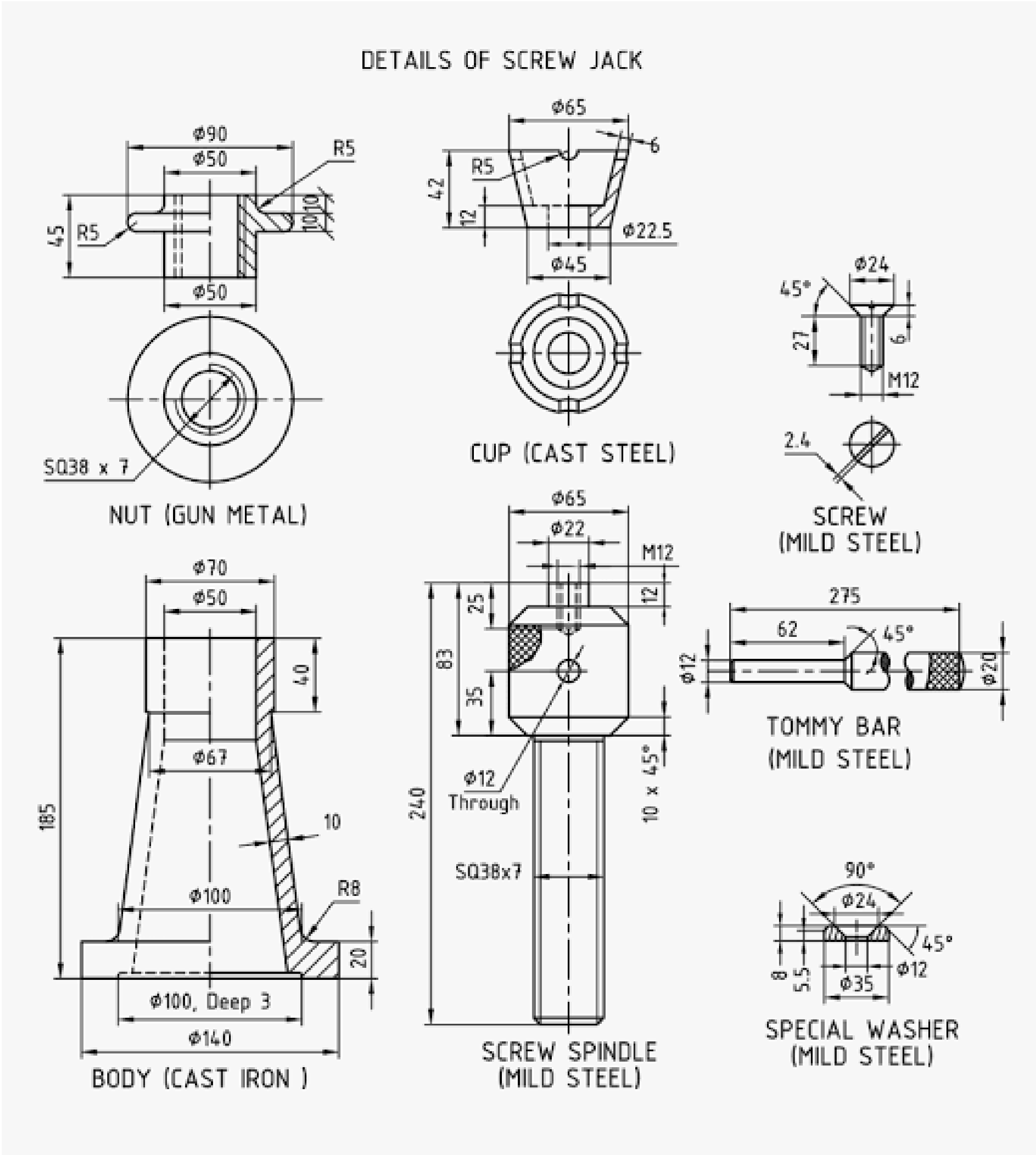
SLEEVE AND COTTER JOINT



BILL OF MATERIALS

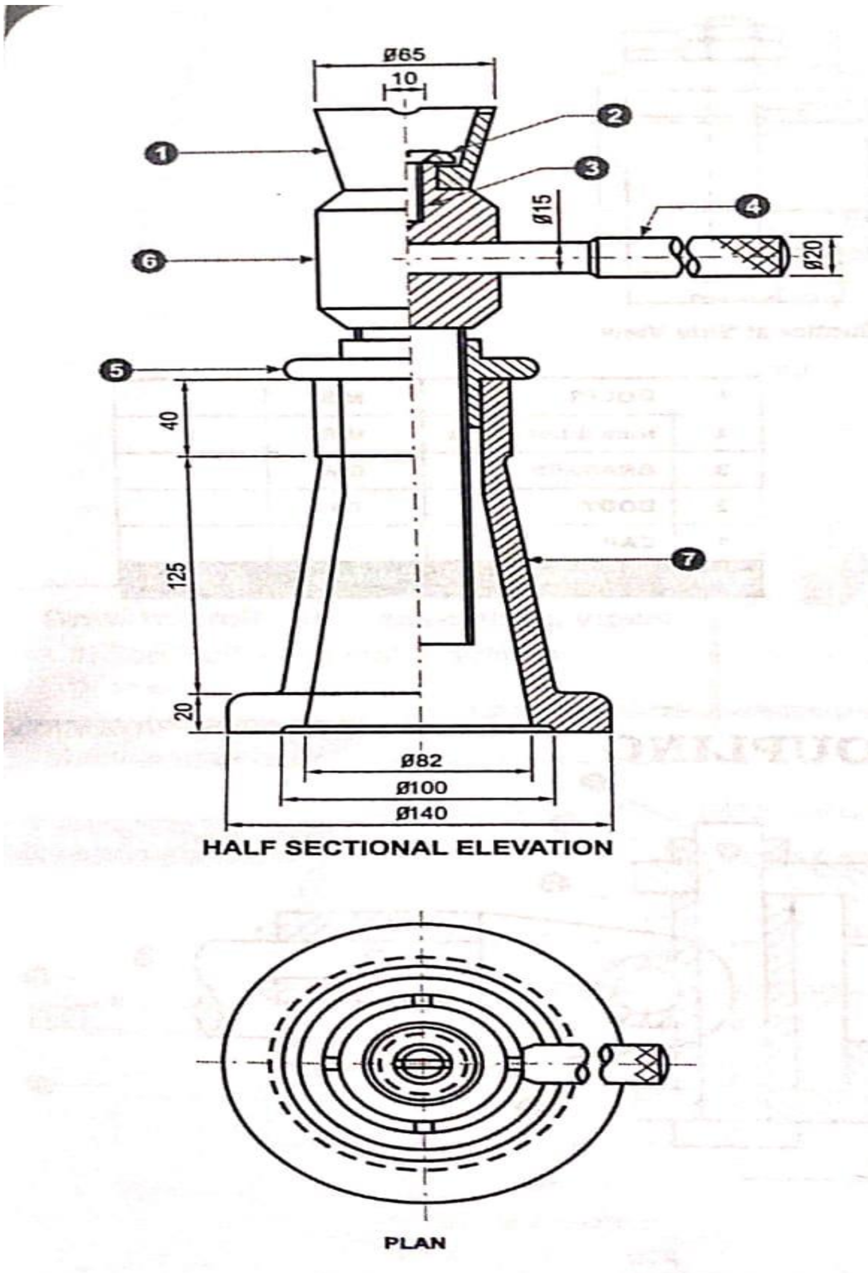
S.No.	PART NAME	MATERIAL	NO.OFF
1.	SLEEVE	MILD STEEL	1
2.	RODS	MILD STEEL	2
3.	COTTER	STEEL	2

PART DRAWING



1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

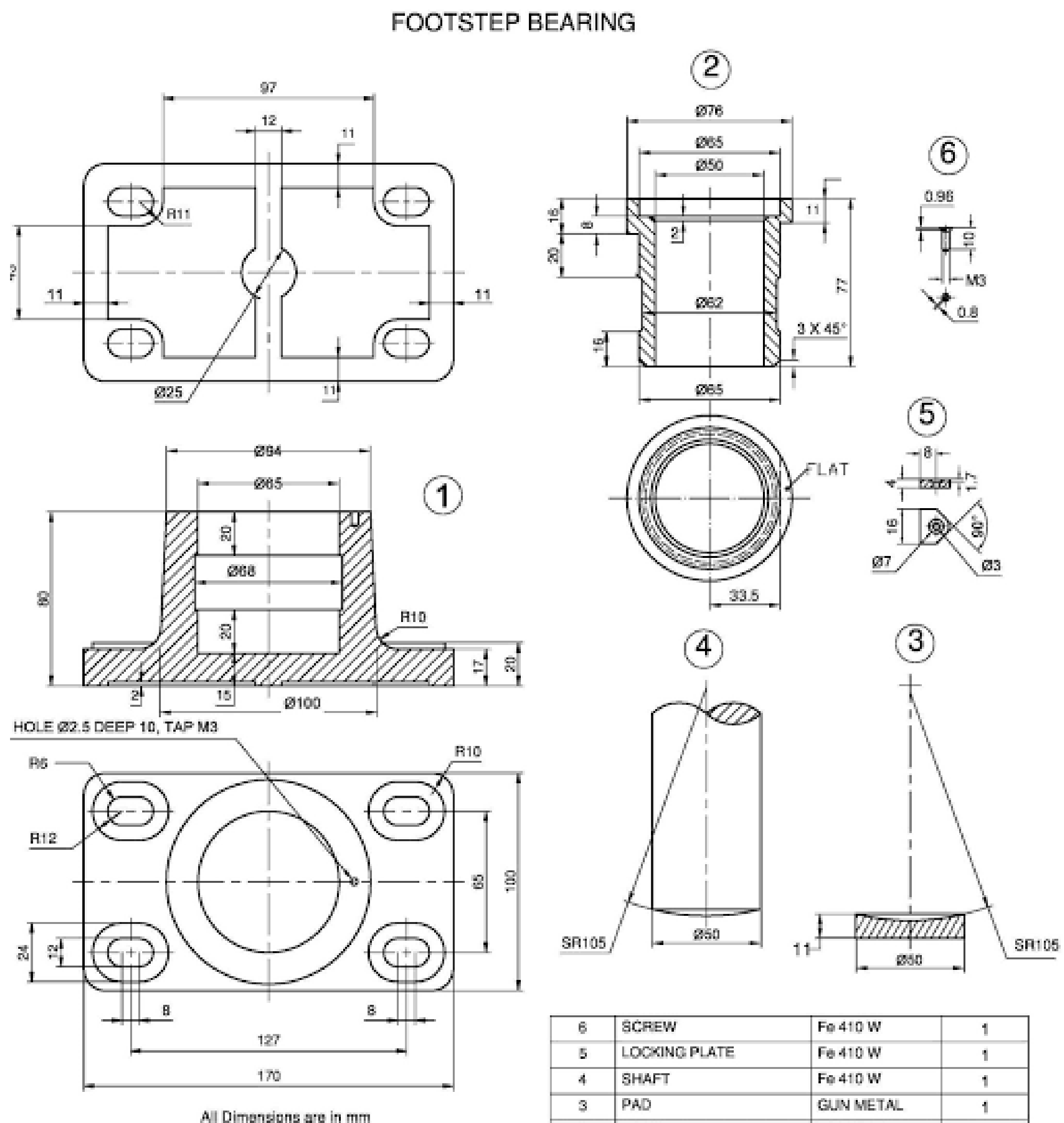
ASSEMBLY DRAWING



1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

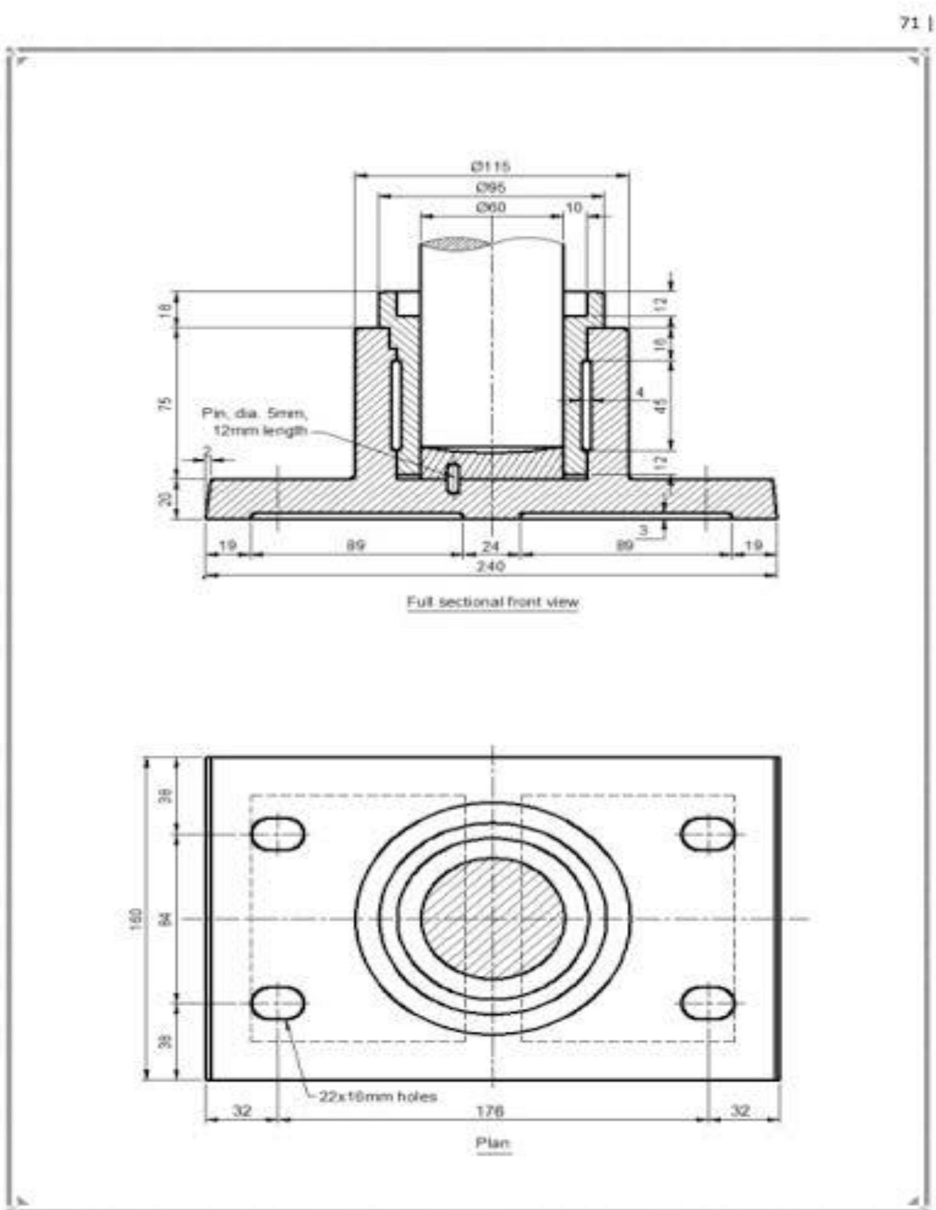
Exercise – 3 FOOT STEP BEARING

PART DRAWING



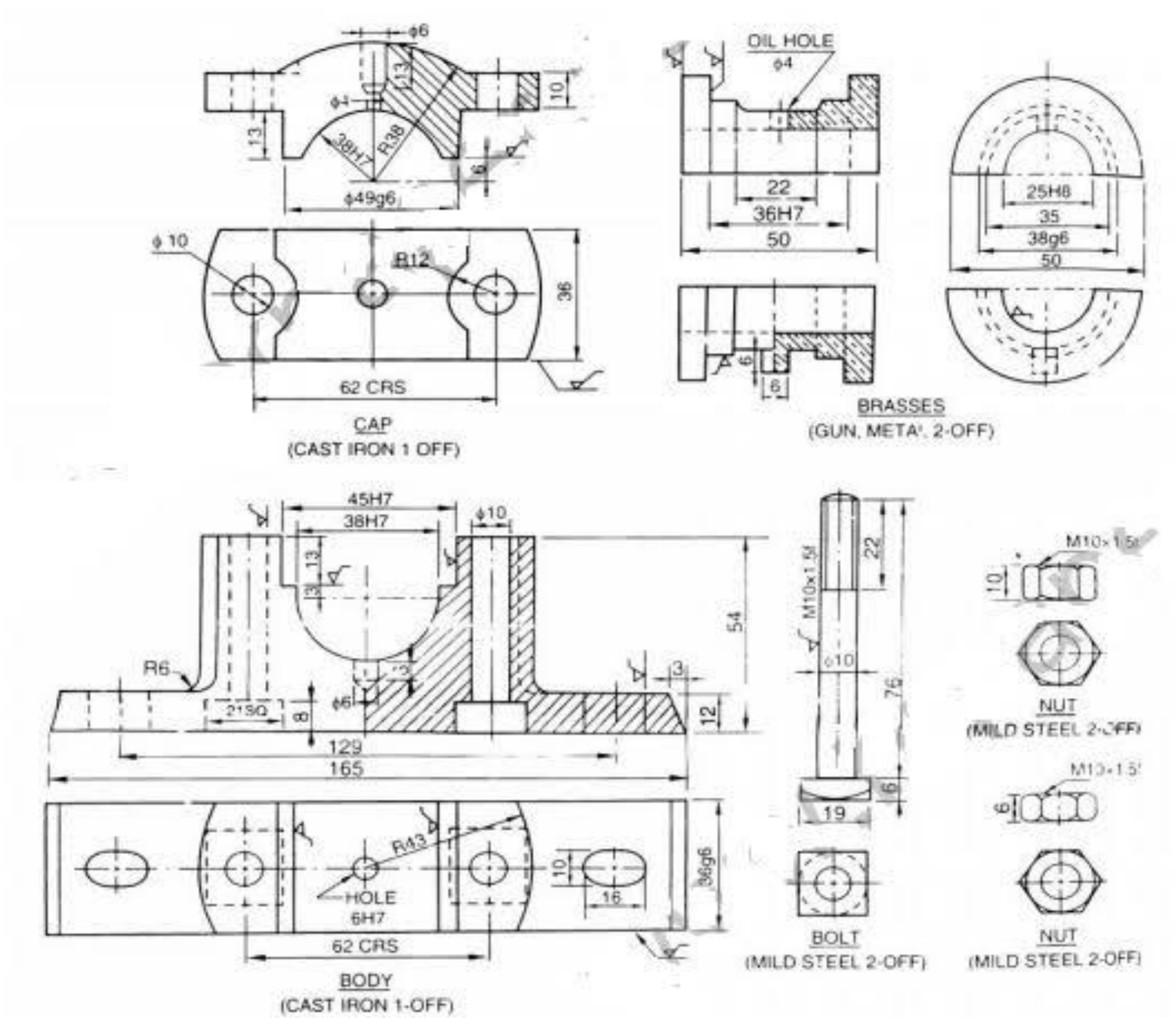
6	SCREW	Fe 410 W	1
5	LOCKING PLATE	Fe 410 W	1
4	SHAFT	Fe 410 W	1
3	PAD	GUN METAL	1
2	BUSH	GUN METAL	1
1	SUPPORTING BRACKET	CAST IRON	1
ITEM NO	DESCRIPTION	MATERIAL	NO OFF

ASSEMBLY DRAWING



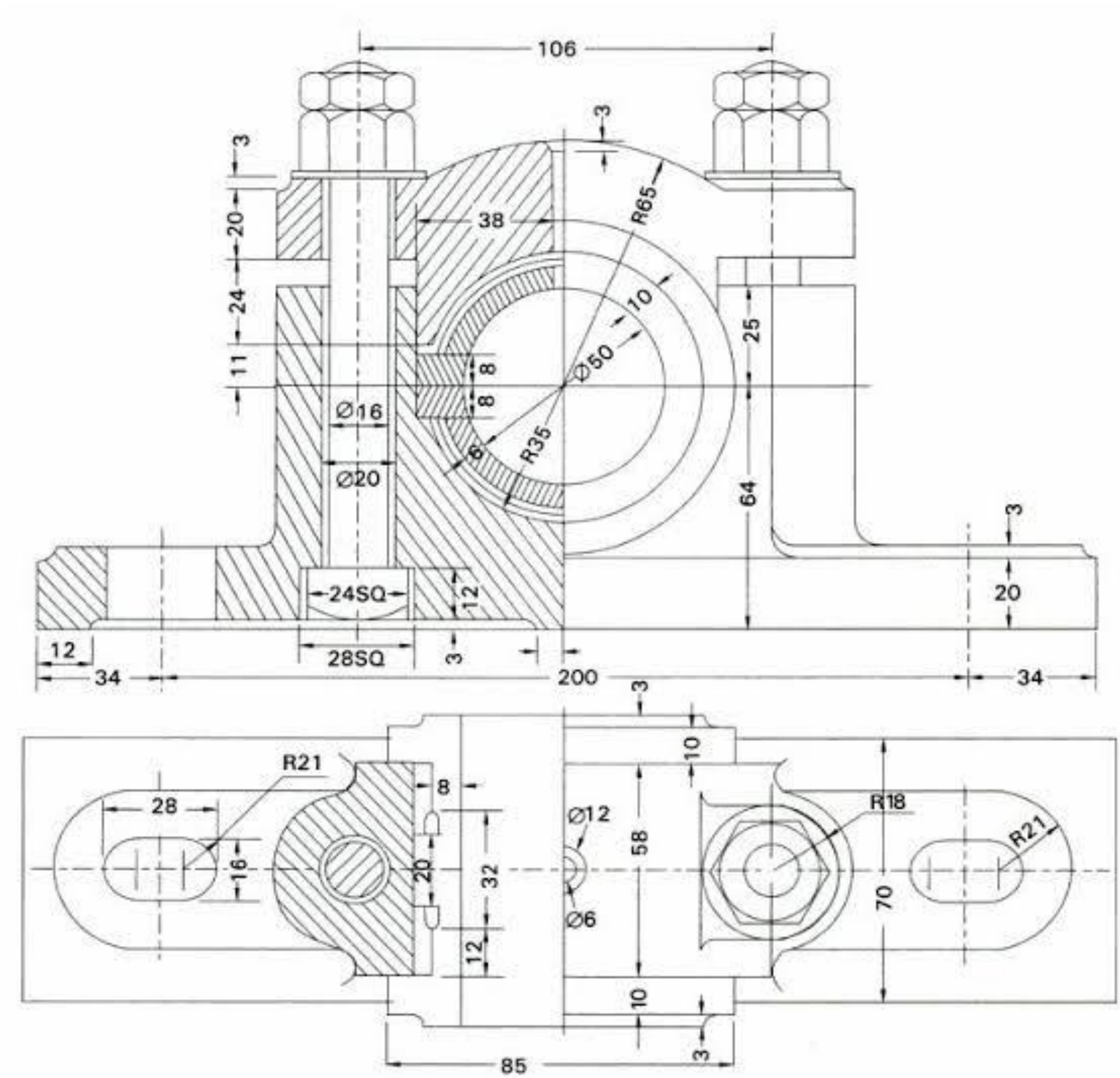
Exercise – 4 PLUMMER BLOCK

PART DRAWING



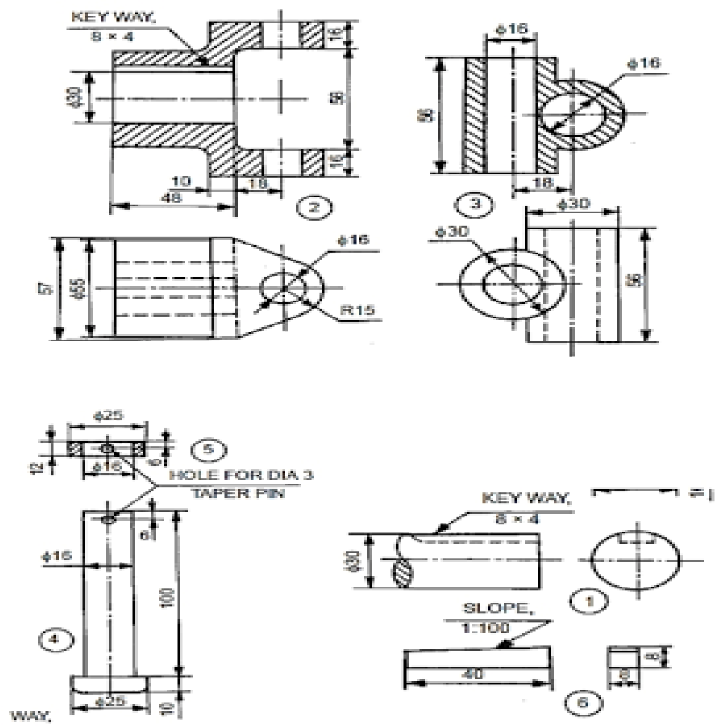
1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

ASSEMBLY DRAWING



Exercise – 5 Universal Coupling

PART DRAWING

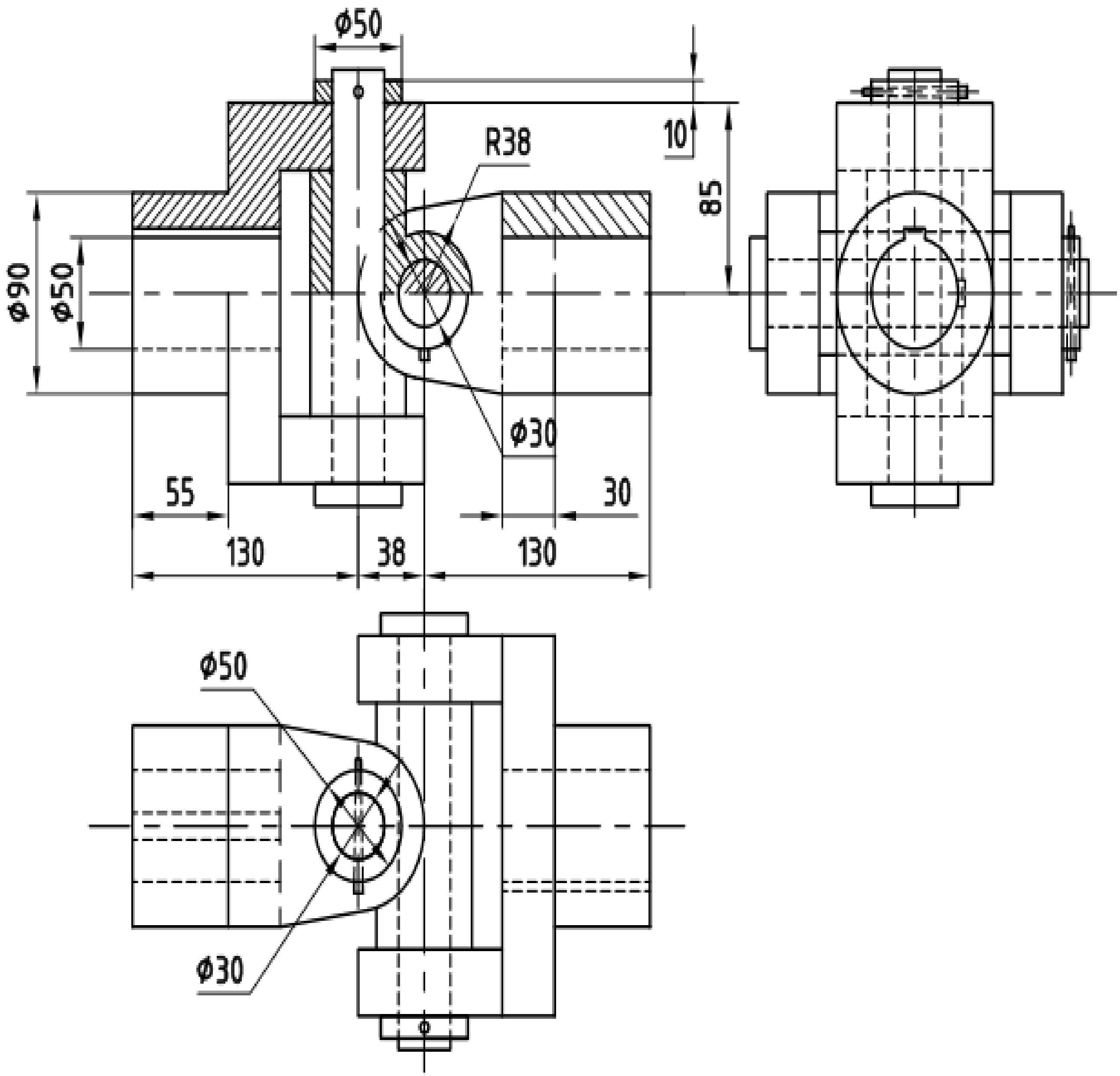


Parts list

Sl. No.	Name	Matl.	Qty.
1	Shaft	MS	2
2	Fork	FS	2
3	Central block	FS	1
4	Pin	MS	2
5	Collar	MS	2
6	Key	MS	2

Fig. 2: Details of a Universal Coupling

ASSEMBLY DRAWING

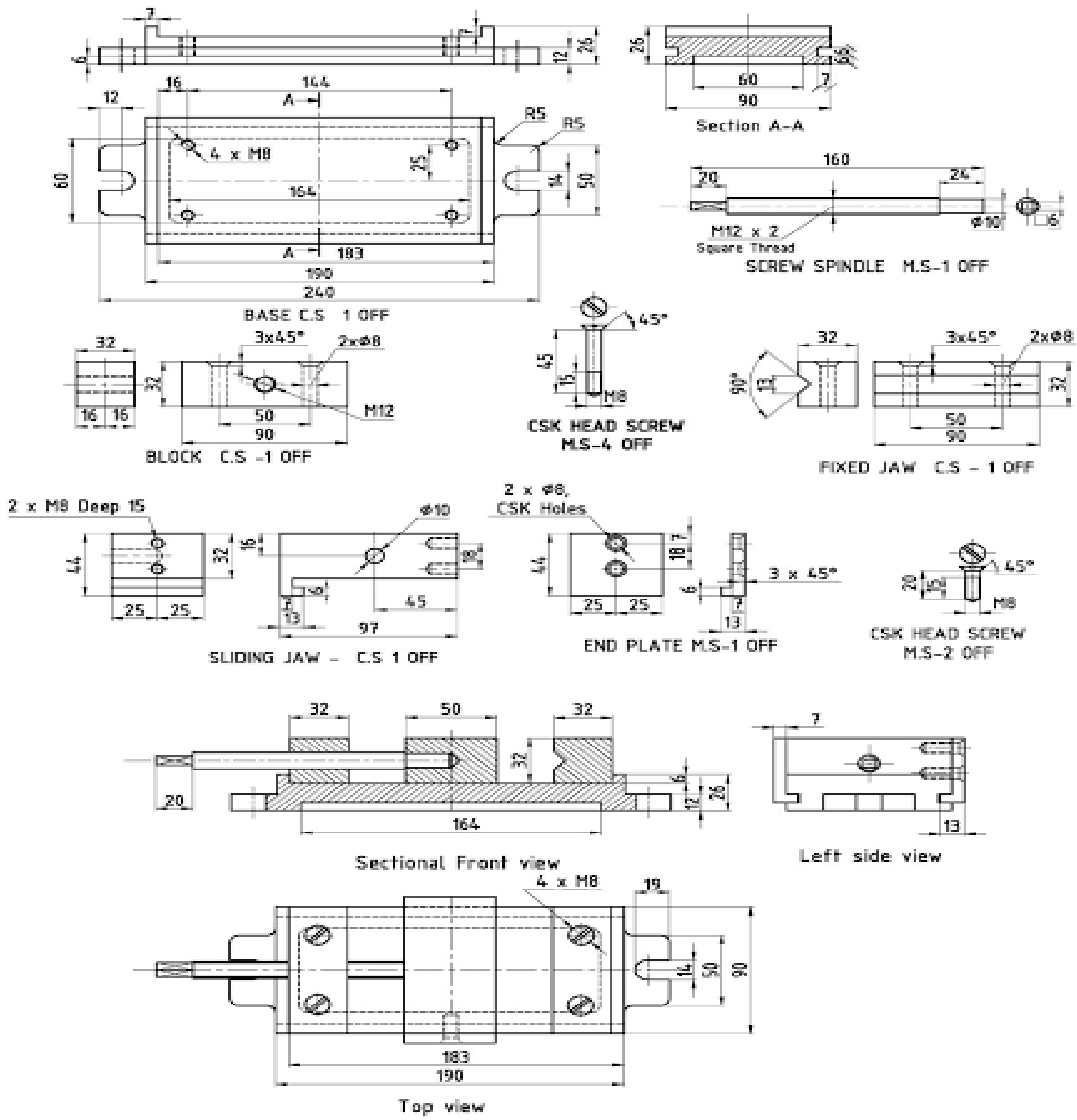


Φ50
R38
10
85
Φ90
Φ50
Φ30
55
30
130
38
130
Φ50
Φ30

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

Exercise – 6 Machine Vice

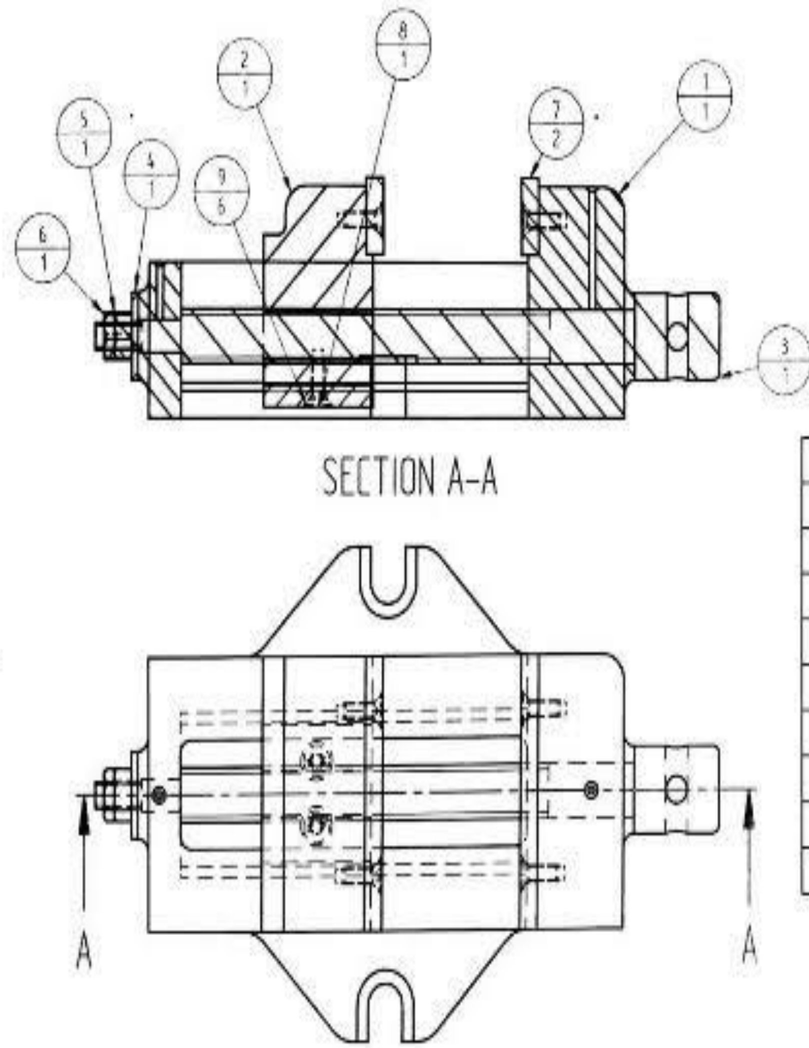
PART DRAWING



MACHINE VICE

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

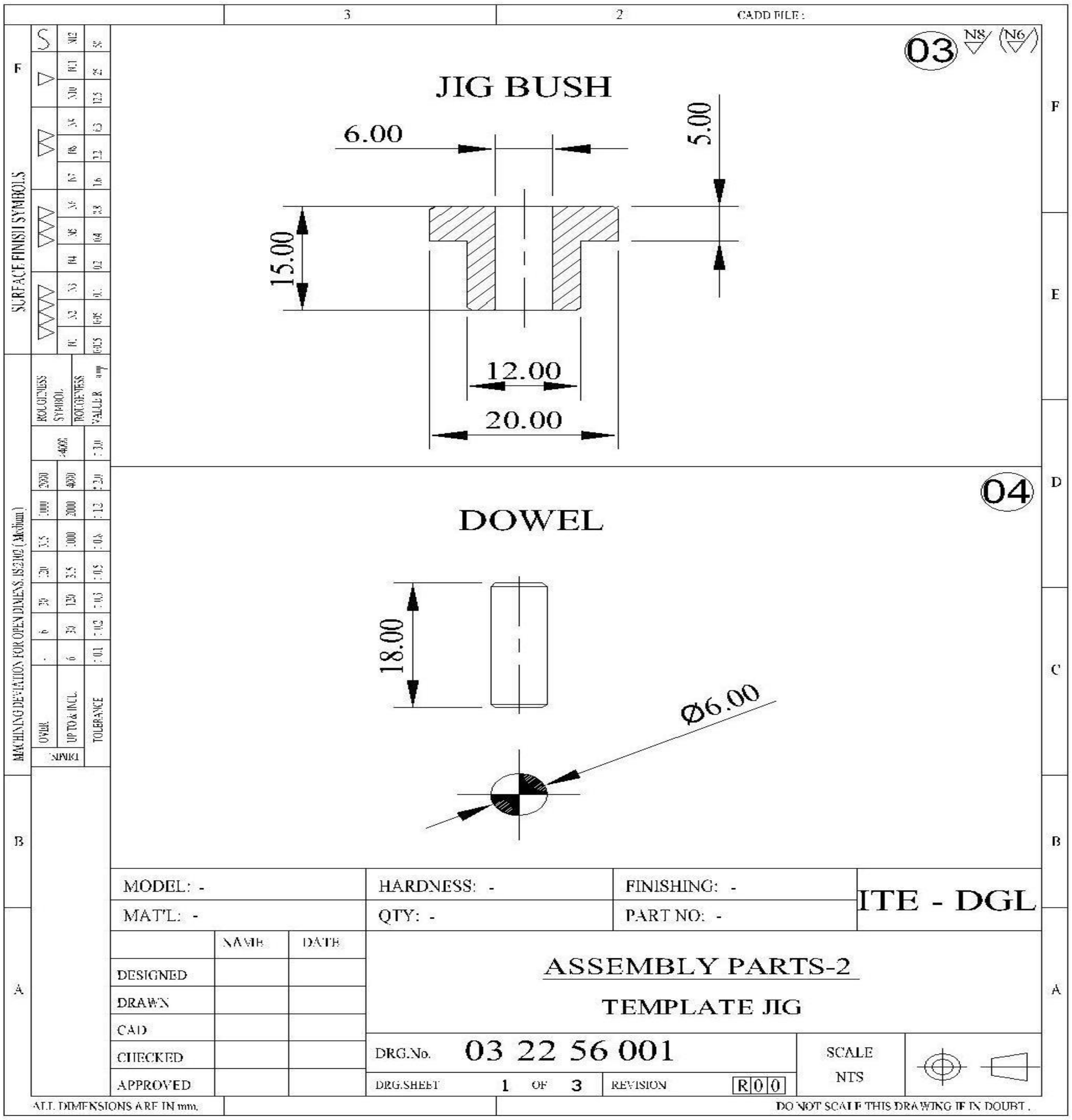
ASSEMBLY DRAWING



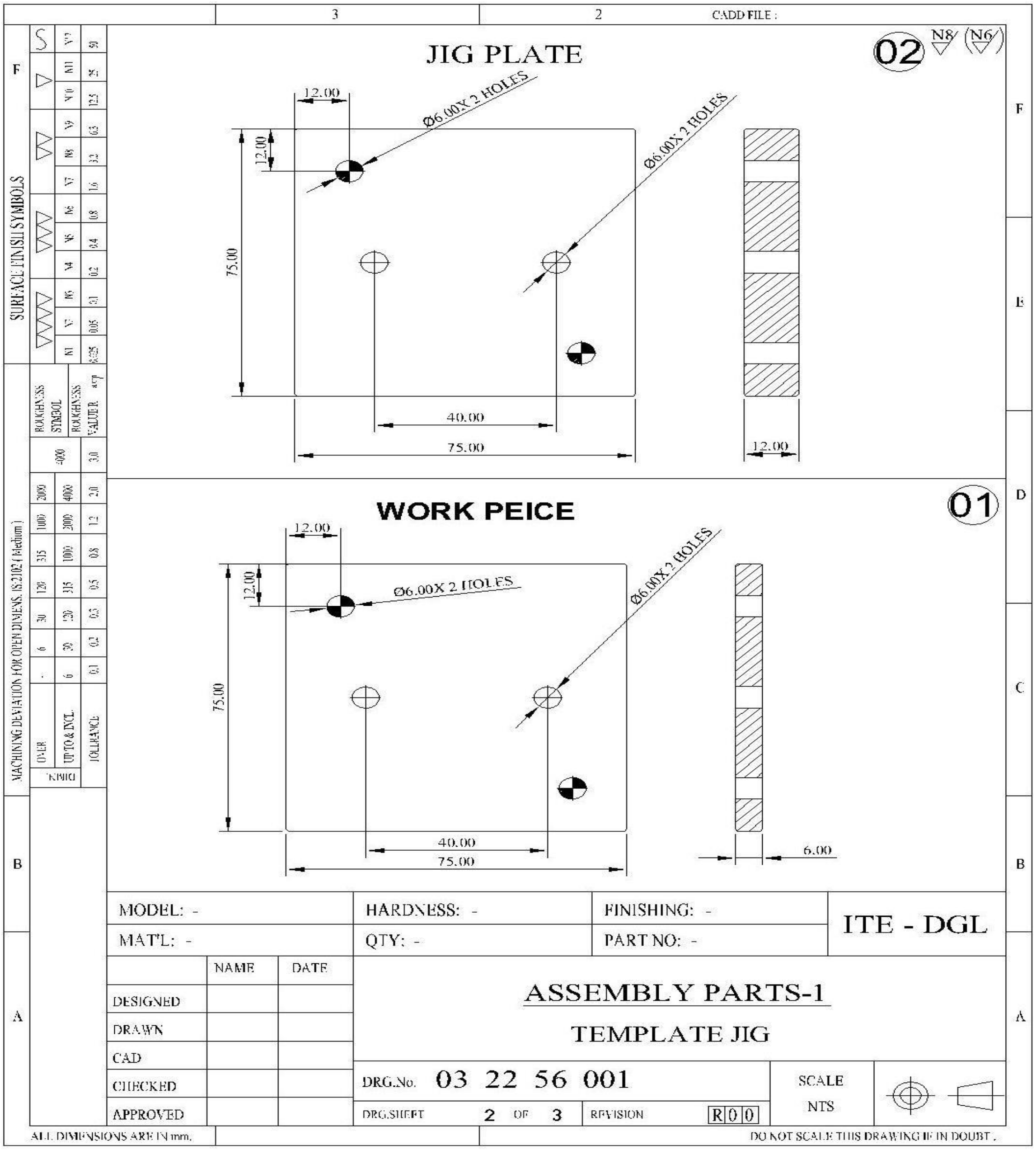
MACHINE VICE

Item Number	Title	Quantity
1	body of vice	1
2	movable jaw	1
3	screw rod	1
4	washer	1
5	nut	1
6	lock nut	1
7	jaw grip	2
8	clamping plate	1
9	screw m6	6

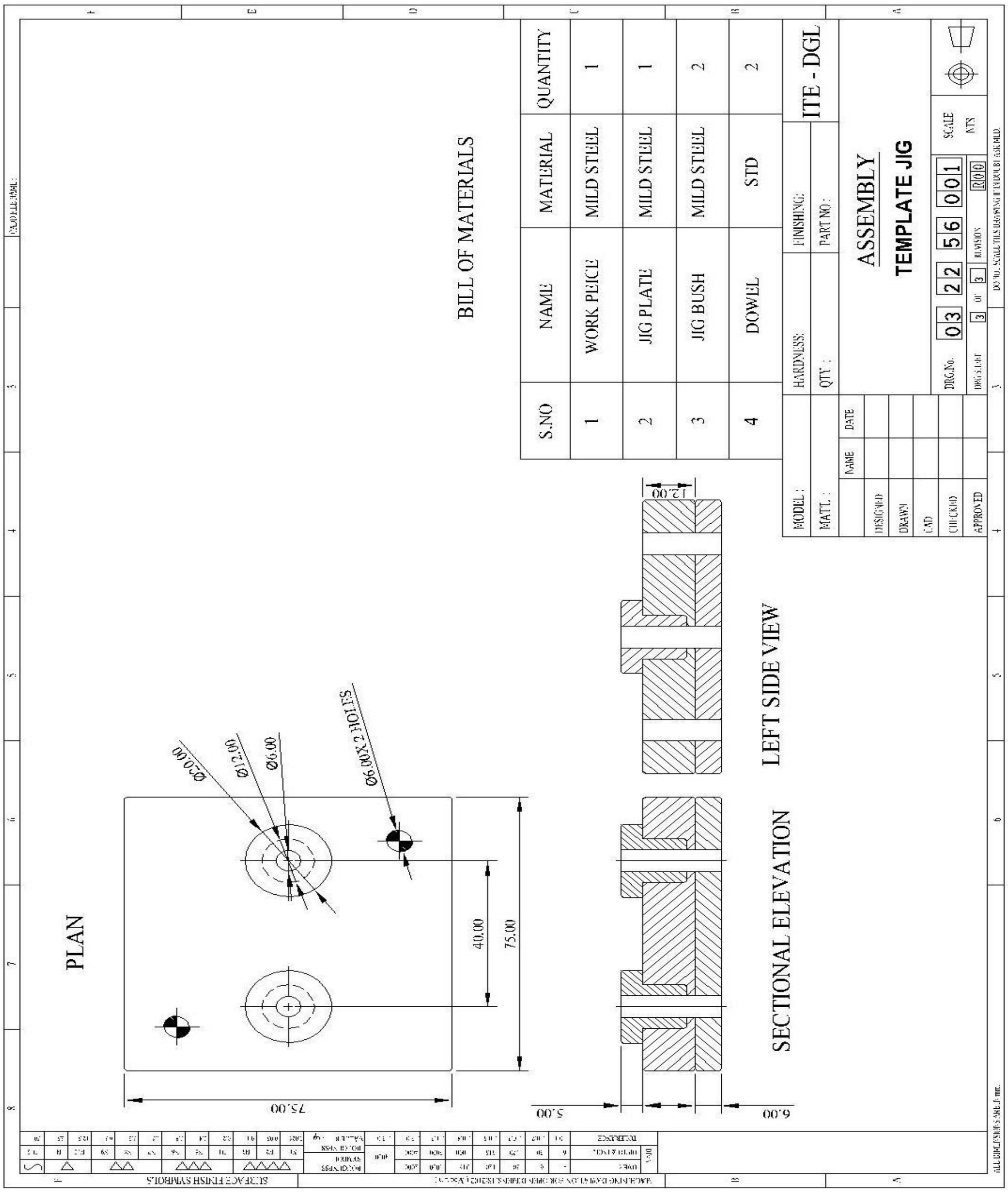
Tool Drawing

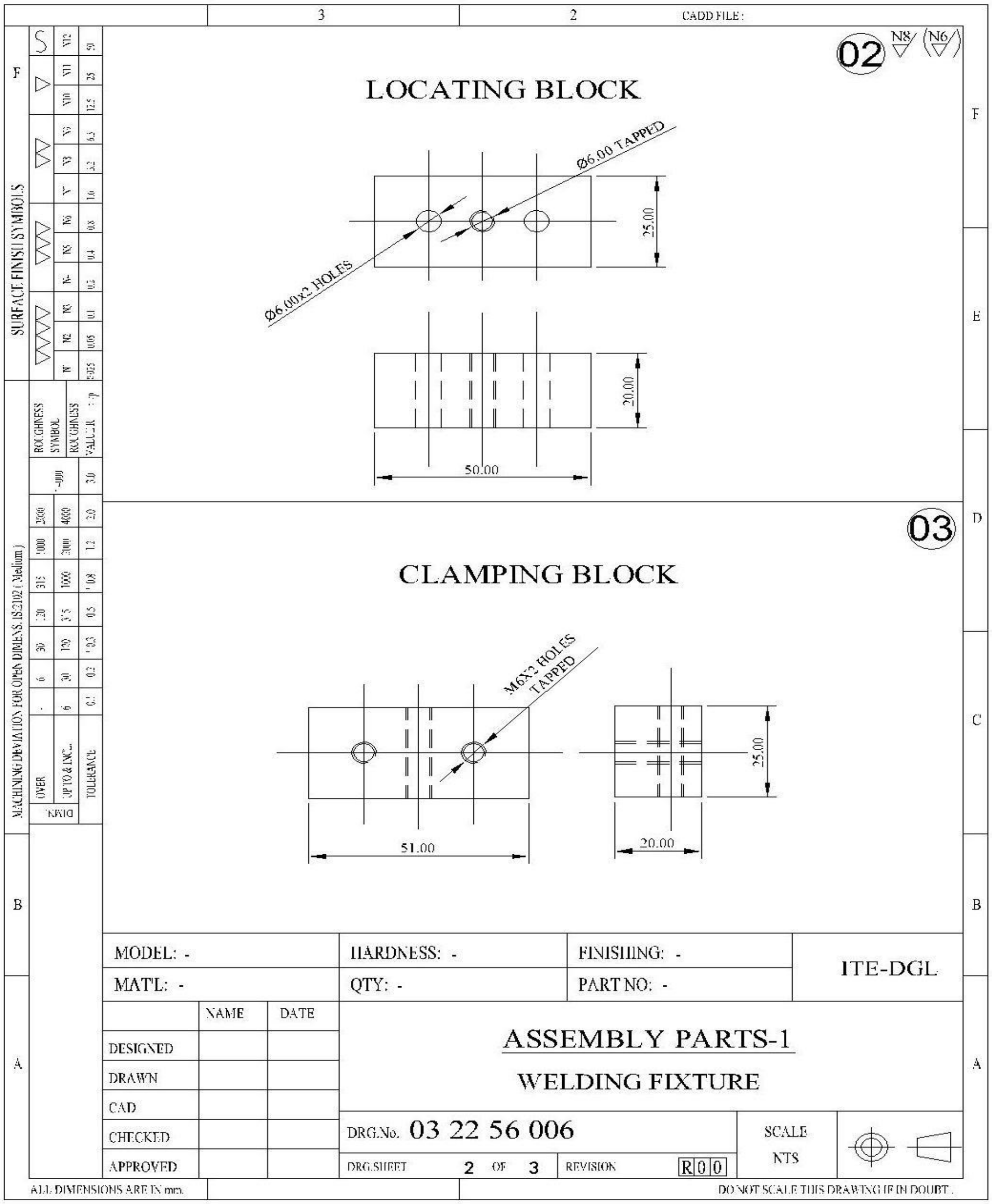


Exercise – 7 Drill Jig(Template)



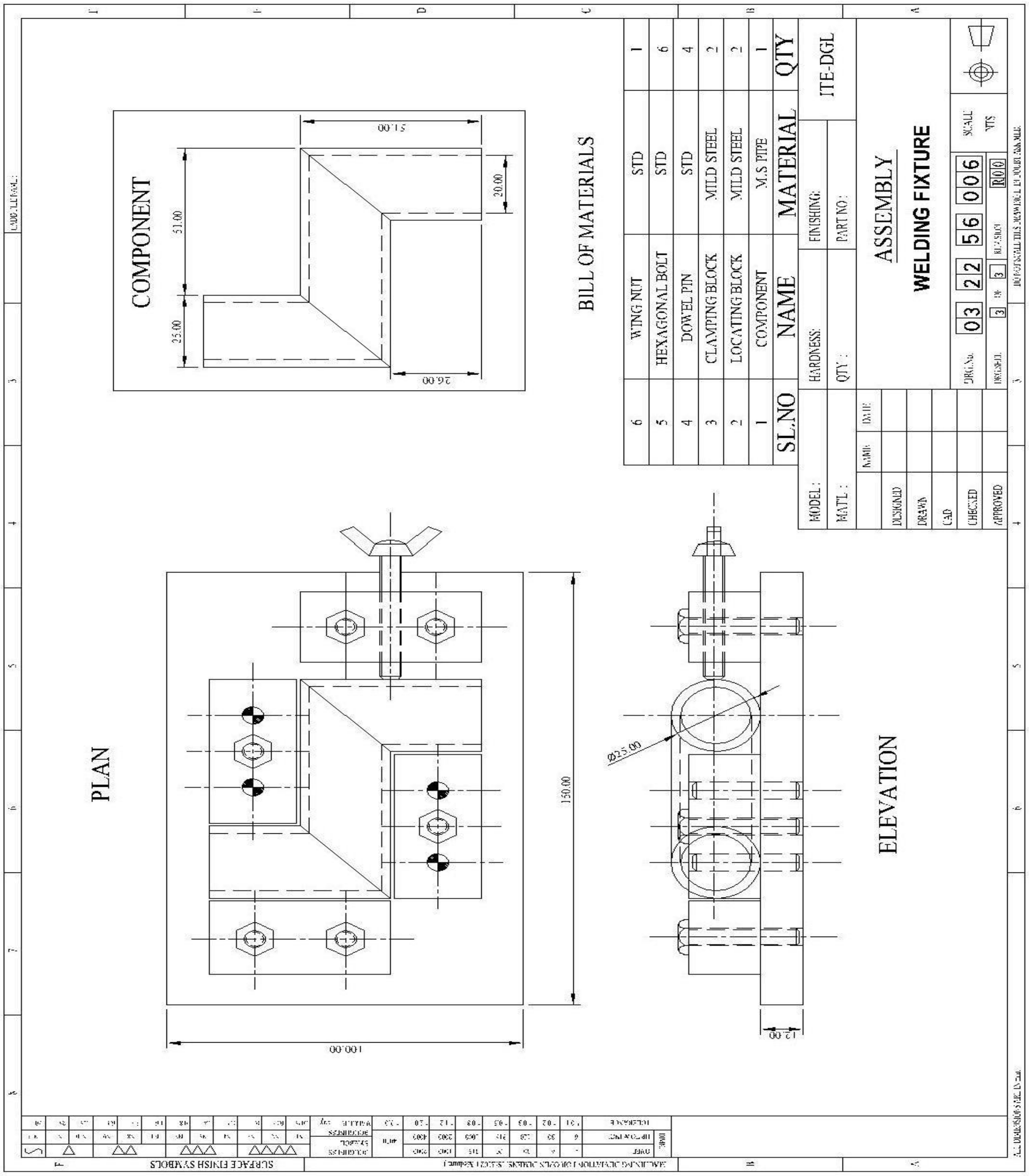
Exercise –8 Welding Fixture





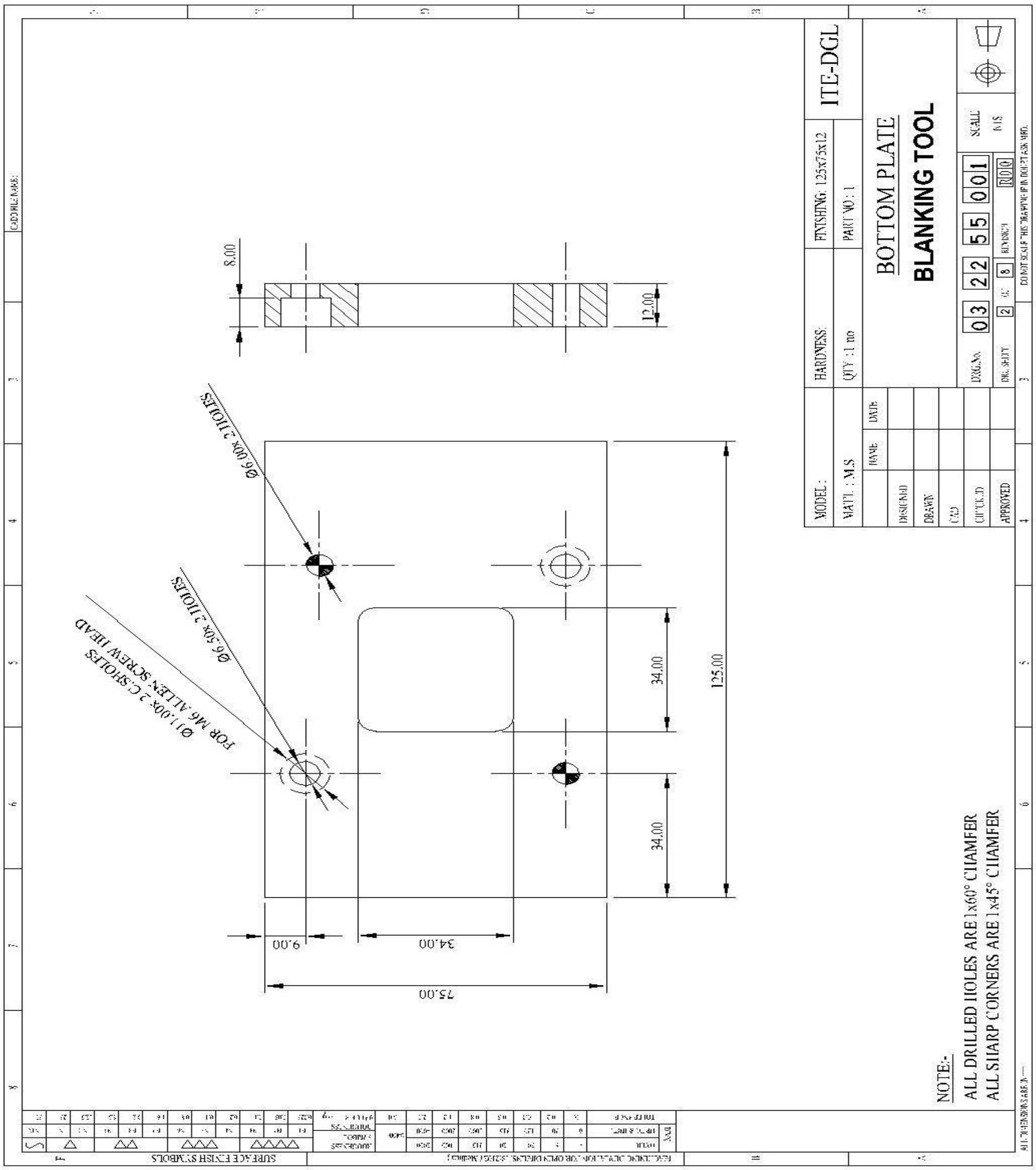
LOCATING BLOCK
02
Ø6.00 TAPPED
Ø6.00x2 HOLES
25.00
20.00
50.00
CLAMPING BLOCK
03
M6X2 HOLES TAPPED
25.00
51.00
20.00
MODEL: -
HARDNESS: -
FINISHING: -
MATL: -
QTY: -
PART NO: -
ITE-DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
WELDING FIXTURE
DRG.No. 03 22 56 006
DRG.SHEET 2 OF 3
REVISION R00
SCALE
NTS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.
SURFACE FINISH SYMBOLS

1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

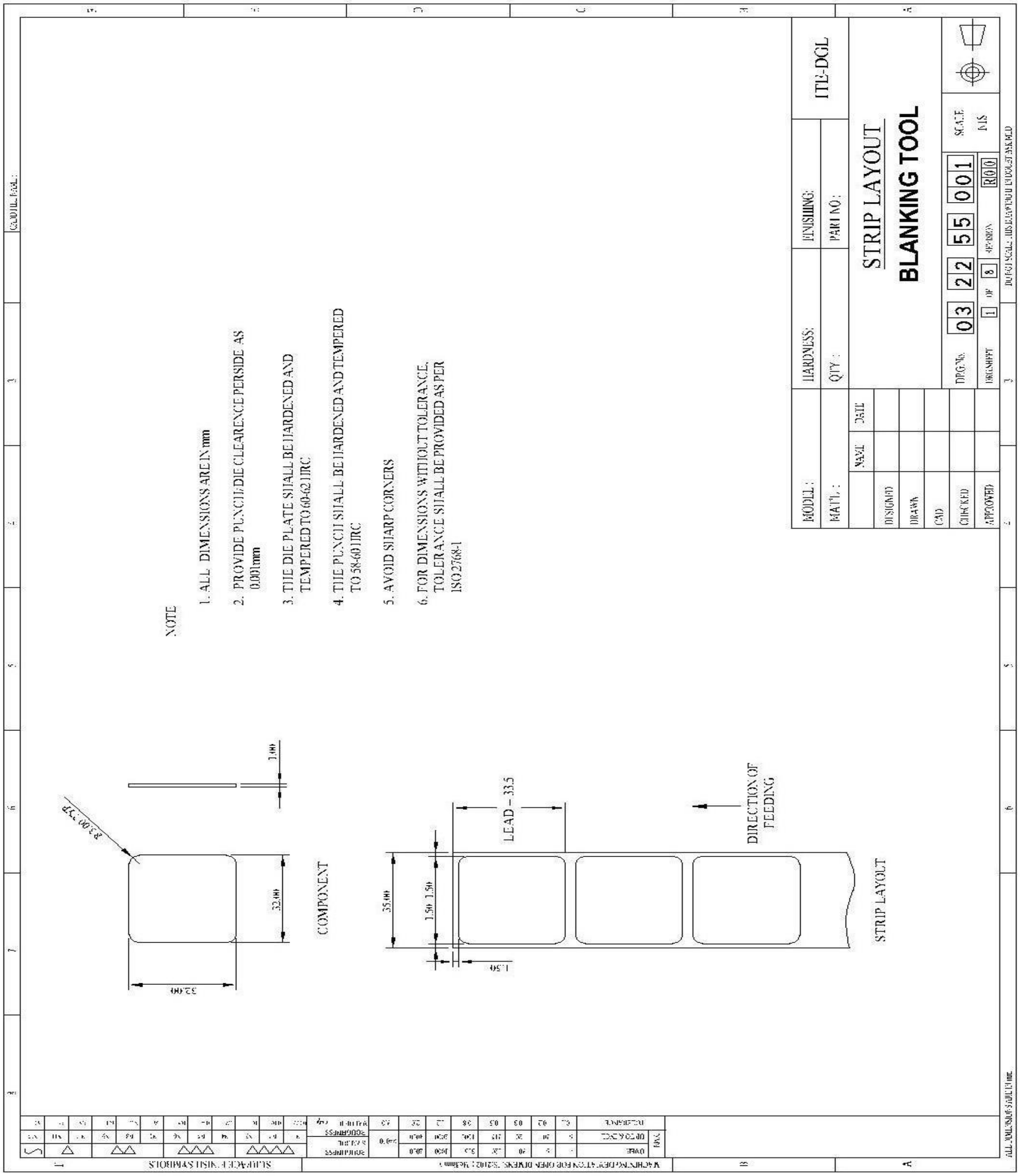


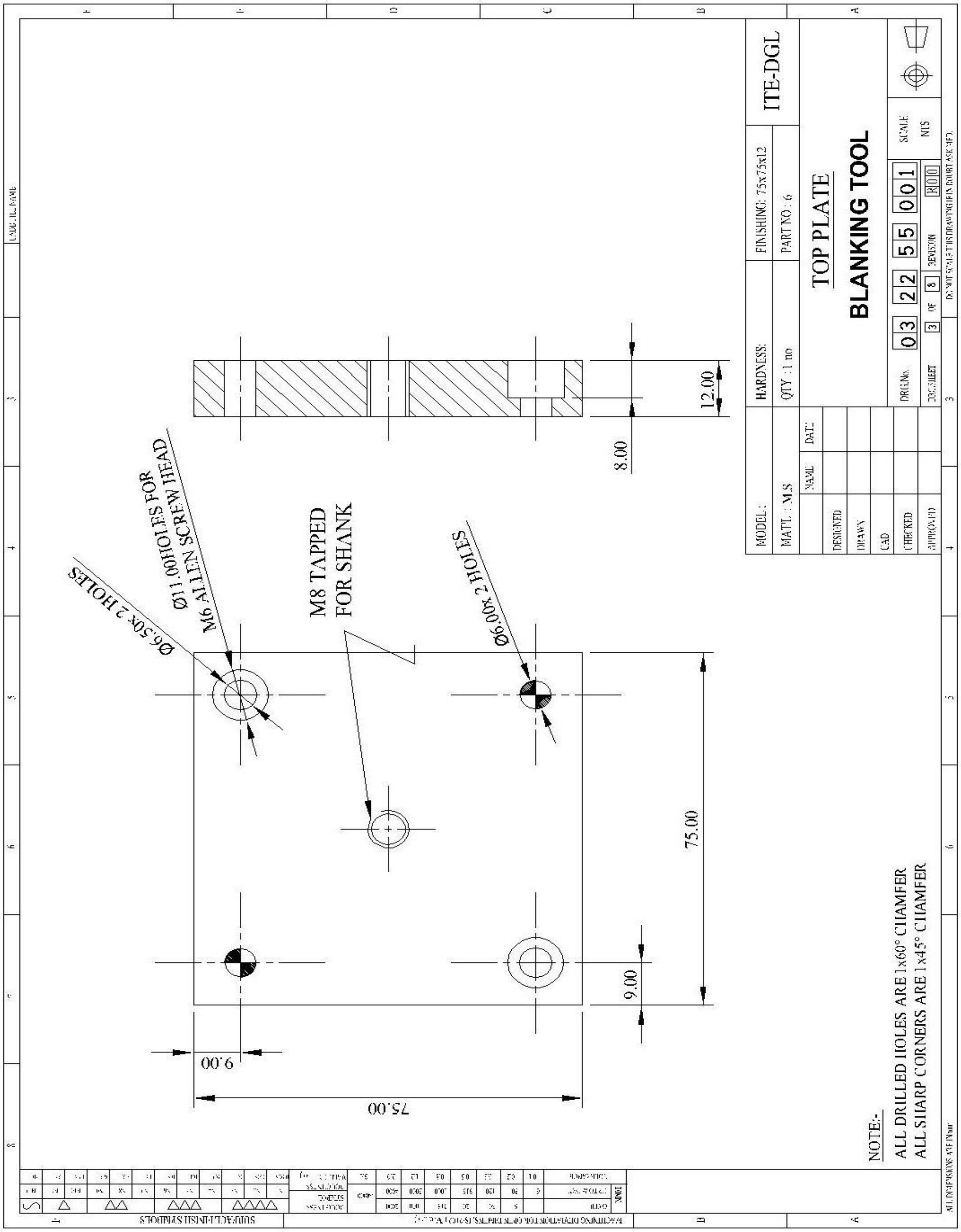
1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

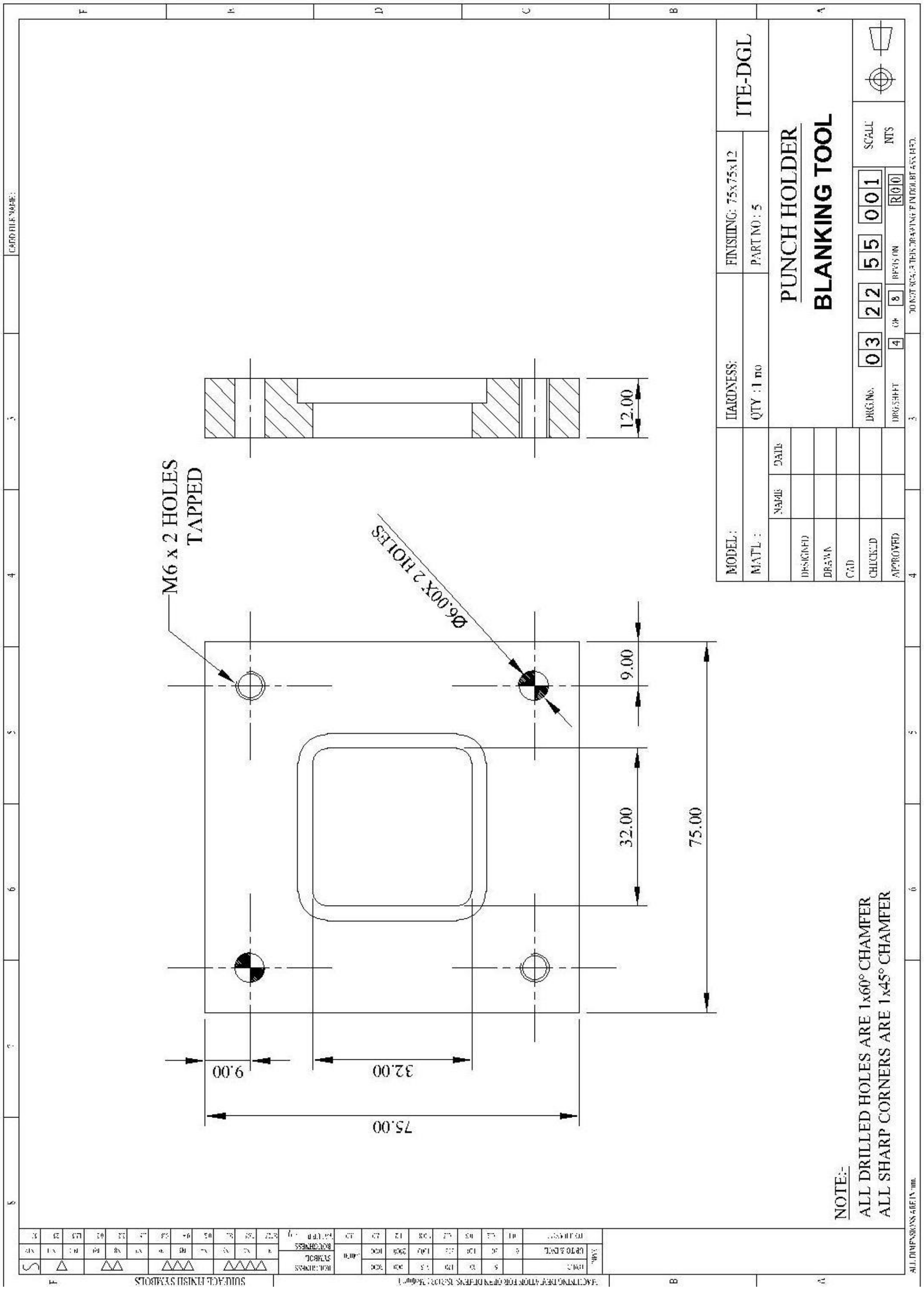
Exercise- 9 Blanking Tool – Drop through type



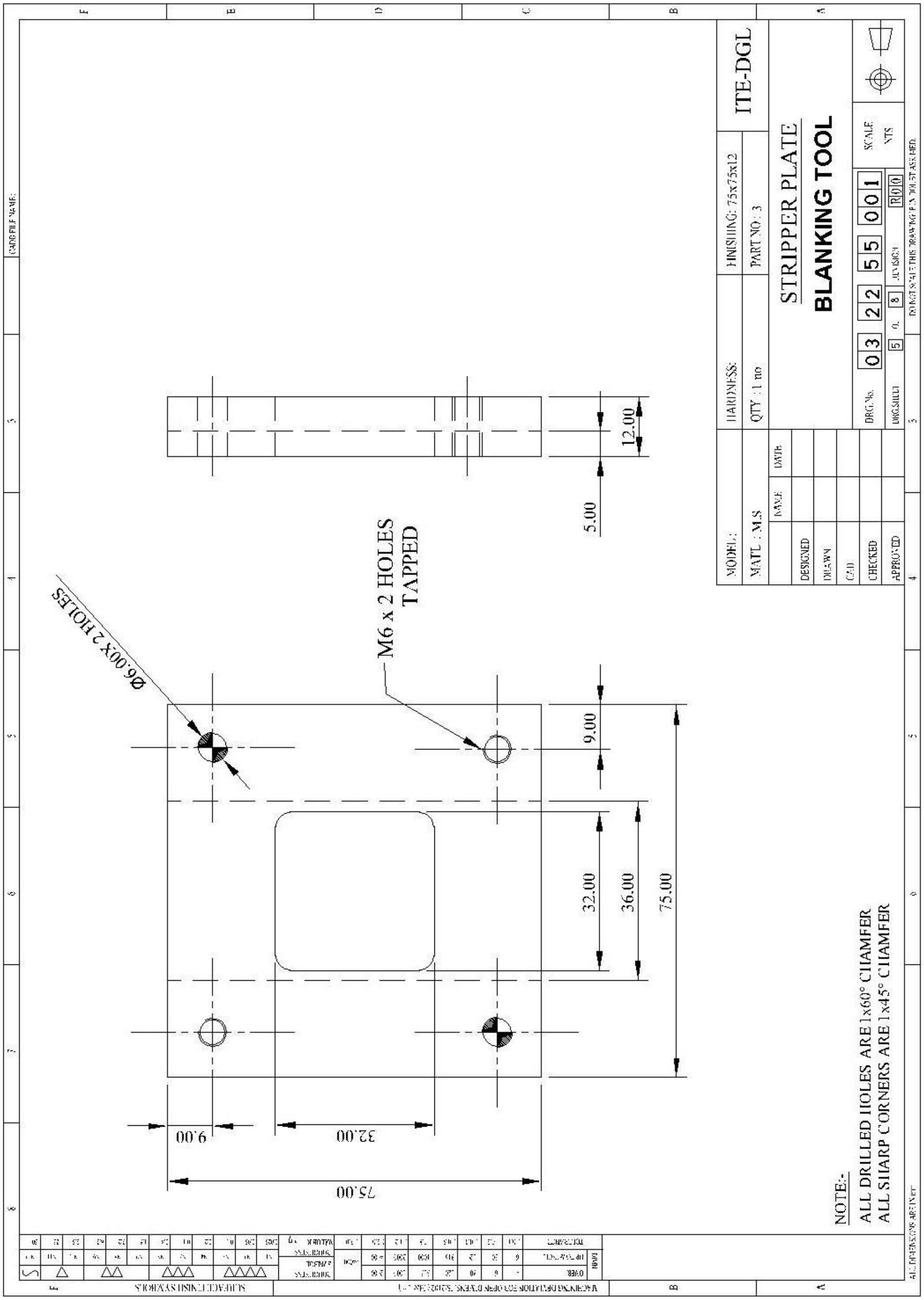
1220233520	Computer Aided Machine and Tool Drawing Practical	L	T	P	C
Practical		0	0	4	2

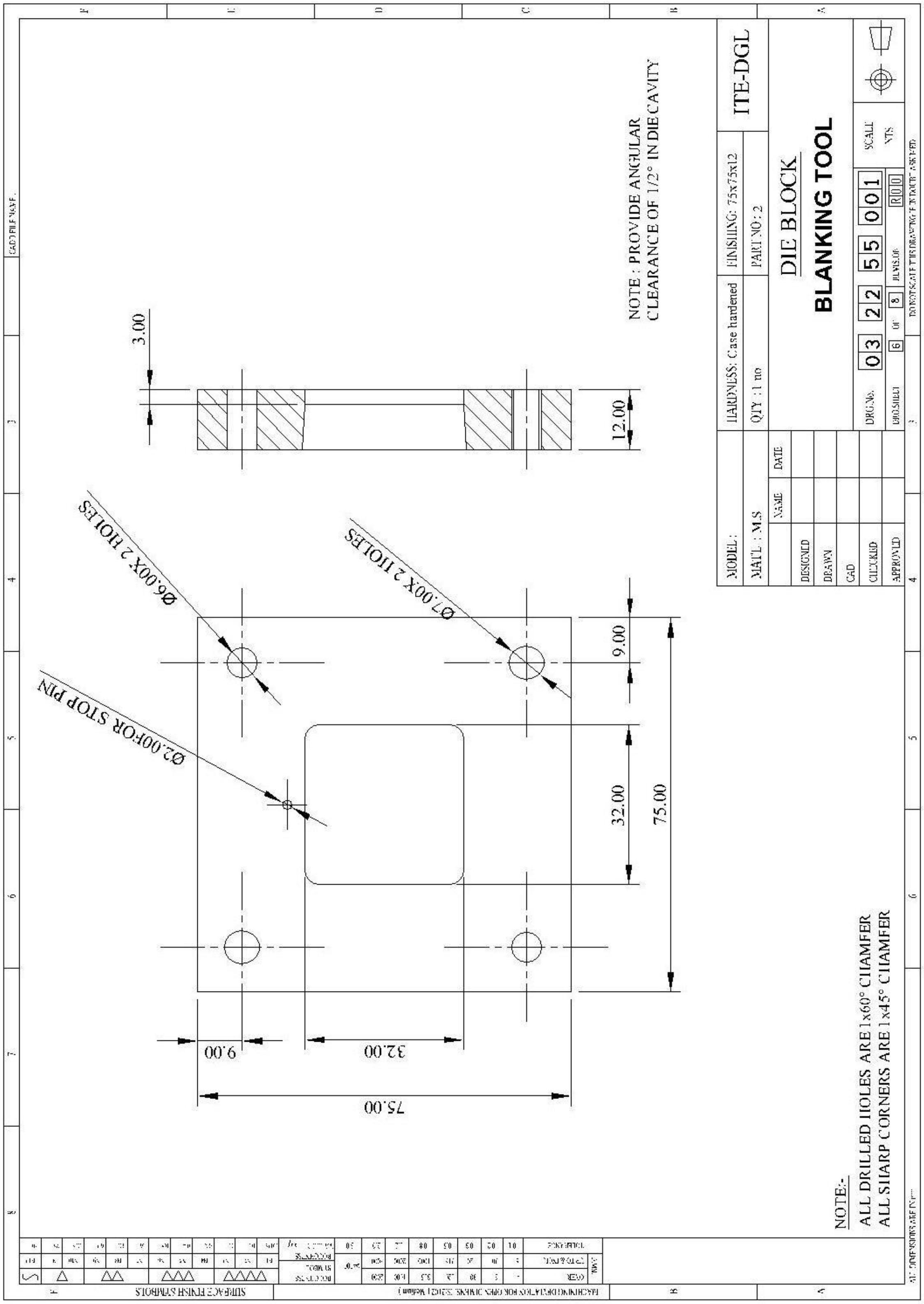


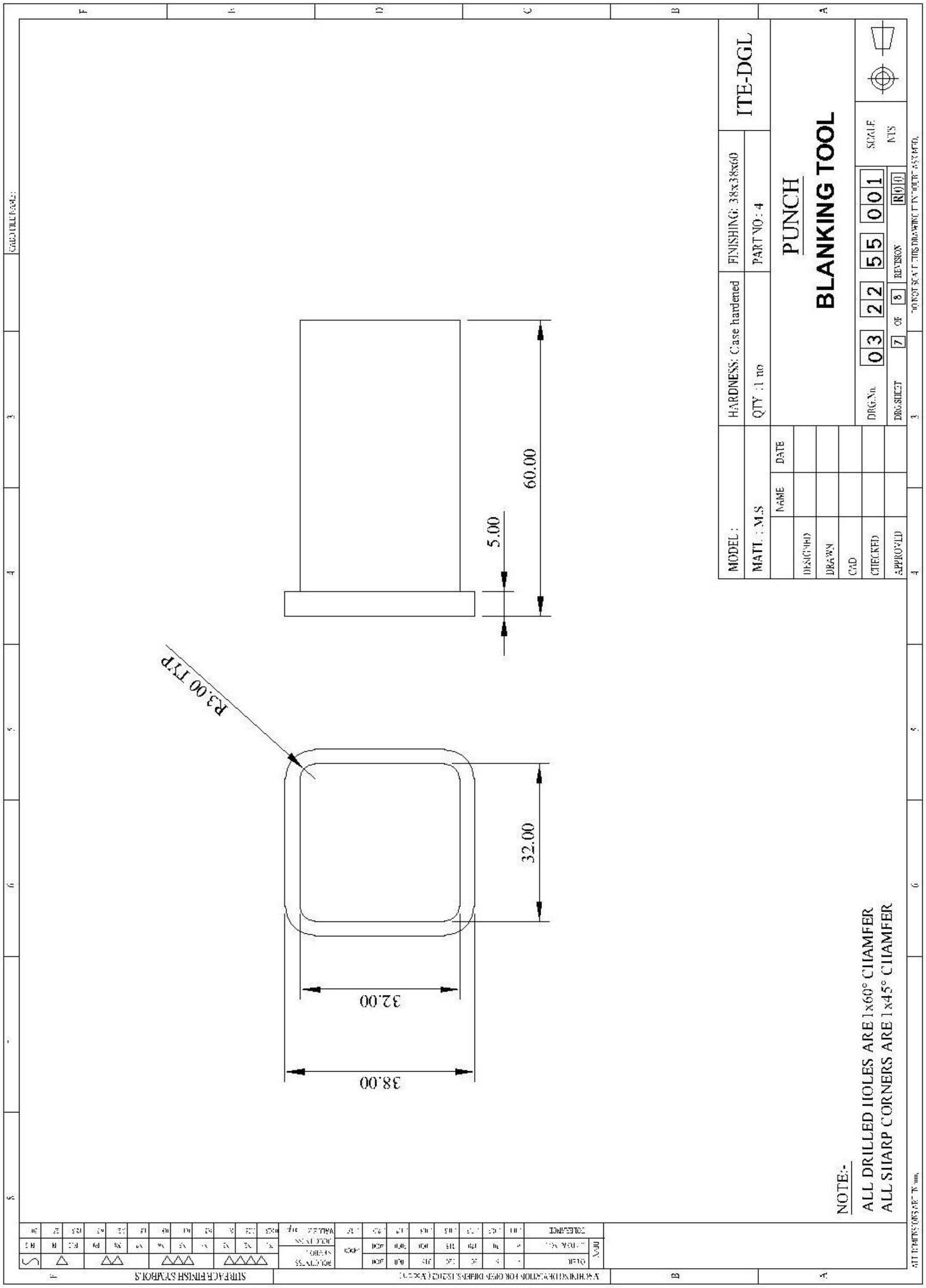

ITE-DGL
FINISHING: 75x75x12
PART NO : 6
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
TOP PLATE
BLANKING TOOL
SCALE
NTS
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
Ø11.00HOLES FOR
M6 ALLEN SCREW HEAD
Ø6.50x 2 HOLES
M8 TAPPED
FOR SHANK
Ø6.00x 2 HOLES
12.00
8.00
75.00
9.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

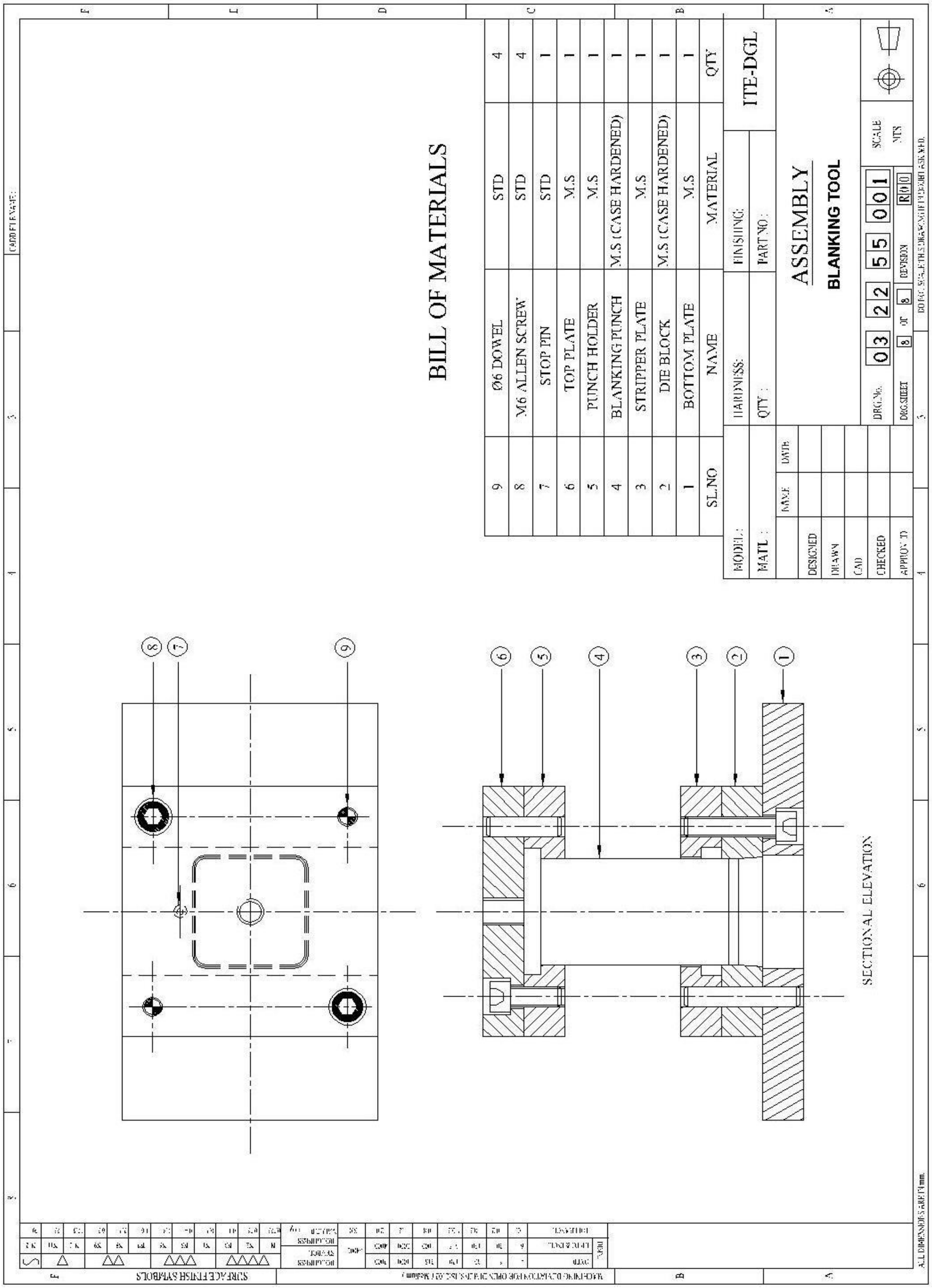


ITE-DGL
FINISHING: 75x75x12
PART NO: 5
HARDNESS:
QTY : 1 no
MODEL:
MAT'L :
PUNCH HOLDER
BLANKING TOOL
DRG.No. 03 22 55 001
R00
SCALE NTS
M6 x 2 HOLES TAPPED
Ø6.00X 2 HOLES
12.00
9.00
32.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

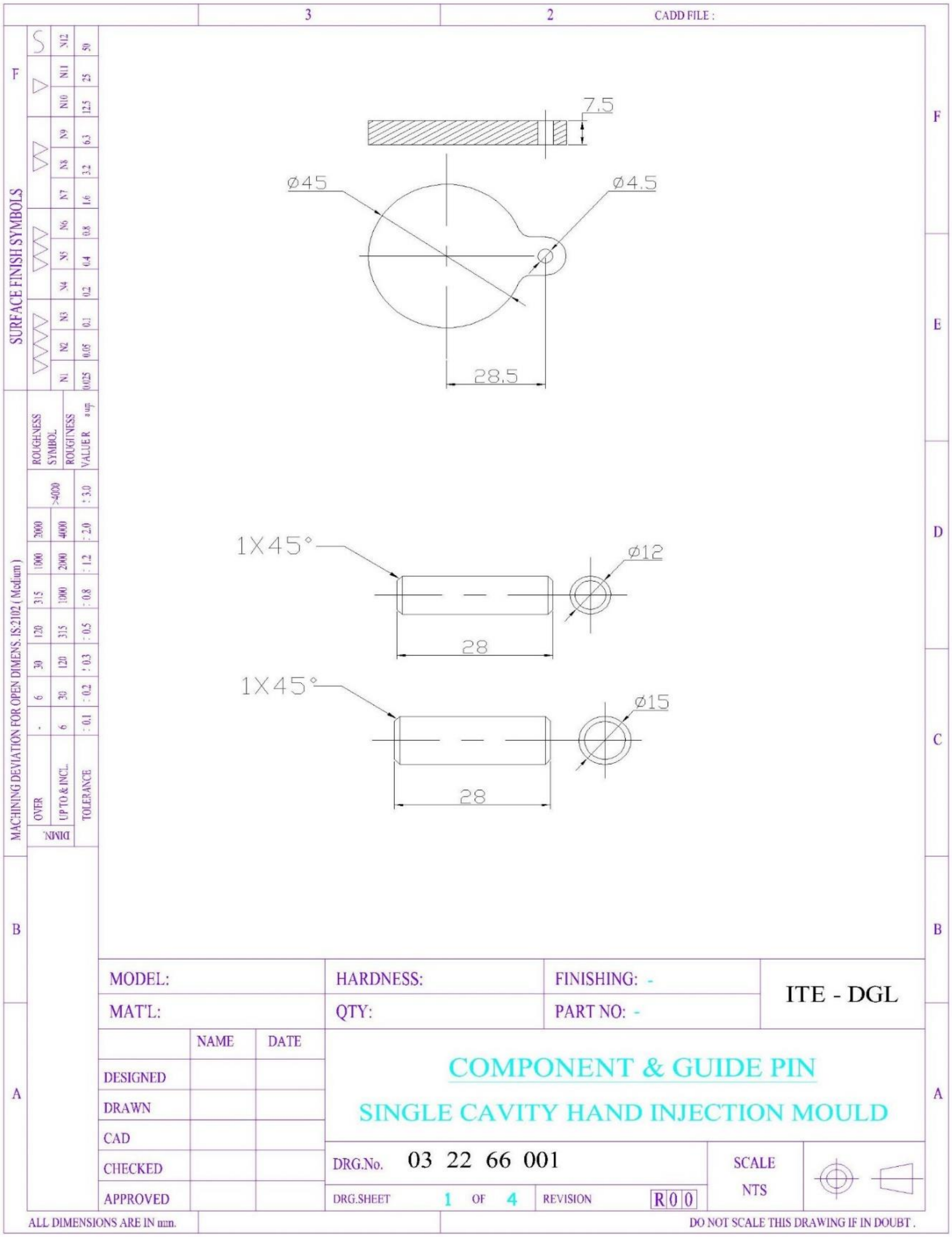

ITE-DGL
FINISHING: 75x75x12
PART NO: 3
STRIPPER PLATE
BLANKING TOOL
HARDNESS:
QTY : 1 no
MODEL:
MATL : M.S
DESIGNED
DRAWN
CHECKED
APPROVED
DRG.No. 03 22 55 001
SCALE
NTS
M6 x 2 HOLES TAPPED
Ø6.00X 2 HOLES
12.00
5.00
9.00
32.00
36.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

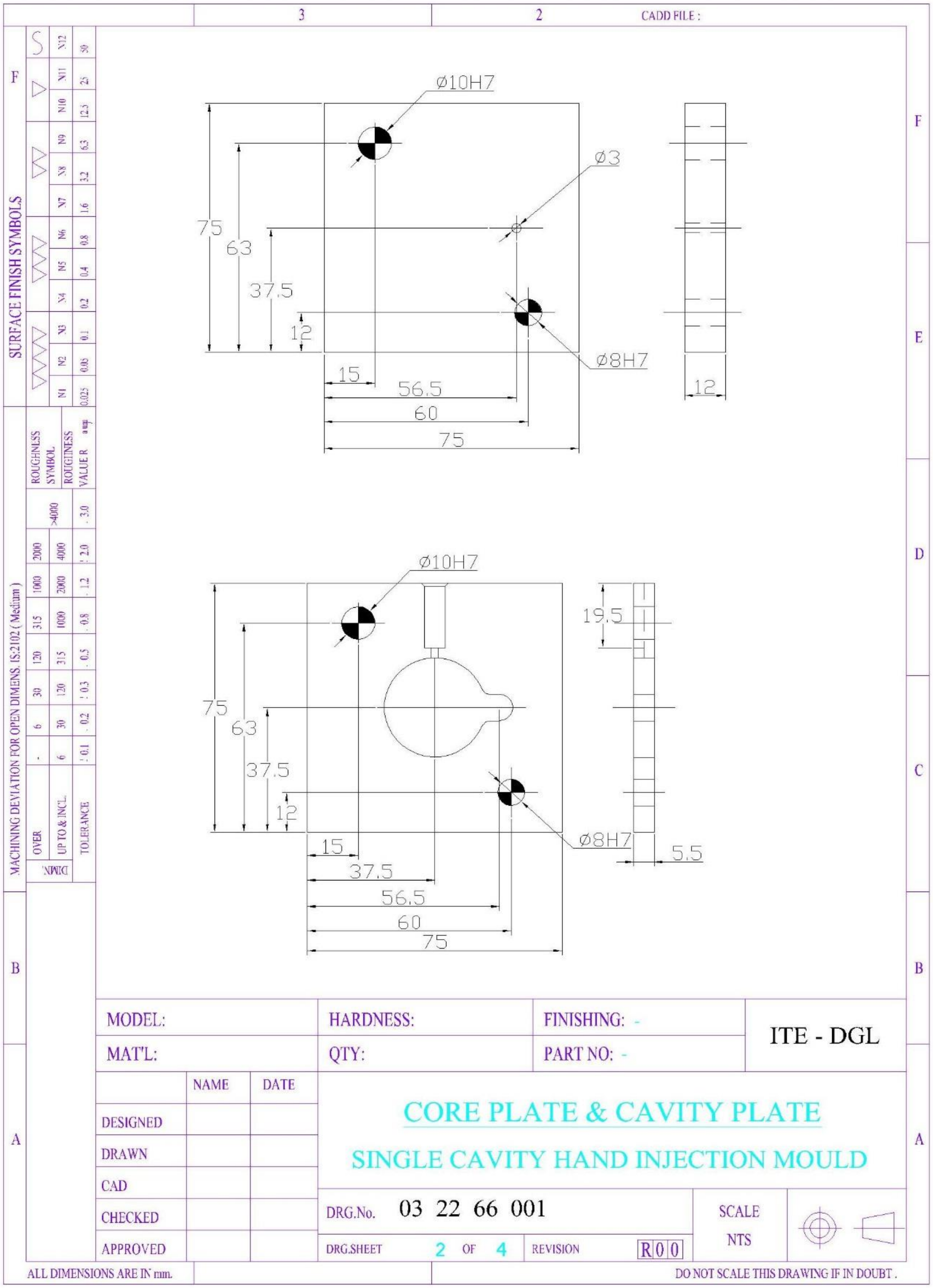

NOTE : PROVIDE ANGULAR
CLEARANCE OF 1/2° IN DIE CAVITY
3.00
12.00
Ø6.00X 2 HOLES
Ø7.00X 2 HOLES
Ø2.00FOR STOP PIN
9.00
32.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
HARDNESS: Case hardened
FINISHING: 75x75x12
QTY :1 no
PART NO: 2
ITE-DGL
MODEL :
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DIE BLOCK
BLANKING TOOL
DRG.No.
03 22 55 001
SCALE
NTS
SURFACE FINISH SYMBOLS

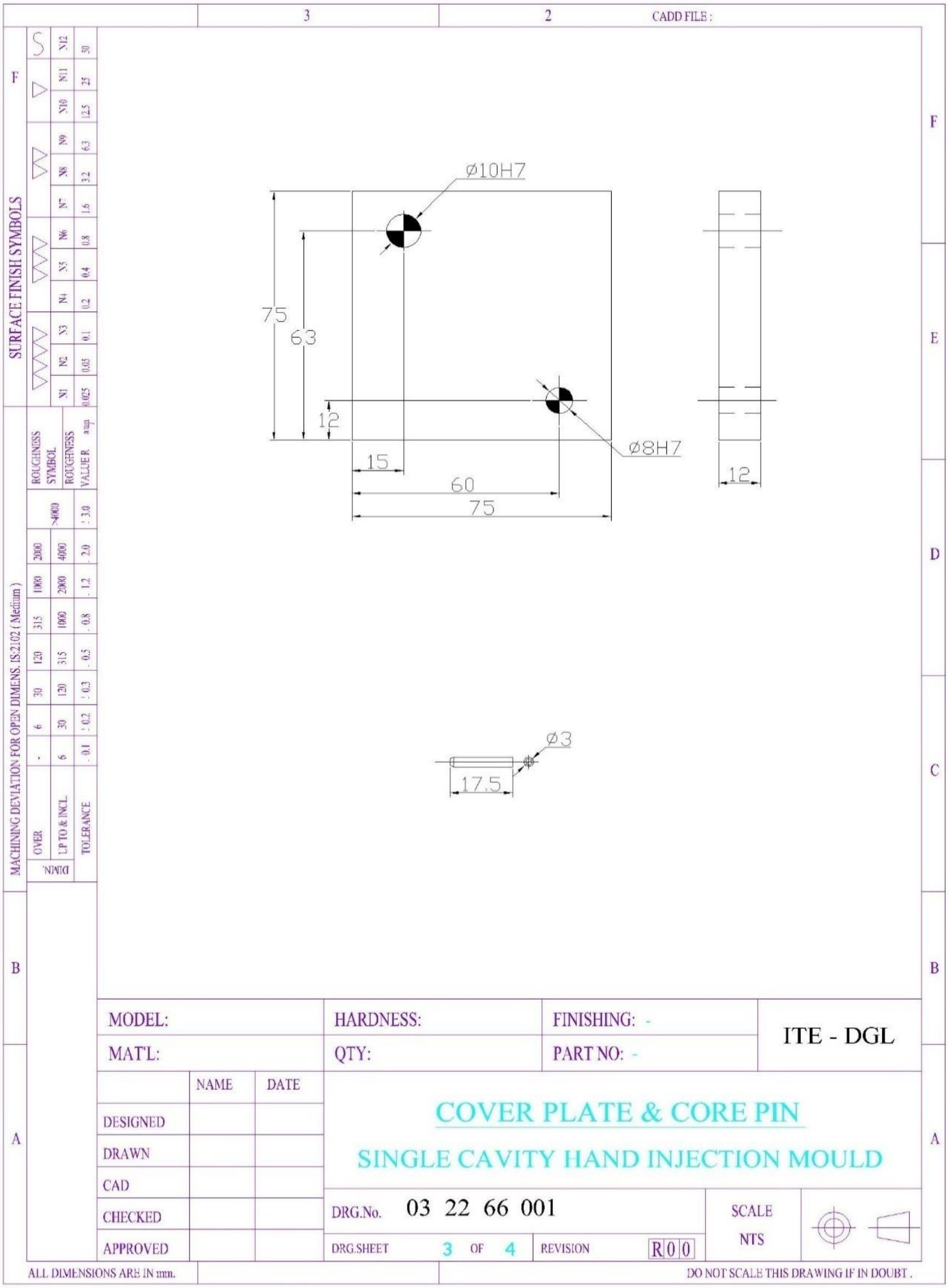

ITE-DGL
HARDNESS: Case hardened
FINISHING: 38x38x60
QTY :1 no
PART NO: 4
PUNCH
BLANKING TOOL
MODEL :
MATL : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
03 22 55 001
DRG.SHEET 7 OF 8
REVISION R0
SCALE NTS
60.00
5.00
R3.00 TYP
32.00
32.00
38.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS


BILL OF MATERIALS
9 Ø6 DOWEL STD 4
8 M6 ALLEN SCREW STD 4
7 STOP PIN STD 1
6 TOP PLATE M.S 1
5 PUNCH HOLDER M.S 1
4 BLANKING PUNCH M.S (CASE HARDENED) 1
3 STRIPPER PLATE M.S 1
2 DIE BLOCK M.S (CASE HARDENED) 1
1 BOTTOM PLATE M.S 1
SL.NO NAME MATERIAL QTY
ITE-DGL
ASSEMBLY
BLANKING TOOL
SECTIONAL ELEVATION
SURFACE FINISH SYMBOLS

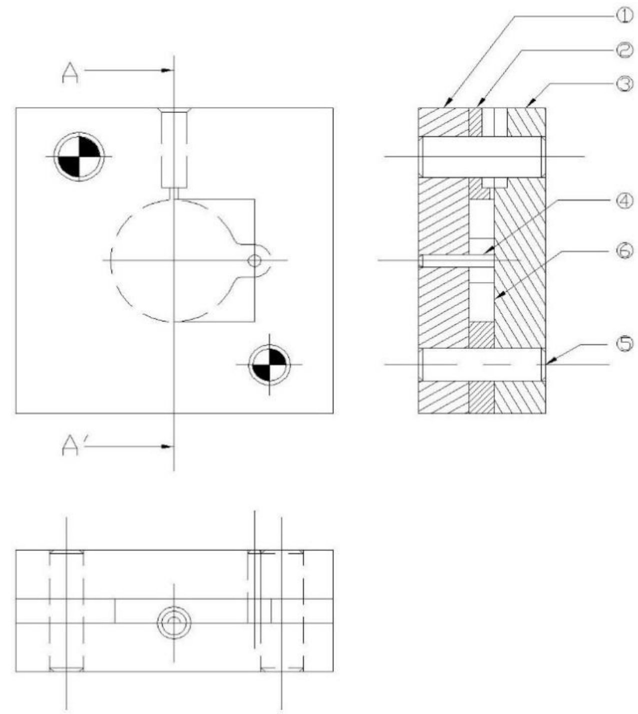
Exercise –10 Single Cavity Injection Mould




CADD FILE :
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
Ø10H7
Ø3
Ø8H7
75
63
37.5
12
15
56.5
60
19.5
5.5
MODEL:
MAT'L:
HARDNESS:
QTY:
FINISHING: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
CORE PLATE & CAVITY PLATE
SINGLE CAVITY HAND INJECTION MOULD
DRG.No. 03 22 66 001
DRG.SHEET 2 OF 4
REVISION R00
SCALE
NTS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .


CADD FILE :
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
Ø10H7
Ø8H7
75
63
12
15
60
75
12
Ø3
17.5
MODEL:
MAT'L:
HARDNESS:
QTY:
FINISHING: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
COVER PLATE & CORE PIN
SINGLE CAVITY HAND INJECTION MOULD
DRG.No. 03 22 66 001
DRG.SHEET 3 OF 4
REVISION R00
SCALE
NTS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .

3 | 2 | CADD FILE :



BILL OF MATERIALS

SI.NO	PART NAME	MATERIAL	QUANTITY
1	CORE PLATE	MS	1
2	CAVITY PLATE	MS	1
3	COVER PLATE	MS	1
4	CORE PIN	STD	1
5	GUIDE PIN	STD	2
6	COMPONENT	HDPE	1

SURFACE FINISH SYMBOLS

ROUGHNESS SYMBOL	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
ROUGHNESS VALUE R a µm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50

MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)

DIMN.								
OVER	-	6	30	120	315	1000	2000	
UP TO & INCL.	6	30	120	315	1000	2000	4000	>4000
TOLERANCE	0.1	0.2	0.3	0.5	0.8	1.2	2.0	3.0

MODEL:	HARDNESS:	FINISHING: -	ITE - DGL
MAT'L:	QTY:	PART NO: -	

	NAME	DATE
DESIGNED		
DRAWN		
CAD		
CHECKED		
APPROVED		

ASSEMBLED VIEW

SINGLE CAVITY HAND INJECTION MOULD

DRG.No. 03 22 66 001

DRG.SHEET 4 OF 4 REVISION R00

SCALE NTS

ALL DIMENSIONS ARE IN mm. DO NOT SCALE THIS DRAWING IF IN DOUBT .

1220233520	Computer Aided Machine and Tool Drawing	L	T	P	C
Practical		0	0	4	2

Suggested List of Students Activity:

1. Simple Floor Plan
2. 2D Objects
3. Simple 3D Mechanical Gear
4. 3D Mechanical Wrench

Text and Reference Books:

1. P N Sankar,Computer Aided Machine and Tool Drawing Practical,5thedition,Geometric publication,2016
2. MURTHY S.T , Computer Aided Machine Drawing ,2ndedition,Medtech Publishers,2019
3. S. TrymbakaMurthy ,computer aided machine drawing,1stedition,Medtech Publishers,2019

Equipment/FacilitiesrequiredtoconductthePracticalCourse.(BatchStrength:30Students)

1. Personal computer (With latest processor to suit Auto CAD) – 30 No's
2. MS Windows OS – 30 No's
3. AutoCAD software (release 2000 or above) – 30 Users

Web-based/Online Resources:

1. https://youtu.be/u0BsgoqmA8E?si=FQQVyXd_k13T-bJZ
2. https://youtu.be/zD-DviP4BjM?si=9I_gQFaJb4K6ZDmH
3. https://youtu.be/DKMKhSi36Co?si=u3XQ3B4p7soEM_Zp

1220233520	Computer Aided Machine and Tool Drawing	L	T	P	C
Practical		0	0	4	2

END SEMESTER EXAMINATION–Practical Exam

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim & Command Required	10
B	Modeling (2 Views Only)	60
C	Bill of Material & Dimensioning	20
F	Viva Voce	10
	TOTAL MARKS	**100**

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Introduction:

To study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

Course Objectives:

1. Identify the parts of a center lathe & Drilling machine.
2. Identify the work holding devices.
3. Set the tools for various operations.
4. Operate the lathe and Machine a component using lathe.
5. Operate the Drilling machine and produce different sizes of holes.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the causes and effects of safety & its importance.

CO2: To be able to practice of different operations of lathe machines (a) Facing (b) Tapper Turning (c) Plain turning (d) Step Turning etc.

CO3: A detailed knowledge of various finishing and super finishing processes such as grinding.

CO4: To be able to be aware of fitting tools & learn practically the process of shaping machine.

CO5: To be able to have working knowledge for selection of materials for various process.

Pre-requisites:

Knowledge of Program core.

1. Design the Product.
2. Finalize and Prototype.

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	3	-	3	3
CO2	3	1	3	3	3	3	3
CO3	3	2	2	3	3	2	2
CO4	3	3	2	-	-	3	3
CO5	3	3	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation andReal-WorldPractice:Conductdemonstrationsandhands-onactivitiesina simulated environment, transitioning to real-world scenarios when possible

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks. **SCHEME OF EVALUATION**

PART	DESCRIPTION	MARKS
A	Preparation / Marking	10
B	Dimensioning	20
C	Finishing	20
TOTAL		**50**

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

- **CA 3:** Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

The details of the documents to be prepared as per the instruction below.

Each exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or in a file with the documents. The procedure and sketch should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The logbook and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

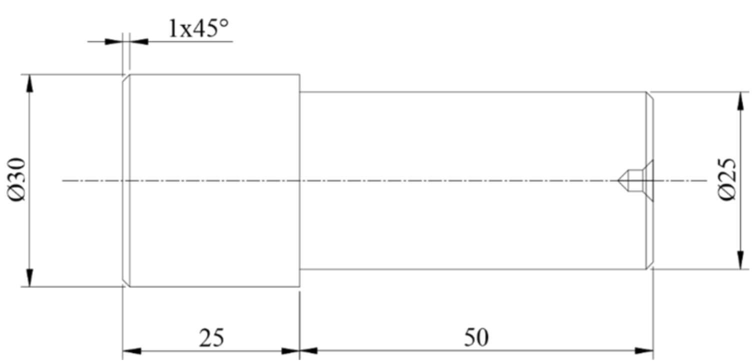
CA 4: All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test (CA4) should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment. **Two questions should be asked in such way that one from lathe and one from drilling**

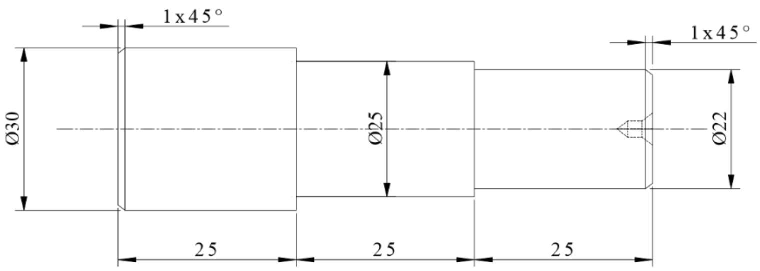
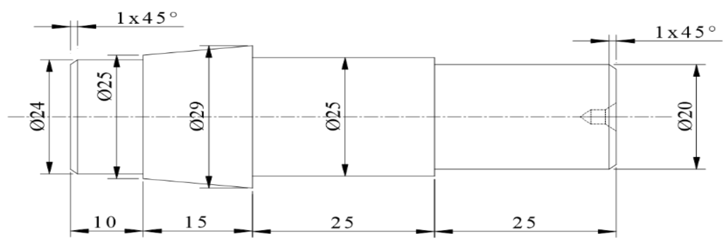
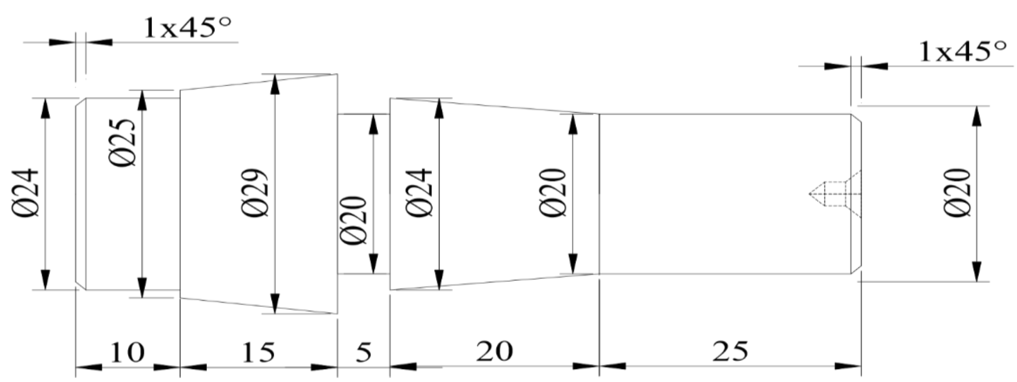
1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

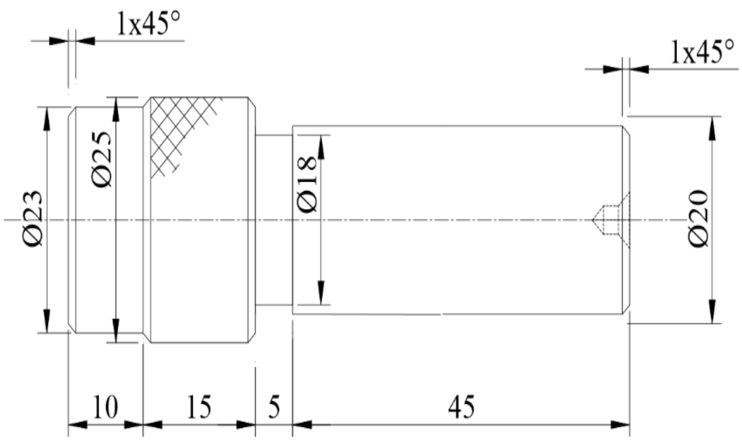
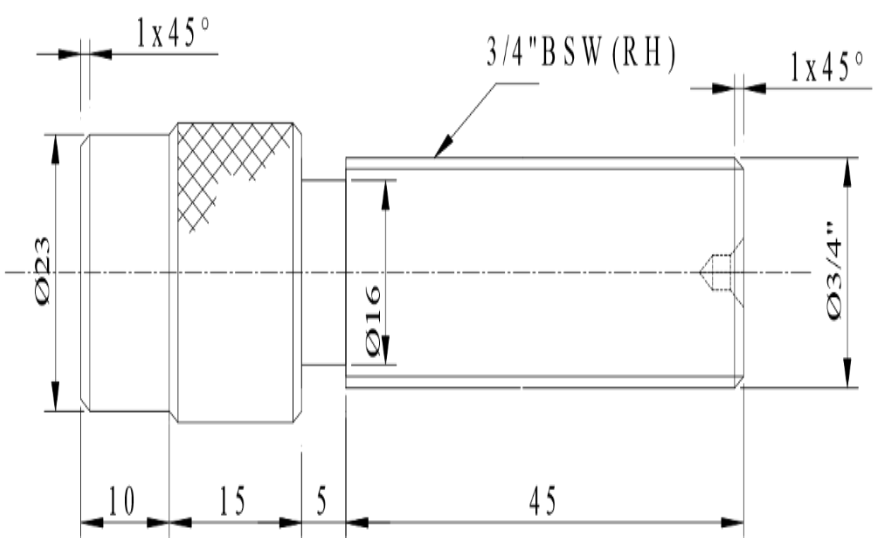
Part A	Description	Marks	Part B	Description	Marks
	Preparation	10		Marking	15
	Dimensions	40		Finishing	15
	Finishing	10			
	VIVA VOICE				10
	TOTAL				100

Syllabus Contents

Introduction	
1. Introduction of safety in operation machines. 2. Introduction to lathe and its parts. 3. Introduction to work holding devices and tool holding devices used in Lathe. 4. Types of tools used in lathe work. 5. Types of measuring instruments and their uses. 6. Setting of work and tools. 7. Operation done in lathe. 8. Practice on a lathe. 9. Introduction of work holding and tool holding devices used in drilling machine. Drilling, Tapping, Counter Boring, Countersinking and Reaming.	5

Practical Exercises *	
1. **Exercise No: 1** –Plain turning. 	4

Exercise No: 2-Step turning 	4
Exercise No: 3-Step and taper turning 	4
Exercise No: 4-Step and taper turning 	4

Exercise No: 5 Knurling and step turning  	**4**
Exercise No:6 BSW Thread cutting  	**4**

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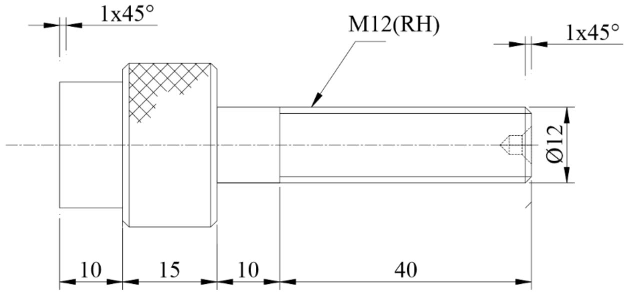
Exercise No:7 – Metric thread cutting



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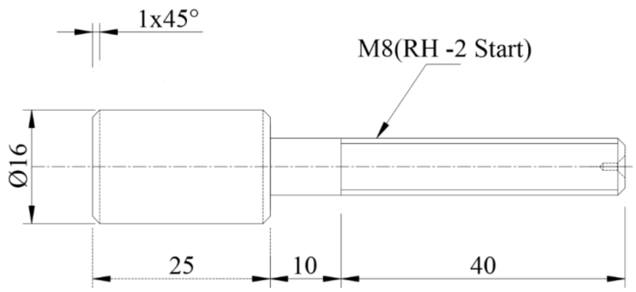
Exercise No:8- Metric thread cutting



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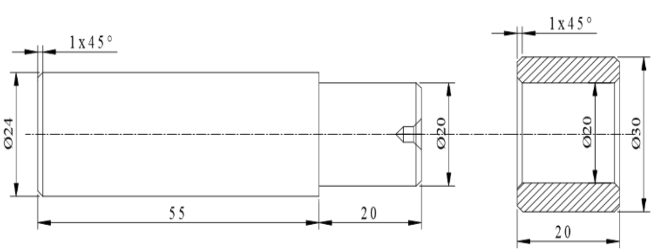
Exercise No: 9-Shaft and bush mating



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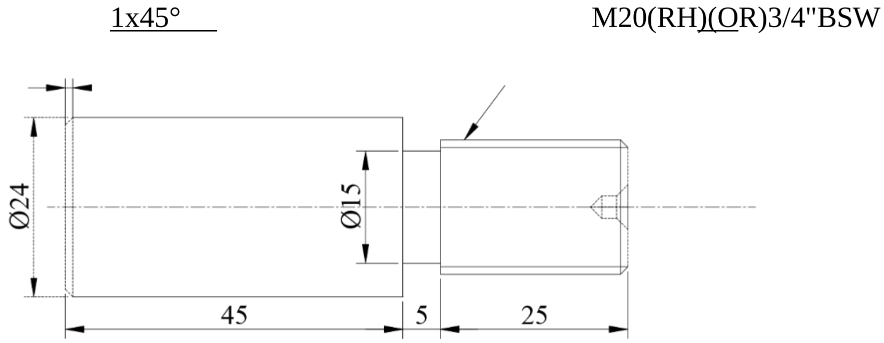
<td>Exercise No: 10- Thread cutting

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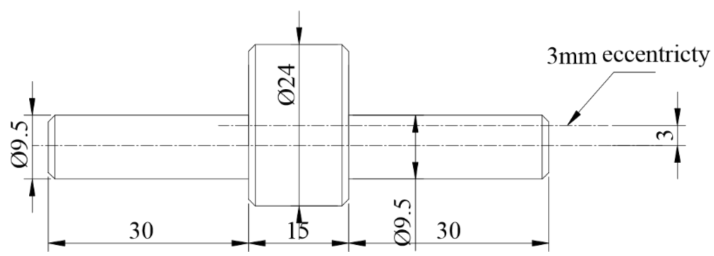
<tr>
<td>Exercise No: 11-Eccentric Turning

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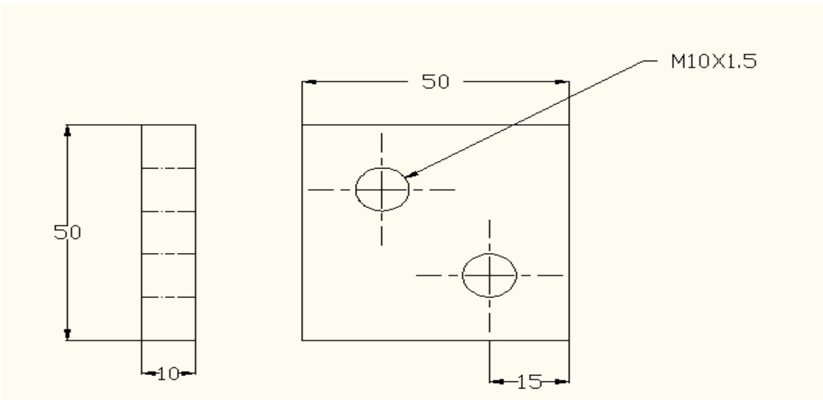
Make the following jobs using drilling machine.

Exercise No: 1 Drilling &Tapping

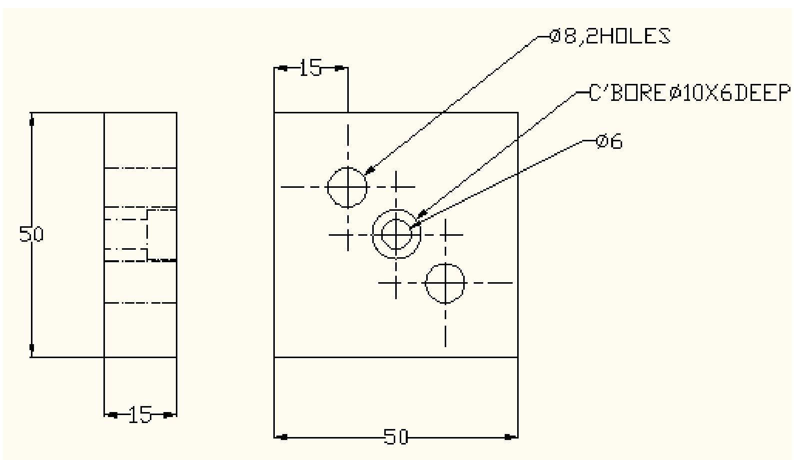
Raw material 50mm X 50mm X 10 mm thick M.S. Flat



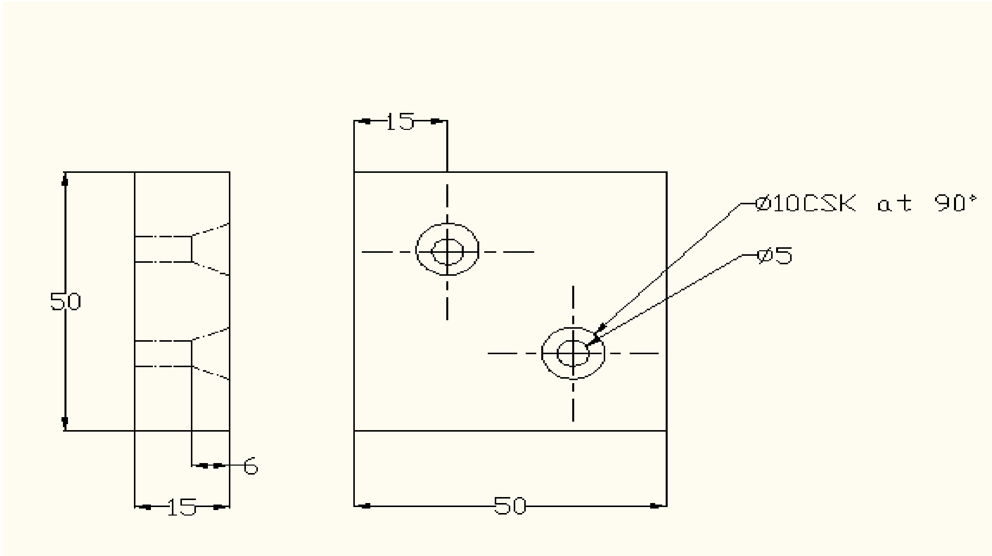
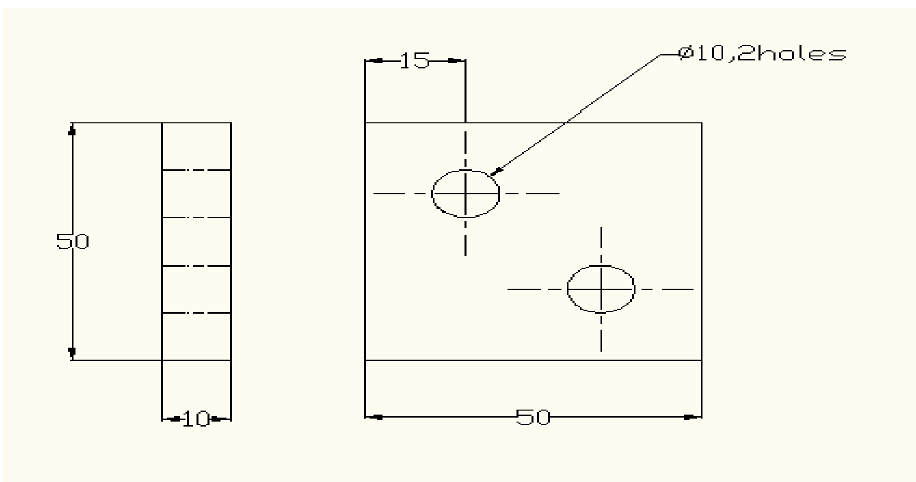
4

Exercise No: 2 Drilling& Counter boring

Raw material 50mm X 50mm X 15 mm thick M.S. Flat



4

Exercise No: 3 Drilling & Countersinking Raw material 50mm X 50mm X 15 mm thick M.S. Flat  	4
Exercise No: 4 Drilling and Reaming Raw material 50mm X 50mm X 10 mm thick M.S. Flat  	4
Total	60

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Suggested List of Students Activity:

1. Study and practice the CNC programming for various component machining
2. Field visit nearby industries based on CNC machines and make report
3. Visittoanythree3Dprintingindustriesandmakereport
4. Study the robot configuration and learn about different application of robot
5. Prepare a presentation about recent applications of 3d printing and robots.

Text and Reference Books:

1. Elumalai P C, ,Manufacturing Technology-I,kindle edition, Khanna Publishers,2017
2. DeepanBalu,Manufacturing Technology Laboratory Manual,3rd edition, Khanna Publishers,2012
3. AnandJayakumarArumugham,Manufacturing Technology I : Laboratory Manual,2nd edition, Notion Press,2020

Web-based/Online Resources:

1. https://books.google.co.in/books/about/A_Textbook_of_Production_Engineering.html?id=GRSbGhQywwC&redir_esc=y
2. https://www.google.co.in/books/edition/A_Textbook_of_Manufacturing_Technology/6wFuw6wufTMC?hl=en&gbpv=1&pg=PT47&printsec=frontcover

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Requirement

1.	Center Lathe 4 ½ ‘ Bed length	15 No’s
2.	4 Jaw / 3 Jaw Chucks	required Numbers
3.	Chuck key (10 mm x 10 mm size)	15 No’s
4.	Box spanner	15 No’s
5.	Cutting Tool H.S.S ¼ ‘’ X ¼ ‘’ X 4 ‘’ long	15 No’s
6.	Pitch gauge	5 Nos
7.	Vernier Caliper (0-25 and 25-50)	5 No’s each
8.	Micrometer, Inside and Outside(0-25 and 25-50)	5 each
9.	Vernier Height Gauge(300mm)	1 no
10.	Snap gauge	1 set
11.	Gear tooth Vernier	1 No
12.	Parallel Block	2 Nos
13.	Steel Rule (0-150)	15 Nos.
14.	Outside and Inside Calipers	15 Nos. each
15.	Thread gauge	5 Nos.
16.	Bevel Protractor	1 No
17.	Jenny Caliper	5 Nos.
18.	Dial Gauge with Magnetic Stand	5 Nos.
19.	Marking Gauge	10 Nos.
20.	Safety Glass	15 Nos.

1220233620	MANUFACTURING TECHNOLOGY PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Board Exam Pattern- End Exam Practical

Note :

Two questions should asked in such way that one from Lathe and One from Drillin

DETAILED ALLOCATION OF MARKS.

Part	Description	Marks
A	**Lathe Work**	
	Preparation	10
	Dimensions	40
	Finishing	10
B	**Drilling**	
	Marking	15
	Finishing	15
	Viva Voice	10
	TOTAL MARKS	**100**

1220234110	TOOL ROOM SPECIAL MACHINES	L	T	P	C
THEORY		3	0	0	3

Introduction:

Tool room special machines are the backbone of the production process: Dies are typically used for molding and casting processes and must be carefully engineered to produce high-quality output and maintain process efficiency and efficacy. Dies are highly engineered products, which must be carefully handled, used, and maintained to protect the major investment that they represent. Tools are used for the shaping and other processes that produce finer details on parts and pieces. Tools can include anything from molding inserts to drill bits for machining, and everything in between: mills, saws, tapping bits and more.

Course Objectives:

- Describe the different forces in orthogonal and oblique cutting.
- Estimate the forces in metal cutting operations.
- Describe about various cutting tool materials.
- Explain the cutting force measurement principles.
- Compare the properties of different cutting fluids.
- Describe about jig boring, jig grinding, tool and cutter grinder.
- Explain the milling machine principles, types and its various operations.
- Explain the various gear generation processes.
- Explain the principle of operation of various un-conventional machining processes.

Course Outcomes:
On successful completion of this course, the student will be able to

CO1: understand the various methods of plastic manufacturing

CO2: Describe the modern machining processes, super finishing processes and various surface treatment methods

CO3: Describe the unconventional Machining processes

CO4: Describe the CNC Machines and ability to apply "G" and "M" coding to CNC programming

CO5: Apply the rapid prototyping technologies in manufacturing

1220234110	TOOL ROOM SPECIAL MACHINES	L	T	P	C
THEORY		3	0	0	3

Pre-requisites:

Production Technology, Machine Tools, Metal Cutting, Computer applications

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	1	2	2	1	2
CO2	2		-	1	-	1	
CO3	2		3	2	3	1	
CO4	2		1		2	1	
CO5		2	1	2	2	1	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1220234110	TOOL ROOM SPECIAL MACHINES	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment**.**

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1220234110	TOOL ROOM SPECIAL MACHINES	L	T	P	C
THEORY		3	0	0	3

Syllabus Contents

Unit I	Cutting Tools and Mechanics of Metal Cutting	
Cutting tools-properties of cutting tool materials-cutting tool materials; High carbon steels, high speed steel, carbides, and ceramics. types of cutting tools Types of metal cutting – orthogonal and oblique cutting- chip formation – continuous, discontinuous, built-up edge – shear angle. Tool signature – importance cutting forces in orthogonal cutting – metal removal rate [MRR] – tool life; Taylor’s life equation, factors influence in tool life. measurement of cutting force – tool dynamometer – types of tool dynamometer – machinability – machinability index – factors affecting machinability – cutting fluids – properties of cutting fluids – selection of cutting fluids – selection of cutting fluids		9
Unit II	**Boring, Jig Boring, Jig grinding, Tool and Cutter Grinder and Cylindrical Grinder**	
Boring and jig boring -Boring machines- horizontal and vertical types- fine boring machines- boring tools jig boring machine- measuring system- hole location procedure- deep hole boring Jig grinding Introduction- construction- operation techniques- setting up and clamping- wheel travel- wheel selection- wheel dressing. optical profile grinding- basic principle and operations Tool and cutter grinder Introduction- selection of cutter- grinding wheels- shape, abrasive grain size and bond, direction of rotation- tooth rest, types, parts of universal tool and cutter grinder, clearance, width of land- producing of clearance angle Cylindrical Grinding Machine Centre Type Cylindrical Grinding Machine – Centre less Grinding Machine – Through feed Grinding – In feed Grinding		9
Unit III	**Milling Machines and Gear Generation Processes**	
Milling machines; Types-specification of milling machines- principles of operation of column and knee type and universal milling machine- work and tool holding devices; Arbor, spring collet, adapter – milling cutters; cylindrical milling cutter, slitting cutter ,side milling cutter, angle milling cutter, T-slot milling cutter, woodruff milling cutter, fly cutter-nomenclature of cylindrical milling cutter-milling process; conventional milling and climb milling-milling operations-milling attachments. Generation process Gear shaper- gear hobbling- principle of operation only gear finishing processes- gear burnishing- gear shaving- gear grinding and gear lapping- gear materials; cast iron, steel, alloy steels brass, bronze, aluminum and nylons.		9

1220234110	TOOL ROOM SPECIAL MACHINES	L	T	P	C
THEORY		3	0	0	3

Unit IV	CNC Machine and its Components	
CNC machines; Numerical control- definition- working principle of a CNC system- features of CNC machines- advantages of CNC machines- difference between NC and CNC- construction and working principle of turning principle- construction and working principle of machining center- machine axes conventions turning center and machining center. Components of CNC machine; slide ways- requirement- types- friction slide ways and antifriction slide ways- linear motion bearings- recirculation ball screw- ATC- tool magazine – feedback devices- linear and rotary transducers- encoders- in process probing- tool material- tool inserts.		**9**
Unit V	**Un-Conventional Machining**	
Un- conventional Machining Processes**:** Construction, working and applications of ultrasonic machining- chemical machining- electro chemical grinding- plasma arc machining- LASER machining- advantages- disadvantage,- Electron Beam Machining – Abrasive Jet Machining Electrical discharge machining Introduction- principle of spark erosion and requirements of dielectric fluid- layout of spark machining system, EDM machine- tool materials – electrical circuits in EDM- metal removal rate- mean current- operation parameters and typical values and toll wear- reasons- classification and types. EDM process characteristic- advantages and disadvantages of EDM process- wire-cut EDM, CNC Wire-cut EDM for machining punch and die cavities.		9
Assessment Test, Revision and Students Activity		10
TOTAL HOURS		55

Suggested List of Students Activity:

- Presentation / Seminars by students on any recent technological development based on the course
- Online MCQ have to be conducted for all the five units

Text and Reference Books:

1. P. Rajesh, tool room special machines (english),4thedition,geometric publication,2019
2. P.H. Joshi, Machine Tools Handbook,1st edition, Tata McGraw Hill Education,2007
3. Steve Krar, Technology Of Machine Tools,7th edition, McGraw-Hill Education,2010

Web-based/Online Resources:

- https://youtu.be/zD-DviP4BjM?si=vSFl2UZGwJMkGDHc
- https://youtu.be/I_6G_8ggmKo?si=r2yP5fhL3P957gus
- https://youtu.be/tmdGq49eJwI?si=32Rg119qllVAlsdX

1220234110	TOOL ROOM SPECIAL MACHINES	L	T	P	C
THEORY		3	0	0	3

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks:** 100

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Introduction:

Modern development of sheet metal industries require more understanding of production of sheet metal products and the machinery and tools involved in the production of the sheet metal products. This subject Press Tools will develop the basic knowledge on the essentials of the production of sheet metal products, the machinery and Tools involved in its production.

Course Objectives:

- To understand the fundamentals of press working, to be familiar with the various press working operations and machines.
- To learn the safety in press working operations.
- To be familiar with the various press and press tool accessories
- To know the various bending, forming and other miscellaneous press working operations.
- To learn about the construction and operation of the different bending dies.
- To be familiar with the various drawing and other related processes
- To know the construction and operating principle of drawing and combination dies.
- To know the basic concepts and the advantages of fine blanking process
- To learn about the concepts of SMED and quick die changes and its advantages in bringing down the press set up time.
- To learn to trouble shoot in various press tools.
- To be familiar with the specialised press tool applications.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Knowledge about the fundamentals of press working operations and compare different types of press.

CO2: Identify the accessories of press tool and die construction.

CO3: To know the constructions and operations of bending dies and forming dies.

CO4: To know the concepts of drawing dies and its operation.

CO5: Correlate blanking dies and fine blanking dies & concepts of SMED and quick die changer

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Pre-requisites:

Production Technology, Machine Tools, Metal Cutting, Computer applications

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	2	-	3	1
CO2	3	-	2	2	2	3	1
CO3	3	2	-	2	-	3	1
CO4	3	3	3	3	2	3	-
CO5	3	3	-	1	2	3	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	**PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY**	
Press working operations- Shearing, cutting off, parting, blanking, Punching, piercing, slotting, perforating, Notching, semi notching, lancing, parting, Trimming , slitting, shaving. Safety in press working. Press working mechanism: Presses according to their functions – energy producing press, force producing presses, stroke controlled presses. Press according to their energy supply – Mechanical, hydraulic, Pneumatic, electromagnetic presses. Presses according to their construction – Solid or gap frame, open back inclinable, knee frame, horning, open end or end wheel. Press according to their operation – Single action, double action, triple action, multi slide press. Press actuating mechanisms. Parts of press, press operating parameters – Tonnage, shut height, stroke, shut height adjustment, strokes per minute, die space. Clearance, cutting terminology, stages of cutting, penetration, and burr. Effects of clearance variation – Secondary shear, large clearance, clearance selection, and cutting characteristic – Dish distortion, spacing distortion, typical wear. Forces for cutting sheet metal – Cutting with square faces, cutting with shear, shear on punch, slug bending force, shear on die steel, stripping force.		**9**

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Unit II	**PRESS & PRESS TOOL ACCESSORIES AND TYPES OF DIE CONSTRUCTION**	
Mechanical handling devices: Feeding and reeling mechanisms for coiled sheet metal – Reels and cradles (de-coiler), roll feeds and its types, hitch feeds. Feeding mechanism for individual parts – Hopper feeds, dial feeds, chutes, slides, magazine feeds, step feeds, special feeds. Ejection mechanism – Gravity, air, kicker, lifter, shovel, mechanical hand, ejection by next part. Transfer mechanisms – Conveyors, shuttle, turnover, turnaround, stacker, rails. Types of die construction: - Cut off, drop through, return type, compound, combination, continental, sub press, follow die, progressive die, transfer die, shuttle die. Function and nomenclature of die components: - Die, die set, die plate, punch, stripper plate, die spring, rubber keeper, stripper bolt, solid stripper, knockout plate, hold down plate, pad plate, blank holder, pressure pin. Types of stock stop. Attachment components – Dowel, screw, key. Miscellaneous components – Heal, stop block, bolster plate, backing plate, pilot, gauges, insert, cams, hinges and rockers. Commercially available die components – Die sets, die set attachment devices, punches, die buttons, retainers, springs, fluid springs, die cushion and its types		**9**
Unit III	**BENDING AND FORMING DIES**	
Bending of sheet metal – Bending theory, neutral axis, metal movement, spring back, methods of overcoming spring back. Bending Operations – Bending, flanging, hemming, curling, seaming, and corrugating. Types of Bending dies (construction and working principle) – V bending and its types, edge bending, u bending. Bending operations done using press brake.Forming operations – Embossing, bulging, crimping, tube forming. Miscellaneous press working operations – slugging, restrike or spank, extrude (holes), coining, hot trimming, cold trimming of die castings and plastic moulding, riveting, burnishing or sizing, Ironing. Forming dies – Construction and working principle of solid form dies, pad form dies, curling dies, embossing dies, coining dies, swaging dies, bulging dies. Assembly dies - Riveting, tab stake, upset stake, crimping.		9

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Unit IV	DRAWING DIES AND DIES FOR SECONDARY OPERATIONS	
Drawing operations – Shallow drawing, deep drawing. Analysis of cup drawing: - Stages of drawing - Bending, straightening, friction, compression, tension, stretch forming. Variables of drawing - Bending and straightening variables, friction variables, compression variables, stretch forming variables, analysis of draw speed. Draw dies &its construction and working principle – Conventional draw die, redrawing die, reverse re drawing die, drawing of square or rectangular shapes. Drawing with flexible tooling – Marform process, Hydro form process, Hydro dynamic process, Verson- wheel on process. Draw die details – Blank holders, blank holding pressure and its importance, air vents, drawing inserts, draw beads. Drawing defects, causes and remedies. Dies for secondary operations: - Construction and working principle of – Semi piercing dies, shear form dies, dies for formed contours, notching die, shaving die, side piercing die.		9
Unit V	**FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS, PRESS**	
Fine blanking basics: Definition and Applications of fine blanking, Working principle of fine blanking tool, V Ring – function of V ring, Dimensions of V ring. Comparison of fine blanking with blanking. Strip width and margin calculations, Calculation of press, Fixing minimum distance from die aperture. Factors affecting Tool life. Importance of punch and die radius. Materials suitable for fine blanking, work hardening during fine blanking, steel, copper and copper alloys, aluminum and aluminum alloys.Fine Blanking Machines: Working principle – Ram movement, Drive systems-Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force. Fine blanking tools: Different types of tools – Compound die tooling system with sliding punch, compound die tooling with fixed punch. Clearance calculation – Importance of clearance.Specialized Press Tool Applications: Construction, advantage and applications of advanced multistage tooling, unit tooling, angular piercing tools, CNC turret press. Principle or Quick Die Change (QDC) – need and advantages. Single Minute Exchange of Dies (SMED) – concept need and advantages.		9
Factors Affecting Tool Service Life: Introduction, Elements of Tool performance, Procedure for investigation of tool failure, Trouble shooting in press tools, effect of heat treatment on service life of tools. Maintenance and Recondition of press tools – Blanking tool – Progressive Tool – Compound tool – wear and reconditioning of press tools components. Causes of tool and die failure, types of failures.		
Assessment Test, Revision and Students Activity		10
TOTAL HOURS		55

1220234210	PRESS TOOL	L	T	P	C
THEORY		3	0	0	3

Suggested List of Students Activity:

- Presentation / Seminars by students on any recent technological development based on the course

Text and Reference Books:

1. Joshi P.H, Press Tools Design And Construction,23rd editon, S Chand & Company,2017
2. M. Luqman, Sheet Metal Press Tools Design and Making, First Edition,2019,
3. K. Venkataraman, Design of Jigs, Fixtures and Press Tools,2nd Edition, Springer,2021

Web-based/Online Resources:

4. https://testbook.com/mechanical-engineering/non-traditional-machining-processes-definit ion
5. https://www.bdeinc.com/blog/understanding-computer-aided-manufacturing-benefits/

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

Introduction:

Properties of Fluids and Pressure Measurements, Pneumatic System, Hydraulic system &Thermodynamics, Internal Combustion Engines &Heat exchangers and E- Vehicles

Course Objectives:

- Define the properties of fluids
- Explain the working of pressure measuring devices
- Appreciate the use of fluid power
- Explain the working of pneumatic system and its elements
- Explain the working of Hydraulic system and its elements
- Compare Pneumatic system with Hydraulic system
- Design Pneumatic and Hydraulic circuits
- Explain the concept and types of thermodynamic systems
- Explain the working of IC engines & heat exchangers

Course Outcomes:
On successful completion of this course, the student will be able to

CO1: Define the properties of fluids and explain the working of pressure measuring devices

CO2: Express the working of Pneumatics & hydraulic elements and its circuits

CO3: Explain the concept and application of Thermo dynamics

CO4: Specify the Concept IC engines.

CO5: Describe the working of heat exchangers and its effectiveness

Pre-requisites:
Mathematical skills, Mechanics.

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	-	-	-	-	-
CO2	3	2	2	2	-	-	-
CO3	3	1	-	-	-	-	-
CO4	2	1	-	-	-	-	-
CO5	2	2	-	-	2	-	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		**2**	**0**	**4**	**4**

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments	Cycle II Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

CA 3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The student should draw the Circuit Diagram and take readings, do calculations and prepare the Graph/Result manually in the documents.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections and Execution	25
TOTAL		50
D	Practical Documents (As per the portions)	10
Total Marks		60

- **Cycle I:** 1, 2, 3, 4 and 5 ,**Cycle II:** 6, 7, 8, 9

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ from the complete theory portions.	30 X 1 Mark	30 Marks
Part – B	Seven Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections and Execution	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		**2**	**0**	**4**	**4**

Syllabus Contents

UNIT I	**PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS**	
	Fluid-Definition-Classification of fluids-Ideal and real fluids-Newtonian and non-Newtonian-Properties of fluids-Density, Specific weight, Specific volume, Specific gravity, Compressibility, Viscosity, Surface tension and capillarity. Pressure-Unit of pressure-Pressure head-Atmospheric pressure-Gauge pressure and Absolute pressure-Problems-Pascal's law-Proof-Applications of Pascal's law-Hydraulic press, Hydraulic jack. Pressure Measurement -Piezometer tube-Simple U-tube manometer- differential U- tube manometer-Inverted differential U-tube manometer-Micro manometer-Inclined tube micro manometer-Problems-Mechanical Pressure gauge-Bourdon tube pressure gauge-Diaphragm pressure gauge-Dead weight pressure gauge.	15
UNIT II	**THERMODYNAMICS**	
	THERMODYNAMICS Thermodynamic system-Types-Closed system, Open system and isolated system-Property and state of a system-Intensive and Extensive properties -Thermodynamic process-Cycle-Point and Path functions-Law of conservation of energy-Thermodynamic equilibrium- laws of thermodynamics Laws of perfect gases- -Equation of state-Universal gas constant-Relationship between the specific heats and gas constants. **INTERNAL COMBUSTION ENGINES** Introduction to IC Engines-Classification-Working of four stroke cycle petrol and diesel engines-Merits & Demerits-Working of two stroke cycle petrol and diesel engines-Merits Demerits-Comparison of four stroke and two stroke engines. **HEAT EXCHANGERS** Heat transfer in engineering –Modes of heat transfer-Conduction, Convection and Radiation. Heat exchanger-types, parallel flow heat exchanger, counter flow heat exchangers-Application of heat exchangers.	1 5

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		**2**	**0**	**4**	**4**

UNIT III	**PNEUMATIC SYSTEM & HYDRAULIC SYSTEM**
Pneumatic system and its elements-Filter, Pressure regulator, Lubricator unit-Pressure control value-3/2 DCV, 5/2DCV, and 5/3DCV-Check value- Flow control value-Throttle value-Shuttle valve-Quick exhaust valve-Time delay value-Pneumatic actuators-Single acting cylinder, Double acting cylinder, Air motor, ISO symbols of Pneumatic components. Pneumatic Circuits-Direct operation of single acting cylinder-Operation of double acting cylinder-Operation of double acting cylinder with metering-in control-Operation of double acting cylinder with metering-out control-Use of shuttle valve in pneumatic circuit-Use of quick exhaust valve in pneumatic circuits-Automatic operation of double acting cylinder-Merits and Demerits of pneumatic system-Applications	5
Practical Exercises on Pneumatics 1. Direct operation of a Single Acting and Double acting Cylinder. 2. Operation of a Single Acting Cylinder controlled from two different positions using Shuttle Valve. 3. Operation of a Double Acting Cylinder with quick return using quick exhaust valve. 4. Controlling the speed of a Double Acting Cylinder using metering –in and metering –out controls. 5. Automatic operation of a Double Acting Cylinder in single cycle and multi cycle using limit switch and memory valve.	12
Hydraulic system and its elements-Merits, Demerits and applications of hydraulic system. Hydraulic pumps-types-positive displacement pumps and non - positive displacement pumps -Gear pumps-External gear and internal gear type-vane pump-Axial piston pump and Radial piston pump-Hydraulic cylinders and Hydraulic motors - ISO symbols for hydraulic components -pressure relief valve-Directional control valves-3/2DCV,4/2DCV,4/3DCV. Hydraulic accumulator and its uses-Types-Gravity type accumulator, spring loaded accumulator, Gas loaded accumulator-Pressure intensifier. Hydraulic circuits-Operation of double acting cylinder using metering-in control and metering out control-Operation of Hydraulic motor using metering-in and metering out- control Hydraulic circuit using sequence valves and counter balance valves - Hydraulic circuit for shaping machine, surface grinding machine and Milling machine. Comparison of Hydraulic system and Pneumatic system.	5

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

Practical Exercises on Hydraulics 1. Direct operation of a Double Acting Cylinder. 2. Direct operation of a Hydraulic motor. 3. Controlling the speed of a Double Acting Cylinder using metering-in and metering-out type control. 4. Controlling the speed of hydraulic motor using metering-in and metering-out control Sequencing of two cylinders using Sequence Valve.	13
CA & MODEL EXAMINATION	10
TOTAL HOURS	**75**

Suggested List of Students Activity:

- Compare the following liquids concerning their density (for the same mass, compare the volume) (1) Petrol (2) Water (3) Edible oil (4) Caster oil (5) Mercury
- Compare the following liquids concerning their viscosity (for the same temperature, compare the velocity) (1) Petrol (2) Water (3) Edible oil (4) Caster oil (5) Mercury
- Observe the working of a Hydraulic Jack at any garage and relate it with Pascal's law.
- Design circuits on hydraulic & pneumatic for various industrial application.
- Draw a line diagram of the water supply & distribution line of your hydraulic lab and indicate the source of major and minor losses in it.
- Visit the manufacturer's website for hydraulic pumps, collect the catalog, and select a suitable pump for your home application.
- Prepare a demonstration model of the hydraulic devices.

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

Text Books & Reference Books:

1. Allan D. Kraus, Introduction to Thermal and Fluid Engineering,1st edition , CRC Press,2019
2. Pankaj Saha, Advances in Fluid and Thermal Engineering, 1st edition, Springer Verlag, Singapore, 2019
3. Basant Singh Sikarwar ,Advances in Fluid and Thermal Engineering, 1st edition, Springer, 2021

Web-based/Online Resources:

1. https://youtu.be/hc35VQlEN98?si=xtLAgL77PcbuANIP
2. https://youtu.be/b1jQseqJuDU?si=nmWQssBWT1_rq2rZ
3. https://youtu.be/gJhHiyZOBAs?si=z7H39bDP4G_glrzV

Equipment / Facilities required for conducting the Practical Course.

1. Pneumatic kit 1 no.
2. Hydraulic kit 1 no.

Required instruments and consumables

1220234340	FLUID POWER AND THERMAL ENGINEERING	L	T	P	C
Practicum		2	0	4	4

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections and Execution	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.
***Written Test:**

Part A - 15 X 1 Mark = 15 Marks. Fifteen MCQ (One mark each) shall be asked from the complete Theory Portions. Students can answer any Ten questions.

Part B - 5 X 3 = 15 Marks. Eight two marks questions shall be asked from the complete Theory Portions. Students can answer any Five questions. Each batch should have a separate set of questions or an online question paper issued by the DOTE can be issued.

1220234420	SPECIAL MACHINES PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Introduction:

To study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

Course Objectives:

1. Identify a milling machine and its parts
2. Identify a cylindrical grinder, surface grinder and tool and cutter grinder
3. Identify Shaping machine and its parts
4. Identify the tools and instruments
5. Handle the different types of work holding devices
6. Machine a component using different machine tools.
7. Calculate the indexing for a work

Course Outcomes:

On successful completion of this course, the student will be able to

CO1 To be able to be aware of fitting tools & learn practically the process of shaping machine.

CO2 To be able to practice of making vee-block on Shaping Machine.

CO3 To be able to practice of making different shapes from cylindrical rod on milling machine (a) Hexagonal (b) Square (c) Triangular & practice of indexing.

CO4 To be able to practice of different operations of milling machine, cylindrical grinder, surface grinder, and tool &cutter grinder.

CO5 The student will be having the capability of selecting suitable manufacturing processes to manufacture the products optimally.

Pre-requisites:

- Basic working practice of Lathe & Milling machines
- Basic knowledge on working principle CNC machines
- Learning of fundamentals

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	2	2	1
CO2	3	3	3	3	2	2	1
CO3	3	3	3	3	2	2	1
CO4	3	3	3	3	2	2	1
CO5	3	3	3	3	2	2	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible

1220234420	SPECIAL MACHINES PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle	Second Cycle	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Cycle 1 - Exercises 1, 2,3,4, and 5.

Cycle 2 - Exercises 6, 7, 8, 9 and 10.

- **CA 3:** Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

  The details of the documents to be prepared as per the instruction below.

  Each exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

  This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The part program and sketch should be written by the student manually.

  The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

1220234420	SPECIAL MACHINES PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

- **CA 4:** All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Tools required	10
B	Machining & Dimension	30
C	Finish	10
TOTAL		50

1220234420	SPECIAL MACHINES PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Syllabus Contents

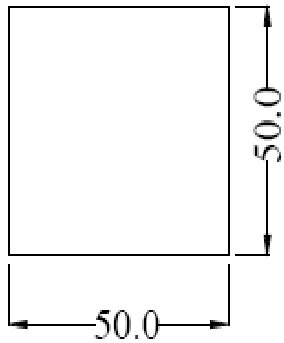
Introduction	
1.Introduction to shaping machine and its parts 2. Introduction to milling machine and its parts. 3.Introduction to grinding machine and its parts 4. Introduction to work holding devices. 5.Types of cutter used in milling machine 6.Types of grinding wheels used in grinding machines 7.Setting of work, tools and cutters in shaping, milling and grinding machines 8.Operations performed in shaping, milling and grinding machine	10
Practical Exercises	
1.Machine a cube by using shaping machine 2.Machine a square block from round rod using Milling machine 3.Machine a 'V' Block using Milling machine 4.Machine Groove cuts using Vertical Milling machine 5.Grind a plain surface using surface Grinder 6.Grind a cylindrical surface using Cylindrical Grinding machine 7.Grind a Progressive type Plug gauge using Cylindrical Grinding machine 8.Machine a Spur Gear using milling machine by Simple Indexing 9. Machine a Helical Gear using milling machine. 10.Grind a Facing Tool using Tool and Cutter Grinder	50
Tests and Model examination	10
TOTAL HOURS	70

Practical Exercises *

EXERCISE NO: 1 SHAPING A PLAIN SURFACE

MANUFACTURE A SQUARE BLOCK USING SHAPING MACHINE.

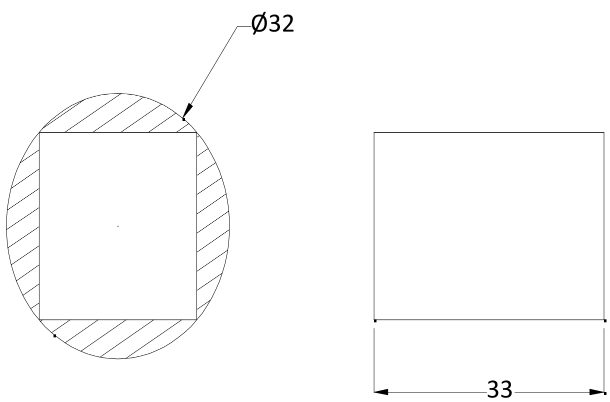
Raw material size:



ALL DIMENSIONS ARE IN mm

EXERCISE NO: 2 MANUFACTURE A MAXIMUM SIZE SQUARE BLOCK FROM GIVEN ROUND ROD USING MILLING MACHINE.

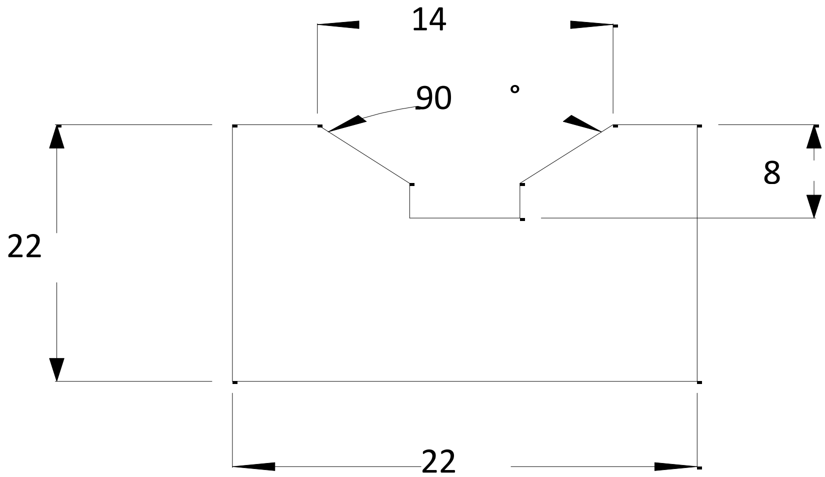
RAW MATERIAL SIZE: Ø32X33 mm MS ROUND



EXERCISE NO: 3

MACHINE A V BLOCK BY USING MILLING MACHINE

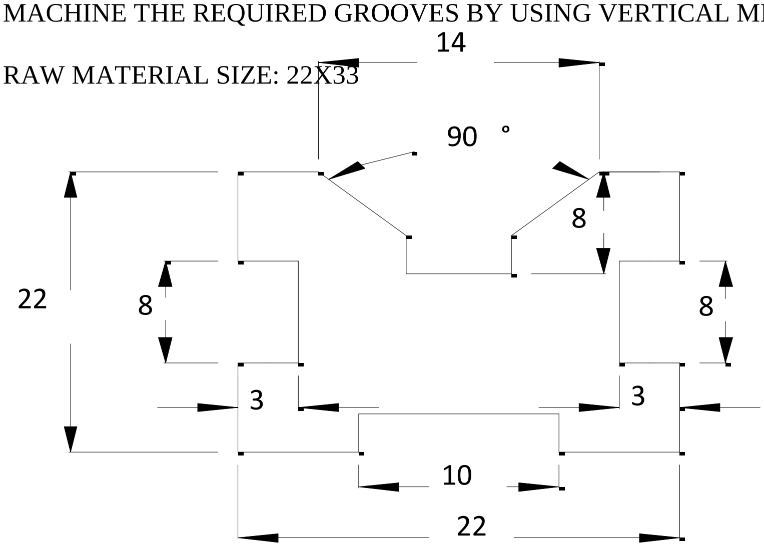
RAW MATERIAL SIZE: 22 X33



EXERCISE NO: 4 GROOVE MILLING

MACHINE THE REQUIRED GROOVES BY USING VERTICAL MILLING MACHINE

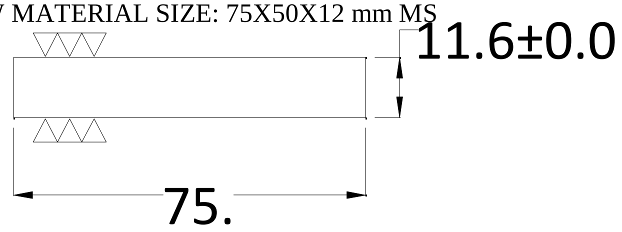
RAW MATERIAL SIZE: 22X33



EXERCISE NO: 5 SURFACE GRINDING

GRIND THE PLAIN SURFACE TO AN ACCURACY OF 0.01mm BY USING SURFACE GRINDING MACHINE.

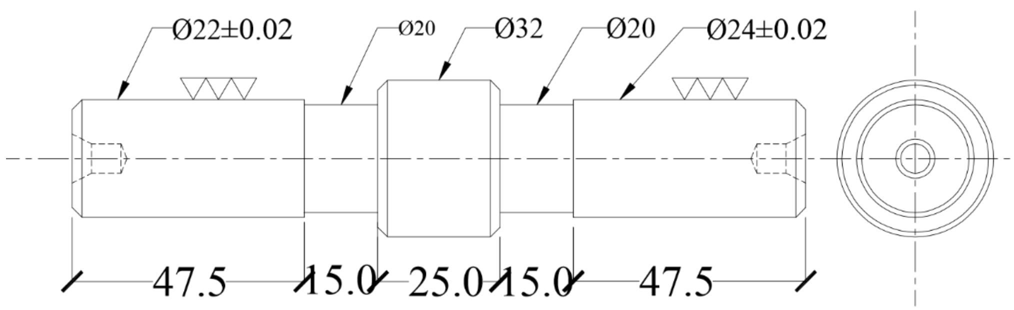
RAW MATERIAL SIZE: 75X50X12 mm MS



EXERCISENO:6 CYLINDRICAL GRINDING

GRIND THE CYLINDRICAL COMPONENT TO AN ACCURACY OF 0.02MM BY USING CYLINDRICAL GRINDING MACHINE

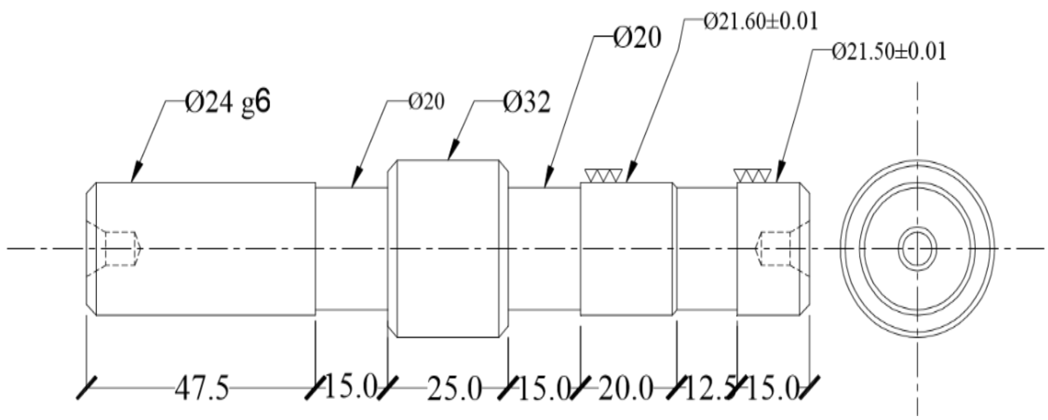
RAW MATERIAL SIZE:Ø32X150 MM MS POLISH ROD



ALL DIMENSIONS ARE IN mm

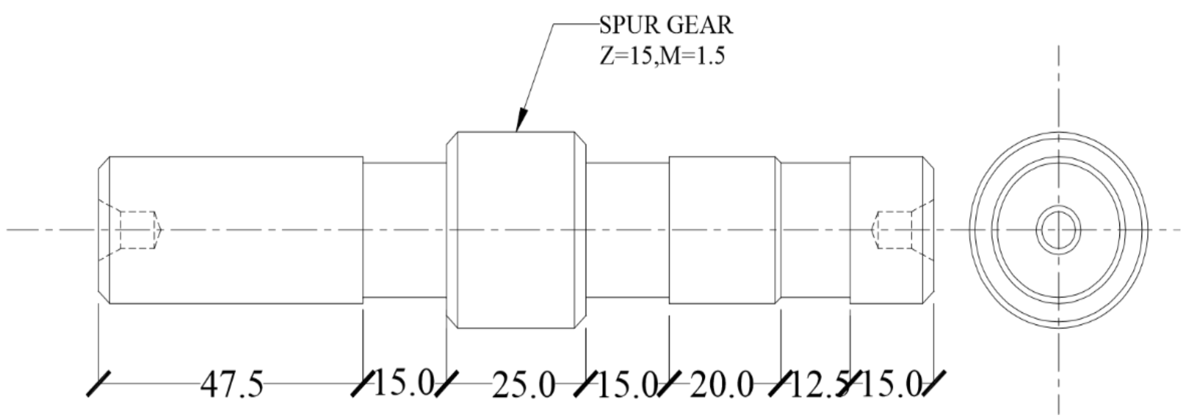
EXERCISE NO:7 CYLINDRICAL GRINDING

MANUFACTURE A PROGRESSIVE TYPE PLUG GAUGE BY USING CYLINDRICAL GRINDING



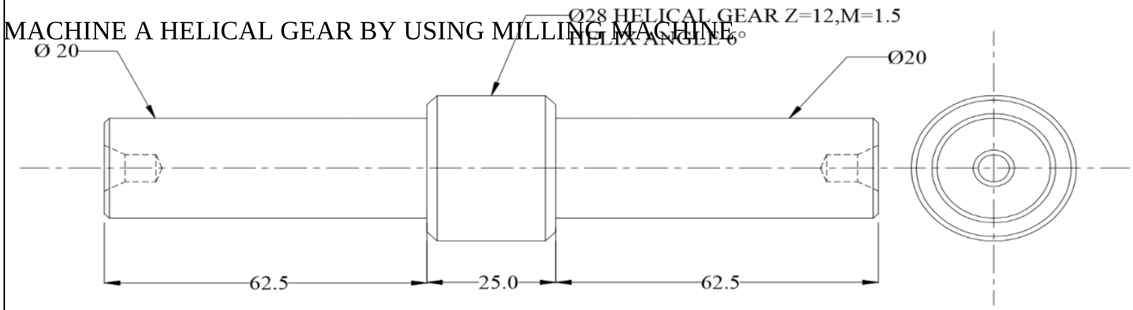
EXERCISE NO: 8 SPUR GEAR MILLING

MACHINE A SPUR GEAR BY USING MILLING MACHINE



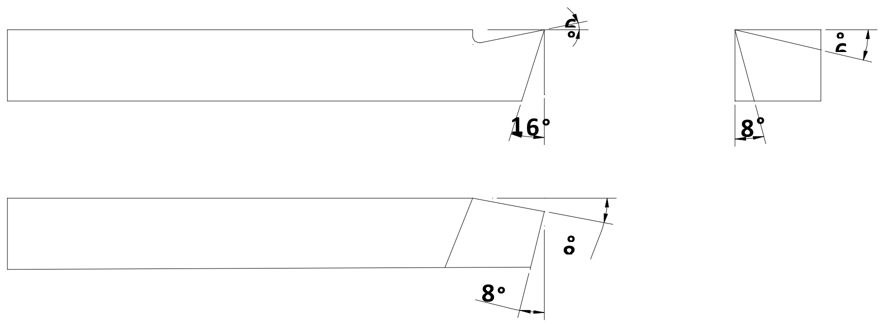
EXERCISE NO: 9 HELICAL GEAR MILLING

MACHINE A HELICAL GEAR BY USING MILLING MACHINE



EXERCISE NO: 10- FACING TOOL (TOOL AND CUTTER GRINDER)

TOOL AND CUTTER GRINDING



1220234420	SPECIAL MACHINES PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Suggested List of Students Activity:

1. Study and practice the conventional & non-conventional machines for various component machining.
2. Field visit nearby industries based on conventional & non-conventional machines and make report.
3. Visit to any industries and make report.

Text and Reference Books:

1. Maddili Praveena Chakravarthy, Machine Tools Laboratory Manual,8th edition, LAP Lambert Academic Publishing ,2023
2. Shivani engineering book, Special machines,4th edition, Shivani engineering book,2020
3. American School of Correspondence, Tool Making a Manual of Practical ,10thedition, Legare Street Press,2023

Web-based/Online Resources:

1. https://download.slicer.org/
2. http://www.roboanalyzer.com/downloads.html

Equipment / Facilities required conducting the Practical Course.

1. Vertical milling machine/ vertical milling attachment in Universal Milling Machine 2 No's
2. Universal Milling Machine with indexing head- 2 Nos
3. Surface Grinding Machine (Horizontal) – 1 No
4. Cylindrical Grinding machine – 1 No
5. Tool and Cutter grinder – 1 No
6. Shaping machine –1 no

EQUIPMENT'S & TOOLS:

1. Milling Cutter (2 Module cutter) & accessories – complete sets
2. Milling Machine Handle and required accessories – 2 sets
3. Grinding wheel OD 150 mm , ID 1''(AA-65, K5, V8) – 2 No's
4. Grinding wheel OD 300 mm , ID 150mm(AA-56, K5, V8) – 1 No

END SEMESTER EXAMINATION – PRACTICAL EXAM.

BOARD EXAMINATIONS

Note:

- All the exercises have to be completed, any one exercise will be given for examination.
- All the exercises should be given in the question paper. The student is allowed to select by lot or question papers issued by the DOTE Exam section shall be used.
- Practical documents along with the activity report should be submitted for the End Semester Examinations.

DETAILED ALLOCATION OF MARKS.

Part	Description	Marks
A	Aim & Tools required	10
B	Procedure	20
C	Preparation	20
D	Cutting	20
E	Accuracy / Tool Handling / Finish / Result	20
F	Viva Voce	10
	TOTAL MARKS	**100**

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

Introduction:

This subject will help you to understand the press tool and die process. A press tool is embedded in a press machine, and it is designed to shape or cut metal using force. The die helps define the shape and size of the cut piece. This process is used to produce a pre-designed component in large quantities. The components that a press tool and die can produce depend on the construction and configuration of that tool and die. Basically, a press tool is an assembly of a tool and a die.

Course Objectives:

- Manufacture press tool components as per the given drawing.
- Assemble the components manufactured.
- Set the tools manufactured in the OBI / gap frame / Fly press as per requirement.
- Adjust the shut height; operate the press to take trial production.
- Compare the result with the requirement and to do the necessary corrections if needed.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1 Capable of performing Blanking Tool independently

CO2 Capable of performing Progressive Tool independently.

CO3 Capable of performing Compound Tool independently.

CO4 Capable of performing V Bending tool independently.

CO5 Capable of performing drawing tool independently

Pre-requisites:

1. Basic press tool assembly, accuracy.
2. Mechanical properties of materials.

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	3	3	1	2	-
CO2	-	-	3	3	1	2	-
CO3	-	-	3	3	1	2	-
CO4	-	-	3	3	1	2	-
CO5	-	-	3	3	1	2	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

Assessment Methodology:

	Continuous Assessment (40 marks)		End Semester Examination (60 marks)
Mode	Record of Work Done	Model Practical Exam	Practical Examination
Portion	All Exercises	Any one Exercise	04 Exercises
Duration	Regularly	8 Hours	16 Hours
Exam Marks	-	100	100
Converted to	20	20	60
Marks	20	20	60
Internal Marks	40		60

Note:

- Record of work done should be maintained and the same have to be evaluated after completion of each practical exercise for 20 Marks. The total marks awarded should be converted to 20 Marks for the internal assessment
- After completion of all the exercises, Model examination should be conducted as per End Semester Exam question pattern. The marks awarded should be converted to 20 Marks for the internal assessment.

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

SCHEME OF EVALUATION

The details of the documents to be prepared as per the instruction below.

Part	Description	Marks
A	Aim & Tools required	10
B	Design of Tools	30
C	Fabrication of Tools	40
D	Tool Finish	10
E	Viva Voice	10
	TOTAL MARKS	**100**

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

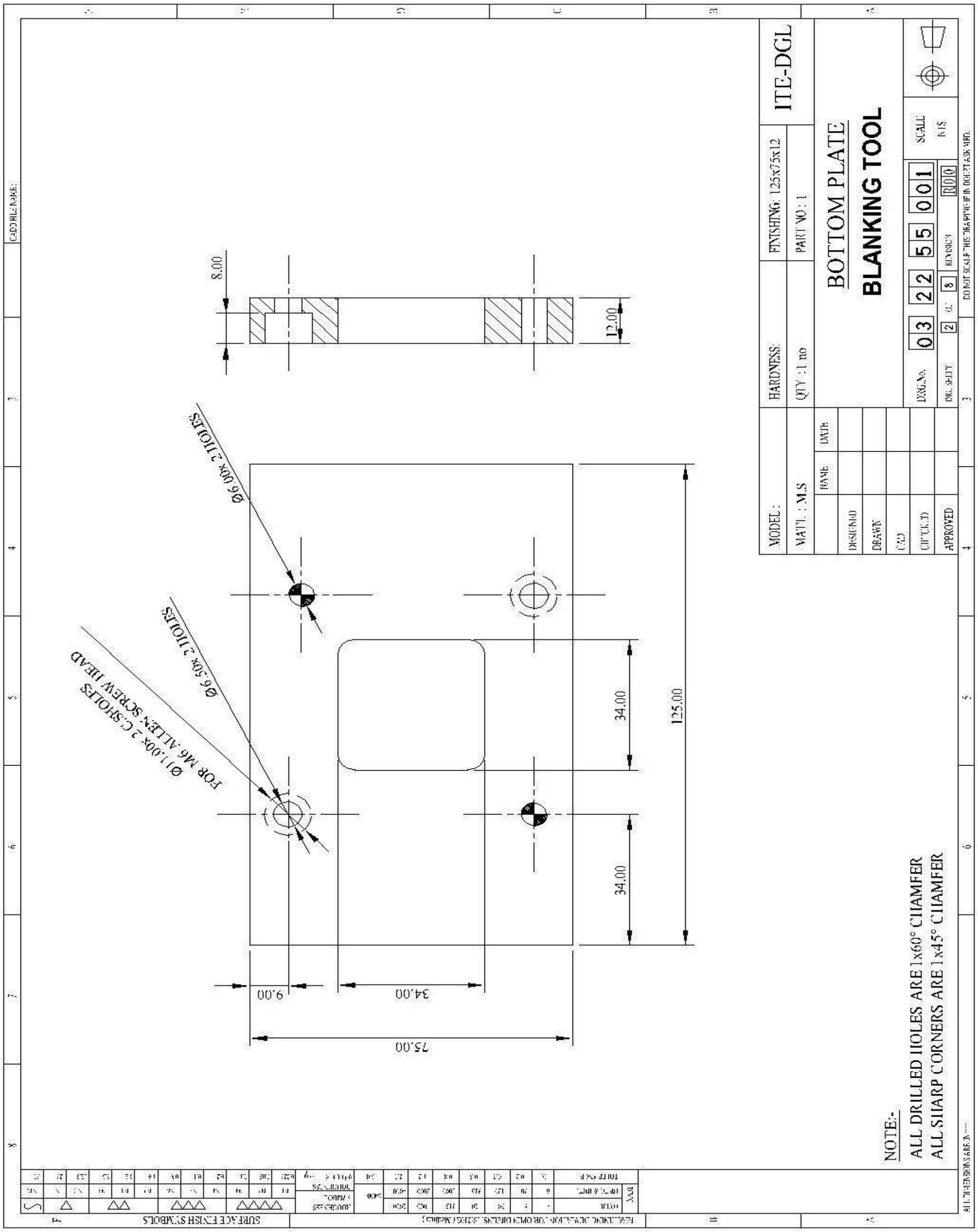
Syllabus Contents

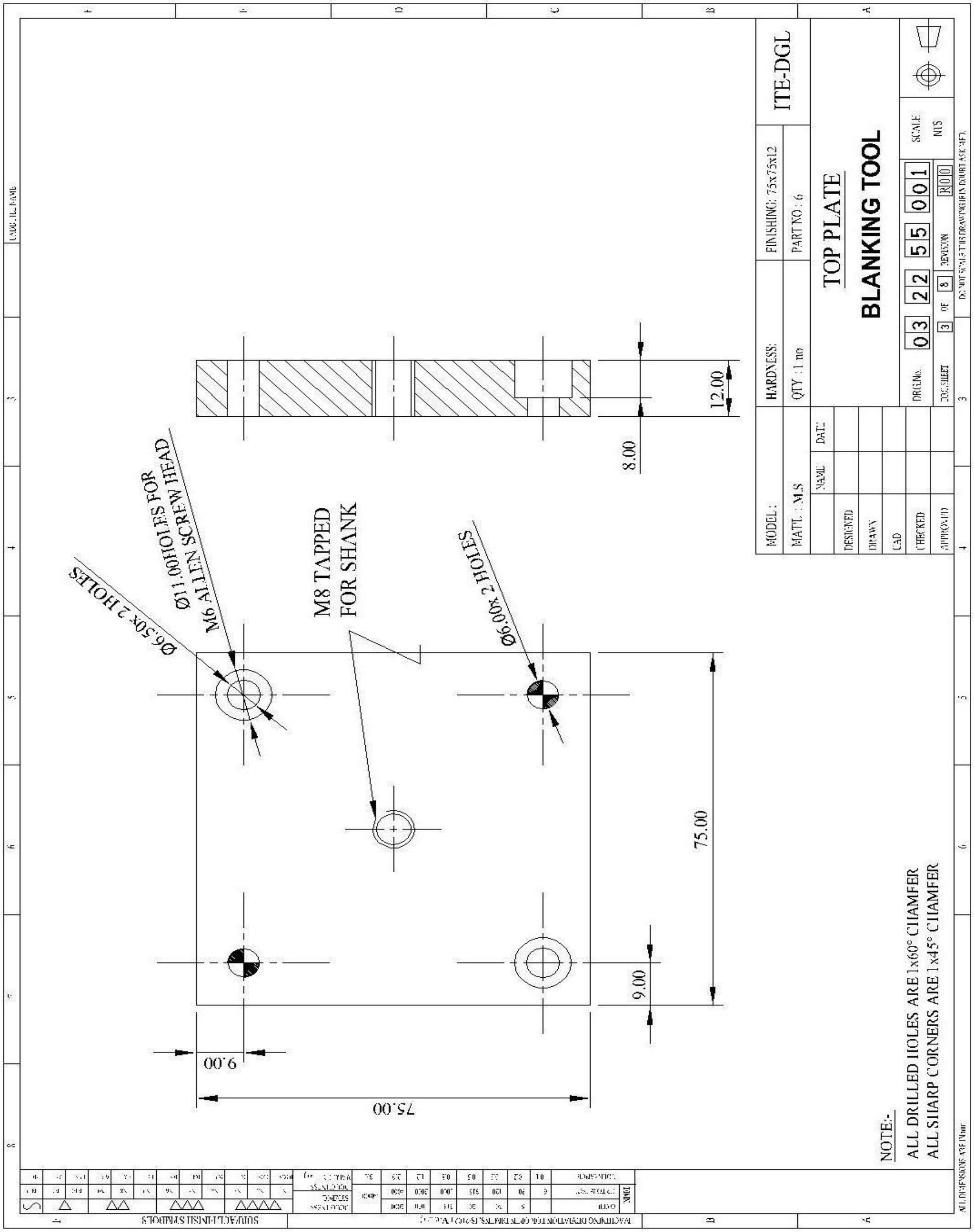
TOPIC	PERIODS
1. Manufacture of Blanking Tool – Drop through type	12
2. Manufacture of Progressive Tool – Drop through type	12
3. Manufacture or Compound Tool	12
4. Manufacture of V Bending tool	12
5. Manufacture of drawing tool (single stage)	12
TOTAL HOURS	60

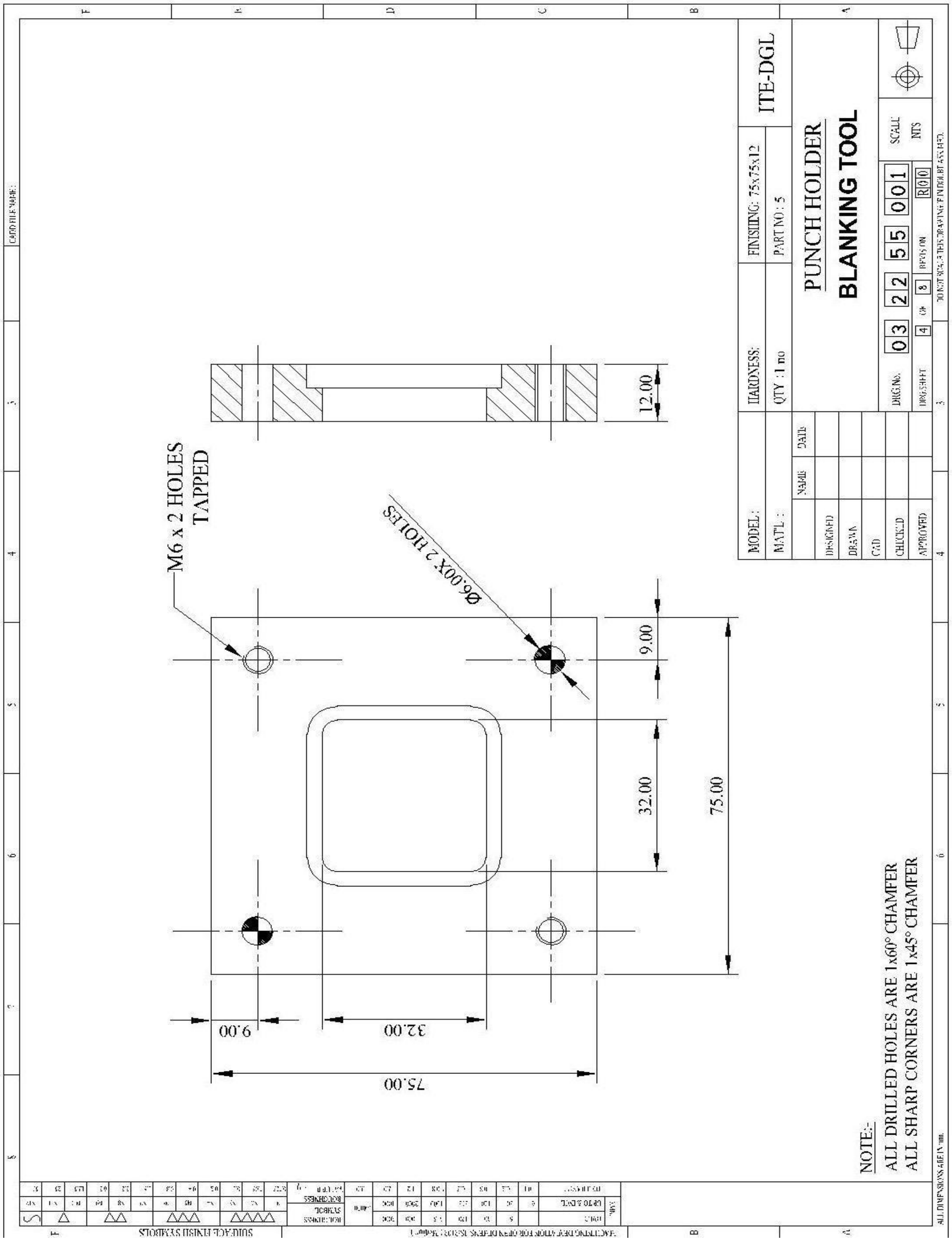
END SEMESTER EXAMINATION – PRACTICAL EXAM.

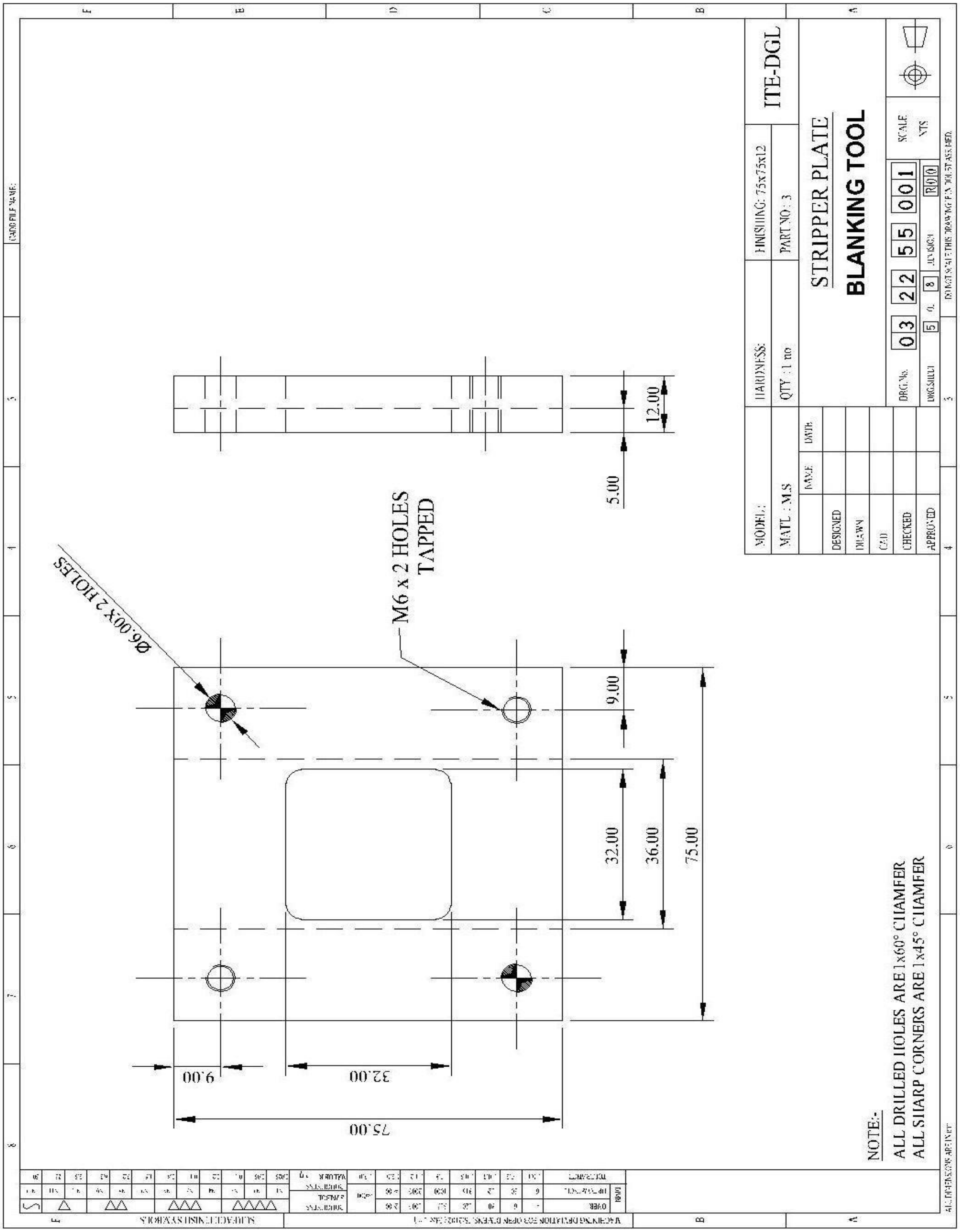
Note:

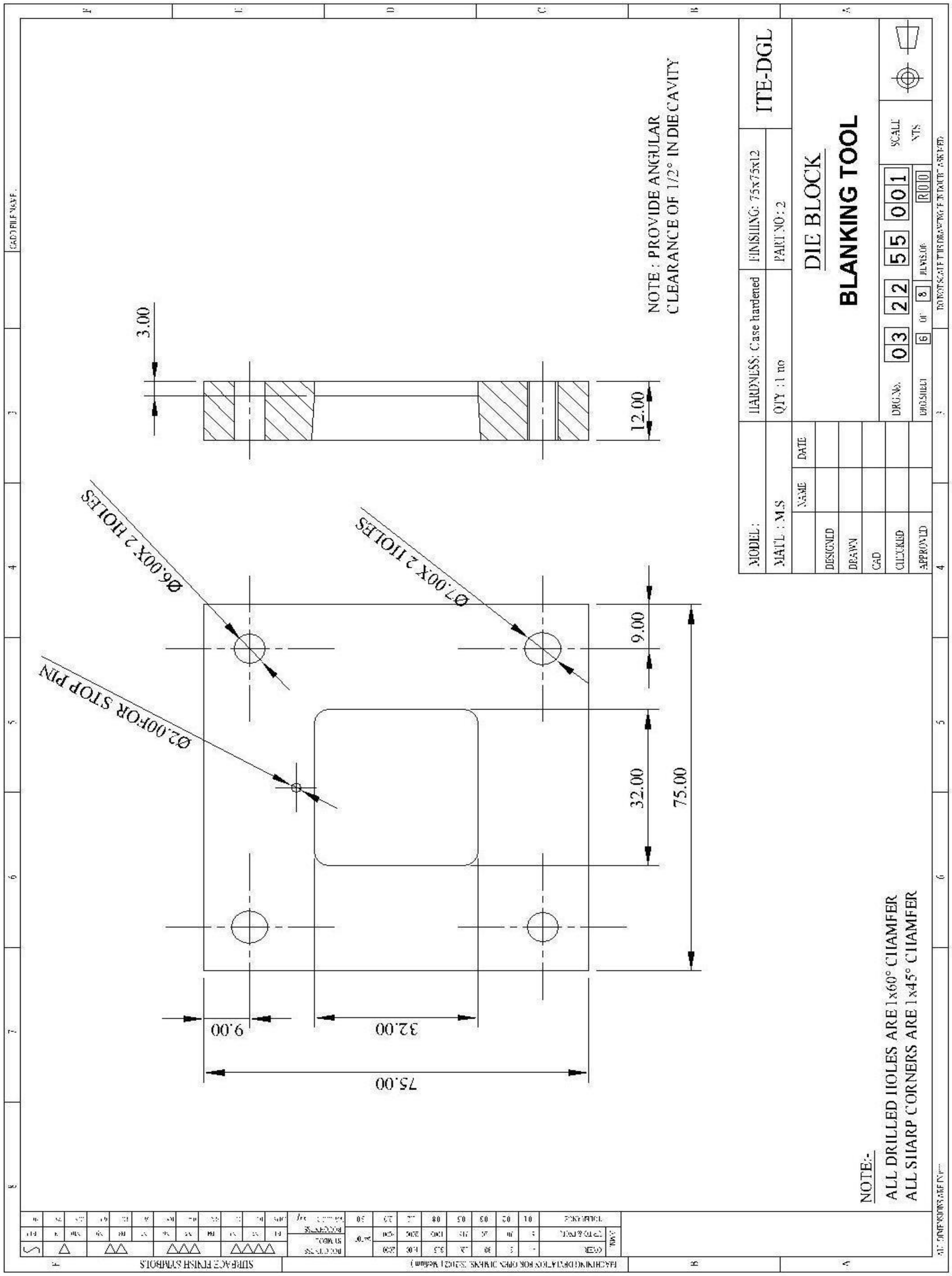
- For examination, exercise should be given to students individually and not in batches.
- **The examination duration is 16 hours.**
- All the exercises have to be completed, any one exercise will be given for examination.
- All the exercises should be given in the question paper. The student is allowed to select by lot or question papers issued by the DOTE Exam section shall be used.
- Record of work done notebook along with the activity report should be submitted for the End Semester Examinations.

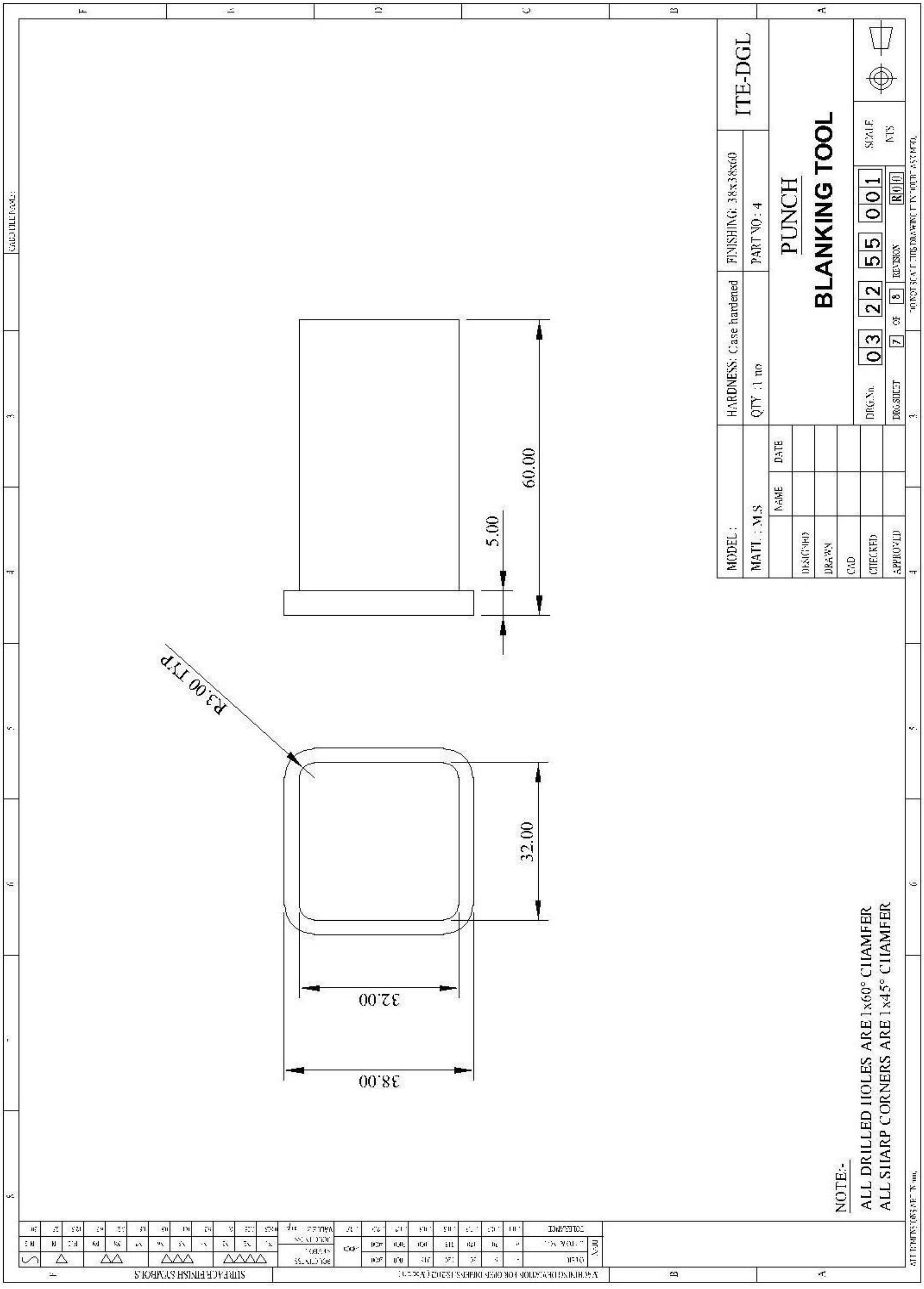

ITE-DGL
FINISHING: 125x75x12
PART NO: 1
HARDNESS:
QTY : 1 no
MODEL :
MAT'L : M.S
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
BOTTOM PLATE
BLANKING TOOL
DRG.No. 0 3 2 2 5 5 0 0 1
SCALE
N.T.S
Ø6.00x 2 HOLES
Ø6.50x 2 HOLES
FOR M6 ALLEN SCREW HEAD
Ø11.00x 2 C.SHOLES
8.00
12.00
34.00
34.00
125.00
9.00
34.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

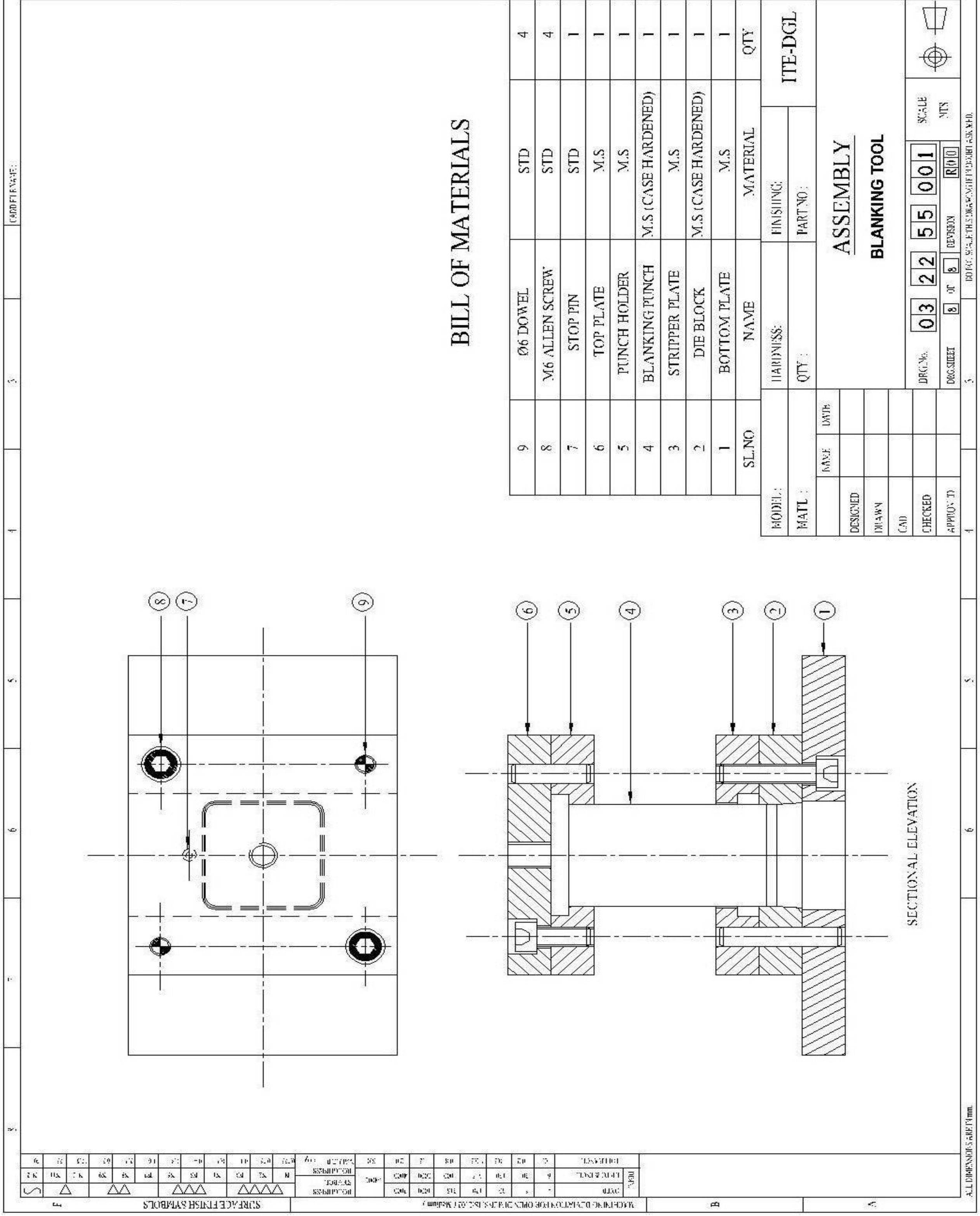

ITE-DGL
FINISHING: 75x75x12
PART NO : 6
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
TOP PLATE
BLANKING TOOL
DRG.No. 03 22 55 001
SCALE NTS
Ø11.00HOLES FOR
M6 ALLEN SCREW HEAD
Ø6.50x 2 HOLES
M8 TAPPED
FOR SHANK
Ø6.00x 2 HOLES
12.00
8.00
75.00
9.00
9.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


ITE-DGL
FINISHING: 75x75x12
PART NO: 5
HARDNESS:
QTY: 1 no
MODEL:
MATL:
PUNCH HOLDER
BLANKING TOOL
DRG.No. 03 22 55 001
SCALE NTS
M6 x 2 HOLES TAPPED
Ø6.00X 2 HOLES
12.00
9.00
32.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

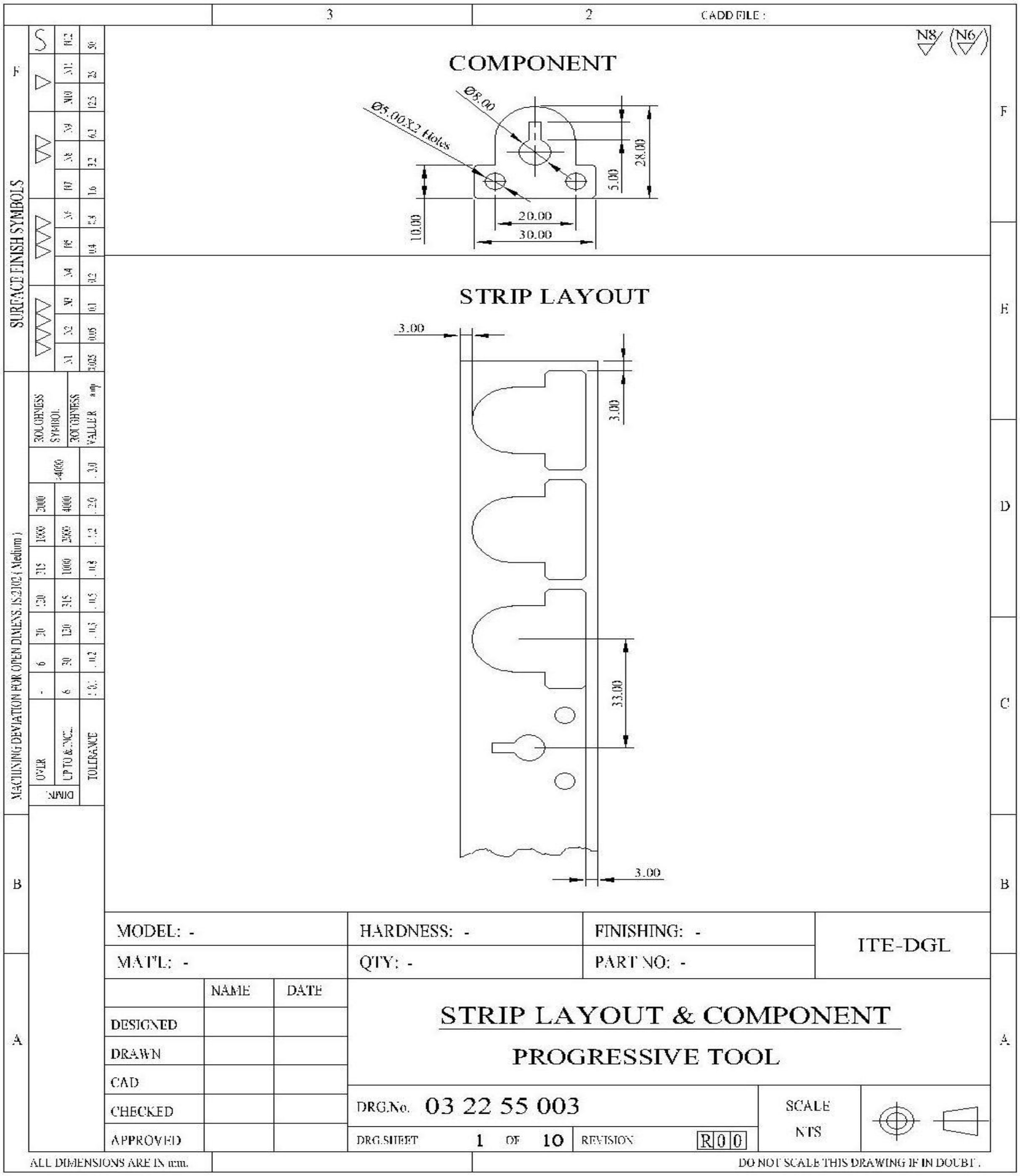

ITE-DGL
HARDNESS:
FINISHING: 75x75x12
QTY : 1 no
PART NO : 3
MODEL :
MATL : M.S
STRIPPER PLATE
BLANKING TOOL
DRG. No. 03 22 55 001
SCALE NTS
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
M6 x 2 HOLES TAPPED
Ø6.00X 2 HOLES
5.00
12.00
9.00
32.00
36.00
75.00
9.00
32.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

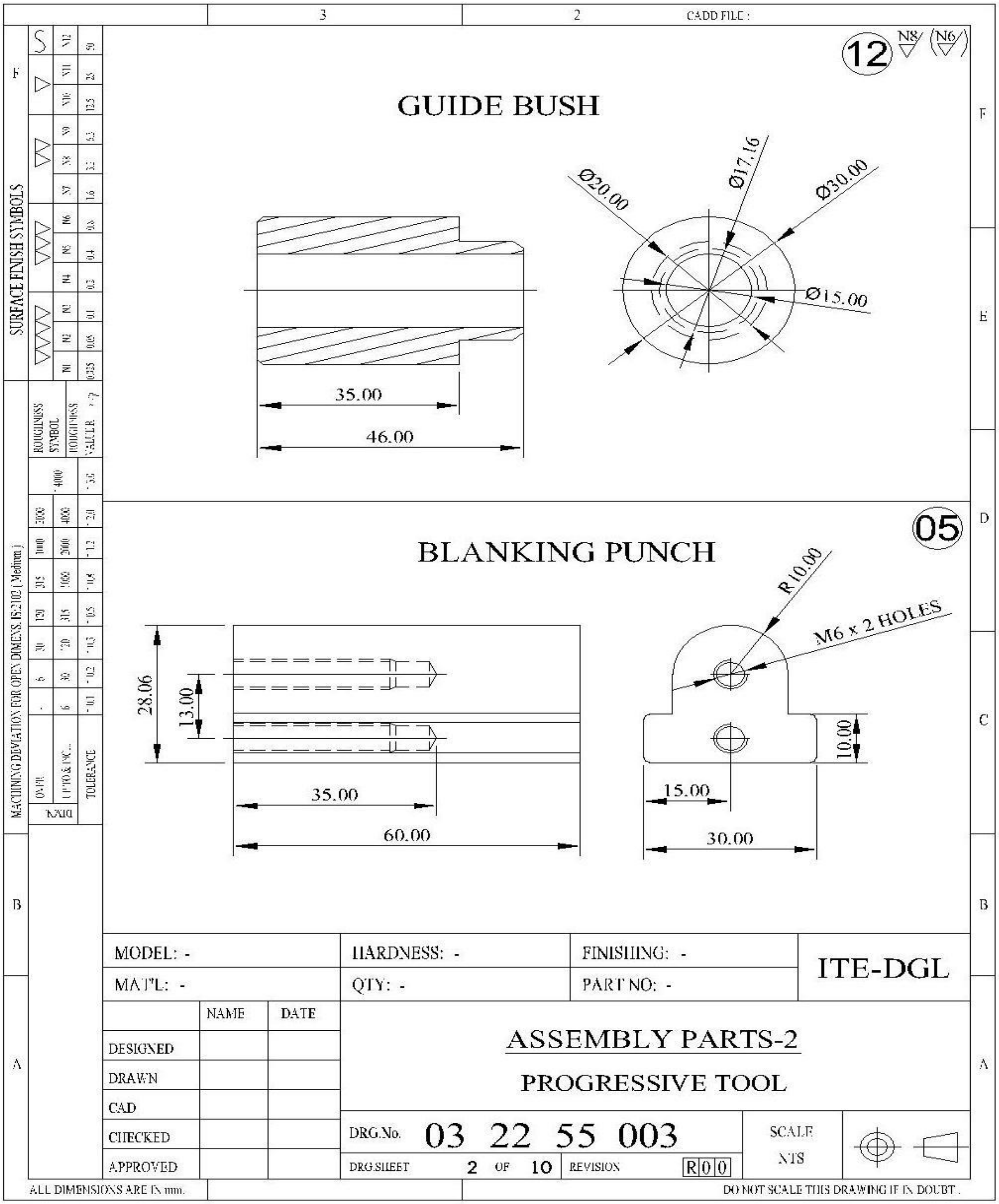

NOTE : PROVIDE ANGULAR
CLEARANCE OF 1/2° IN DIE CAVITY
3.00
12.00
Ø6.00X 2 HOLES
Ø7.00X 2 HOLES
Ø2.00FOR STOP PIN
9.00
32.00
75.00
9.00
32.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
ITE-DGL
HARDNESS: Case hardened
FINISHING: 75x75x12
QTY : 1 no
PART NO: 2
DIE BLOCK
BLANKING TOOL
MODEL :
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 55 001
SCALE
NTS
SURFACE FINISH SYMBOLS


ITE-DGL
HARDNESS: Case hardened
FINISHING: 38x38x60
MODEL :
MATL : M.S
QTY :1 no
PART NO : 4
PUNCH
BLANKING TOOL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 55 001
DRG.SHEET 7 OF 8
REVISION R0|0
SCALE NTS
60.00
5.00
R3.00 TYP
32.00
32.00
38.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS


BILL OF MATERIALS
SL.NO | NAME | MATERIAL | QTY
9 | Ø6 DOWEL | STD | 4
8 | M6 ALLEN SCREW | STD | 4
7 | STOP PIN | STD | 1
6 | TOP PLATE | M.S | 1
5 | PUNCH HOLDER | M.S | 1
4 | BLANKING PUNCH | M.S (CASE HARDENED) | 1
3 | STRIPPER PLATE | M.S | 1
2 | DIE BLOCK | M.S (CASE HARDENED) | 1
1 | BOTTOM PLATE | M.S | 1
ITE-DGL
ASSEMBLY
BLANKING TOOL
DRG.No. 03 22 55 001
REVISION R00
SCALE NTS
SECTIONAL ELEVATION
SURFACE FINISH SYMBOLS
ALL DIMENSIONS ARE IN mm.

Exercise – II Progressive Tool





MODEL: -	HARDNESS: -	FINISHING: -	ITE-DGL
MAT'L: -	QTY: -	PART NO: -	

	NAME	DATE
DESIGNED		
DRAWN		
CAD		
CHECKED		
APPROVED		

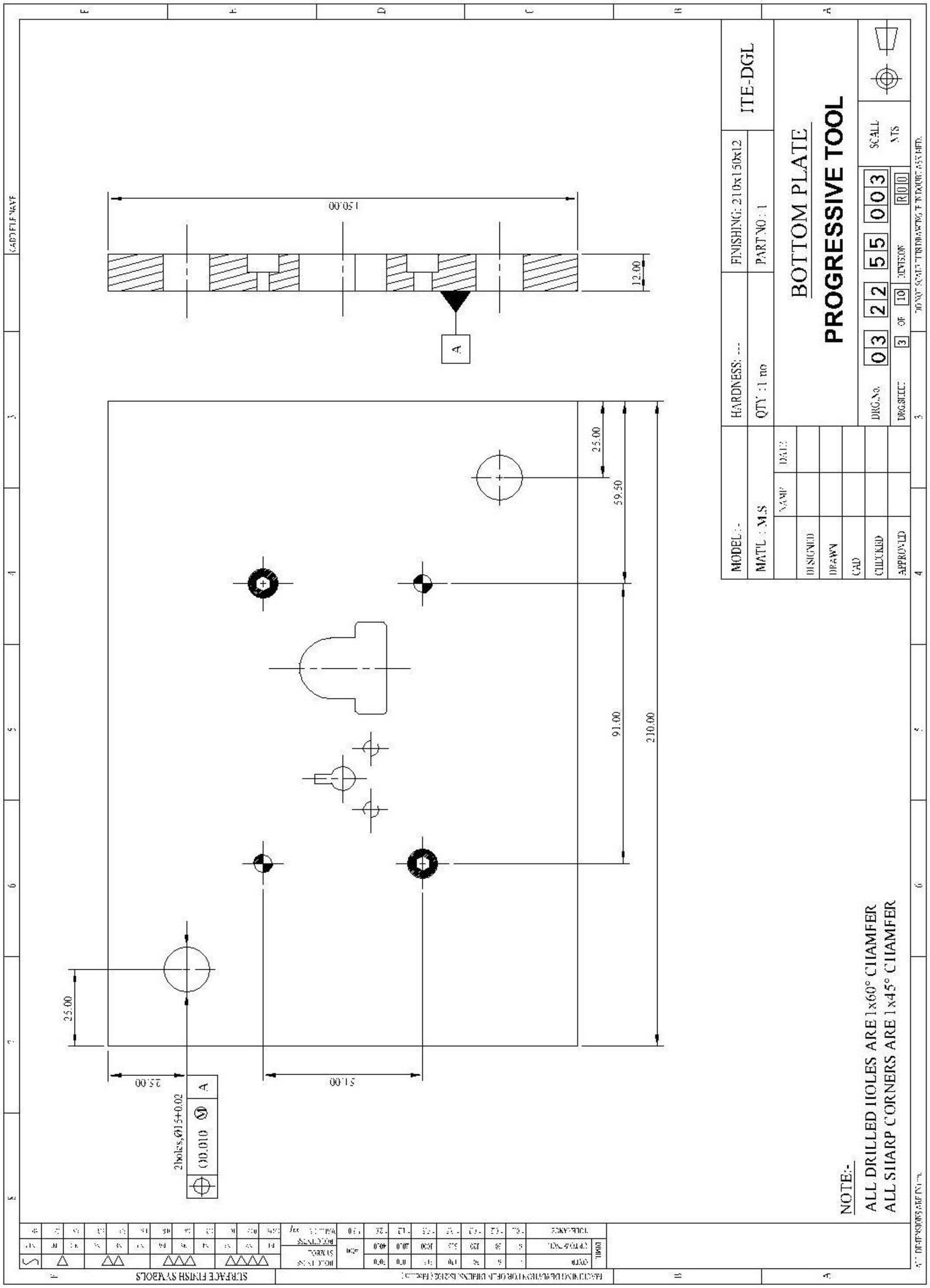
ASSEMBLY PARTS-2

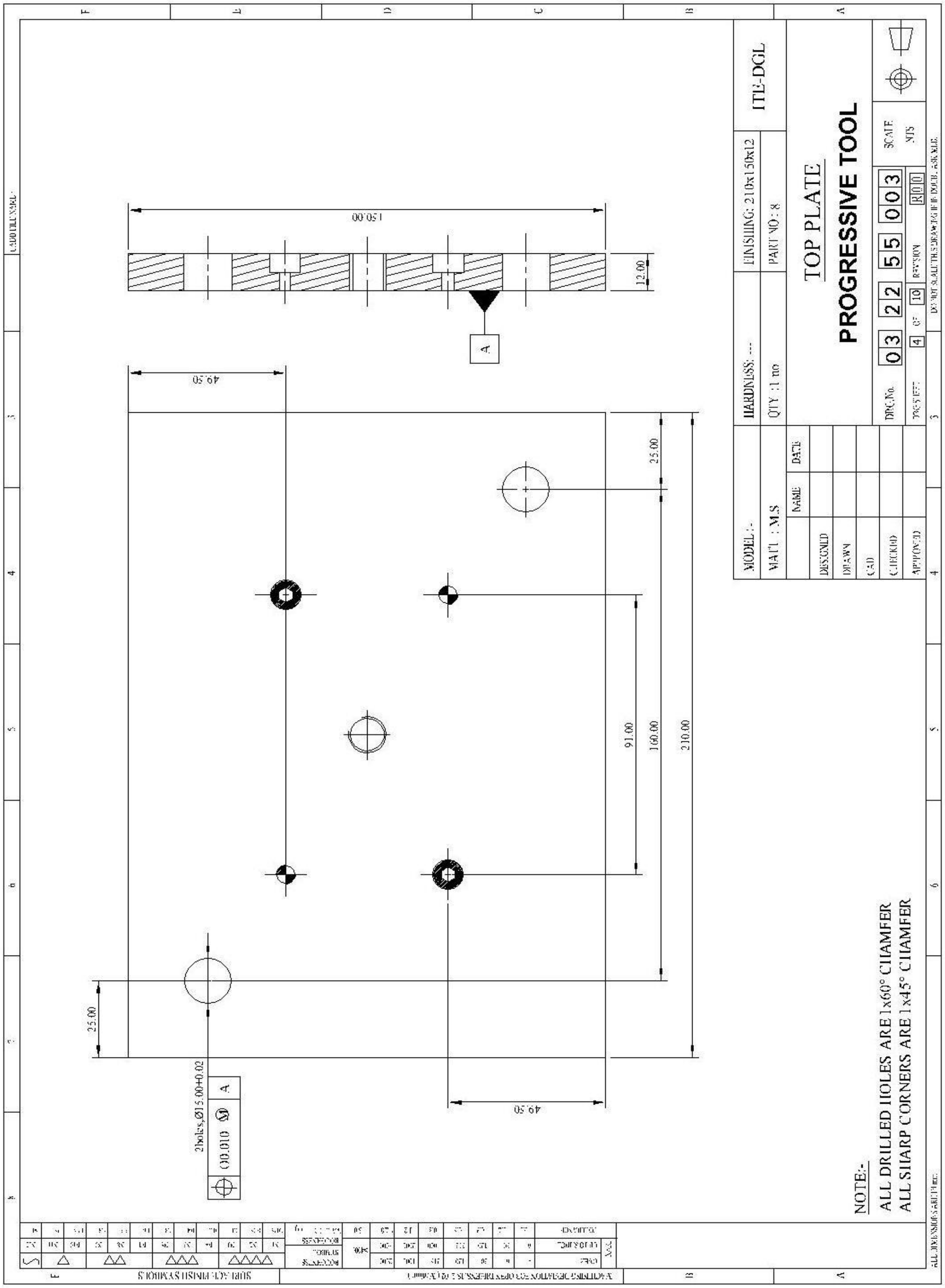
PROGRESSIVE TOOL

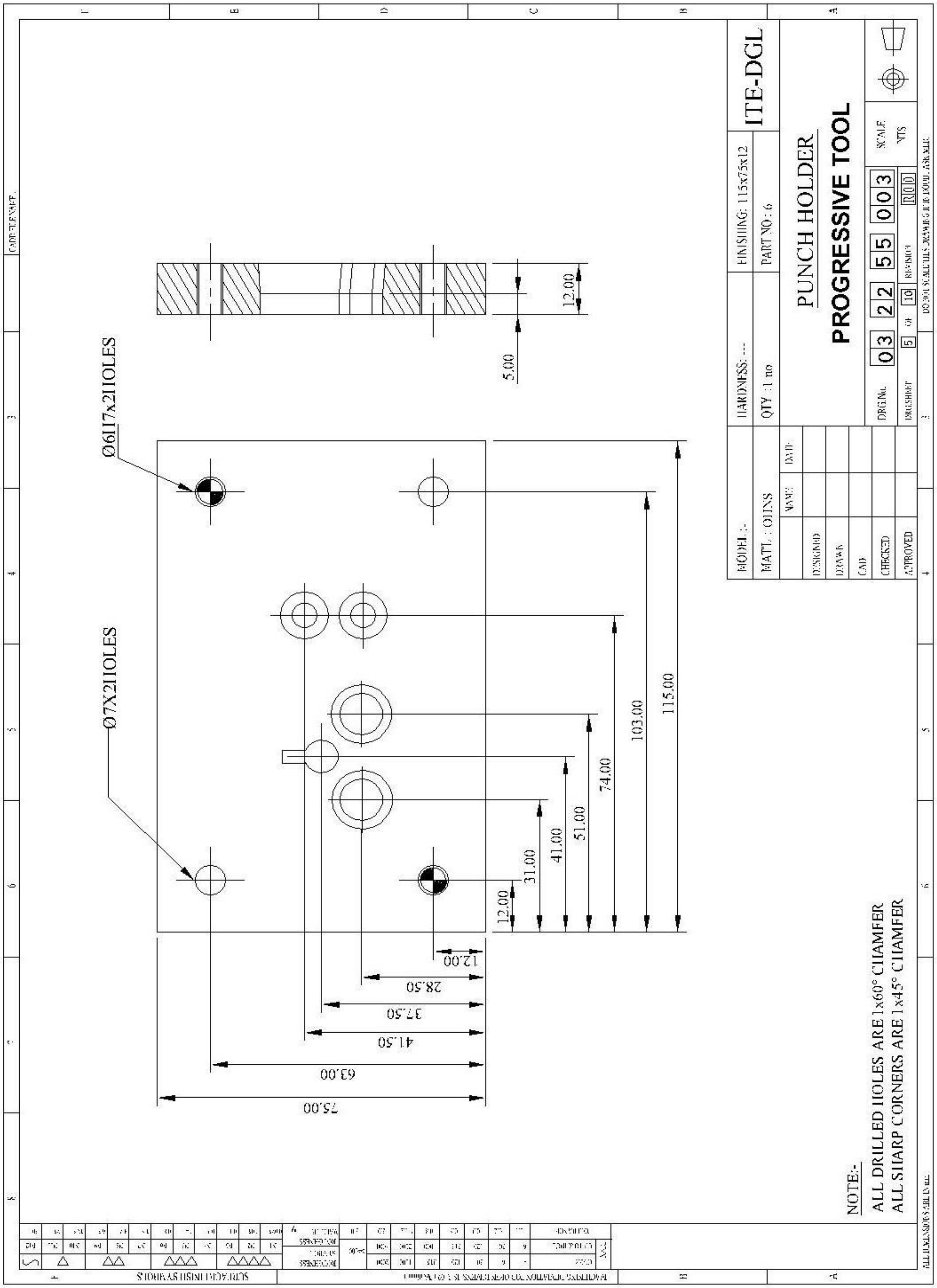
DRG.No. 03 22 55 003

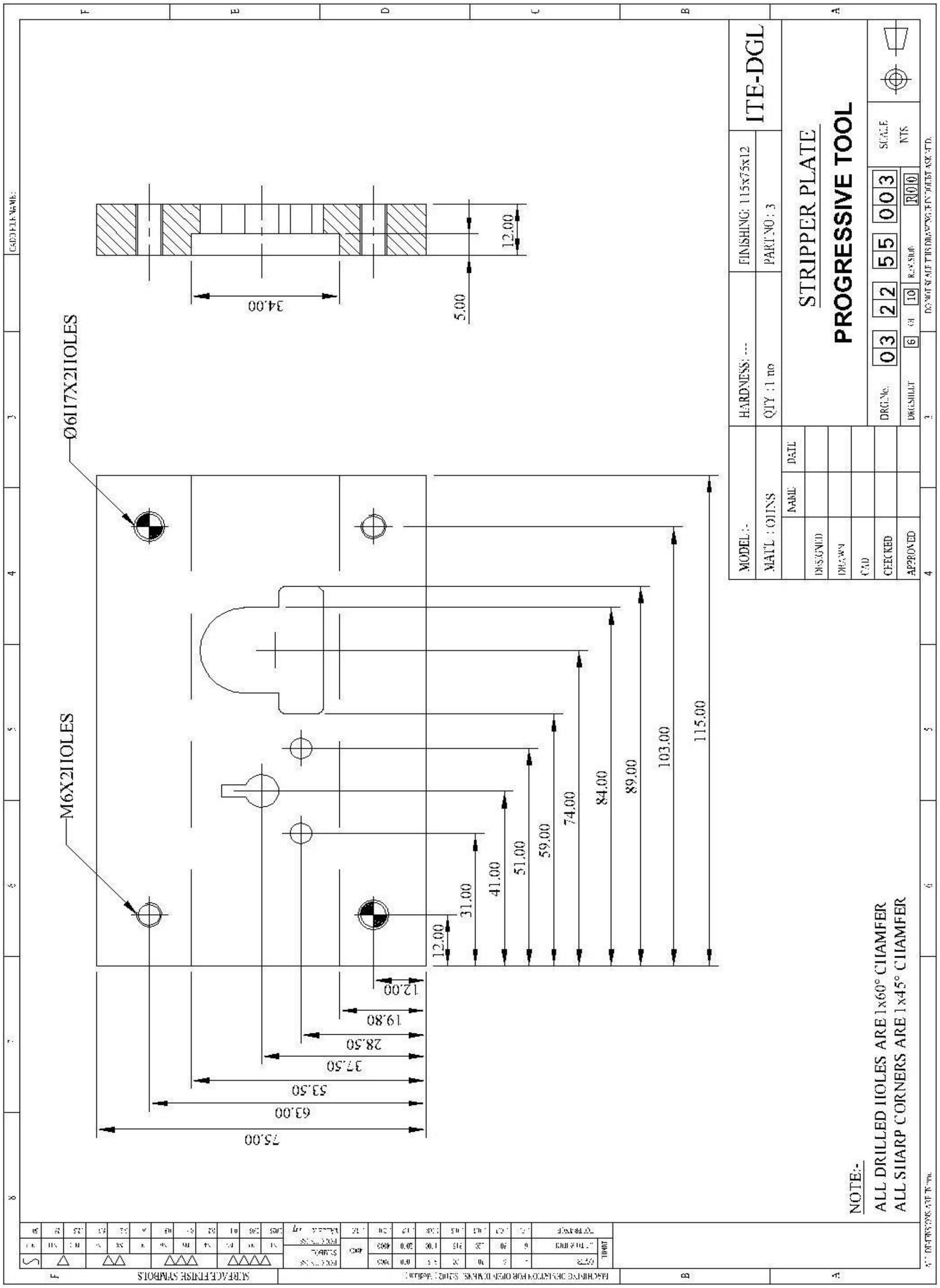
DRG.SHEET 2 OF 10 REVISION R00

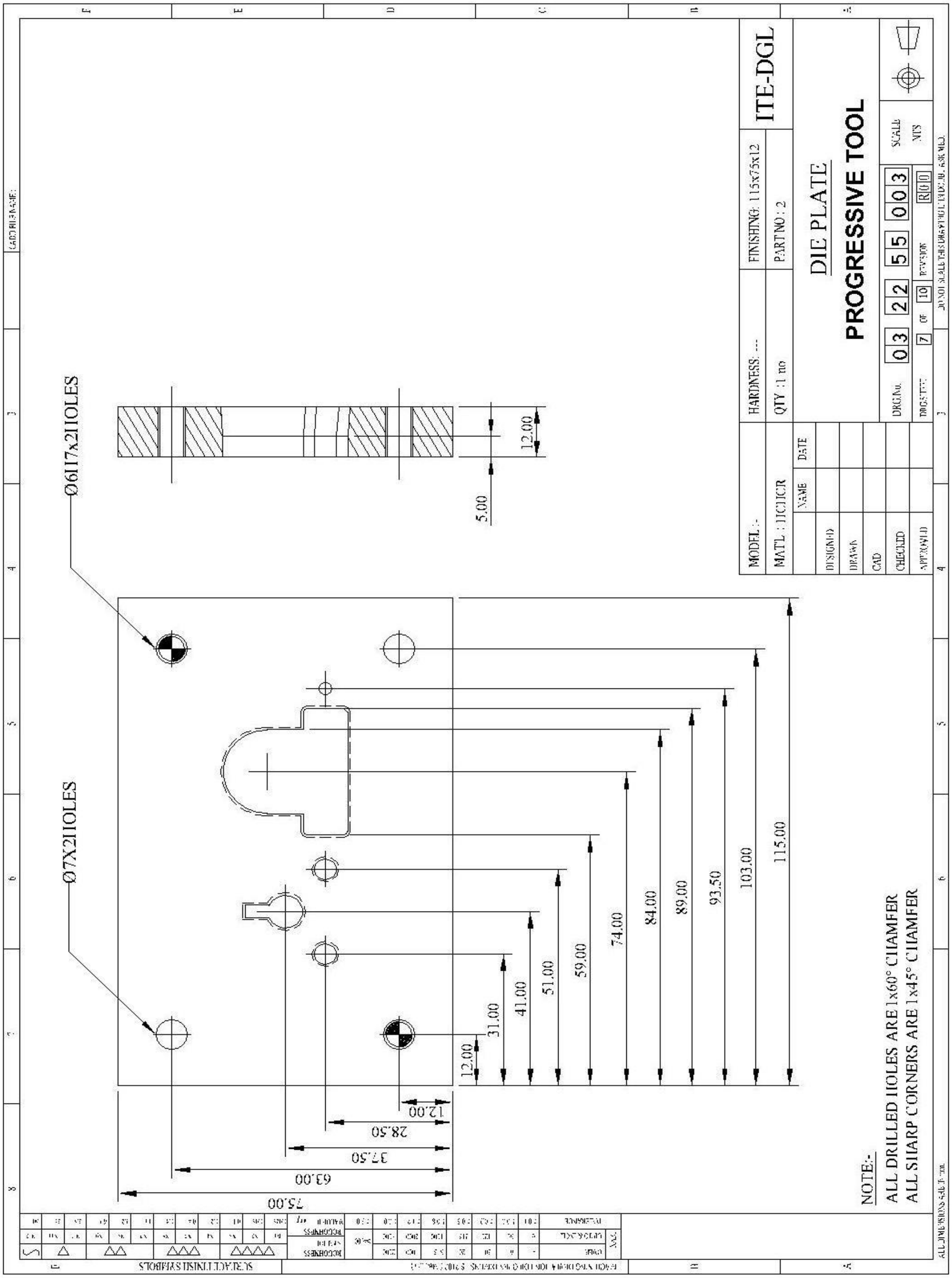
SCALE NTS

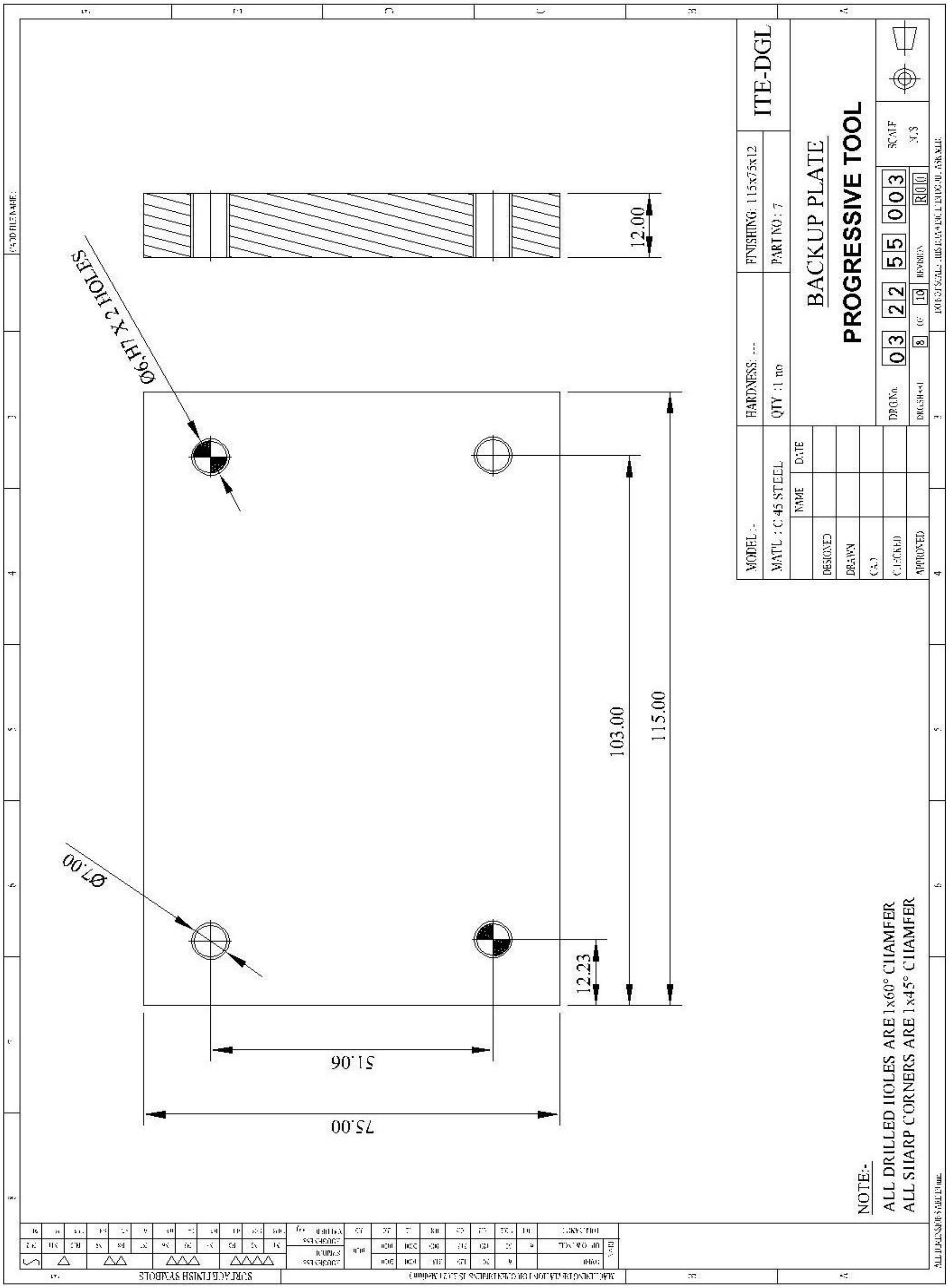

ITE-DGL
FINISHING: 210x150x12
PART NO : 1
HARDNESS: ---
QTY : 1 no
MODEL : -
MATL : M.S
BOTTOM PLATE
PROGRESSIVE TOOL
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
03 22 55 003
DRG.SHEET 3 OF 10
REVISION R00
SCALE NTS
150.00
12.00
A
25.00
59.50
91.00
210.00
25.00
25.00
51.00
2holes,Ø15+0.02
0.010 M A
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

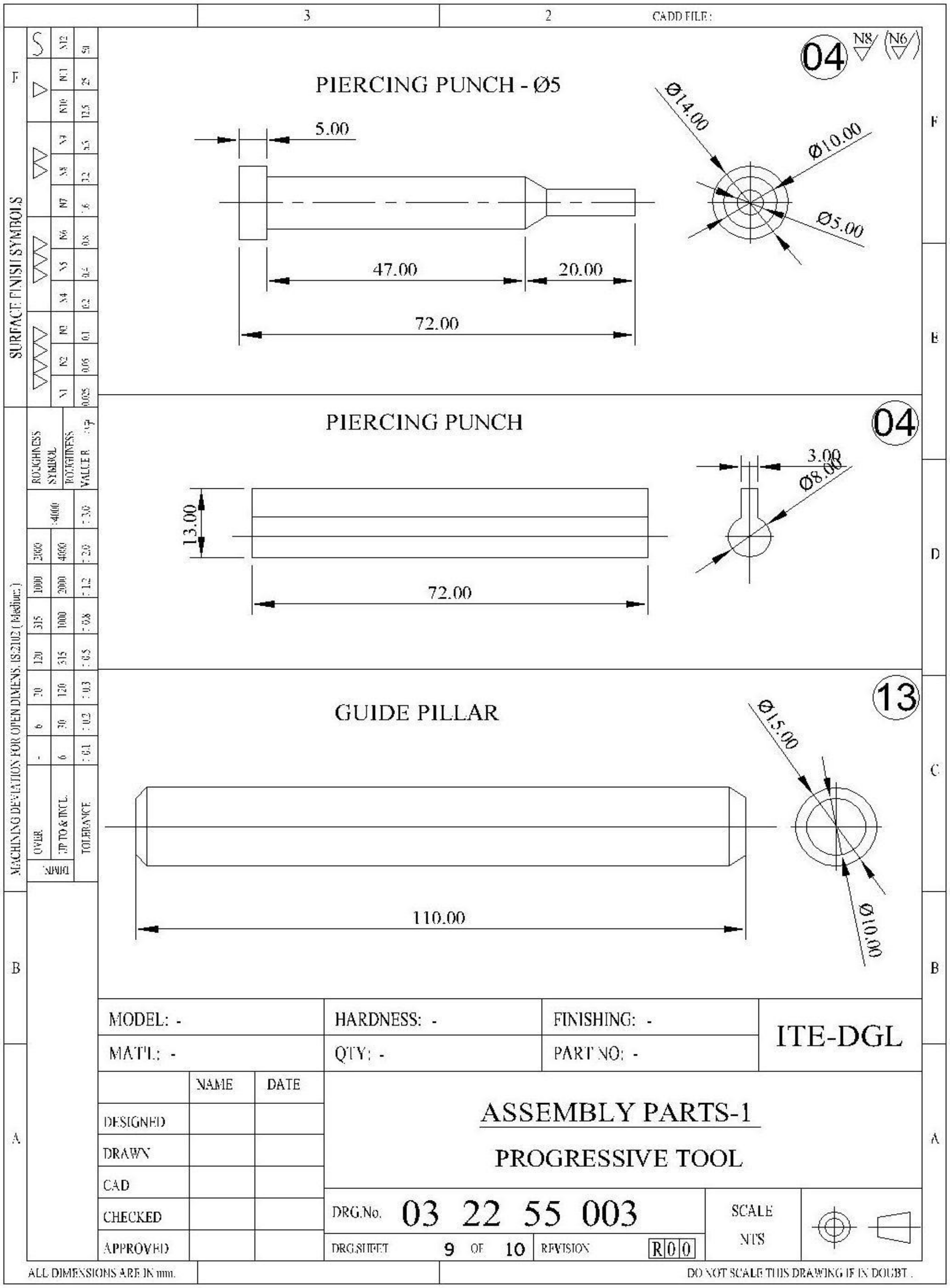

ITE-DGL
FINISHING: 210x150x12
PART NO : 8
HARDNESS: ---
QTY :1 no
MODEL :-
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
TOP PLATE
PROGRESSIVE TOOL
DRG.No.
0 3 2 2 5 5 0 0 3
SCALE
NTS
150.00
12.00
A
49.50
25.00
91.00
160.00
210.00
2holes,Ø15.00+0.02
0.010 M A
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

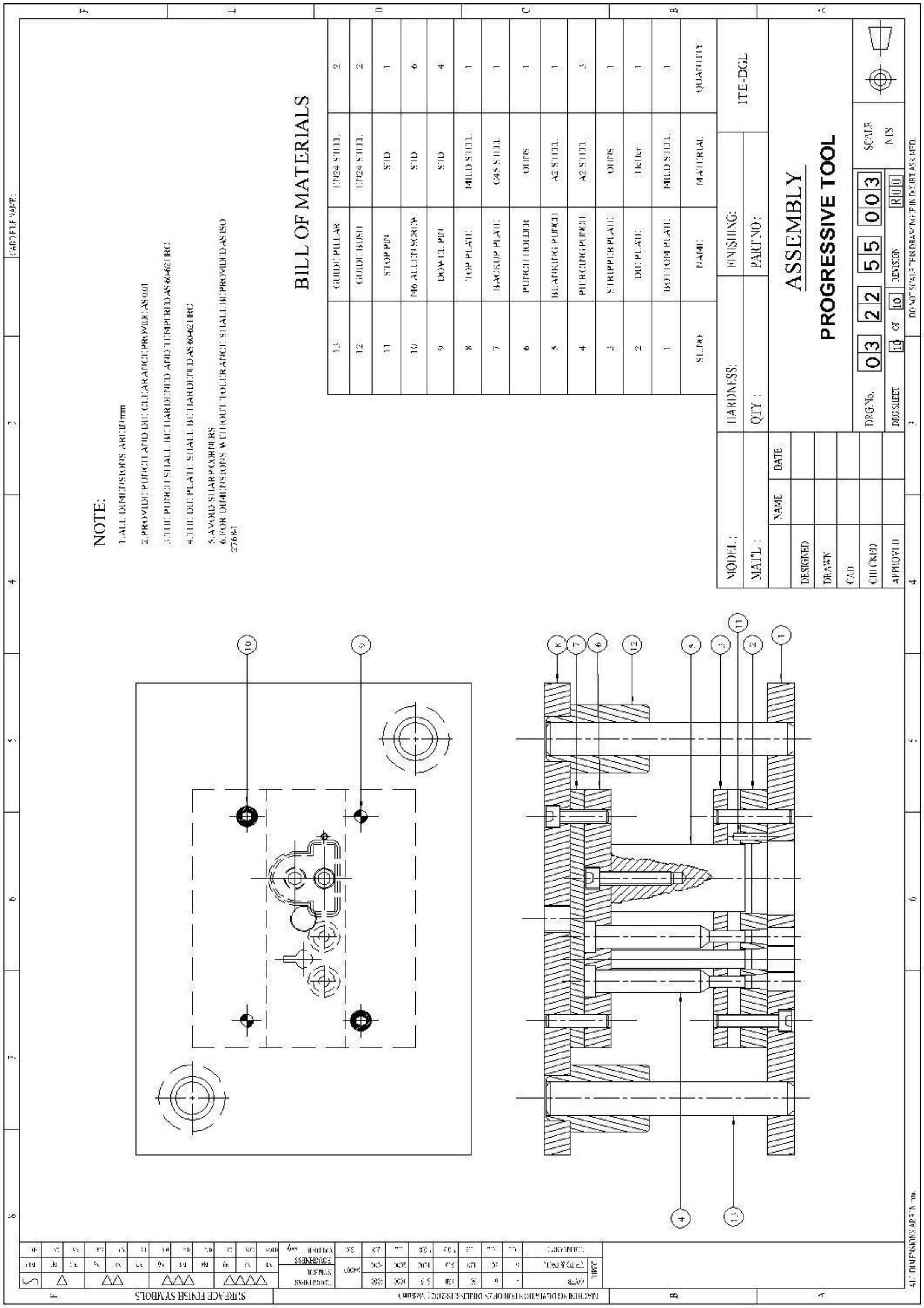

ITE-DGL
FINISHING: 115x75x12
PART NO: 6
HARDNESS: ---
QTY :1 no
MODEL:-
MATL : OHNS
PUNCH HOLDER
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
SCALE NTS
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
Ø6H7x2HOLES
Ø7X2HOLES
5.00
12.00
115.00
103.00
74.00
51.00
41.00
31.00
12.00
12.00
28.50
37.50
41.50
63.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


ITE-DGL
FINISHING: 115x75x12
PART NO: 3
HARDNESS: ---
QTY: 1 no
MODEL:-
MAT'L: OHNS
STRIPPER PLATE
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
SCALE NTS
R00
Ø6H7X2HOLES
M6X2HOLES
34.00
12.00
5.00
12.00
31.00
41.00
51.00
59.00
74.00
84.00
89.00
103.00
115.00
12.00
19.80
28.50
37.50
53.50
63.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
SURFACE FINISH SYMBOLS

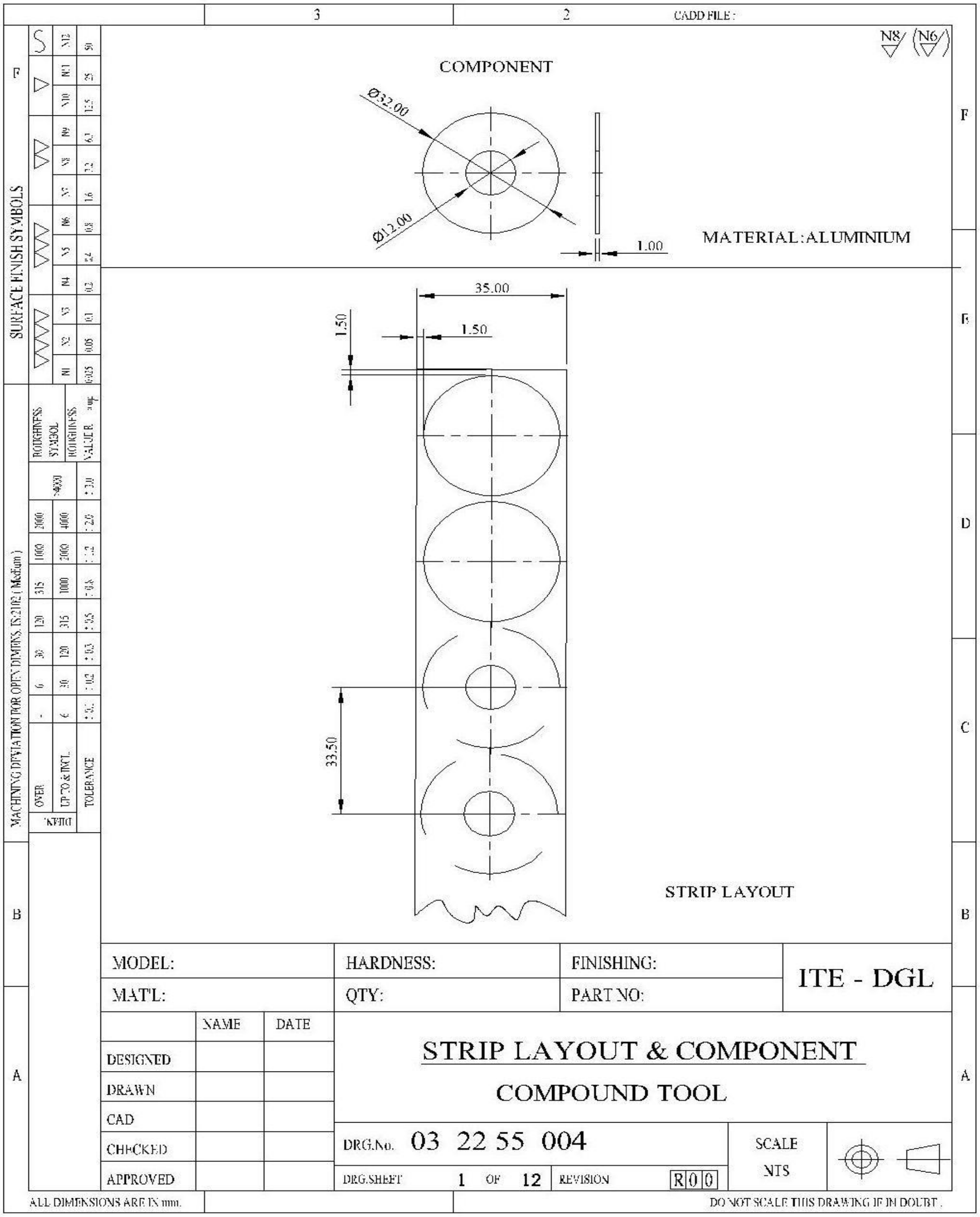

ITE-DGL
FINISHING: 115x75x12
PART NO : 2
DIE PLATE
PROGRESSIVE TOOL
HARDNESS: ---
QTY :1 no
MODEL :-
MATL : HCHCR
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
0 3 2 2 5 5 0 0 3
REVISION
R0
SCALE
NTS
Ø6H7x2HOLES
Ø7X2HOLES
5.00
12.00
31.00
41.00
51.00
59.00
74.00
84.00
89.00
93.50
103.00
115.00
28.50
37.50
63.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

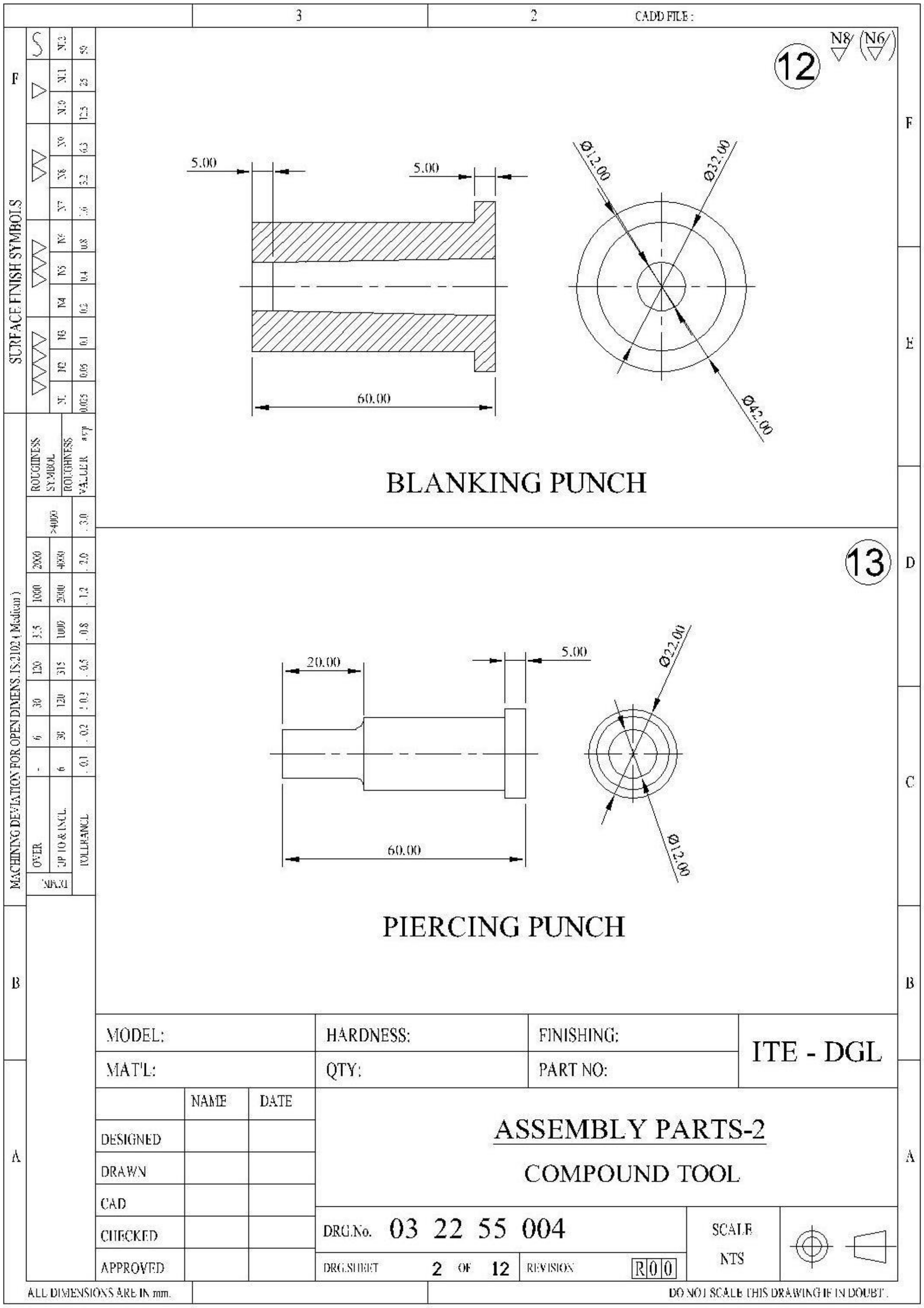

ITE-DGL
BACKUP PLATE
PROGRESSIVE TOOL
MODEL :-
MAT'L : C 45 STEEL
HARDNESS: ---
QTY :1 no
FINISHING: 115x75x12
PART NO : 7
NAME
DATE
DESIGNED
DRAWN
CHECKED
APPROVED
DRG.No. 03 22 55 003
SCALE
NTS
Ø6,H7 X 2 HOLES
Ø7.00
12.00
103.00
115.00
12.23
51.06
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS


PIERCING PUNCH - Ø5
04
5.00
47.00
20.00
72.00
Ø14.00
Ø10.00
Ø5.00
PIERCING PUNCH
04
13.00
72.00
3.00
Ø8.00
GUIDE PILLAR
13
110.00
Ø15.00
Ø10.00
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
MODEL: -
HARDNESS: -
FINISHING: -
MAT'L: -
QTY: -
PART NO: -
ITE-DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
SCALE
NTS
DRG.SHEET 9 OF 10
REVISION R00
CADD FILE:
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.

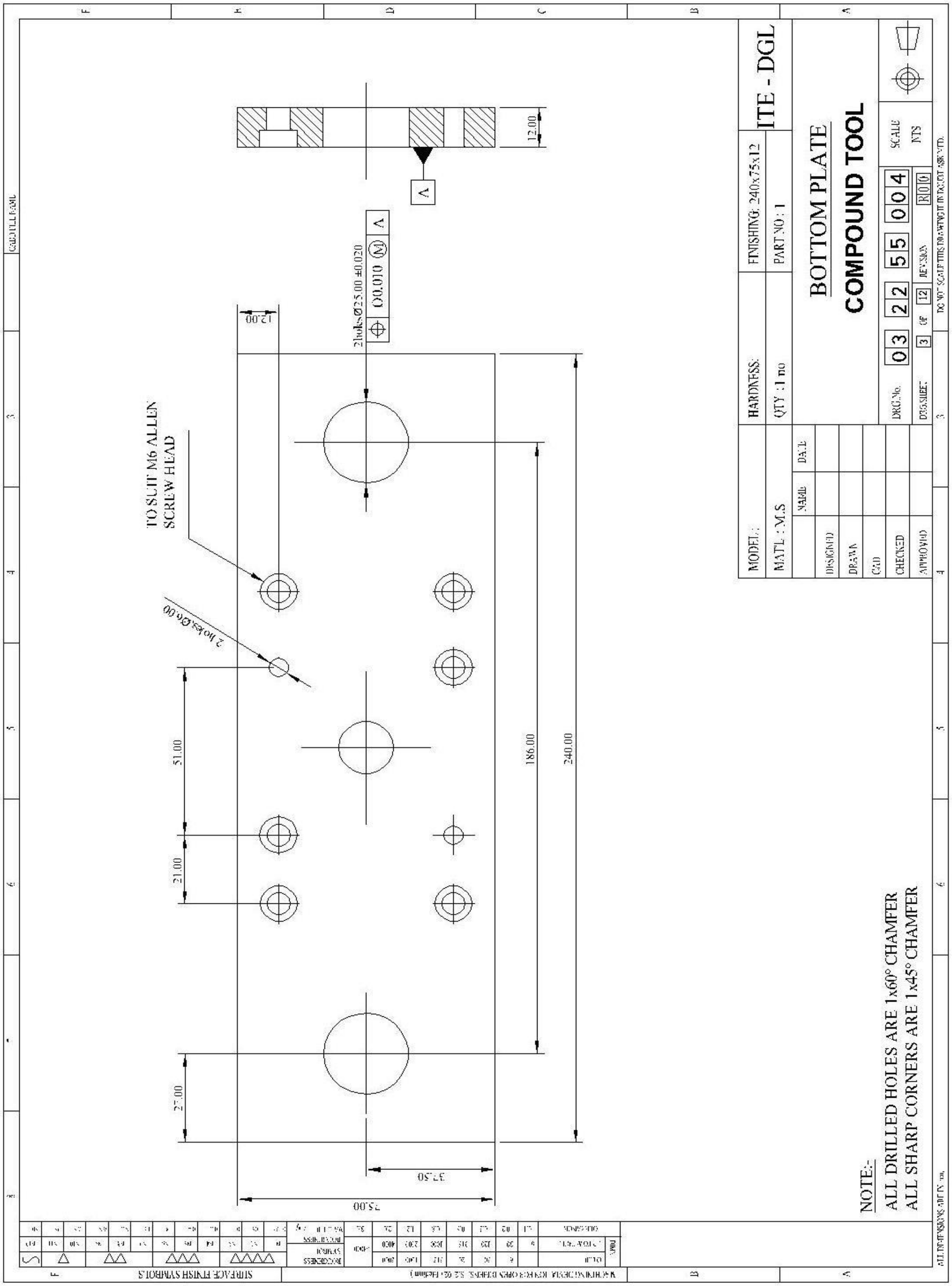

NOTE:
1.ALL DIMENSIONS ARE IN mm
2.PROVIDE PUNCH AND DIE CLEARANCE PROVIDE AS 0.01
3.THE PUNCH SHALL BE HARDENED AND TEMPERED AS 60-62 HRC
4.THE DIE PLATE SHALL BE HARDENED AS 60-62 HRC
5.AVOID SHARP CORNERS
6.FOR DIMENSIONS WITHOUT TOLERANCE SHALL BE PROVIDED AS ISO 2768-1
BILL OF MATERIALS
SL.NO | NAME | MATERIAL | QUANTITY
13 | GUIDE PILLAR | EN24 STEEL | 2
12 | GUIDE BUSH | EN24 STEEL | 2
11 | STOP PIN | STD | 1
10 | M6 ALLEN SCREW | STD | 6
9 | DOWEL PIN | STD | 4
8 | TOP PLATE | MILD STEEL | 1
7 | BACKUP PLATE | C45 STEEL | 1
6 | PUNCH HOLDER | OHNS | 1
5 | BLANKING PUNCH | A2 STEEL | 1
4 | PIERCING PUNCH | A2 STEEL | 3
3 | STRIPPER PLATE | OHNS | 1
2 | DIE PLATE | Heller | 1
1 | BOTTOM PLATE | MILD STEEL | 1
MODEL :
MAT'L :
HARDNESS:
QTY :
FINISHING:
PART NO :
ITE-DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
DRG.SHEET 10 OF 10
REVISION R U U
SCALE
NTS
SURFACE FINISH SYMBOLS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK HOD.
CAD FILE NAME:

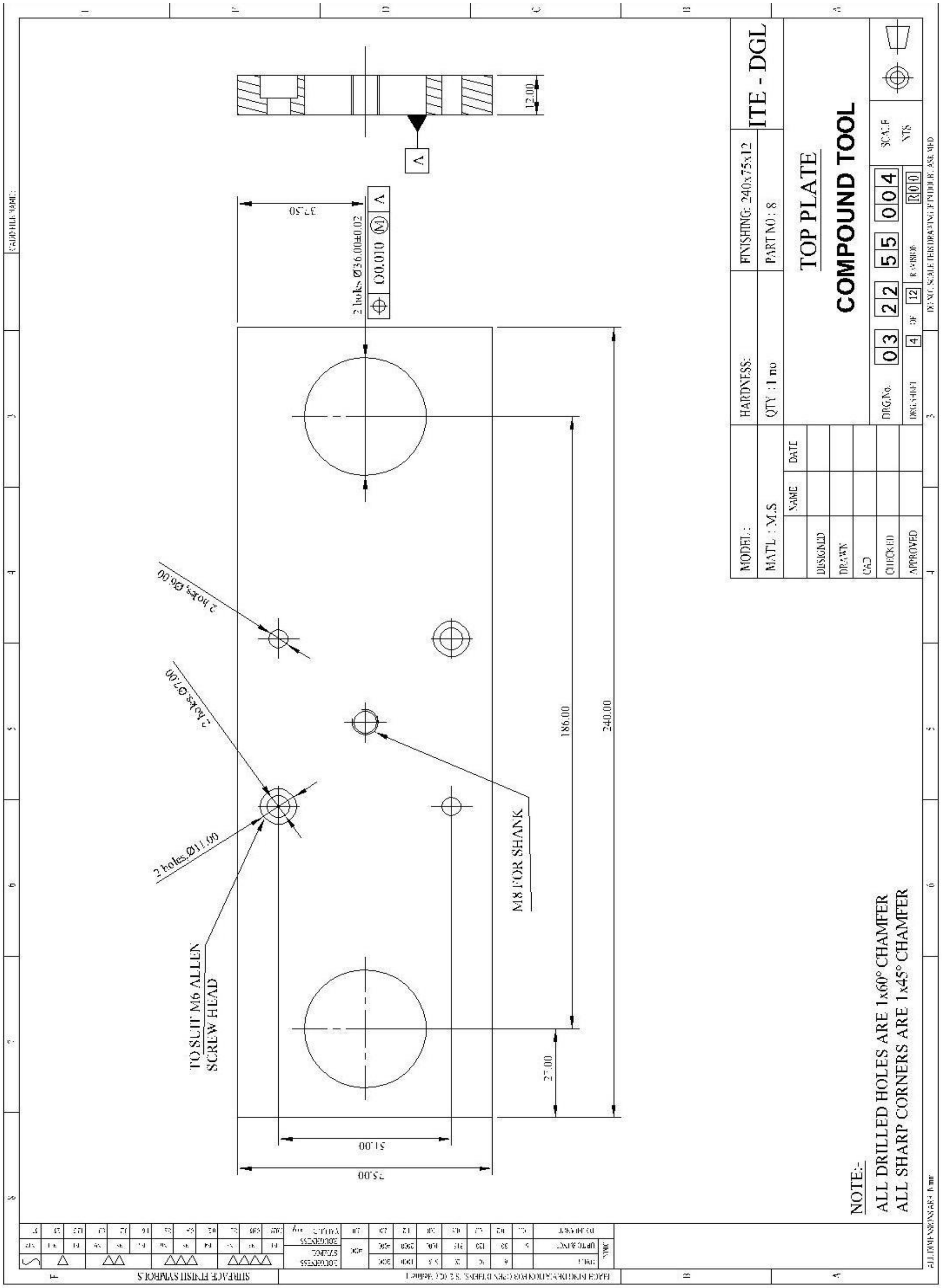
Exercise – III Compound Tool

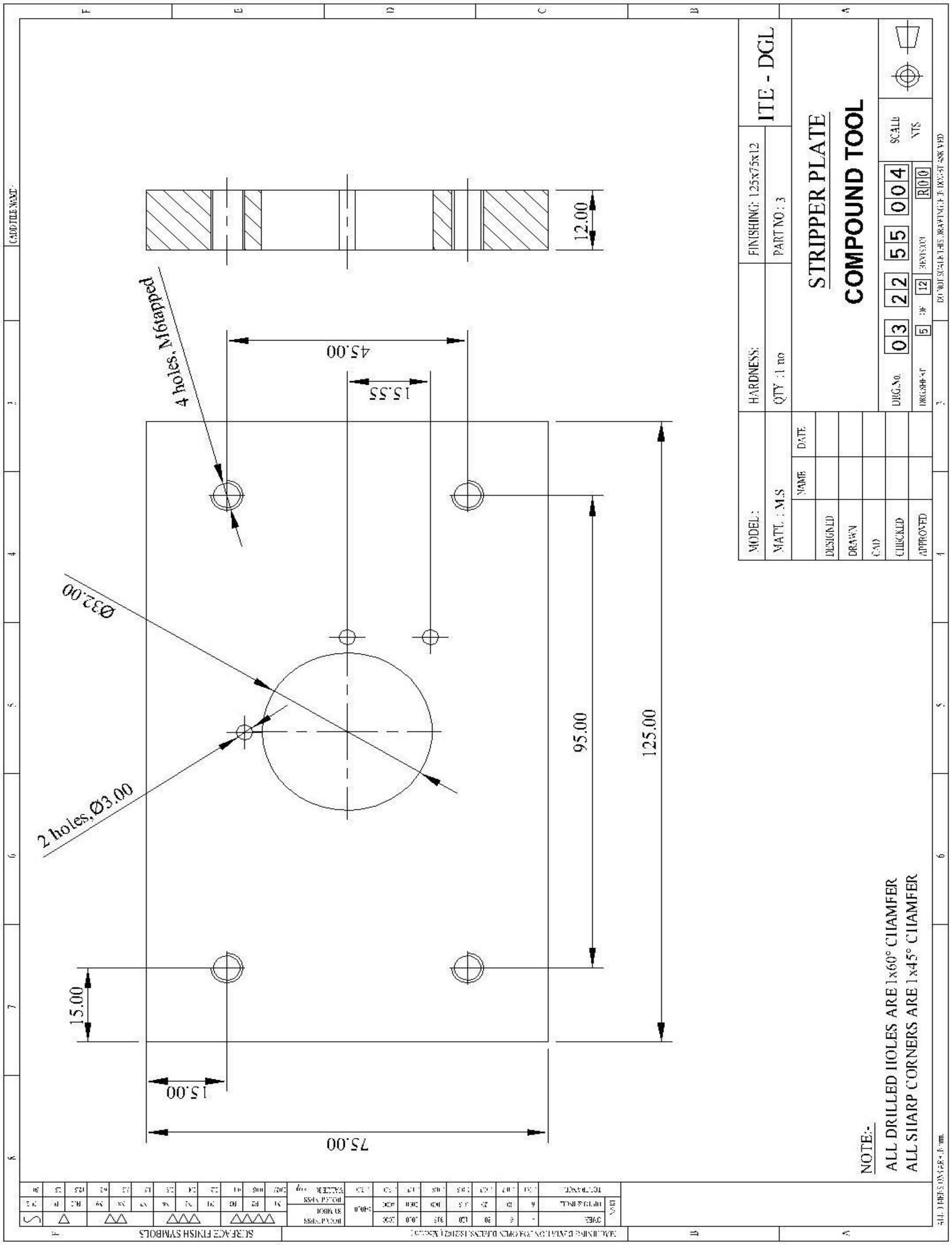


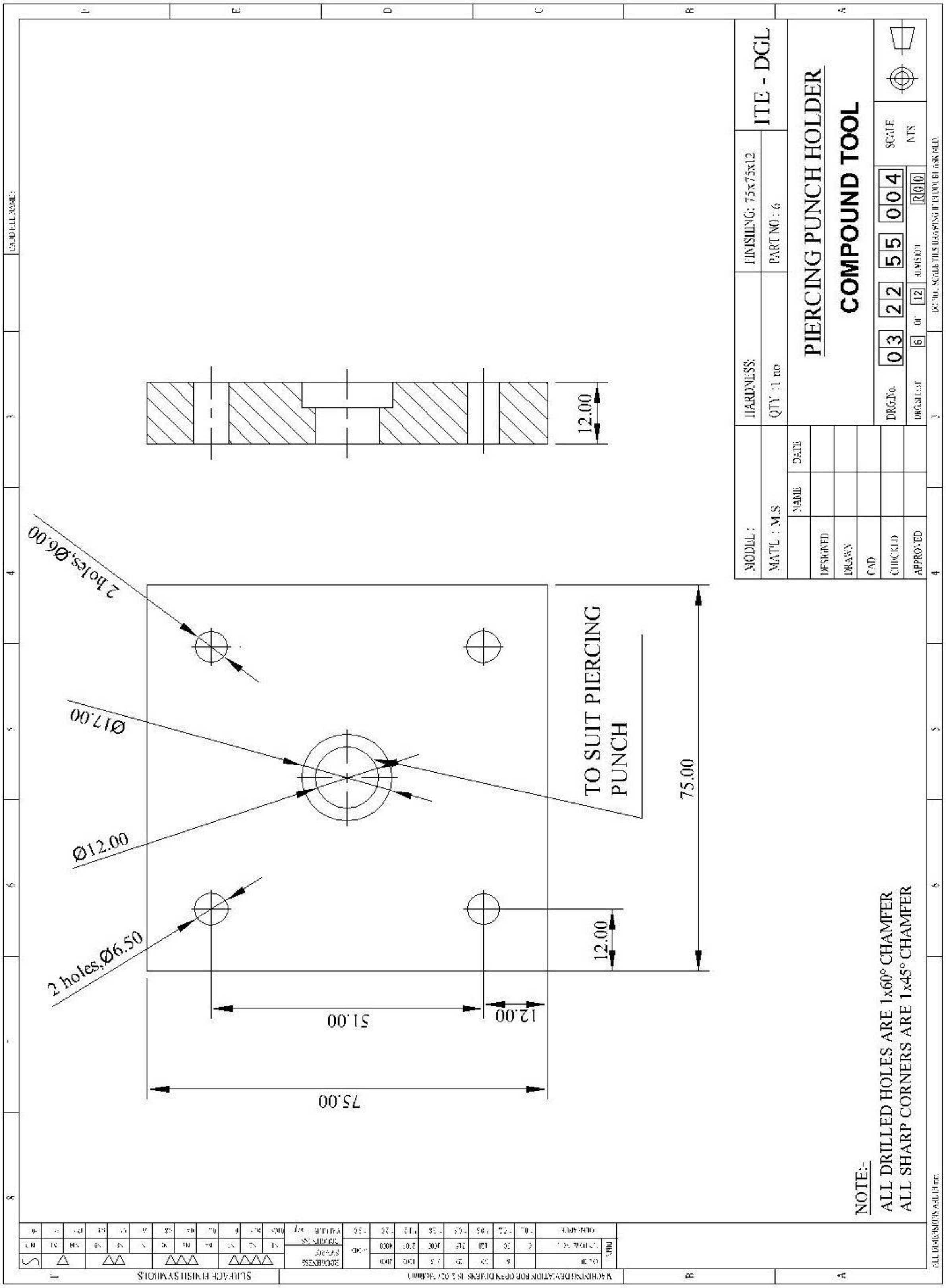


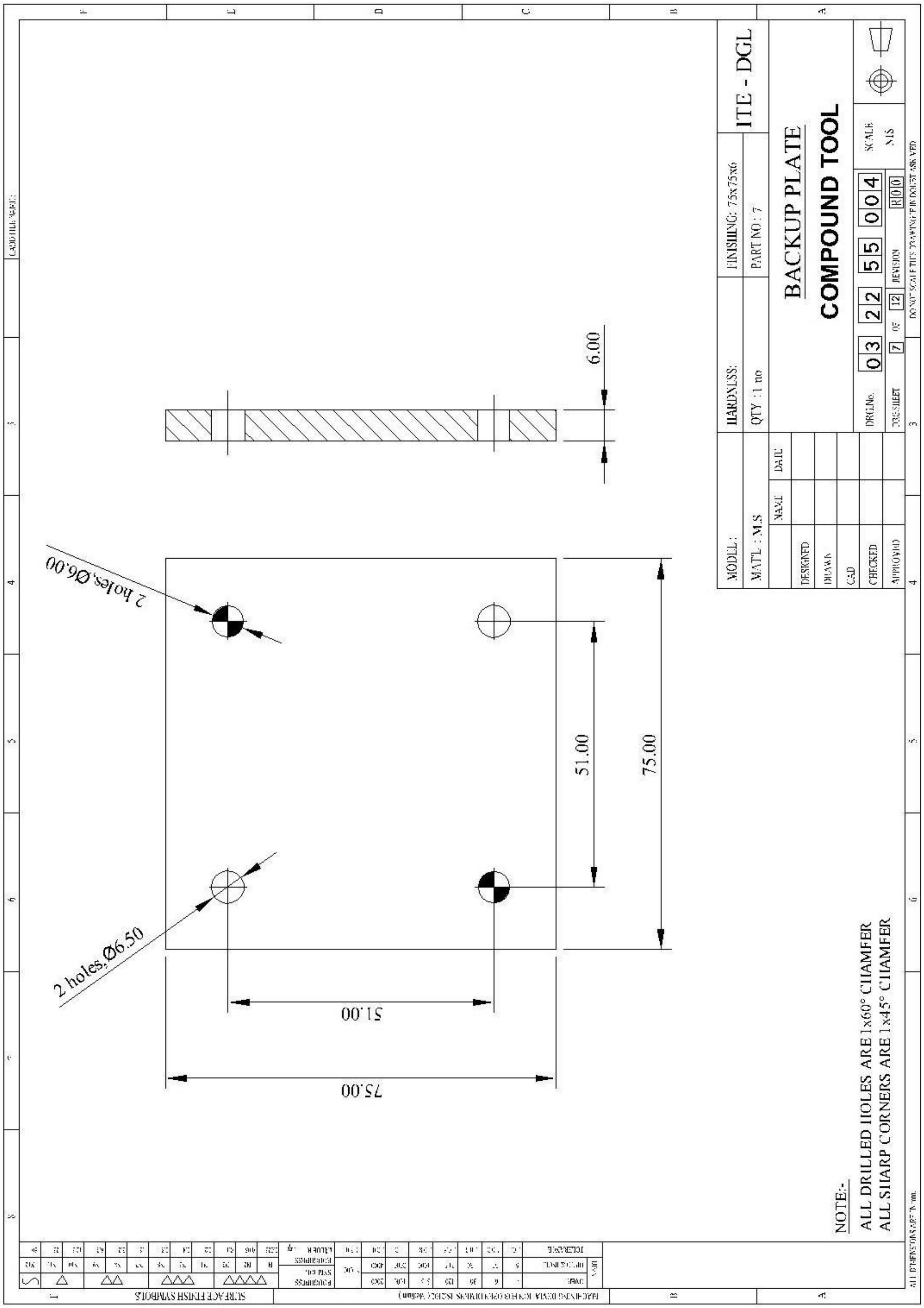
BLANKING PUNCH
PIERCING PUNCH
ASSEMBLY PARTS-2
COMPOUND TOOL
DRG.No. 03 22 55 004
DRG.SHEET 2 OF 12
REVISION R00
SCALE NTS
ITE - DGL
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.

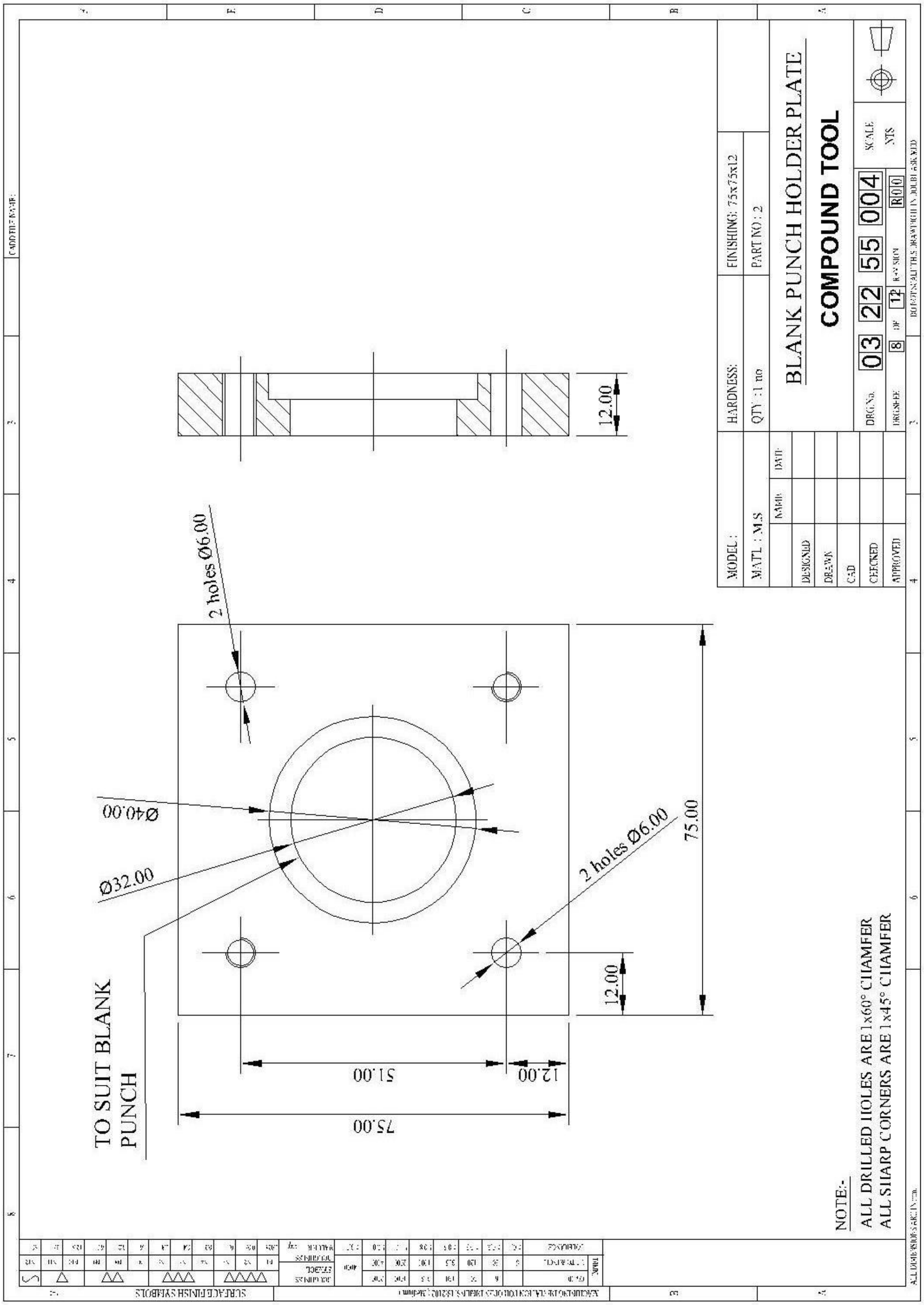

ITE - DGL
FINISHING: 240x75x12
PART NO: 1
HARDNESS:
QTY : 1 no
MODEL:
MAT'L : M.S
BOTTOM PLATE
COMPOUND TOOL
DRG.No. 03 22 55 004
SCALE NTS
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
TO SUIT M6 ALLEN SCREW HEAD
2 holes Ø6.00
2holes Ø25.00 ±0.020
Ø0.010 Ⓜ A
A
12.00
240.00
186.00
75.00
37.50
51.00
21.00
27.00
SURFACE FINISH SYMBOLS


ITE - DGL
FINISHING: 240x75x12
PART NO: 8
HARDNESS:
QTY : 1 no
MODEL :
MAT'L : M.S
TOP PLATE
COMPOUND TOOL
DRG.No. 03 22 55 004
SCALE NTS
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
2 holes Ø36.00±0.02
2 holes Ø6.00
2 holes Ø7.00
2 holes Ø11.00
TO SUIT M6 ALLEN SCREW HEAD
M8 FOR SHANK
240.00
186.00
27.00
51.00
75.00
37.50
12.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

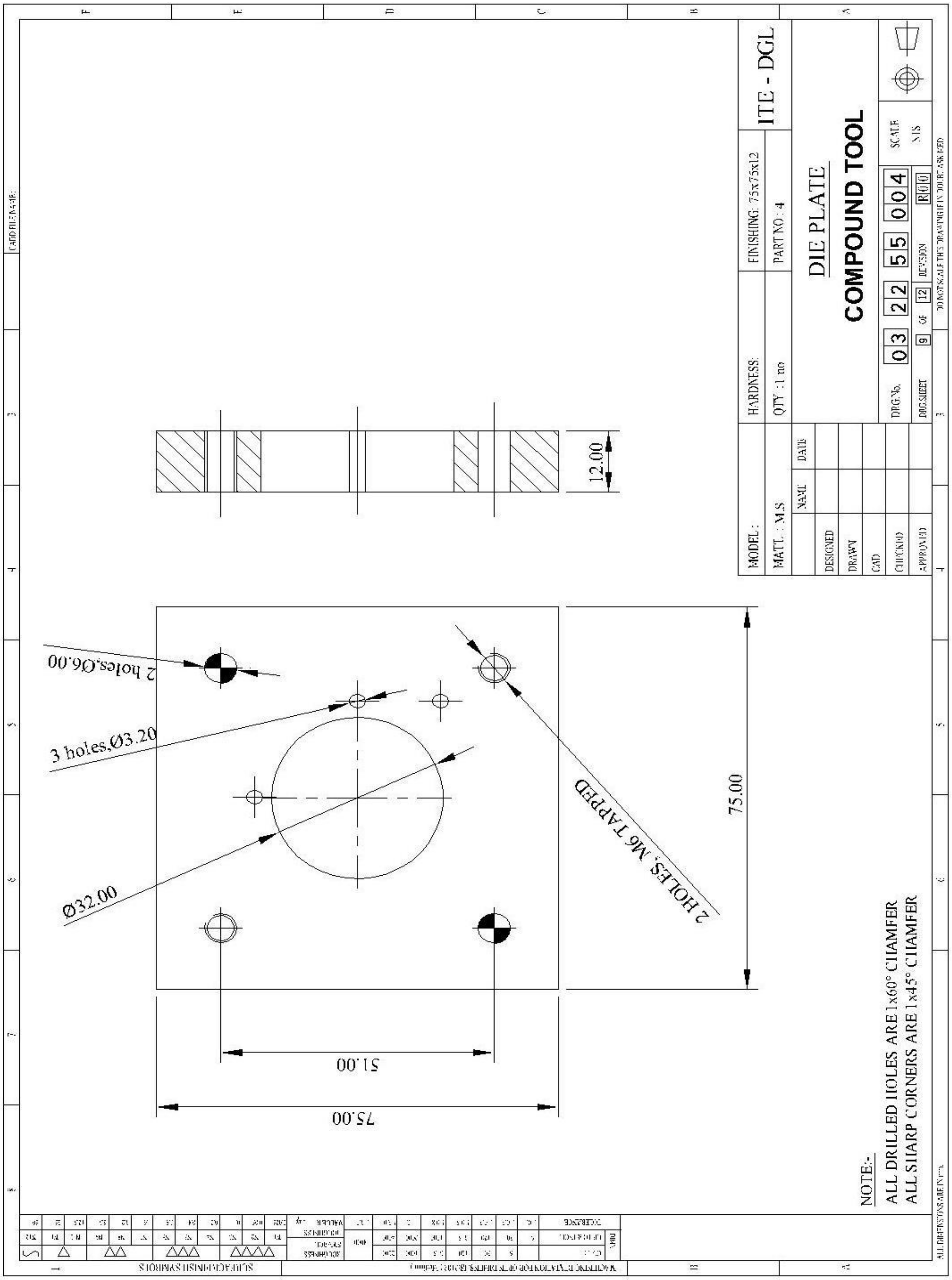

ITE - DGL
FINISHING: 125x75x12
PART NO: 3
HARDNESS:
QTY :1 no
MODEL:
MATL : M.S
STRIPPER PLATE
COMPOUND TOOL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 55 004
SCALE
NTS
4 holes, M6tapped
Ø32.00
2 holes,Ø3.00
45.00
15.55
12.00
95.00
125.00
15.00
15.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

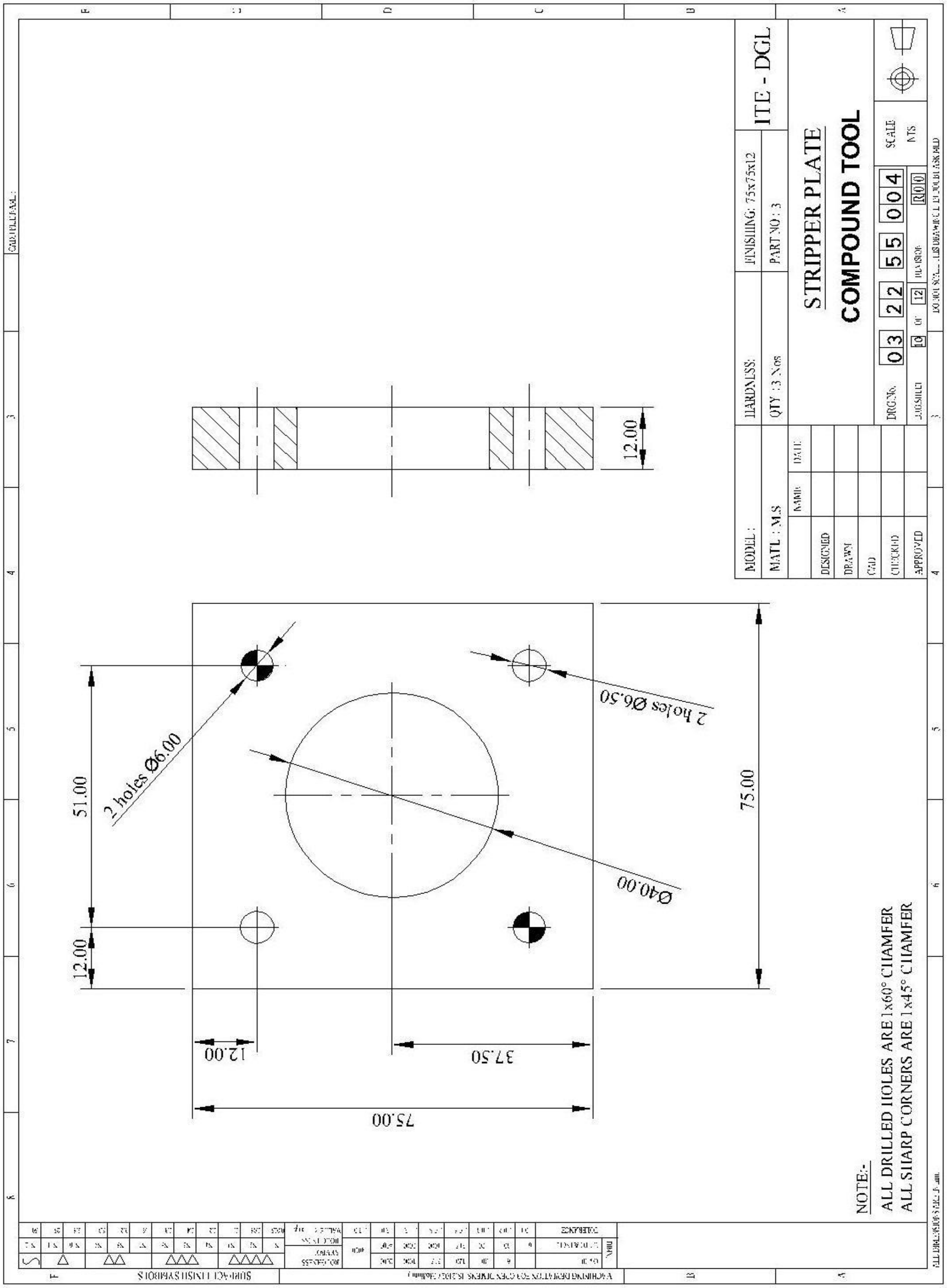

ITE - DGL
PIERCING PUNCH HOLDER
COMPOUND TOOL
FINISHING: 75x75x12
PART NO : 6
HARDNESS:
QTY :1 no
MODEL :
MAT'L : M.S
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
0 3 2 2 5 5 0 0 4
SCALE
NTS
2 holes,Ø6.00
Ø17.00
Ø12.00
2 holes,Ø6.50
TO SUIT PIERCING PUNCH
75.00
12.00
51.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

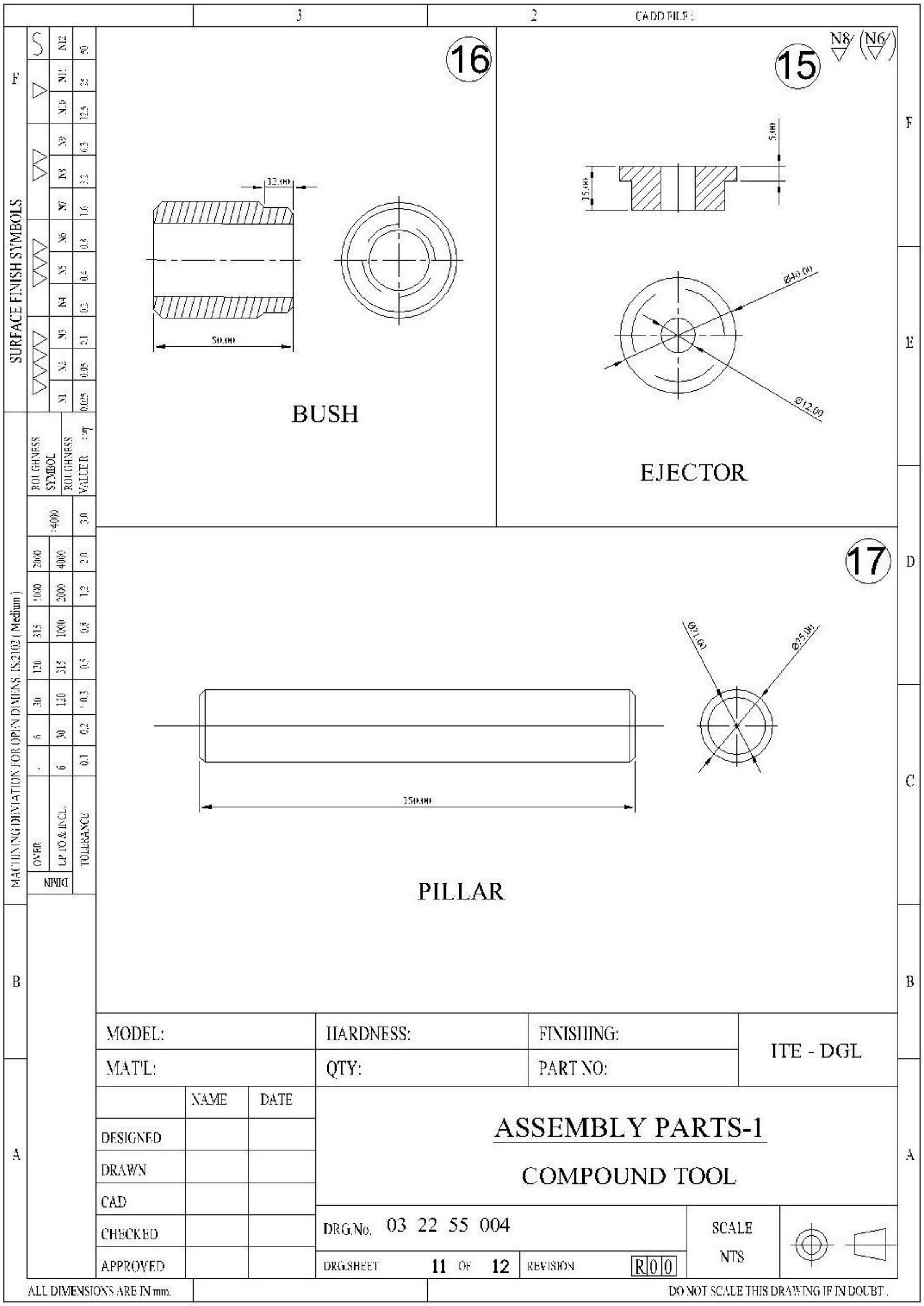

ITE - DGL
FINISHING: 75x75x6
PART NO : 7
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
BACKUP PLATE
COMPOUND TOOL
DRG.No. 0 3 2 2 5 5 0 0 4
SCALE NTS
6.00
2 holes,Ø6.00
2 holes,Ø6.50
51.00
75.00
51.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

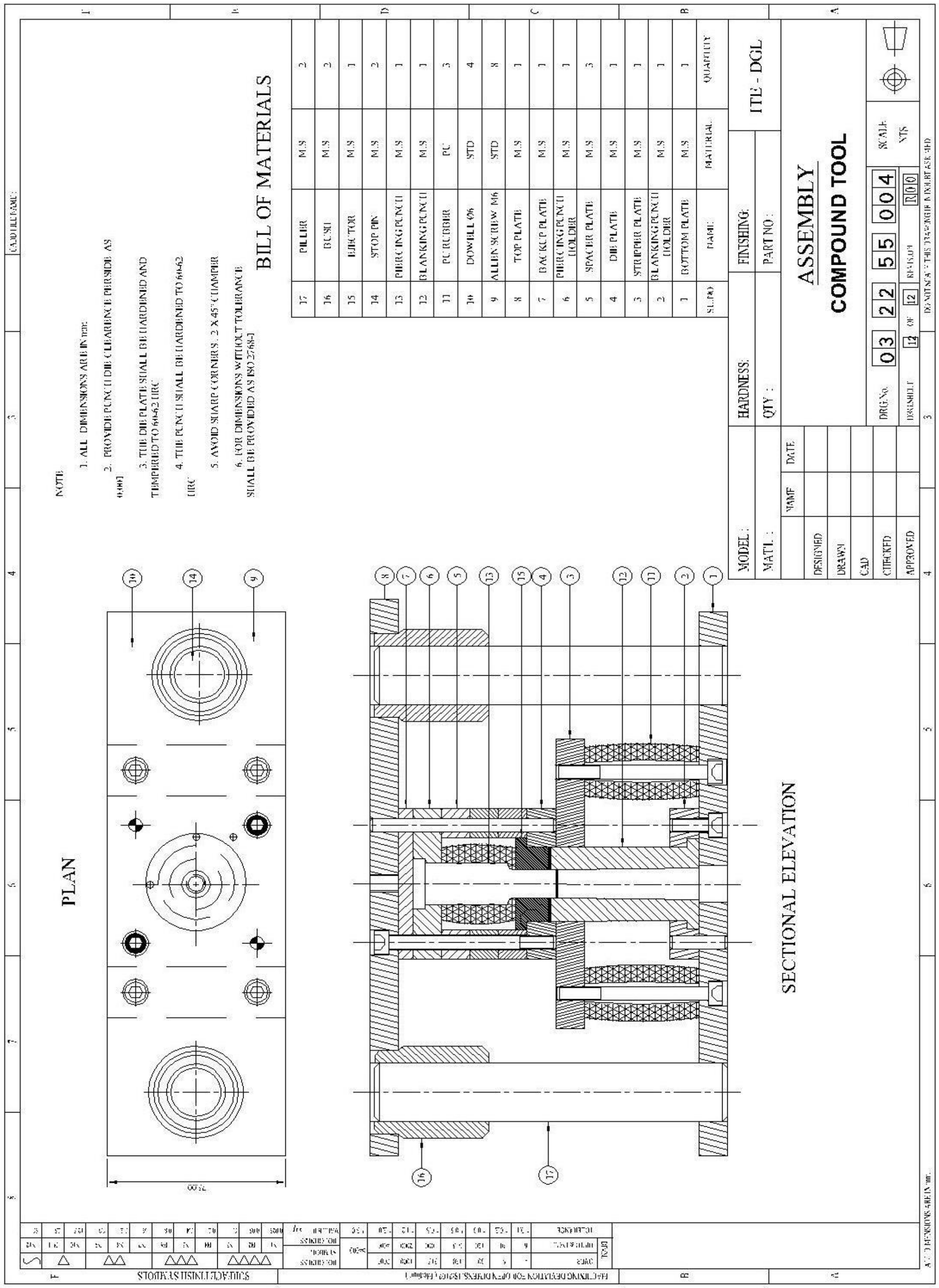


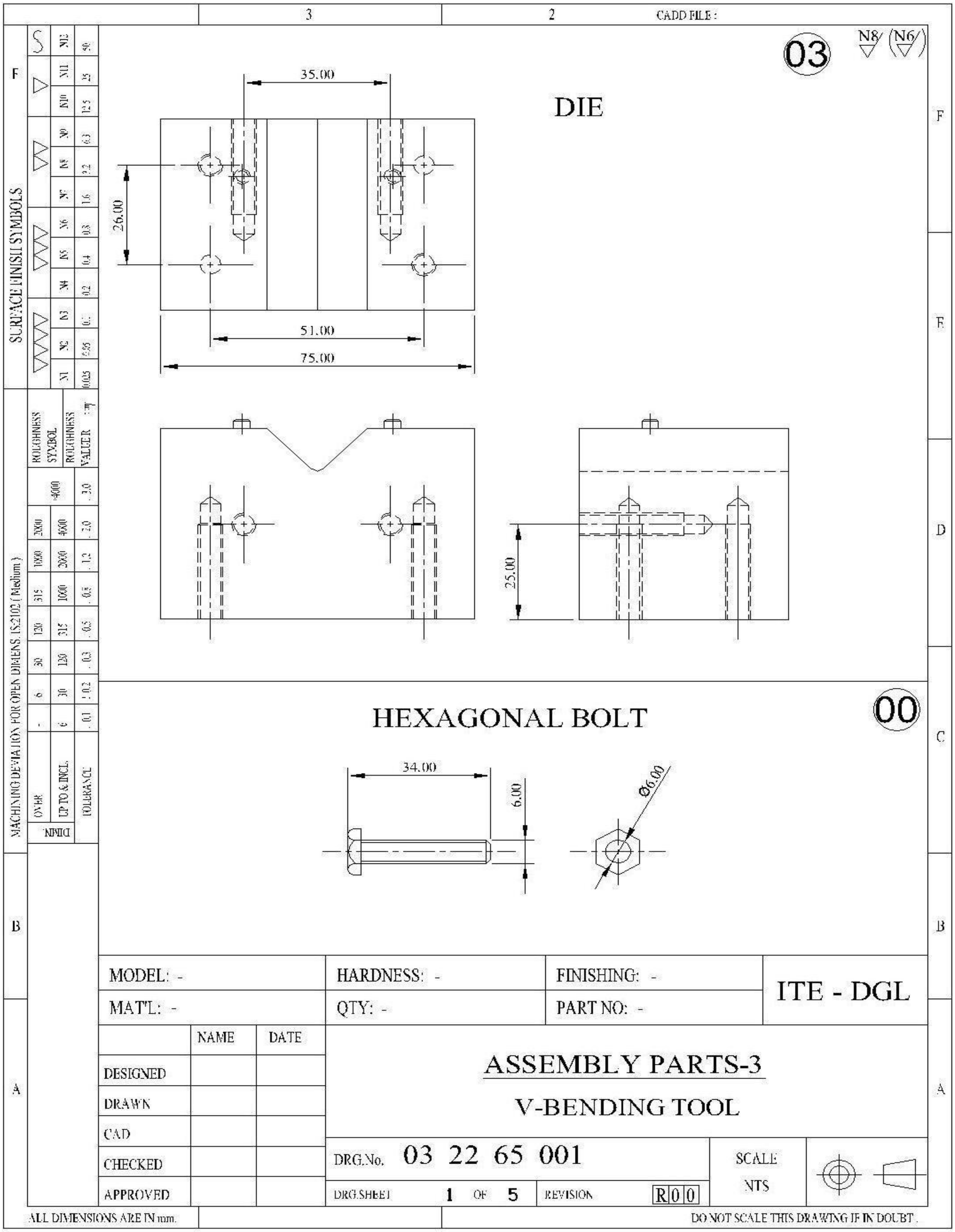
BLANK PUNCH HOLDER PLATE
COMPOUND TOOL
MODEL :
HARDNESS:
FINISHING: 75x75x12
MAT'L : M.S
QTY : 1 no
PART NO : 2
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
03 22 55 004
SCALE
NTS
2 holes Ø6.00
Ø40.00
Ø32.00
TO SUIT BLANK PUNCH
2 holes Ø6.00
75.00
12.00
51.00
12.00
75.00
12.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

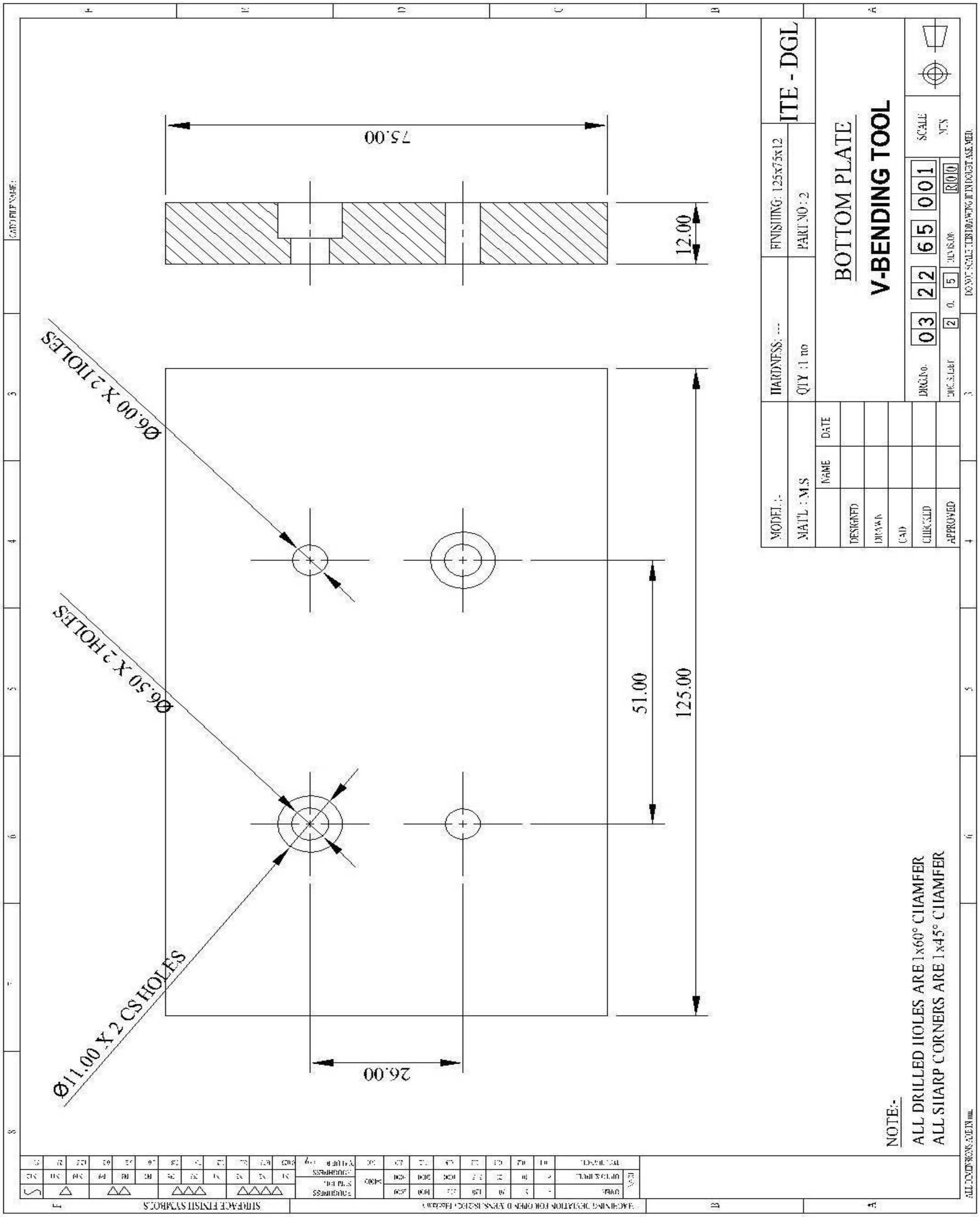

ITE - DGL
FINISHING: 75x75x12
PART NO : 4
HARDNESS:
QTY :1 no
MODEL :
MATL : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DIE PLATE
COMPOUND TOOL
DRG No. 03 22 55 004
DRG SHEET 9 OF 12
REVISION R00
SCALE
NTS
12.00
75.00
51.00
75.00
2 holes,Ø6.00
3 holes,Ø3.20
Ø32.00
2 HOLES, M6 TAPPED
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

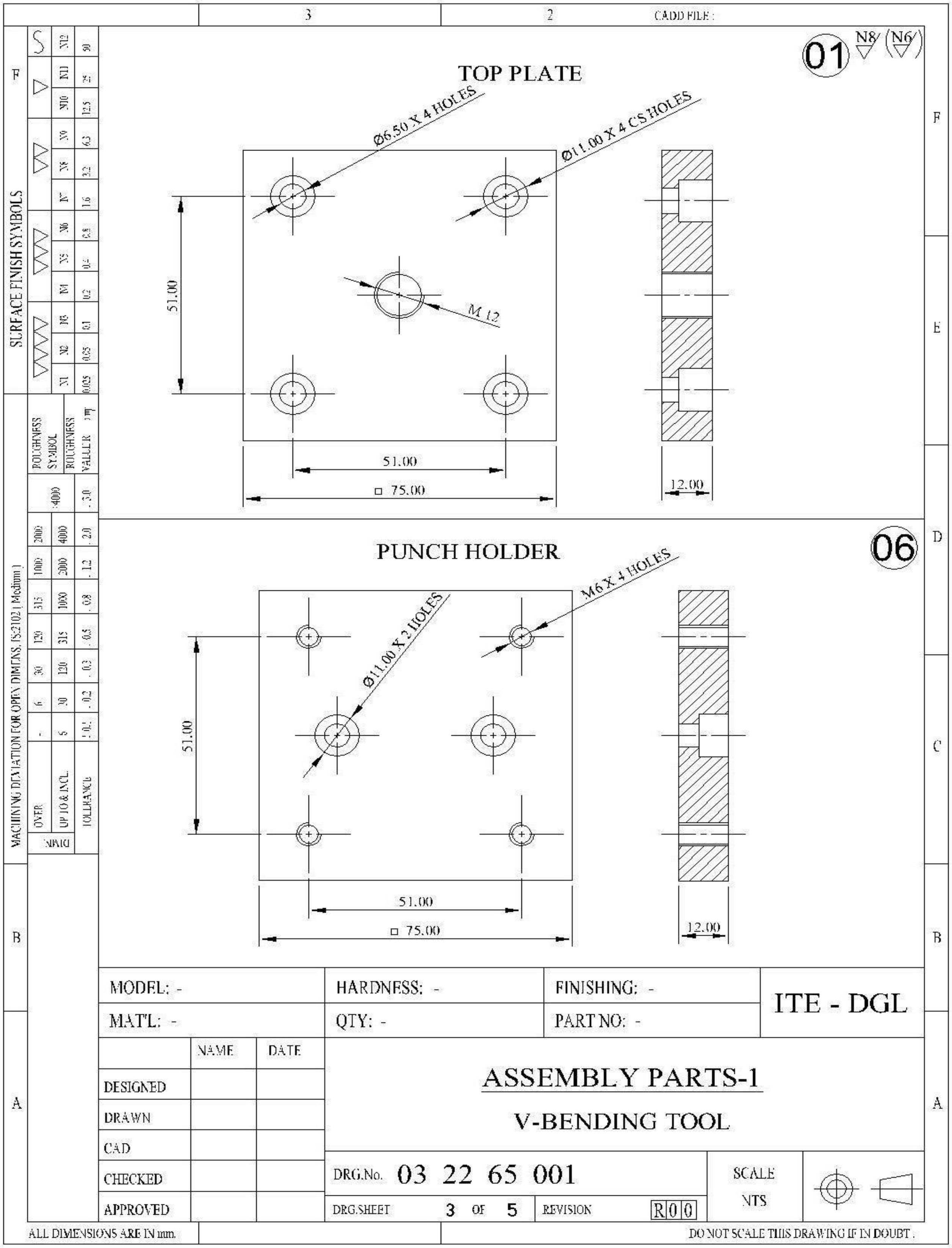

ITE - DGL
FINISHING: 75x75x12
PART NO : 3
HARDNESS:
QTY :3 Nos
MODEL :
MATL : M.S
STRIPPER PLATE
COMPOUND TOOL
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
0 3 2 2 5 5 0 0 4
SCALE
NTS
R00
2 holes Ø6.00
2 holes Ø6.50
Ø40.00
51.00
12.00
75.00
37.50
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


CADD FILE :
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
16
15
17
12.00
50.00
BUSH
5.00
15.00
Ø40.00
Ø12.00
EJECTOR
Ø21.00
Ø25.00
150.00
PILLAR
MODEL:
HARDNESS:
FINISHING:
ITE - DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
COMPOUND TOOL
DRG.No. 03 22 55 004
SCALE
NTS
DRG.SHEET 11 OF 12
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.

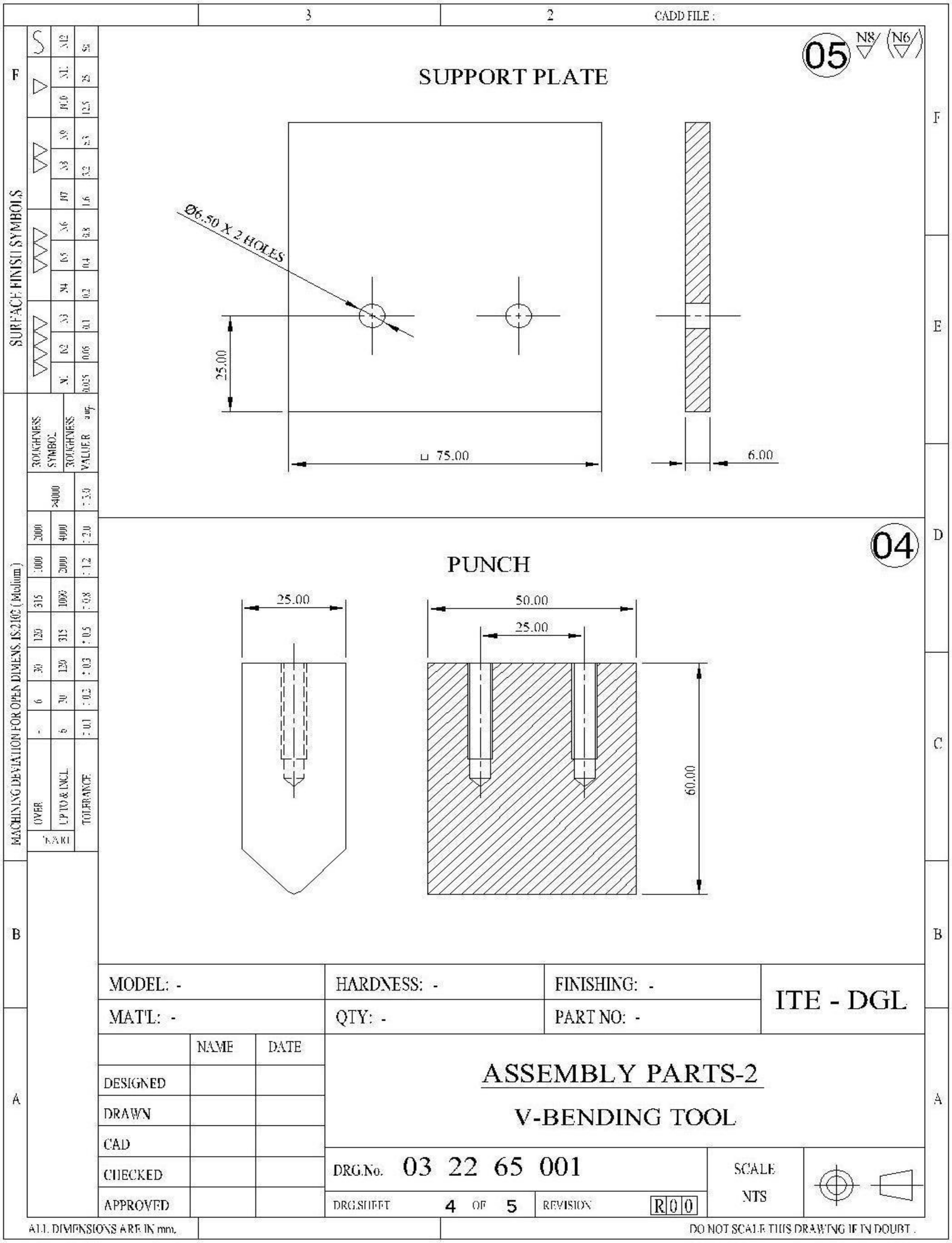

PLAN
SECTIONAL ELEVATION
NOTE
1. ALL DIMENSIONS ARE IN mm
2. PROVIDE PUNCH DIE CLEARENCE PERSIDE AS 0.001
3. THE DIE PLATE SHALL BE HARDENED AND TEMPERED TO 60-62 HRC
4. THE PUNCH SHALL BE HARDENED TO 60-62 HRC
5. AVOID SHARP CORNERS : 2 X 45° CHAMFER
6. FOR DIMENSIONS WITHOUT TOLERANCE SHALL BE PROVIDED AS ISO 2768-1
BILL OF MATERIALS
17 PILLER M.S 2
16 BUSH M.S 2
15 EJECTOR M.S 1
14 STOP PIN M.S 2
13 PIERCING PUNCH M.S 1
12 BLANKING PUNCH M.S 1
11 PU RUBBER PU 3
10 DOWELL Ø6 STD 4
9 ALLEN SCREW M6 STD 8
8 TOP PLATE M.S 1
7 BACKUP PLATE M.S 1
6 PIERCING PUNCH HOLDER M.S 1
5 SPACER PLATE M.S 3
4 DIE PLATE M.S 1
3 STRIPPER PLATE M.S 1
2 BLANKING PUNCH HOLDER M.S 1
1 BOTTOM PLATE M.S 1
SL.NO NAME MATERIAL QUANTITY
MODEL :
MATL :
HARDNESS:
QTY :
FINSHING:
PART NO :
ITE - DGL
NAME DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY
COMPOUND TOOL
DRG.No. 03 22 55 004
SCALE NTS
R00
SURFACE FINISH SYMBOLS
ALL DIMENSIONS ARE IN mm
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK HED


DIE
03
N8 (N6)
35.00
26.00
51.00
75.00
25.00
HEXAGONAL BOLT
00
34.00
6.00
Ø6.00
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
MODEL: -
HARDNESS: -
FINISHING: -
ITE - DGL
MAT'L: -
QTY: -
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-3
V-BENDING TOOL
DRG.No. 03 22 65 001
SCALE
NTS
DRG.SHEET 1 OF 5
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.
CADD FILE :


ITE - DGL
FINISHING: 125x75x12
PART NO : 2
HARDNESS: ---
QTY :1 no
MODEL :-
MAT'L : M.S
BOTTOM PLATE
V-BENDING TOOL
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
03 22 65 001
SCALE
NTS
75.00
12.00
125.00
51.00
26.00
Ø6.00 X 2 HOLES
Ø6.50 X 2 HOLES
Ø11.00 X 2 CS HOLES
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

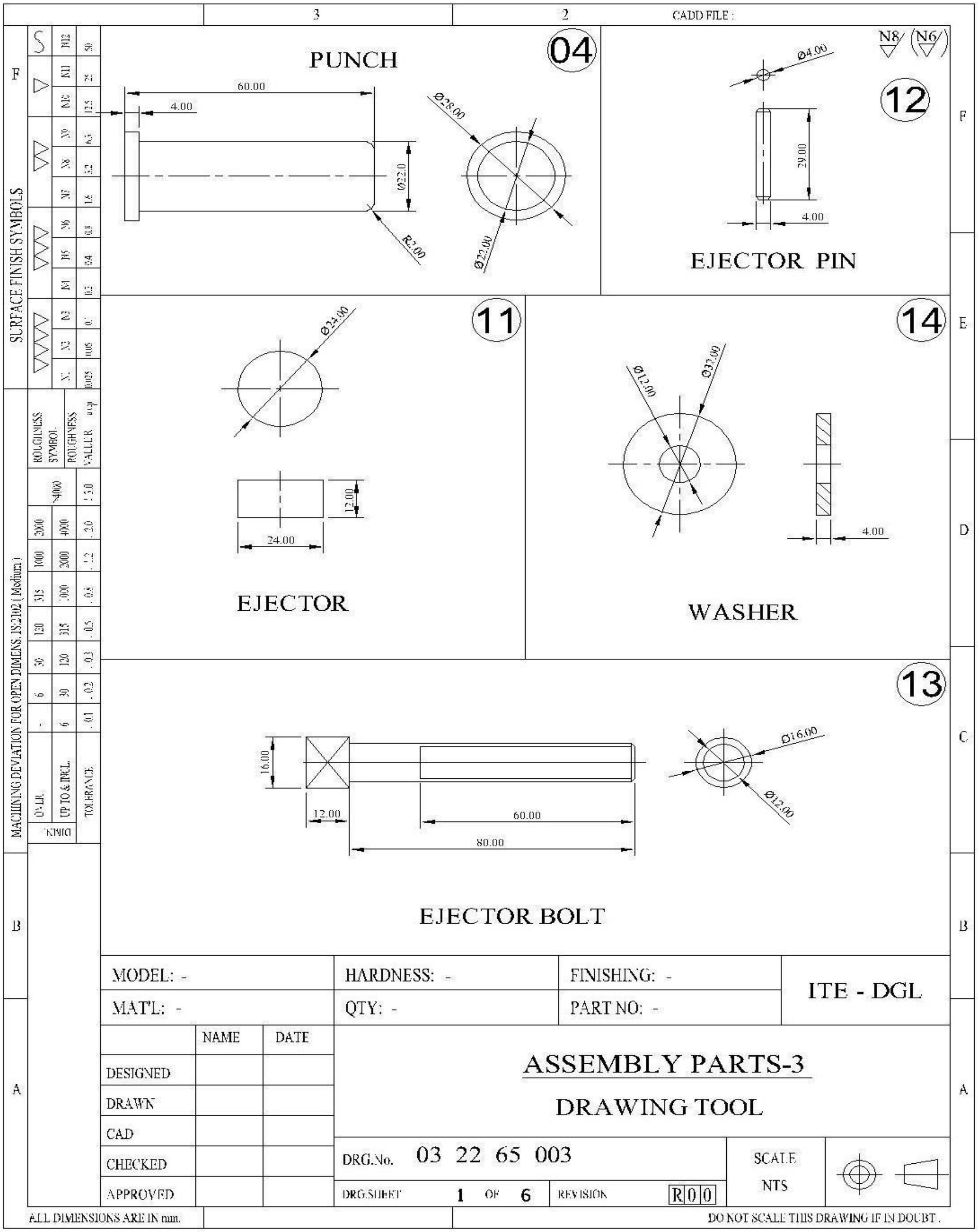


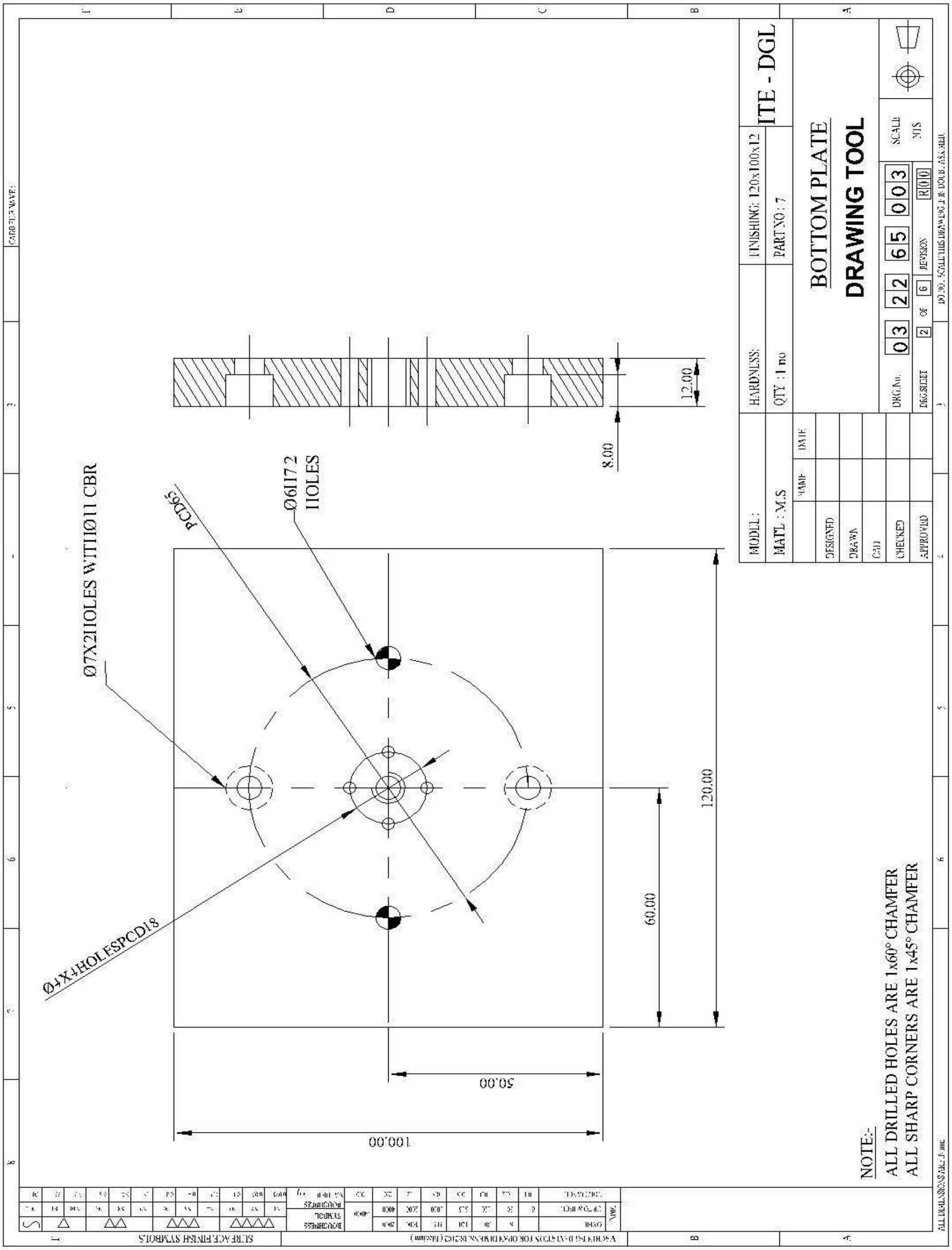
CADD FILE :
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
TOP PLATE
01
N8 (N6)
Ø6.50 X 4 HOLES
Ø11.00 X 4 CS HOLES
M 12
51.00
51.00
□ 75.00
12.00
PUNCH HOLDER
06
M6 X 4 HOLES
Ø11.00 X 2 HOLES
51.00
51.00
□ 75.00
12.00
MODEL: -
HARDNESS: -
FINISHING: -
MAT'L: -
QTY: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
V-BENDING TOOL
DRG.No. 03 22 65 001
SCALE
NTS
DRG.SHEET 3 OF 5
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .

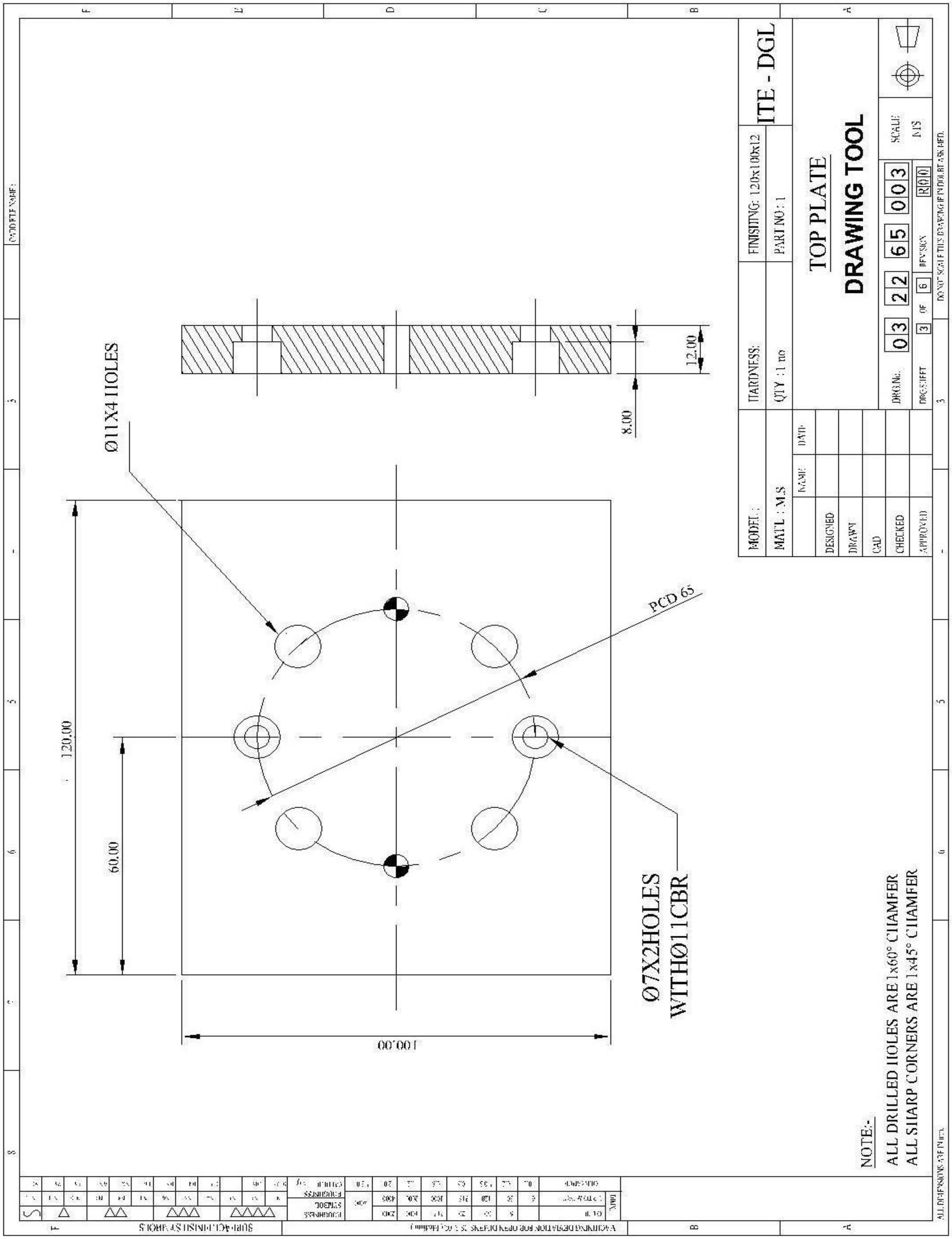


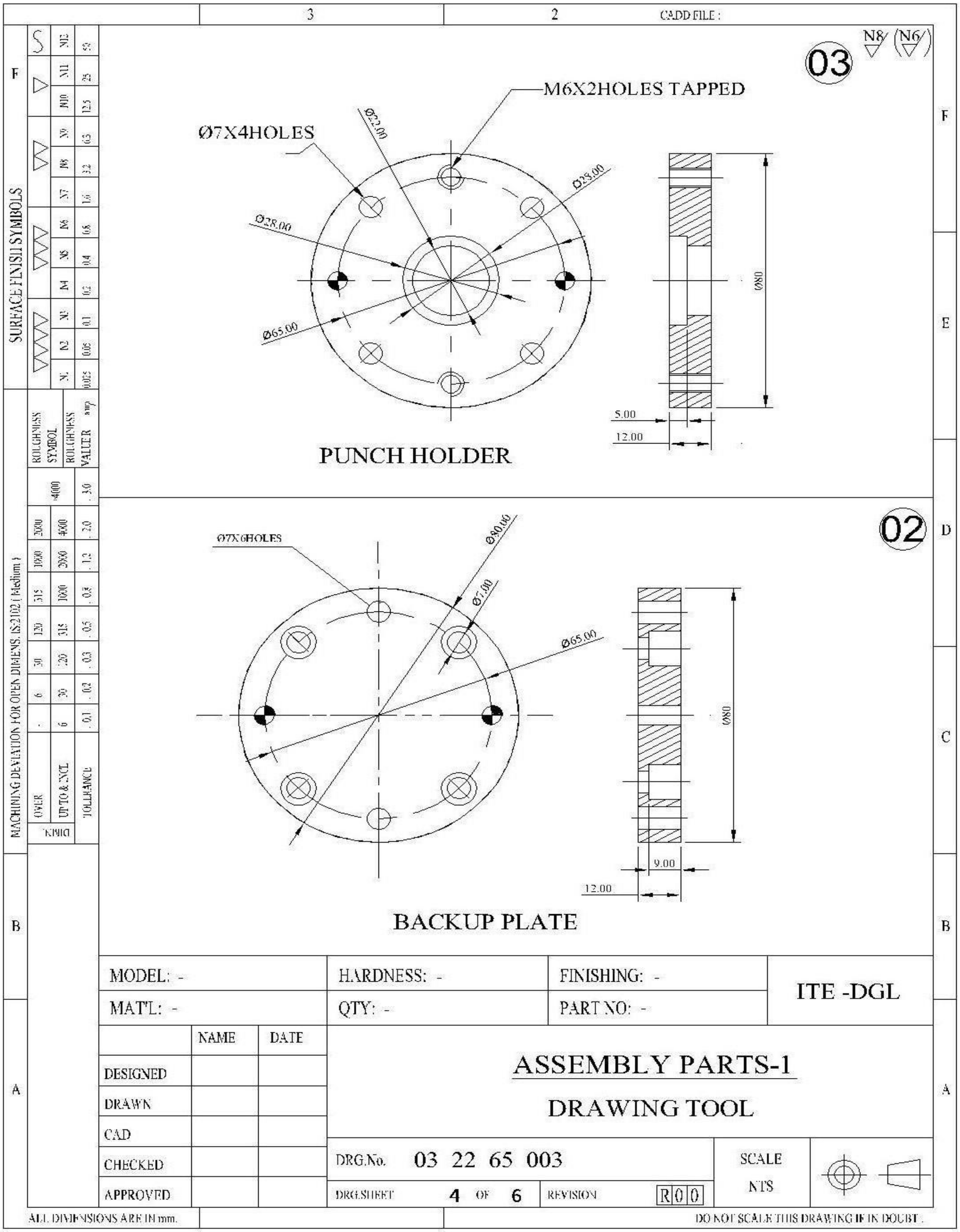
SUPPORT PLATE
Ø6.50 X 2 HOLES
25.00
□ 75.00
6.00
05
PUNCH
04
25.00
50.00
25.00
60.00
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
MODEL: -
HARDNESS: -
FINISHING: -
MAT'L: -
QTY: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-2
V-BENDING TOOL
DRG.No. 03 22 65 001
DRG.SHEET 4 OF 5
REVISION R00
SCALE
NTS
CADD FILE :
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .

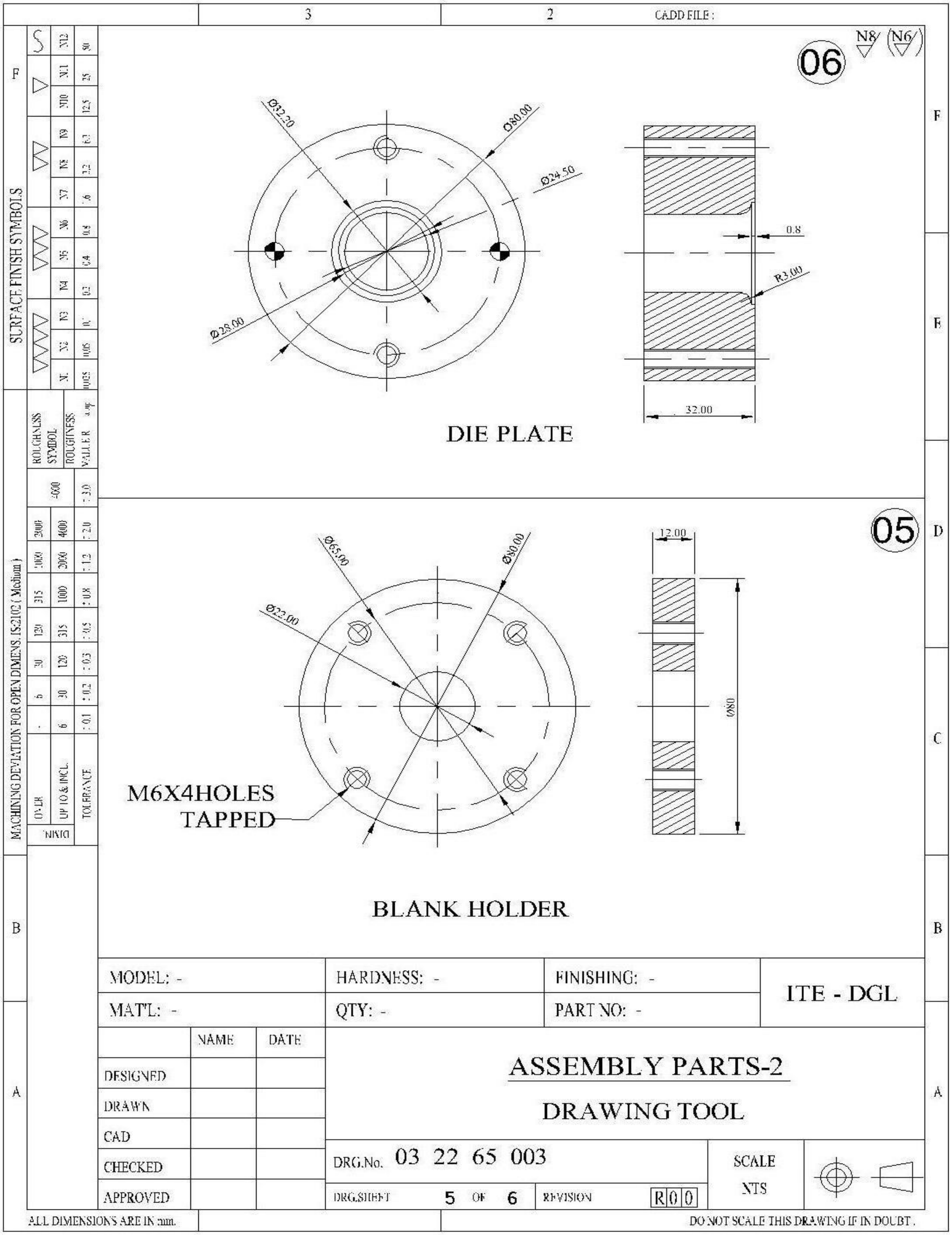
Exercise : 5 Drawing Tool



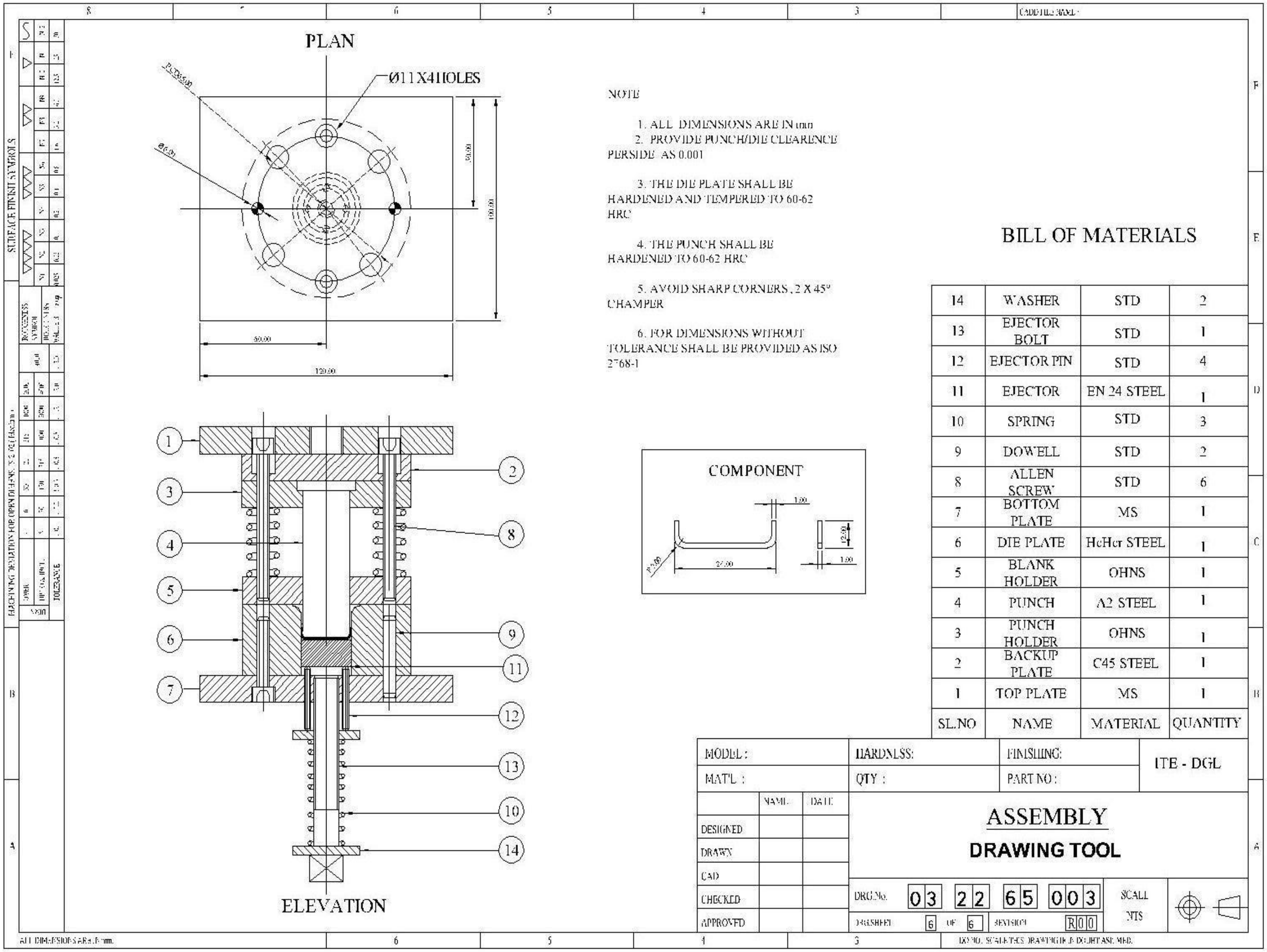

ITE - DGL
FINISHING: 120x100x12
PART NO : 7
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
BOTTOM PLATE
DRAWING TOOL
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
03 22 65 003
DRG.SHEET
2 OF 6
REVISION
R00
SCALE
NTS
Ø7X2HOLES WITHØ11 CBR
PCD65
Ø6H7 2 HOLES
Ø4X4HOLESPCD18
12.00
8.00
120.00
60.00
50.00
100.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS


TOP PLATE
DRAWING TOOL
ITE - DGL
FINISHING: 120x100x12
PART NO: 1
HARDNESS:
QTY :1 no
MODEL:
MAT'L : M.S
Ø11X4 HOLES
Ø7X2HOLES
WITHØ11CBR
PCD 65
120.00
60.00
100.00
12.00
8.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


CADD FILE :
03
N8 (N6)
M6X2HOLES TAPPED
Ø7X4HOLES
Ø22.00
Ø25.00
Ø28.00
Ø65.00
Ø80
5.00
12.00
PUNCH HOLDER
02
Ø7X6HOLES
Ø80.00
Ø7.00
Ø65.00
Ø80
9.00
12.00
BACKUP PLATE
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
ROUGHNESS SYMBOL
ROUGHNESS VALUE
MODEL: -
HARDNESS: -
FINISHING: -
ITE -DGL
MAT'L: -
QTY: -
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
DRAWING TOOL
DRG.No. 03 22 65 003
SCALE
NTS
DRG.SHEET 4 OF 6
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.



06
N8 (N6)
Ø32.20
Ø80.00
Ø24.50
Ø28.00
0.8
R3.00
32.00
DIE PLATE
05
12.00
Ø65.00
Ø80.00
Ø22.00
Ø80
M6X4HOLES
TAPPED
BLANK HOLDER
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
OVER
UP TO & INCL.
TOLERANCE
MODEL: -
HARDNESS: -
FINISHING: -
MAT'L: -
QTY: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-2
DRAWING TOOL
DRG.No. 03 22 65 003
SCALE
NTS
DRG.SHEET 5 OF 6
REVISION R00
CADD FILE :
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .


PLAN
Ø11 X4 HOLES
NOTE
1. ALL DIMENSIONS ARE IN mm
2. PROVIDE PUNCH/DIE CLEARENCE PERSIDE AS 0.001
3. THE DIE PLATE SHALL BE HARDENED AND TEMPERED TO 60-62 HRC
4. THE PUNCH SHALL BE HARDENED TO 60-62 HRC
5. AVOID SHARP CORNERS, 2 X 45° CHAMPER
6. FOR DIMENSIONS WITHOUT TOLERANCE SHALL BE PROVIDED AS ISO 2768-1
BILL OF MATERIALS
COMPONENT
ELEVATION
14 WASHER STD 2
13 EJECTOR BOLT STD 1
12 EJECTOR PIN STD 4
11 EJECTOR EN 24 STEEL 1
10 SPRING STD 3
9 DOWELL STD 2
8 ALLEN SCREW STD 6
7 BOTTOM PLATE MS 1
6 DIE PLATE HcHcr STEEL 1
5 BLANK HOLDER OHNS 1
4 PUNCH A2 STEEL 1
3 PUNCH HOLDER OHNS 1
2 BACKUP PLATE C45 STEEL 1
1 TOP PLATE MS 1
SL.NO NAME MATERIAL QUANTITY
MODEL :
HARDNESS:
FINISHING:
ITE - DGL
MAT'L :
QTY :
PART NO :
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY
DRAWING TOOL
DRG.No. 03 22 65 003
SCALE NTS
SURFACE FINISH SYMBOLS
TOLERANCE

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

S.NO	LIST OF THE EQUIPMENT'S WITH SPECIFICATIONS REMARKS IF ANY	QUANTITY REQUIRED
1	Centre Lathe, 4 ½' bed length	5
2	Drilling machine	2
3	Shaping machine, stroke length 300mm	2
4	Vertical milling machine	2
5	Surface grinding machine	2
6	Bench vice	10
7	Fitting file set	10
8	Tap set	4
9	Surface plate	2
10	Vernier height gauge 0-250mm	2
11	Dial test indicator with magnetic stand	2
12	Angle plate	2
13	Mechanical power press (15tons- 100 tons)	1
14	Tool maker's straight edge – 150 mm	1
15	Digital Micrometer – 0.-25mm range, 0.001mm least count	3

Guidelines to Design Practical Exercise / Experiment *

- The experiment / exercise should be prepared in such a way that it should be completed within the prescribed duration.
- Uniform weightage should be given for each experiment / exercise, if it has the subdivision.
- Check the availability of equipment required / Possibility to complete the exercise / experiment by the student with safety.

1220234520	PRESS TOOLS PRACTICAL	L	T	P	C
PRACTICAL		0	0	6	3

Suggested List of Students Activity:

- Identify simple press tool components and understand the manufacturing processes

Text and Reference Books:

1. V. Balachandran, Design of Jigs, Fixtures and Press Tools,1st edition, Ane Books Pvt. Ltd,2015
2. Elanchezhian c. Et.al, design of jigs, fixtures and press tools,2nd edition, eswar press,2007
3. Ernest Perry, Press Tool Making a Practical Manual,1st edition, Read Books,2008

Web-based/Online Resources:

1. https://youtu.be/uOYIoX3srbw?si=gOpYGFd8odLfi34u
2. https://youtu.be/dX_vyQb3w1M?si=jCpEh18bsk3iUF6T

END SEMESTER EXAMINATION – Practical Exam

Note:

- For Board Examination Exercise should be given to students individually and not in batches
- The examination duration is 16 hours
- All the exercises should be completed. All the exercise should be given for examinations, students can select any one exercise by lot of the question paper supplied by the DOTE shall be used.
- Record of work done should be prepared, the same should be submitted for the End Semester Examinations along with the bonafide certificate.

DETAILED ALLOCATION OF MARKS.

Part	Description	Marks
A	Manufacturing of Tools	50
B	Tool Finish	20
C	Component Finish / Accuracy	10
D	Tool Setting & Trail Production	10
E	Viva Voce	10
TOTAL MARKS		**100**

			L	T	P	C
1220234641	**INDUSTRIAL AUTOMATION PRACTICAL**		L	T	P	C
PRACTICUM			1	-	4	3

Introduction

To impart practical knowledge to the diploma students, practical subjects are introduced for every corresponding theory subject. This practical supports the aim and objective of Industrial automation.

Objectives:

- To Familiarize Understand & Explain various linear actuators.
- To understand & explain various rotary actuators.
- To Understand & Explain various directional control valves.
- To Understand & Explain various pressure control valves.
- To Understand & Explain Various Hydraulic components.
- To Understand & Explain Various Directional Control valves.
- To Understand & Explain Various Pneumatic system.
- Interpolate the hydraulic and pneumatic systems
- Understand Basic concepts of PLC.
- Understand the various module of PLC parts
- Develop ladder diagram for the various process of automation
- Applications of PLC

Course Outcomes

CO1: Understand the basic Linear Actuators,Rotary actuators, Directional Control Valves,Pressure Control Valve andFlow Control Valve

CO2: Develop simple assembly single Acting cylinder, Double Acting cylinder and Hydraulic Motor by using Hydraulic System

CO3: Develop simple assembly single Acting cylinder, Double Acting cylinder and shuttle valve / quick exhaust valve by using Pneumatics system

CO4: Develop simple ladder programs for a standard PLC

CO5: Develop ladder programs for various applications and interface I/O devices with the PLC modules.

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Pre-requisites

1. Single Acting cylinder, Double Acting cylinder and Hydraulic Motor by using Hydraulic System
2. Single Acting cylinder, Double Acting cylinder and shuttle valve / quick exhaust valve by using Pneumatics system
3. Ladder programs for various applications with the PLC modules.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3		2	3	2		1
CO2	3		1	3	2		1
CO3	3		1	3	2		1
CO4	3		1	3	2		1
CO5	3		1	3	2		1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- A theory – demonstrate – practice – activity strategy may be used throughout the course to ensure that learning is outcome – based and employability - based
- Encourage students through illustrated problems and hand – on activity to use visual methods and simulations to solve real problem

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	PracticalTest	PracticalTest	Written Test Theory	PracticalTest	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:**CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the schemeof evaluation as below.

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Readings, Calculations and Graph / Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Procedure / Preparation	15
B	Circuit / Program	20
C	Execution / Connection	15
TOTAL		50
D	Practical Documents (As per the portions)	10
Total Marks		60

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

CA 4: All the exercises/experiments should be completed and kept for the practical test.The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. The marks awarded should be converted to 15 Marks for the internal assessment

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Procedure / Preparation	15
B	Circuit / Program	20
C	Execution / Connection	15
D	Result	10
E	Viva voce	10
F	Written test	30
	Total	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Unit I	**Linear actuators, Rotary actuators and Control Valve (Direction, Pressure & flow)**
Linear Actuators - Rotary actuators - Directional Control Valves - Pressure Control Valve -Flow Control Valve	5
Experiment 1. a. Direct operation of a single Acting cylinder. b. Direct operation of Double Acting cylinder. Experiment 2. Operations of Single and double Acting Cylinder controlled from two different positions using shuttle valve / quick exhaust valve.	10
Unit II	**Hydraulic System & its components**
Hydraulic Components - Instrumentation and Measurement - Conduits and Fittings - Hydraulic Circuits- Booster and Intensifier Circuits	5
Experiment 3. a. Direct operation of Double Acting cylinder. b. Direct operation of hydraulic Motor. Experiment 4. a. Speed control of Double Acting cylinder - Using metering-in and metering-out control. b. Speed control Hydraulic Motor - Using metering-in and metering-out control. Experiment 5. Automatic operation of two Double Acting cylinder in following sequencing using Pressure sequence valve Experiment 6. Operation of a Double Acting cylinder using solenoid operated Directional control valve.	10
Unit III	**Pneumatics system**
Pneumatics - Basic principles of pneumatics-difference between hydraulics and pneumatics-compressor - Electronic control of fluid power - solenoid valves-servo valves pump controls.	5
Experiment 7. Speed control of Double Acting cylinder using metering in and metering out circuit. Experiment 8. Automatic operation of Double Acting cylinder in multi cycles -Using limit switches and memory valves.	10

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Unit IV	**Basic concepts of PLC**	
Introduction to Programmable Logic controller - Block diagram of PLC – Processor – Memory – Input and output modules –PLC Scan - PLC scan – memory organization - Communication with PLC Module		5
Experiment 9. a. Direct operation of a Pneumatic cylinder using solenoid valve and latch circuit. b. Direct operation of a hydraulic cylinder using solenoid valve and latch circuit. Experiment 10. a. Operation of a pneumatic/hydraulic cylinder using AND logic control. b. Operation of a pneumatic/hydraulic cylinder using OR logic control. Experiment 11. a. On-delay timer control of pneumatic/hydraulic cylinder b. Off-delay timer control of pneumatic/hydraulic cylinder.		10
Unit V	**Programming and Applications of PLC**	
Programming - Different programming languages - Ladder Programming Bit instruction – Logic functions (OR, AND, NAND & EX –OR)- timer- counter –program control instruction – data handling		5
Experiment 12. Automatic operation of Two Double Acting pneumatic cylinder in multi cycles Using proximities in the following sequence i.) A+B+A-B ii). A-B+A+B Experiment 13. Wire and test the sequential operation of solenoid valve and a motor for tank filling operation using PLC. Experiment 14. Develop and execute the ladder logic to interface PLC with conveyor model for counting the object moving in the conveyer.		10
TOTAL HOURS		75

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

Students Activity: simple PLC Programming

Reference Books

1. Industrial Hydraulics –Third Edition John J.Pippenger Tyler, G.Hicks. Mc.Graw-Hill Book Company.

2. Introduction to Fluid Power--James L. Johnson.-Delmar Thomson Learning Inc.

3. Hydraulics And Pneumatics - (HB) Adrewparr –Jaico Publishing House.

4. Pneumatic And Hydraulic Systems - Bolton W. Butterworth-Heinemann-1987

5. Frank D Petruzella, ―Programmable logic controllers‖, McGraw-Hill, 2011

6. John R Hackworth and Fredrick D Hackworth Jr., ―Programmable Logic Controllers: Programming Methods and Applications‖, Pearson Education

Web-based/Online Resources

a. Software:- www.fossee.com
b. Software:- www.logixpro.com
c. Software:- www.plctutor.com
d. Software;-www.ellipse.com
e. PLC lecture:- https://www.youtube.com/watch?v=pPiXEfBO2qo
f. PLC tutorial:-http://users.isr.ist.utl.pt/~jag/aulas/api13/docs/API_I_C3_3_ST.pdf

Equipment / Facilities required to conduct the Practical Course.

Note: The components should be supplied separately. Students should fix the board to executethe circuit.

1. Pneumatic Trainer Board – 1 Nos

   (All Cylinders, Control Valves, Limit switches and other accessories should be kept separately and should not be fixed permanently in the board/ stand.)

2. Hydraulics Trainer Board – 1 No.

   (All Cylinders, Control Valves, Limit switches and other accessories should be kept separately and should not be fixed permanently in the board / stand.)

3. PLC – 1 Nos.

4. Computer with software – 05 Nos.

1220234641	INDUSTRIAL AUTOMATION PRACTICAL	L	T	P	C
PRACTICUM		1	-	4	3

END SEMESTER EXAMINATIONS – PRACTICAL EXAM. SCHEME OF EVALUATION

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

PART	DESCRIPTION	MARKS
A	Procedure / Preparation	15
B	Circuit / Program	20
C	Execution / Connection	15
D	Result	10
E	Viva voce	10
F	Written test	30
	Total	100

Note : For the written test 30 MCQ shall be asked from the theory portions.

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Sensors are needed to measure (sense) unknown signals and parameters of an engineering system and its environment. Essentially, sensors are needed to monitor and learn about the system. Sensor is a device that when exposed to a physical phenomenon (temperature, displacement, force, etc.) produces a proportional output signal (electrical, mechanical, magnetic, etc.). Actuators are needed to drive a plant. A diploma holder when employed in automated industrial process controls will be required to know the basics of Sensors and Actuators.

Course Objectives:

The objective of this course is to enable the student to

- Explain the types and working of various types of sensors.
- Practice with temperature sensor, proximity sensor, LVDT and Light Sensors.
- Describe the functions of Linear and Rotary Electrical actuators.
- Describe the functions of Electrical, Pneumatic and Hydraulic actuators.
- Practice with interfacing of Arduino compatible sensors and actuator with Arduino.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Describe the working of Resistive, Inductive, Temperature and Light Sensors.

CO2: Interface and observe the behaviour of Proximity sensors with relay and buzzer.

CO3: Construct the circuit and observe the behaviour of the solid state electronic actuator.

CO4: Describe the working of Electrical, Pneumatic and Hydraulic actuators.

CO5: Demonstrate the applications of Arduino compatible sensors and actuators.

Pre-requisites:

Applied Physics, Basic Electrical and Mechanical Engineering.

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	2	2			
CO2	3	1	2	2			
CO3	3	1	2	2			
CO4	3	1	2	2			
CO5	3	1	2	2			

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments	Cycle II Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The student should draw the Circuit Diagram and take readings, do calculations and prepare the Graph/Result manually in the documents.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections and Execution	25
TOTAL		50
D	Practical Documents (As per the portions)	10
Total Marks		60

Cycle I: 1, 2, 3, 4 and 5.

Cycle II: 6, 7, 8, 9 and 10.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
		TOTAL	100 Marks

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections and Execution	25
D	Output / Result	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

Theory Portion UNIT I: SENSORS		Period
Resistance, Inductance and Capacitive Sensors: Definition – Classification of Sensors/Transducers - Elements of measurement system – Primary Sensing Elements (Bellows, Bourdon Tube) - Potentiometer - Linear potentiometer – Rotary potentiometer - Load Cell – Strain Gauge Load Cell - Linear Variable Differential Transformer (LVDT) – Rotary - Variable Differential Transformer (RVDT) – DC Tachogenerator – AC Tachogenerator - Principles of Capacitive Sensors – Hall effect sensor. Temperature Sensors: Thermocouple – Resistance Temperature Detector –Thermistor - Infrared (IR) thermometer. Proximity Sensors: Inductive Proximity Sensor – Capacitive Proximity Sensor - Photoelectric Proximity Sensor - Ultrasonic Proximity Sensor - Basic Reed Switch. Light Sensor: Photodiode – Phototransistor – Photoconductive Cell - Photovoltaic Cells - Bar Code Reader - Shaft Encoders - Encoder Types (Incremental Encoder, Absolute Encoder) - Optical Shaft Encoder - Photoelectric Tachometer. Arduino Compatible Sensor : Voltage Sensor – Current Sensor – LM35 Sensor - Ultrasonic Sensor - Force Sensor – Moisture Sensor – Gas Sensor.		**8**
Practical Exercises:		
Ex.No	**Name of the Experiment**	**Period**
1.	TEMPERATURE MEASUREMENT Activities to Perform: i) Construct a circuit to measure Temperature of Liquid using Thermistor or Thermocouple or RTD. ii) Also find the graphical relationship between input and output.	**4**

2.	BEHAVIOUR OF PROXIMITY SENSORS Activities to Perform: i) Observe the behaviour of Inductive proximity sensor and Capacitive Proximity sensor for different material samples. ii) Interface relay and buzzer with sensors to test the output.	**4**
3.	LVDT Activities to Perform: i) Construct a circuit for Measurement of Linear Displacement using LVDT. ii) Find the graphical relationship between input and output.	**4**
4.	PERFORMANCE OF LIGHT SENSOR Activities to Perform: i) Construct a circuit to obtain the VI characteristics and Response Characteristics of Photoconductive Cell (LDR). ii) Construct a circuit to measure the speed of the motor using Optical Sensor.	**4**
5.	PERFORMANCE OF ULTRASONIC AND MOISTURE SENSORS Activities to Perform: i) Interface Ultrasonic sensor with Arduino and measure the distance of the object. ii) Interface Moisture sensor with Arduino and measure the moisture content in the soil.	**4**

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

UNIT II: ACTUATORS		
Electrical Actuators: General aspects - Switching Devices – Mechanical Switches (Push button – SPST –SPDT – Limit Switch – Solenoid – Relays) – Solid State switches (Diode, Transistor and Thyristor) – DC Motors – AC Motors – Stepper Motors – Servo Motors. Pneumatic Actuators: Introduction – Components of a Pneumatic Systems –Linear actuators – Construction and working of Single acting and Double acting cylinders - Rotary Actuators – Air Motors – Types of Air Motors - Piston type Motor, Vane Motor, Turbine Motor - Applications of Air Motors. Hydraulic Actuators: Hydraulic Power Supply - Components of Hydraulic system - Linear actuators - Construction and working of Single acting and Double acting cylinders – Applications of Hydraulic Cylinders - Some example mechanism driven by an Hydraulic cylinders - Rotary Actuators – Hydraulic Motors – Advantages and Applications of Hydraulic Motors.		**7**
Ex.No	**Name of the Experiment**	**Period**
6.	OBSERVE THE BEHAVIOUR OF TRANSISTOR AS A SWITCH Activities to Perform: i) Construct a circuit to get ON/OFF control on DC Motor using Push Button, SPST, SPDT and Limit Switch. ii) Construct a circuit to get ON/OFF control on DC Motor using Transistor and Relay.	**4**
7.	FORWARD AND REVERSE CONTROL OF AC MOTOR Activities to Perform: i) Connect Forward Reverse Control switch to change the direction of rotation of three phase induction motor. ii) Demonstrate the Forward and Reverse operation of Motor. iii) Measure the No-Load current in each phase using Tongue tester (Clamp Meter).	**4**

8.	PNEUMATIC CIRCUIT FOR DOUBLE ACTING CYLINDER <u>Activities to Perform:</u> i) Construct a Pneumatic Circuit to control double acting pneumatic cylinder using 5/2 Solenoid Valve. ii) Discuss the behaviour of cylinder as linear actuator.	**4**
9.	OBSERVE THE BEHAVIOUR OF HYDRAULIC MOTOR <u>Activities to Perform:</u> i) Construct a Hydraulic Circuit to control Hydraulic Motor. ii) Observe the behaviour of Hydraulic Motor.	**4**
10.	SERVO MOTOR CONTROL WITH AN ARDUINO <u>Activities to Perform</u>: i) Construct an Arduino based circuit to sweeps the shaft of servo motor back and forth across 180 degree. ii) Interface potentiometer with Arduino and based on its position get the control of servo motor shaft.	**4**
	Revision + Test + Practice	**20**
	Total	**75**

Suggested List of Students Activity:

1. Activity 1 : Each student writes and submits the assignment on the topic Basics of Electricity, Ohm's Law and Electromagnetism.
2. Activity 2 : Four students can be grouped as a batch and practice an additional experiment to interface any one of the Arduino compatible sensors (LM35 Temperature sensor, Force Sensor, Gas Sensor, Voltage Sensor, Humidity Sensor, Rain Sensor, Acceleration sensor, magnetic sensor, Infrared sensor etc.,) with Arduino and observe the behaviour of sensors.

Text book for Reference:

1. D. Patranabis, Sensors and Transducers, Multicolour Edition, Second Edition, PHI Learning Private Limited., 2013.
2. Er. R.K. Rajput, A Textbook of Mechatronics, Fourth Edition, S. Chand & Co., 2016.
3. Jacob Fraden, Handbook of Modern Sensors: Physics, Designs and Application, Fourth edition, Springer, 2010.
4. Massood Tabib and Azar, Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures, First edition, Kluwer academic publishers, Springer, 1997.

Web-based/Online Resources:

- https://archive.nptel.ac.in/courses/108/108/108108147/
- https://www.youtube.com/watch?v=H9OEAn3Uc2w
- https://www.youtube.com/watch?v=Ab9U7NQB1kA

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

Equipment / Facilities required to conduct the Practical Course.

S.No	Name of the Equipment’s	Quantity Required
1.	Temperature Measurement using Thermocouple / Thermistor / RTD Kit	1 No
2.	Inductive and Capacitive Proximity Sensors, Relay, Buzzer, Suitable Power Supply Unit	Each 1 No
3.	LVDT Trainer Kit	1 No
4.	LDR, MC Ammeter and Voltmeter, 0-30V DC Power Supply Unit, DC Motor with Optical Sensor set up	Each 1 No
5.	Arduino Shield, Arduino compatible Ultrasonic Sensor and Moisture sensor	Each 1 No
6.	Push Button, SPST, SPDT, Limit Switch, Low Voltage DC Motor, Transistor and Relay	Each 1 No
7.	3 Phase Induction Motor, Forward Reverse Control switch and Clamp Meter	Each 1 No
8.	Double acting Pneumatic cylinder, Directional Control Valve, Compressor	Each 1 No
9.	Hydraulic Motor, Control Valve, Hydraulic Power Bank	Each 1 No
10.	Arduino shield, Arduino compatible Servo Motor and Potentiometer	Each 1 No
11.	Other Consumables	As Required

1020234440	SENSORS AND ACTUATORS	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The record of work done by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections / Execution	25
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Introduction

The purpose of heat power engineering is to give conceptual and principles involving thermal science, especially focusing on internal combustion engine, Refrigerator, and compressors. Through experiments and simulations conducted in the lab, students can validate theoretical concepts, optimize system performance, testing of various oil properties for using as a fuel and lubricant in thermal systems and develop innovative solutions for real-world applications. This practical knowledge enhances their problem-solving skills and prepares them for the challenges they will face in their careers.

Course Objectives

The objective of this course is to enable the student,

- To understand the fundamental concepts involved in thermal systems.
- To analyze the various performance parameters of internal combustion (IC) engines.
- To analyze the performance of refrigeration cycle/ components.
- To analyze the performance of the compressor and its volumetric efficiency.
- To study the properties, complete combustion of fuels and its products.

Course Outcomes

On successful completion of this course, the student will be able to

CO1: Interpret the performance indicators of air standard cycles.

CO2: Analyze the performance characteristics of IC engines for various fuels

CO3: Categorize the principles of refrigeration and air conditioning with applications

CO4: Categorize the principles of air compressor applications

CO5: Evaluate the combustion products of fuels by using the exhaust gas analyzer.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites

Basic knowledge of Science, Maths

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2			
CO2	3	2	1	2			
CO3	3	2	1	2			
CO4	3	2	1	2			
CO5	3	2	1	2			

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It's recommended that teachers take action to grab students' interest and increase their confidence in their ability to learn.
- Teachers should use examples from everyday life, realistic scenarios, and real-world engineering and technological applications to help students understand and appreciate the many concepts and principles in each subject.
- The demonstration might spark interest in the subject and encourage a scientific perspective. Every topic should have planned student activities.
- To make sure that learning is outcome-and employability - based, a theory - demonstrate - practice - activity approach may be used throughout the course.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Units	All Exercises	All Exercises
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The observations, readings, calculations and sketches should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim and procedure	10
B	Tabular Column / Formulae	10
C	Observation / Calculation / Diagram	30
D	Practical Documents (As per the portions)	10
TOTAL		60

Cycle 1: Exercise 1, 2, 3, 4 and 5.

Cycle 2: Exercise 6, 7, 8, 9 and 10.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.
- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ from the complete theory portions.	30 X 1 Mark	30 Marks
Part – B	Seven Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim and procedure	10
B	Tabular Column / Formulae	10
C	Observation / Calculation / Diagram	30
D	Result / Graph	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		**1**	**0**	**4**	**3**

Syllabus contents

Unit I	**THEORY :AIR CYCLES AND IC ENGINES**	
Basic concept of thermodynamics, definition and units of pressure, temperature, volume, density, specific heat, energy, work, force, power, heat, enthalpy, and entropy. Laws of perfect gases and its Equation. Thermodynamic processes such as constant volume, constant pressure, constant temperature, adiabatic, polytrophic. (simple problems) Air cycles - air standard efficiency - reversible and irreversible processes - Carnot cycle - Otto cycle - Diesel cycle. Illustration of above cycles on pressure, volume, temperature, and entropy scale- working and calculation of efficiency. (simple problems) Internal combustion engines – classification - comparison of four stroke and two stroke engines. Testing of IC engines– indicated power – brake power – friction power – efficiencies of I.C. engines – indicated thermal, brake thermal, mechanical, and relative efficiencies – Specific fuel consumption.		9
Ex.No	**Practical Exercises: Name of the Experiment**	**Period**
1	Determine the flash and fire point of the lubricating oil by using Open cup apparatus and Closed cup apparatus and compare the value for the given sample.	5
2	Draw the valve timing diagram of single cylinder four stroke petrol engines.	5
3	Draw the valve timing diagram of single cylinder four stroke diesel engines.	5
4	Draw the port timing diagram of a single cylinder two stroke Petrol Engine.	5
5	Load test (Performance test) on Four Stroke Diesel Engine or Four Stroke Petrol Engine.	5
6	Morse test on multi-cylinder petrol engine.	5
7	Heat balance test on Four Stroke Diesel or Petrol Engine.	5

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Unit II	AIR COMPRESSOR , REFRIGERATION AND FUELS	
Air Compressor and its functions, Single stage & Multi stage reciprocating air compressor - Refrigeration: Introduction to refrigeration, refrigerant, refrigeration effects. COP, TON of refrigeration. Vapor compression refrigeration (VCR) system. Classifications of fuels– requirements of a good fuel – stoichiometric air required for complete combustion of fuels –products of combustion – analysis of exhaust gases - calorific value of fuels – higher and lower calorific values.		6
Ex.No	**Practical Exercises: Name of the Experiment**	**Period**
8	Volumetric efficiency of Air Compressor.	5
9	Determination of COP of Refrigeration System.	5
10	Find the Percentage of CO, CO_2, O_2, and amount of HC, NOx using Exhaust gas analyser.	5
	Test + Revision	10
	TOTAL HOURS	75

List of Students Activity to be performed:

- Dismantling and assembling a reciprocating and rotary compressor .
- Study the types of Refrigerants and their properties.
- Study the working principle of two stroke and four stroke engines.
- Study the Valve Timing / Port Timing of multi cylinder engine.

Textbook for reference

1. R. K. Rajput, Thermal Engineering, 11th Edition, Laxmi publications Pvt Ltd , 2020.
2. R.S. Khurmi, J. K. Gupta, A Textbook of Thermal Engineering, S. Chand Publishing, 2019.
3. R. K. Rajput , A Text Book of Automobile Engineering, Laxmi publications Pvt Ltd, New Delhi, 2012.
4. P. K. Nag, Basic And Applied Thermodynamics 2/E, McGraw-Hill Education (India) Pvt Limited, 2010

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

Website links for reference

- NPTEL (Website): https://archive.nptel.ac.in/courses/112/103/112103316/
- NPTEL (Website): https://archive.nptel.ac.in/courses/112/103/112103262/

List of Equipment's

S.No.	Name of Equipment's	Quantity
1.	Open cup apparatus	1 No.
2.	Closed cup apparatus	1 No.
3.	Four stroke petrol engine cut section model for valve timing diagram.	1 No.
4.	Four stroke diesel engine cut section model for valve timing diagram.	1 No.
5.	Two stroke petrol cut section model for port timing diagram.	1 No.
6.	Four Stroke Petrol Engine or Diesel Engine Test rig.	1 No.
7.	Multi- Cylinder Petrol or Diesel Engine Test rig.	1 No.
8.	Air Compressor Test rig.	1 No.
9.	Refrigeration Test rig.	1 No.
10.	Exhaust Gas Analyzer.	1 No.
11.	Reciprocating and Rotary Air compressor for dismantling and assembling	1 No.

1020234540	HEAT POWER ENGINEERING	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATION – PRACTICAL EXAM

Note: All the exercises should be given in the question paper and students are allowed to select by a lot or the question paper allotted from the DOTE shall be used.

Practical document should be submitted for the examination with a bonafide certificate.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim and procedure	10
B	Tabular Column / Formulae	10
C	Observation / Calculation / Diagram	30
D	Result / Graph	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Introduction:

Study the Basics of Work Holding Devices, Clamping and Tool Guiding Elements. Principles of Jig Design, Principles of Fixture Design and Gauges.

Course Objectives:

- Identify the Difference between Jig & Fixtures
- Explain possible freedom of movement of job in a jig, fixtures
- Study locating of work piece in a jig, fixture
- To understand the construction of various types of Jigs , Fixtures and gauges
- Usage of different machine tools to produce various jigs ,Fixtures and Gauges

Course Outcomes:

CO1: State the requirement, advantages & Limitations of Jigs & Fixtures

CO2: Explain the concepts of degrees of freedom & locating & supporting principles

CO3: List the various clamping & Tool Guiding elements

CO4: Describe the constructions of various types of Jigs, Fixtures and gauges

CO5: produce a template jig, channel jig, Milling and welding fixture

Pre-requisites:

Mathematical skills, Mechanics.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	2	3	2
CO2	3	3	2	3	3	2	2
CO3	3	2	3	3	3	3	2
CO4	3	2	2	2	1	3	3
CO5	3	2	2	2	1	2	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		3	0	2	4

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employa theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancy

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written Test Theory (First Two Units)	Written Test Theory (Another Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Examination (Complete Theory Portions)
Duration	2 Periods	2 Periods	8 Hours	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best of one will be considered for the internal assessment of 10 Marks.

  CA1 and CA2, Assessment written test should be conducted for two units as below.

  Answer any Five questions. (5 X 10 Marks = 50 Marks).

  Eight questions will be asked, students should write Five questions.

  Each unit Four questions can be asked. Each question may have subdivisions. Maximumtwo subdivisions shall be permitted.

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		3	0	2	4

- **CA 3:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test

should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

The details of the practical documents to be prepared as per the instruction below.

Each Exercise observation and calculations should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice beforecommencement of the next exercise.

This documentation can be carried out in a separate notebook or printed manual or file. The reading and calculations and graph should be written by the student manually. The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		3	0	2	4

SCHEME OF EVALUATION - Practical Test

Sl.No.	Description	Marks
A	Manufacture of Jig / Fixture	30
B	Tool Finish	20
C	Component finish / Accuracy	20
D	Tool Setting & Trail Production	10
E	Practical document (All Practicals)	10
F	Viva Voce	10
Total		100

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.
- Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		3	0	2	4

Syllabus Contents:

Unit I	BASICS OF WORKHOLDING DEVICES	
	Work holding Concepts – Basic Work holders, work holder purpose and function, General Considerations **Jigs and Fixtures –** Introduction – Definition – Difference between Jigs and Fixtures – Advantages of Jigs and Fixtures. **Locating and supporting principles -** Location types, Degrees of freedom - 12 degrees of freedom. Location methods - 6 points location principle (or) 3-2-1 principle of location, concentric and Radial methods – Basic rules, position and number of locators, Redundant locators, Locational Tolerances, Fool proofing. **Locator Types**: External – Fixed locators, Integral locators, Commercial pin, Assembled locators, Pins, V Type, locating nests. Adjustable locators, Sight locators. Internal – Machined internal, Relieved, Diamond pins, Floating locating pin, conical locators, self-adjusting locators, spring locating pins. Spring stop buttons. Chip and burr problems	8
Unit - II	**CLAMPING AND TOOL GUIDING ELEMENTS**	
	CLAMPING: Clamping principles – Tool forces, clamping forces, positioning clamps. Rigid Vs Elastic work holders. Types of Clamps – Strap clamp, screw clamp, cam action clamps, Toggle action clamps, wedge action clamps, latch clamps, rack and pinion clamps, specialty clamps. Chucks –Operations, Nomenclature. Lathe chucks – Solid Arbors and Mandrels. Split collet and bushing work holders, axial location, self-actuating wedge cam and wedge roller work holders. VISES – Special jaws, independent jaws. Non-Mechanical Clamping –Magnetic chucks, vacuum chucking, Electrostatic chuck. Power Clamping – Hydraulic and Pneumatic clamping. Multiple part clamping. **TOOL GUIDING ELEMENTS:** **Drill jig bushings and liners –** Selection, Bushing / liner installation, interference fit, chip clearance, accuracy and life. **Types of bushes –** Head less press fit bushes, Headed press fit bushes, Slip renewable and Slip fixed renewable bushings / liners, Headless press fit liners, Headed press fit liners, Oil groove bushings, Gun drill bushings, Special bushings. Bushings and liners for polymers, castable and soft material tooling. Template bushings, Rotary bushings. Drill bushing tips and accessories. Drill bush material and manufacture.	10

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		3	0	2	4

Unit III	PRINCIPLES OF JIG DESIGN	
Introduction – General considerations – Machine considerations – Process considerations. Basic requirements of Drill jigs. **TYPES OF JIGS –** Template drill jigs, Plate jigs, Universal jigs, Leaf jig, Channel and Tumble box jigs, Indexing Jigs, Boring jigs, – Post jig – Pot jig. Miscellaneous drill jigs – Wooden drill jigs, Polymer Drill Jigs, modified vises, collet fixtures, self-centering vises. Jig design Example – Plate Jig design example		8
Practical: Manufacture of following Jigs 1. Template drill jig 2. Channel drill jig		10

UnitIV	PRINCIPLES OF FIXTURE DESIGN	
Theory: **Introduction:** General Considerations, fixture cost, production capabilities, Production process, part considerations. **Types of fixtures** – Milling fixture, Lathe fixture, Grinding fixture, Broaching fixture, Assemble fixture, Inspection fixture, Boring fixture, Indexing fixture, welding fixture and sawing fixture. **Basic Design Characteristics that apply to** – Milling fixture, Lathe fixture, Grinding fixture, Boring fixture, Broaching fixture, welding fixture and sawing fixtures. **Fixture Design -** Standard fixture mounting, Relationship between fixture and cutting tool, Tool positioning, Relationship to locators, Cutter-setting devices, Step by step approach to fixture design. Fixture design Example – Plain Milling fixture.Fixture design for numerically controlled machine Tools		9
Practical: Manufacture of following Fixtures 1.. Milling Fixture 2. Welding Fixture		10

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

Unit V	**GAUGES**	
Theory: Introduction – limit gauges –Taylor's principle of limit gauging – Application of limit gauges – Gauging principles – Allocation of Gauge Tolerance – Bilateral system, Unilateral system, Gauge wear allowance, Gauge materials, Gauging policy. Types of Gauges – Commercial Gauges – Screw pitch gauges, plug gauges, Ring gauges, Snap gauges, Flush pin gauges– IS specifications for gauges – Design of plug and Snap gauges		10
TEST & MODEL EXAMINATIONS		**10**
TOTALHOURS		**75**

Text Books:-

1. Edward Griffiths,Gages, Jigs, And Fixtures: Gage Making,1st edition, Literary Licensing, LLC,2013
2. Sheojee Prasad, Jigs, Fixtures and Precision Measuring Instruments,3rd edition,ReeSaa Pty. Ltd.,2019
3. Lucian L Haas, Jigs and Fixtures,2nd edition, Maxwell Press,2022

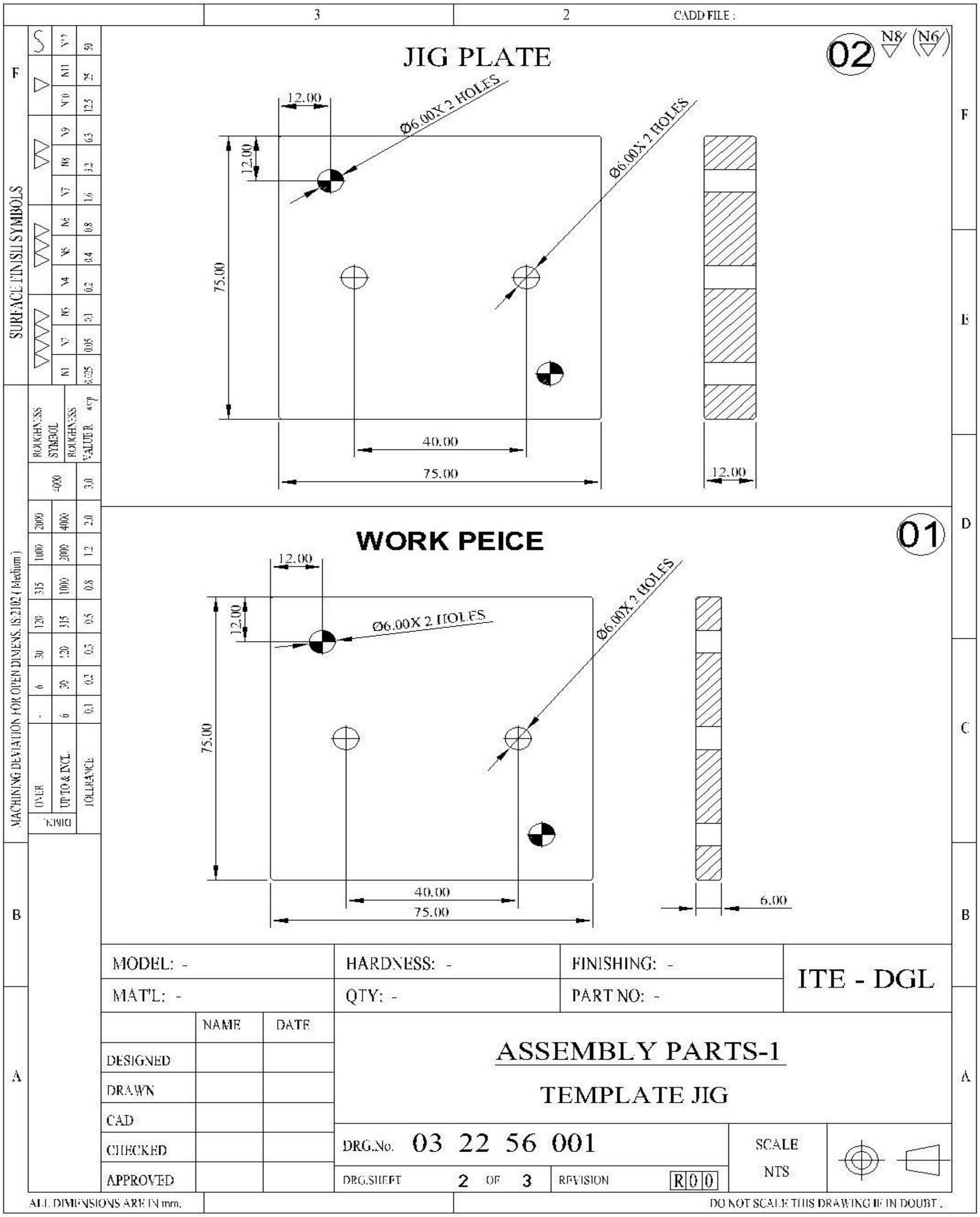
Web-based/Online Resources:

1. https://youtu.be/hyuqSdeA7P8?si=oFMakcwptkhGBRB6
2. https://youtu.be/hyuqSdeA7P8?si=hpqNCCH2FyLMlzwi
3. https://youtu.be/IY34YVhpEPo?si=CceovH-8MbLmfiTz

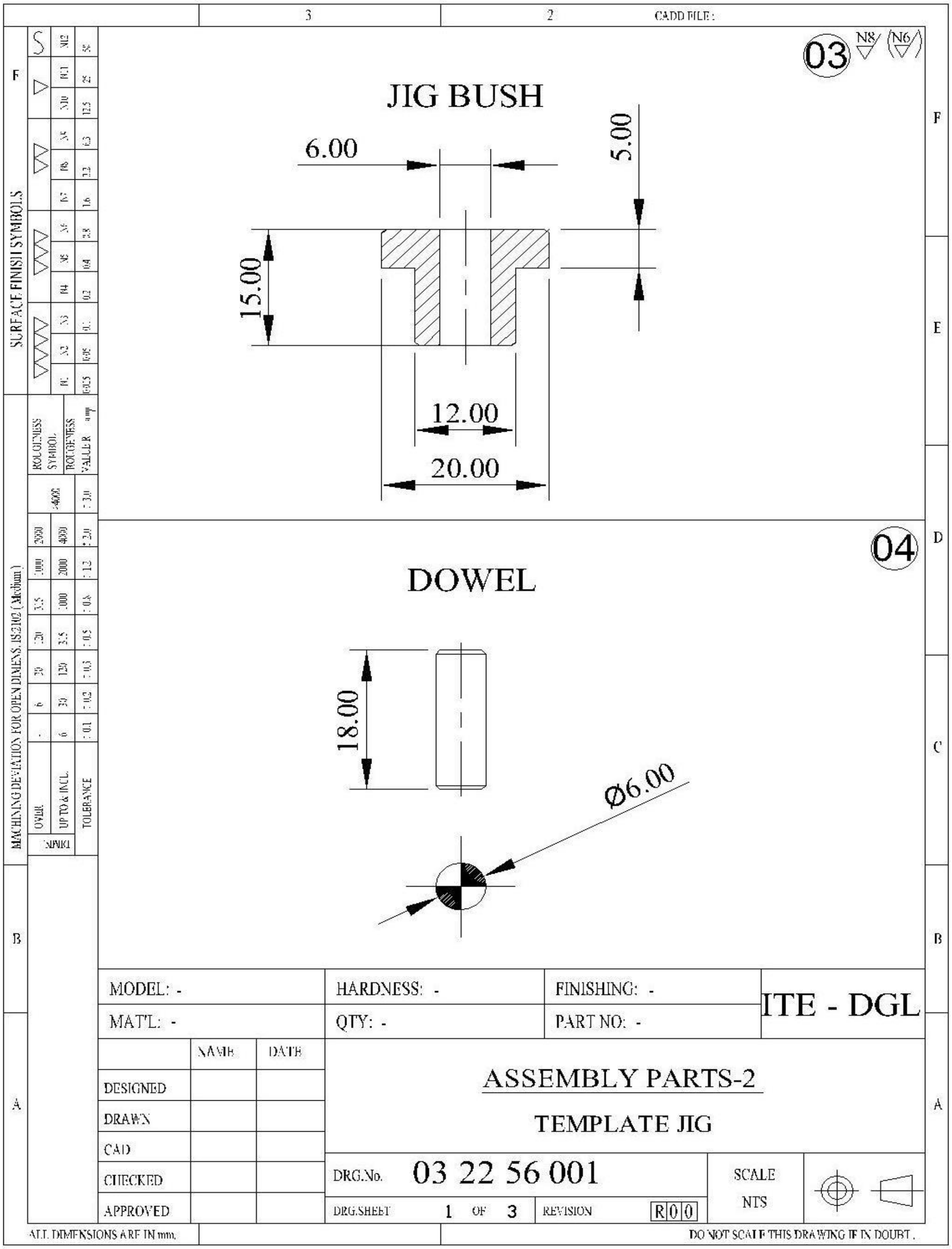
1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		**3**	**0**	**2**	**4**

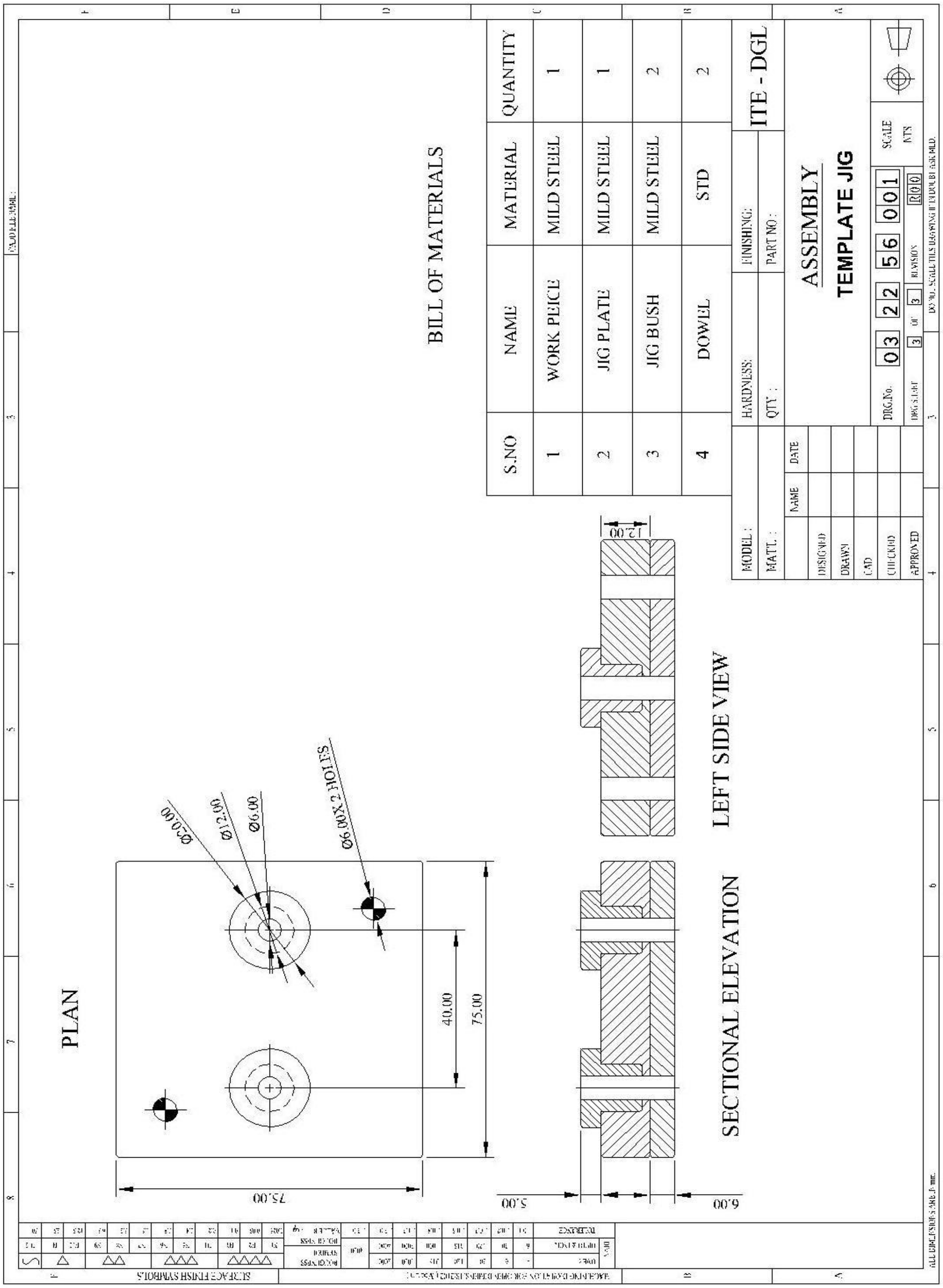
Equipment/Facilities required for conducting the Practical Course.

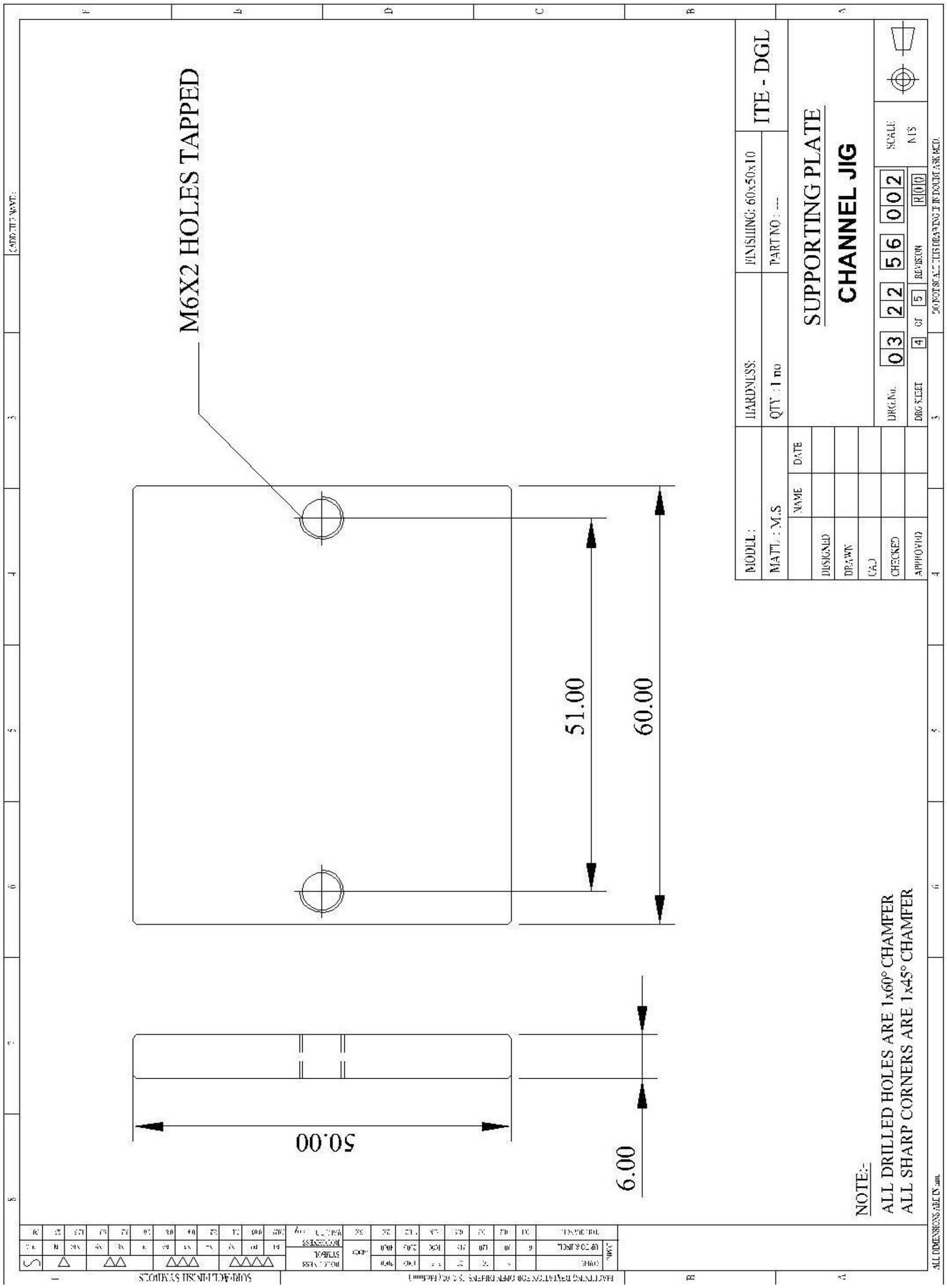
Sl.N0	LIST OF THE EQUIPMENTS WITH SPECIFICATIONS REMARKS, IFANY	QUANTITY REQUIRED
1	Centre Lathe, 4 ½' bed length	5
2	Drilling machine	2
3	Shaping machine, stroke length 300mm	2
4	Vertical milling machine	2
5	Surface grinding machine	2
6	Bench vice	10
7	Fitting file set	10
8	Tap set	4
9	Surface plate	2
10	Vernier height gauge 0-250mm	2
11	Dial test indicator with magnetic stand	2
12	Angle plate	2
13.	Tool maker's straight edge – 150 mm	1
14.	Digital Micrometer – 0.-25mm range, 0.001mm least count	3

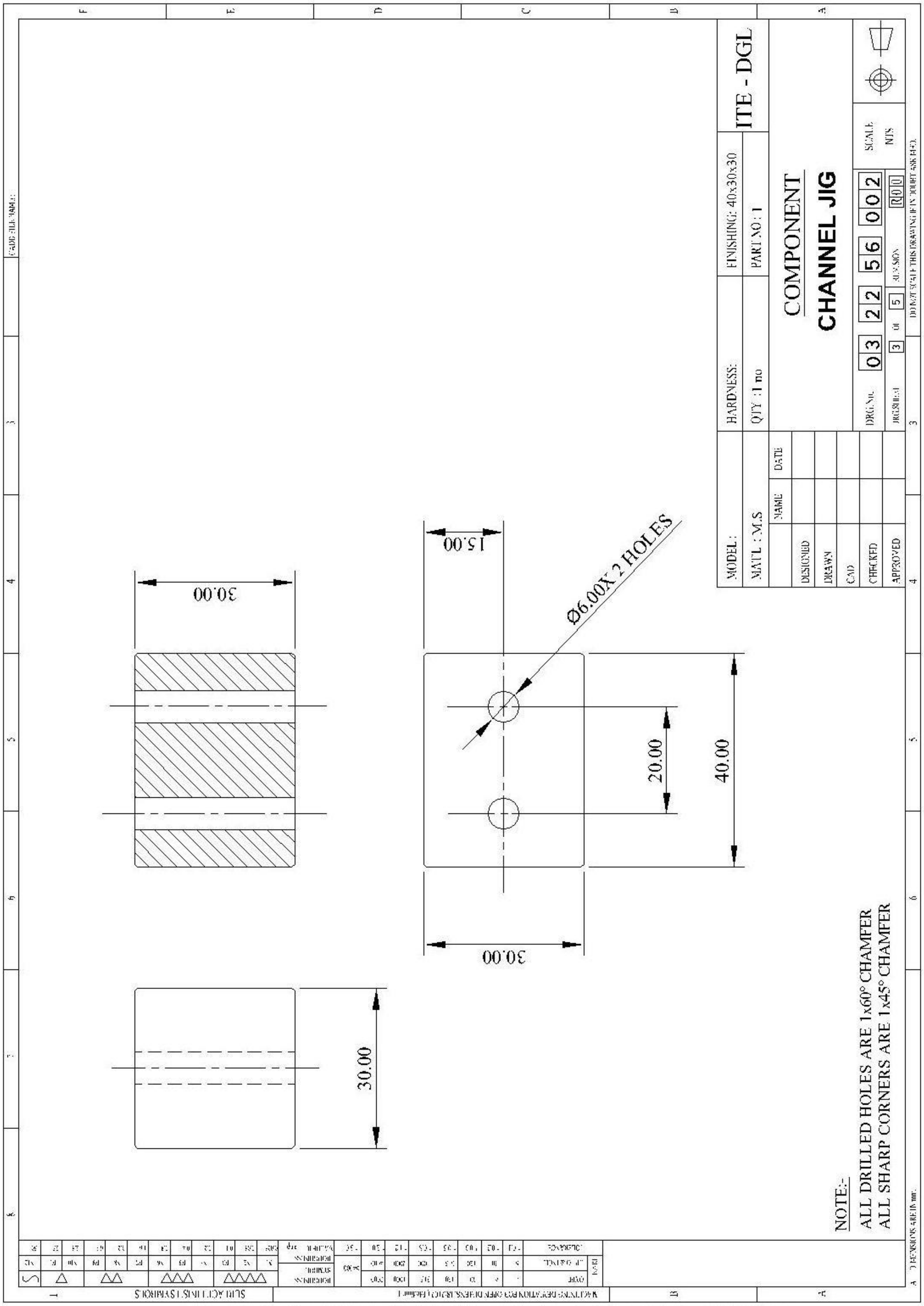

CADD FILE :
JIG PLATE
02
Ø6.00X 2 HOLES
Ø6.00X 2 HOLES
12.00
12.00
75.00
40.00
75.00
12.00
WORK PEICE
01
12.00
12.00
Ø6.00X 2 HOLES
Ø6.00X 2 HOLES
75.00
40.00
75.00
6.00
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE R
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
OVER
UP TO & INCL.
TOLLRANCE
DIMN.
MODEL: -
HARDNESS: -
FINISHING: -
MAT'L: -
QTY: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
TEMPLATE JIG
DRG.No. 03 22 56 001
SCALE
NTS
DRG.SHEET 2 OF 3
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .

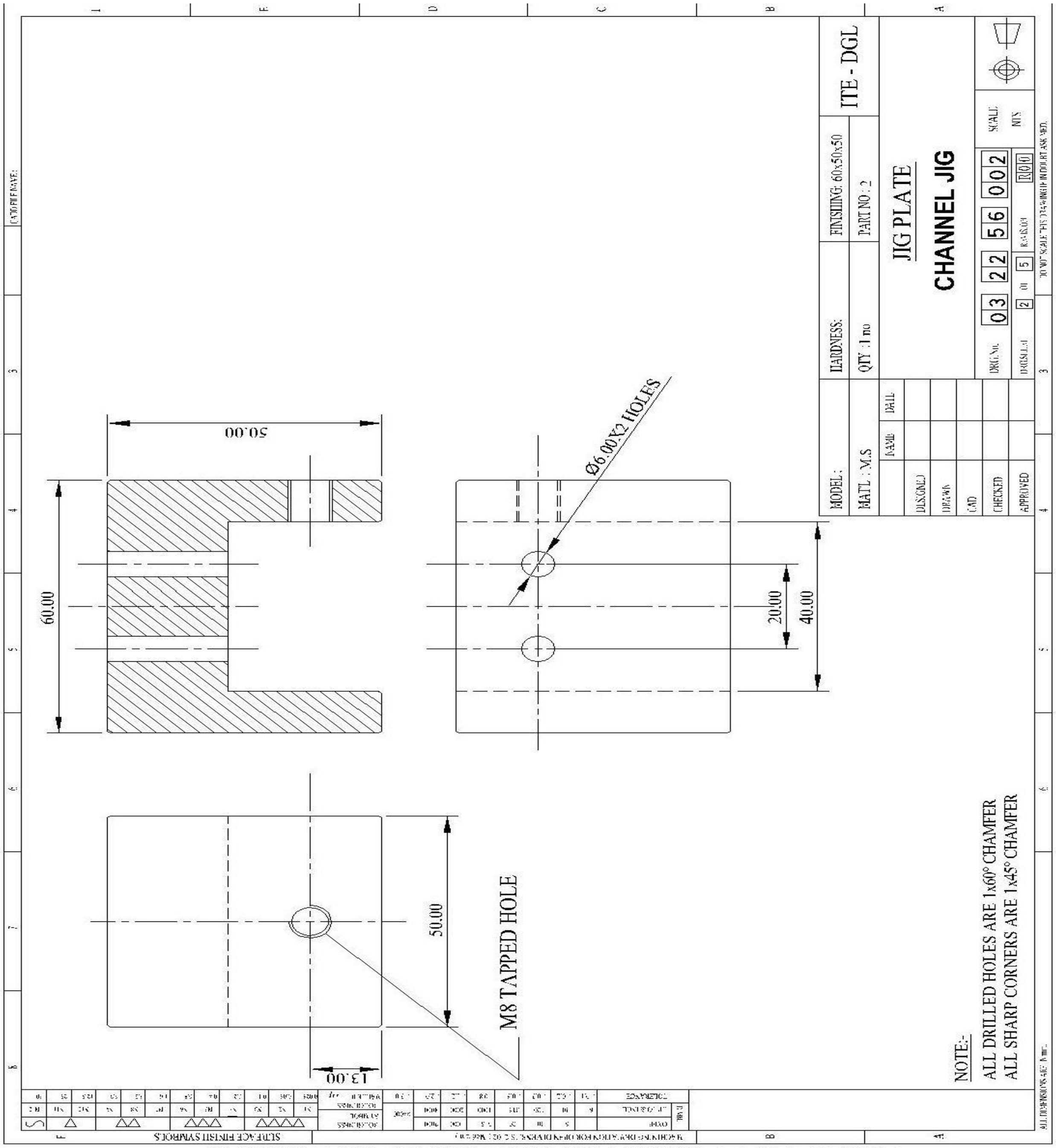
Exercise – I Template Jig

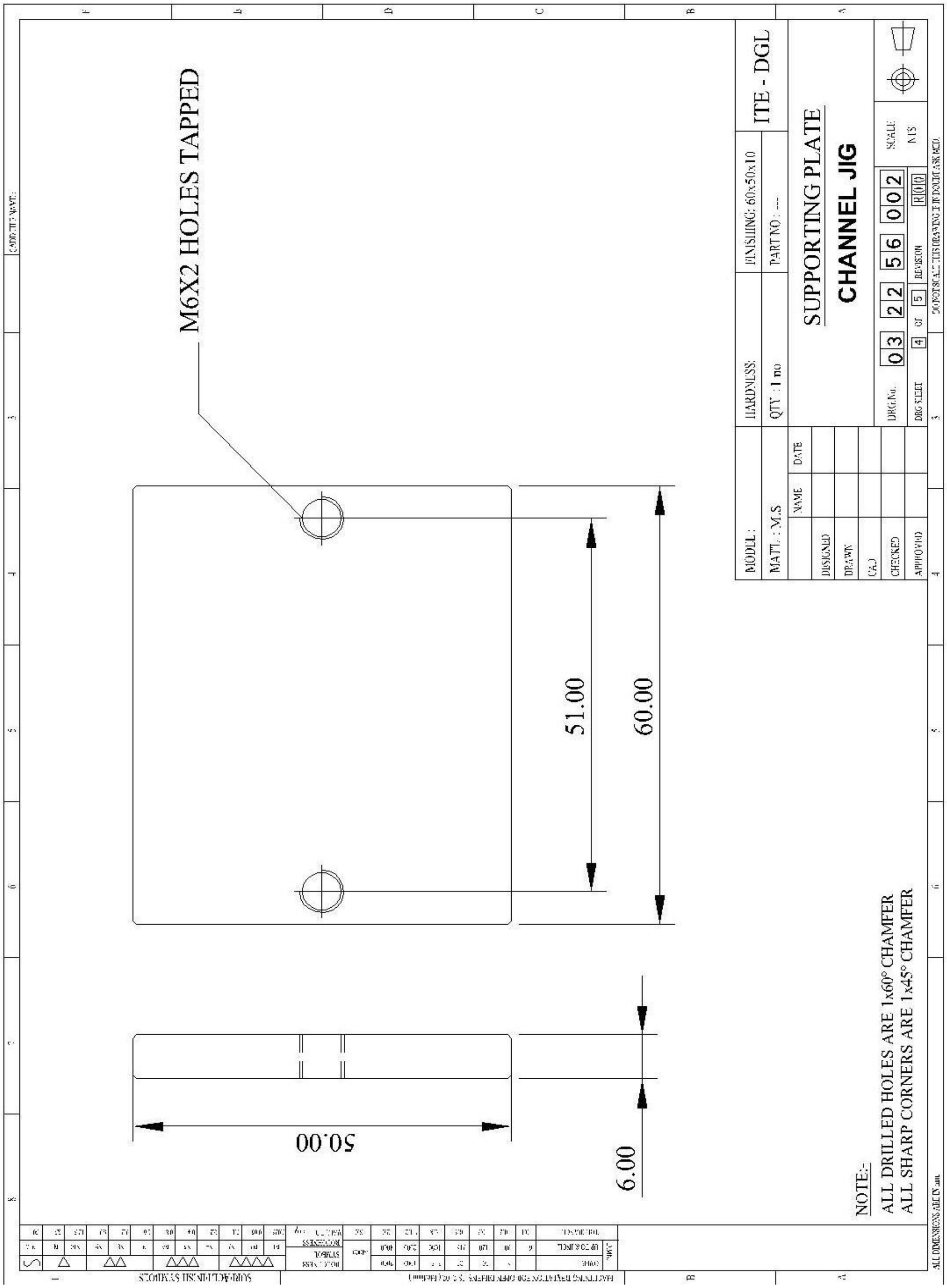


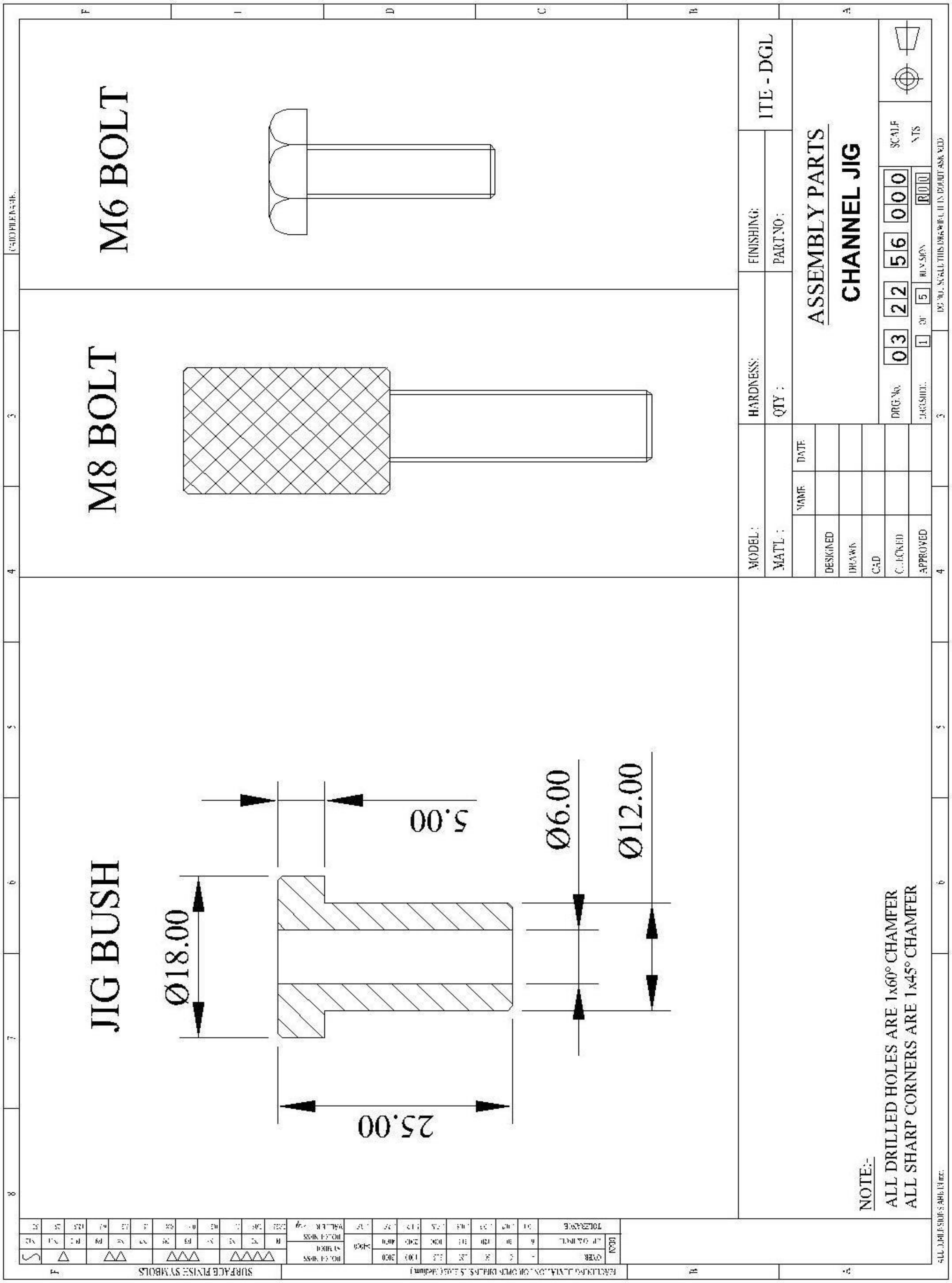

BILL OF MATERIALS
S.NO | NAME | MATERIAL | QUANTITY
1 | WORK PEICE | MILD STEEL | 1
2 | JIG PLATE | MILD STEEL | 1
3 | JIG BUSH | MILD STEEL | 2
4 | DOWEL | STD | 2
ITE - DGL
ASSEMBLY
TEMPLATE JIG
DRG.No. 03 22 56 001
PLAN
Ø20.00
Ø12.00
Ø6.00
Ø6.00X2 HOLES
40.00
75.00
75.00
LEFT SIDE VIEW
SECTIONAL ELEVATION
12.00
5.00
6.00

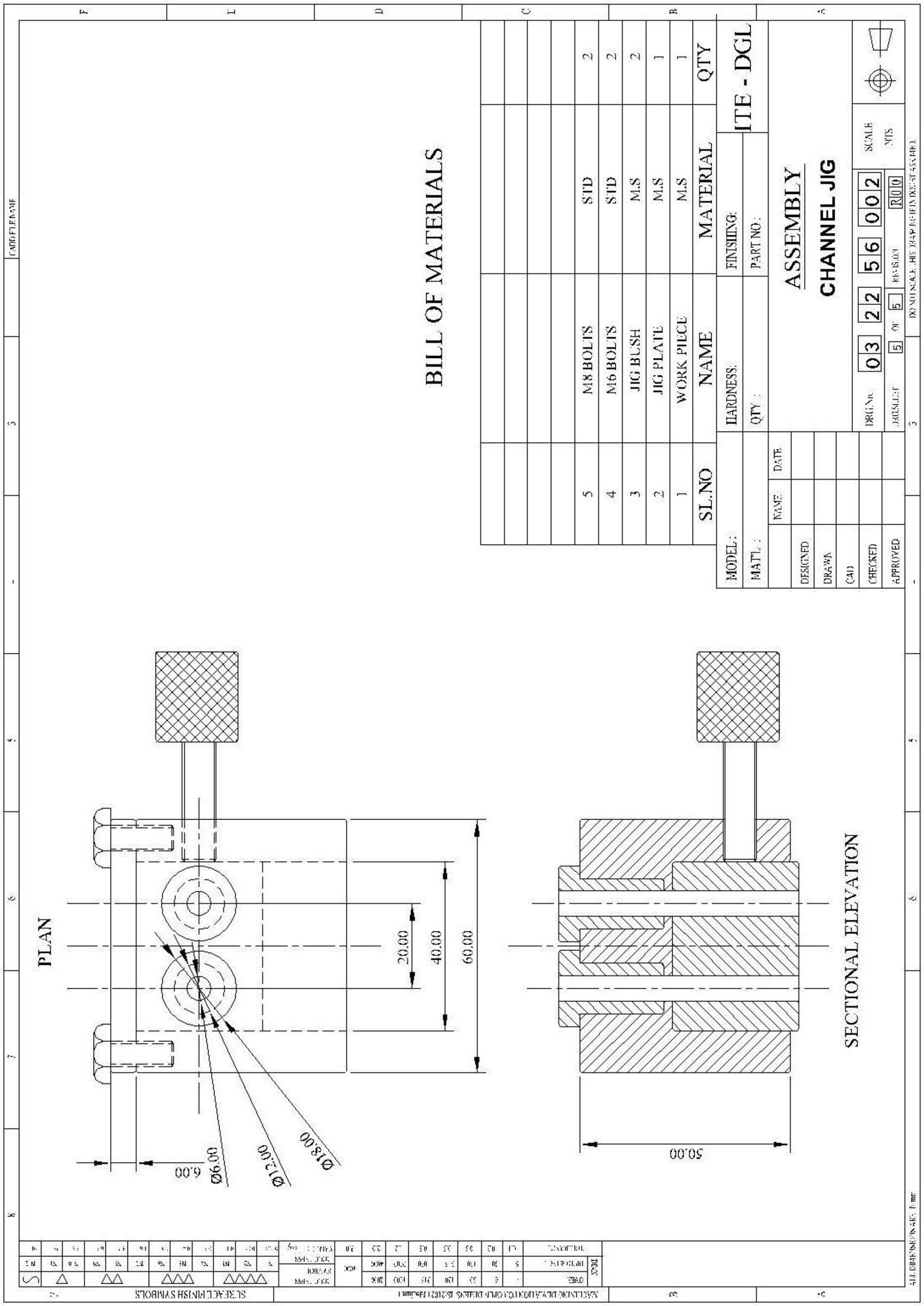

M6X2 HOLES TAPPED
51.00
60.00
50.00
6.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL :
MATL : M.S
HARDNESS:
QTY : 1 no
FINISHING: 60x50x10
PART NO : ---
ITE - DGL
SUPPORTING PLATE
CHANNEL JIG
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
0 3 2 2 5 6 0 0 2
DRG SHEET
4 OF 5
REVISION
R 0 0
SCALE
NTS

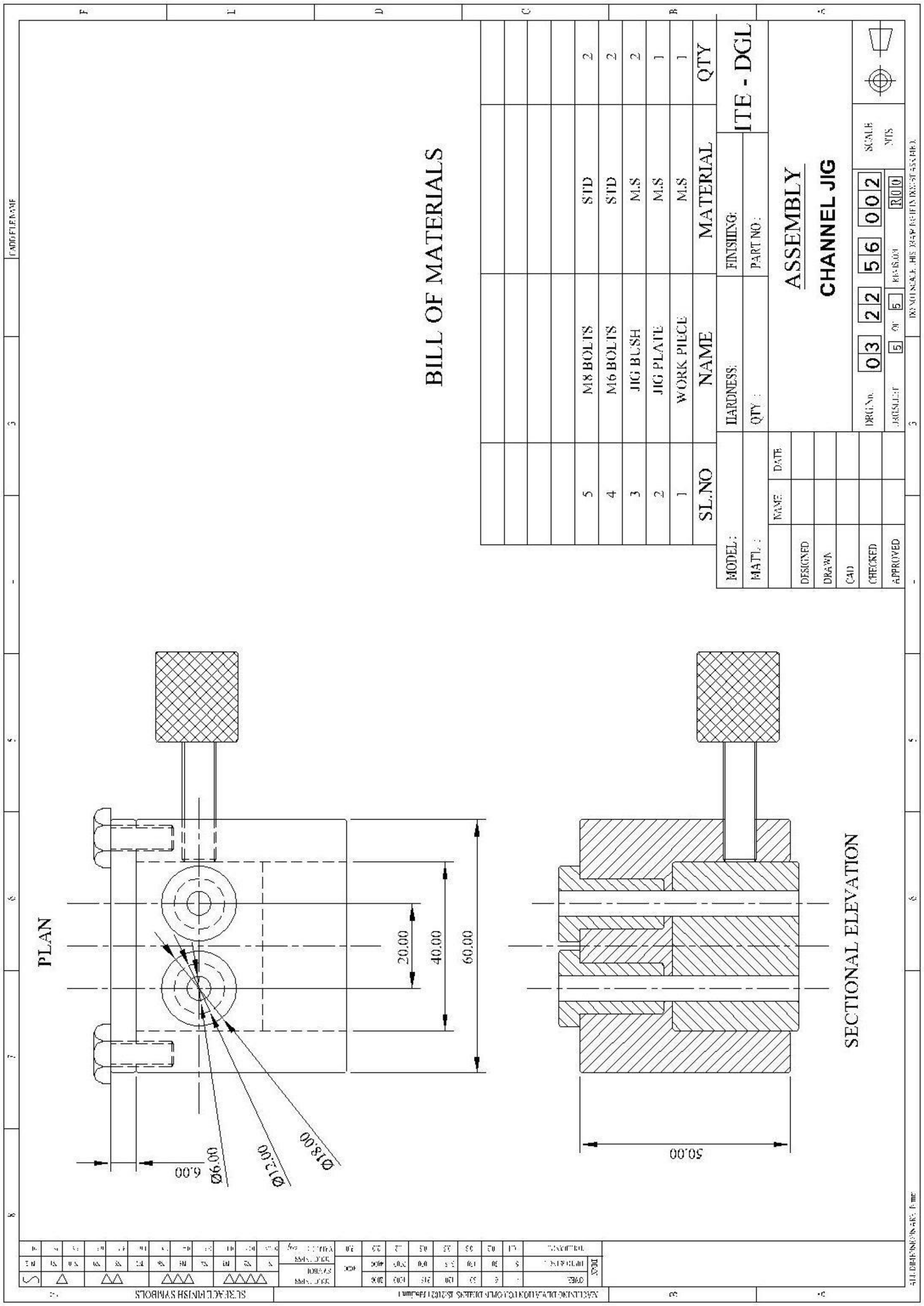

30.00
15.00
Ø6.00X 2 HOLES
20.00
40.00
30.00
30.00
MODEL :
MAT'L : M.S
HARDNESS:
QTY :1 no
FINISHING: 40x30x30
PART NO: 1
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
COMPONENT
CHANNEL JIG
DRG No. 0 3 2 2 5 6 0 0 2
SCALE
NTS
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


ITE - DGL
FINISHING: 60x50x50
PART NO : 2
HARDNESS:
QTY :1 no
MODEL :
MATL : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
JIG PLATE
CHANNEL JIG
DRG. No.
03 22 56 002
R00
SCALE
NTS
Ø6.00X2 HOLES
50.00
60.00
20.00
40.00
50.00
M8 TAPPED HOLE
13.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

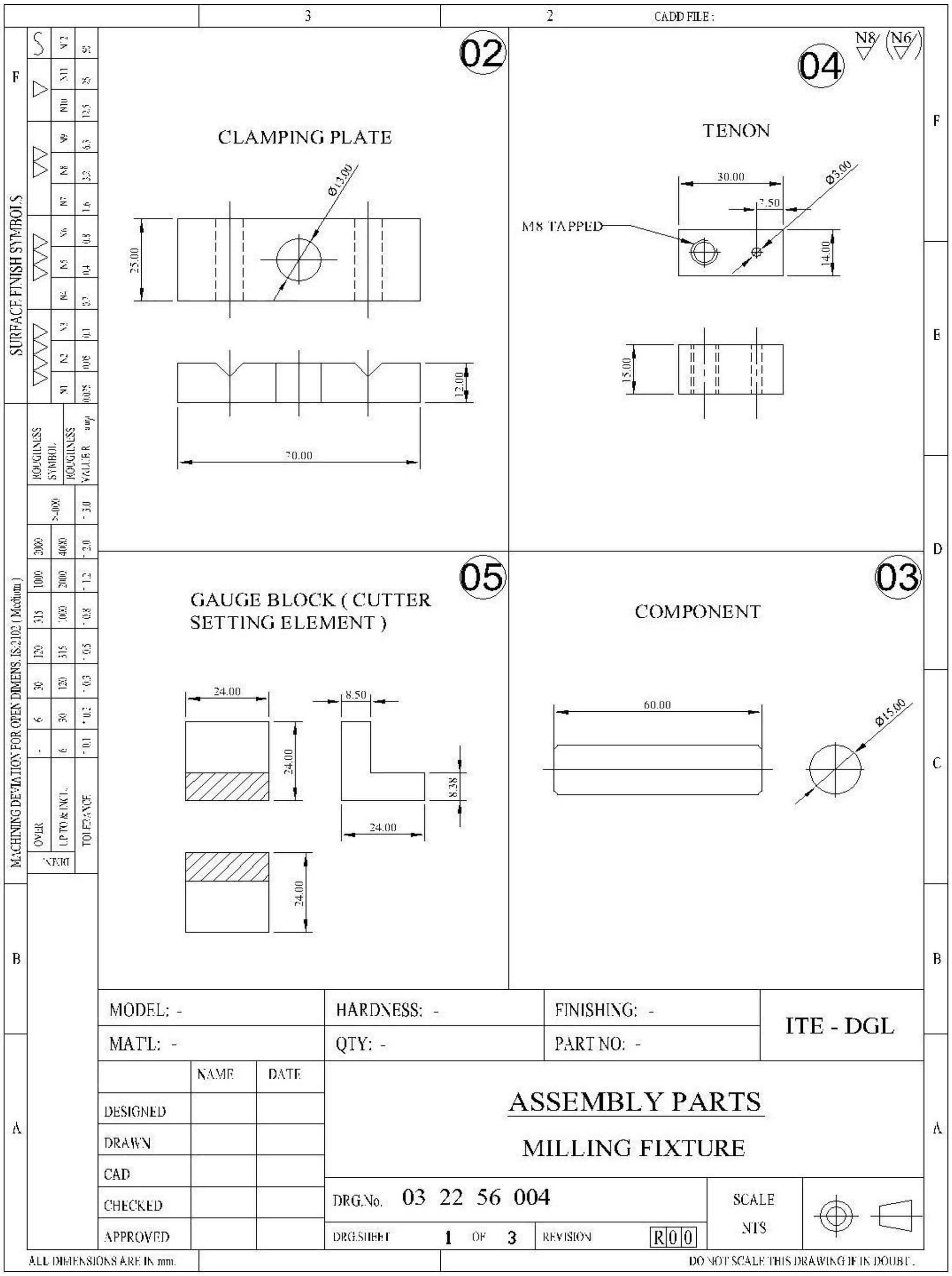

M6X2 HOLES TAPPED
51.00
60.00
50.00
6.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
ITE - DGL
SUPPORTING PLATE
CHANNEL JIG
MODEL :
MATL : M.S
HARDNESS:
QTY : 1 no
FINISHING: 60x50x10
PART NO : ---
NAME
DATE
DESIGNED
DRAWN
CHECKED
APPROVED
DRG.No. 03 22 56 002
DRG SHEET 4 OF 5
REVISION R00
SCALE NTS

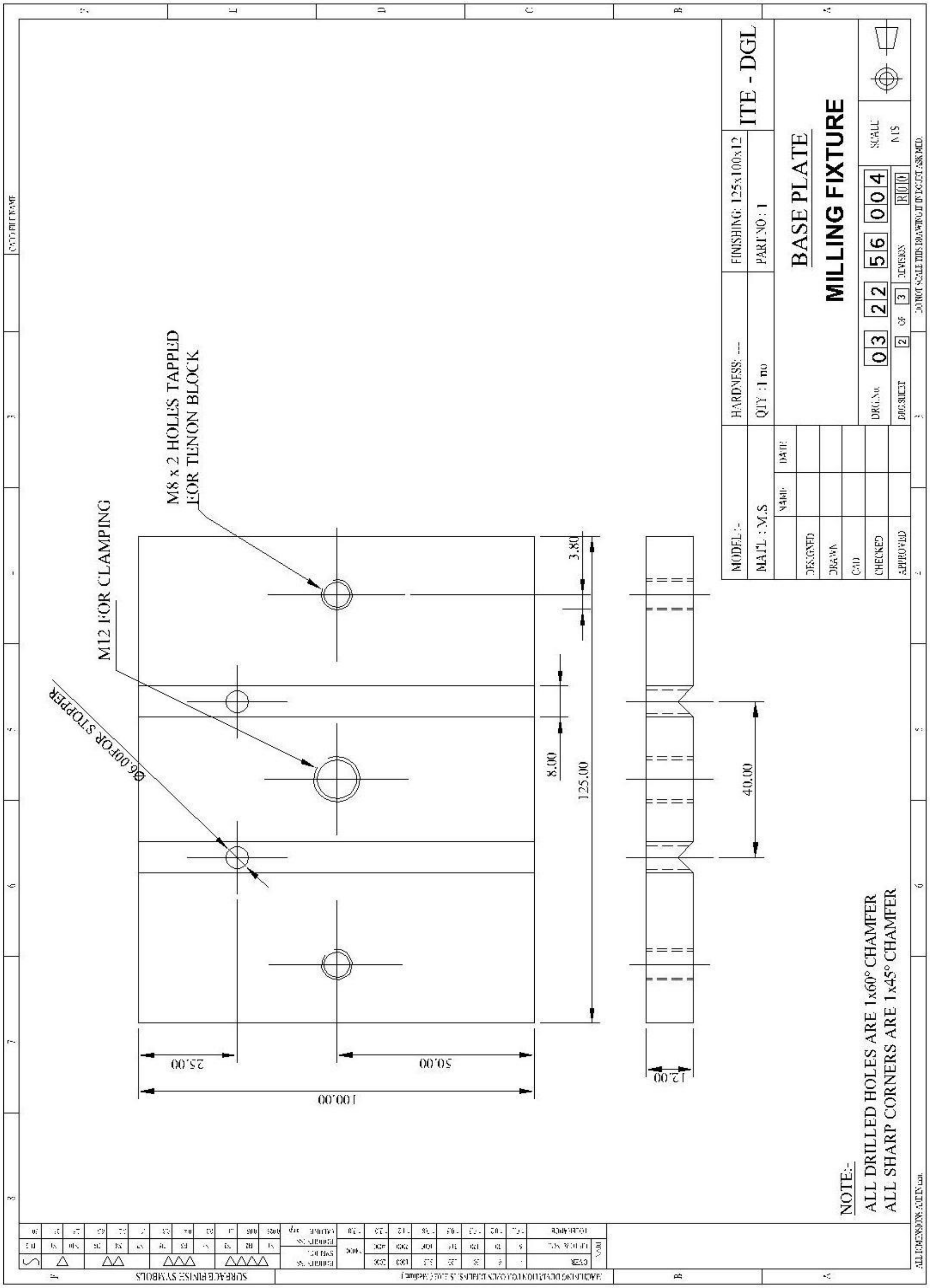

M6 BOLT
M8 BOLT
JIG BUSH
Ø18.00
5.00
Ø6.00
Ø12.00
25.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
ITE - DGL
FINISHING:
PART NO :
HARDNESS:
QTY :
MODEL :
MATL :
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS
CHANNEL JIG
DRG No.
03 22 56 000
1 OF 5
R00
SCALE
NTS
SURFACE FINISH SYMBOLS
TOLERANCE

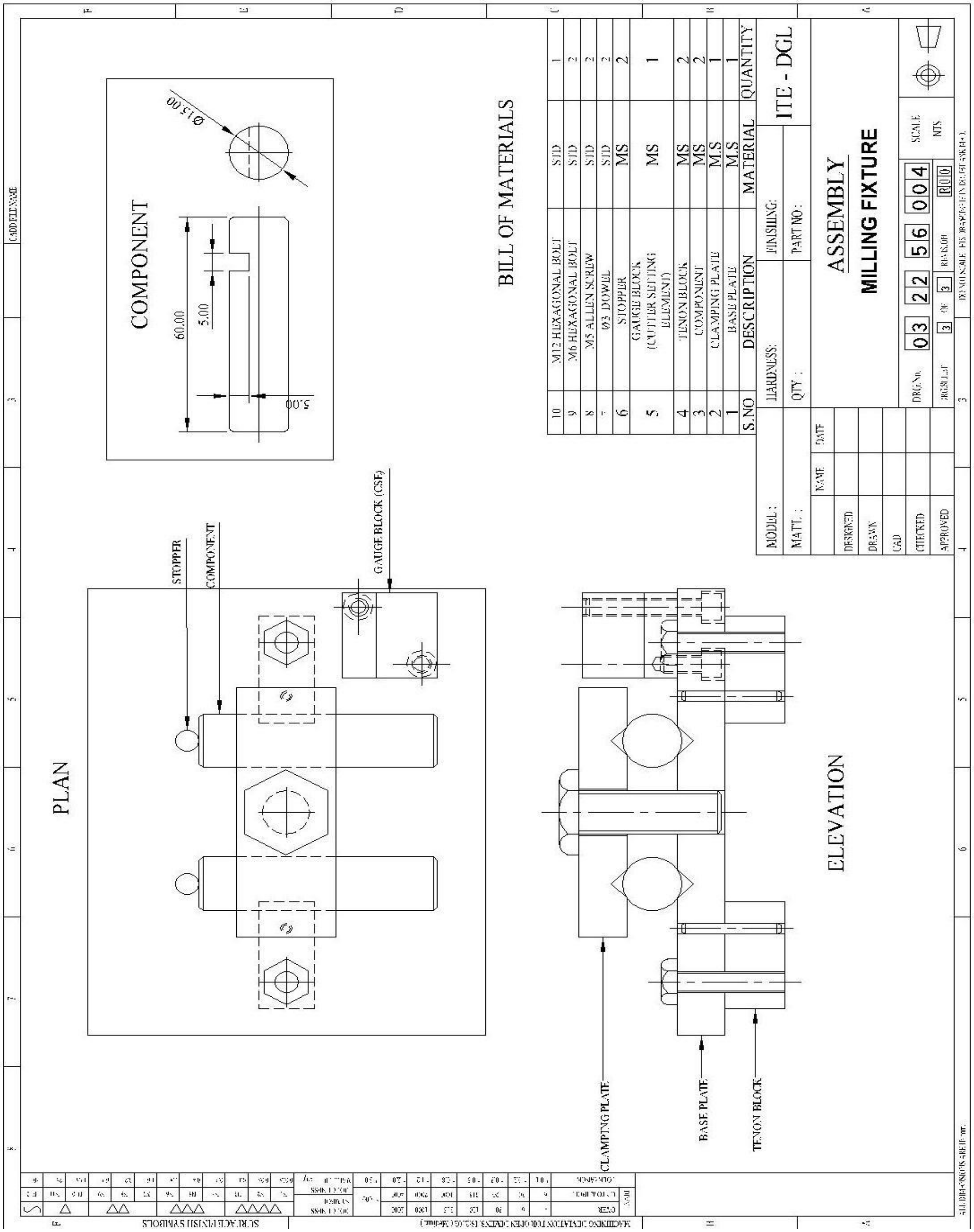

BILL OF MATERIALS
SL.NO
NAME
MATERIAL
QTY
5
M8 BOLTS
STD
2
4
M6 BOLTS
STD
2
3
JIG BUSH
M.S
2
2
JIG PLATE
M.S
1
1
WORK PIECE
M.S
1
ITE - DGL
ASSEMBLY
CHANNEL JIG
03 22 56 002
R00
SCALE
NTS
PLAN
SECTIONAL ELEVATION
20.00
40.00
60.00
50.00
6.00
Ø6.00
Ø12.00
Ø18.00


BILL OF MATERIALS
SL.NO
NAME
MATERIAL
QTY
5 M8 BOLTS STD 2
4 M6 BOLTS STD 2
3 JIG BUSH M.S 2
2 JIG PLATE M.S 1
1 WORK PIECE M.S 1
MODEL :
MAT'L :
HARDNESS:
QTY :
FINSHING:
PART NO :
ITE - DGL
ASSEMBLY
CHANNEL JIG
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG. No.
0 3 2 2 5 6 0 0 2
SCALE
NTS
PLAN
SECTIONAL ELEVATION
20.00
40.00
60.00
50.00
6.00
Ø6.00
Ø12.00
Ø18.00
SURFACE FINISH SYMBOLS

Exercise – I Milling Fixture

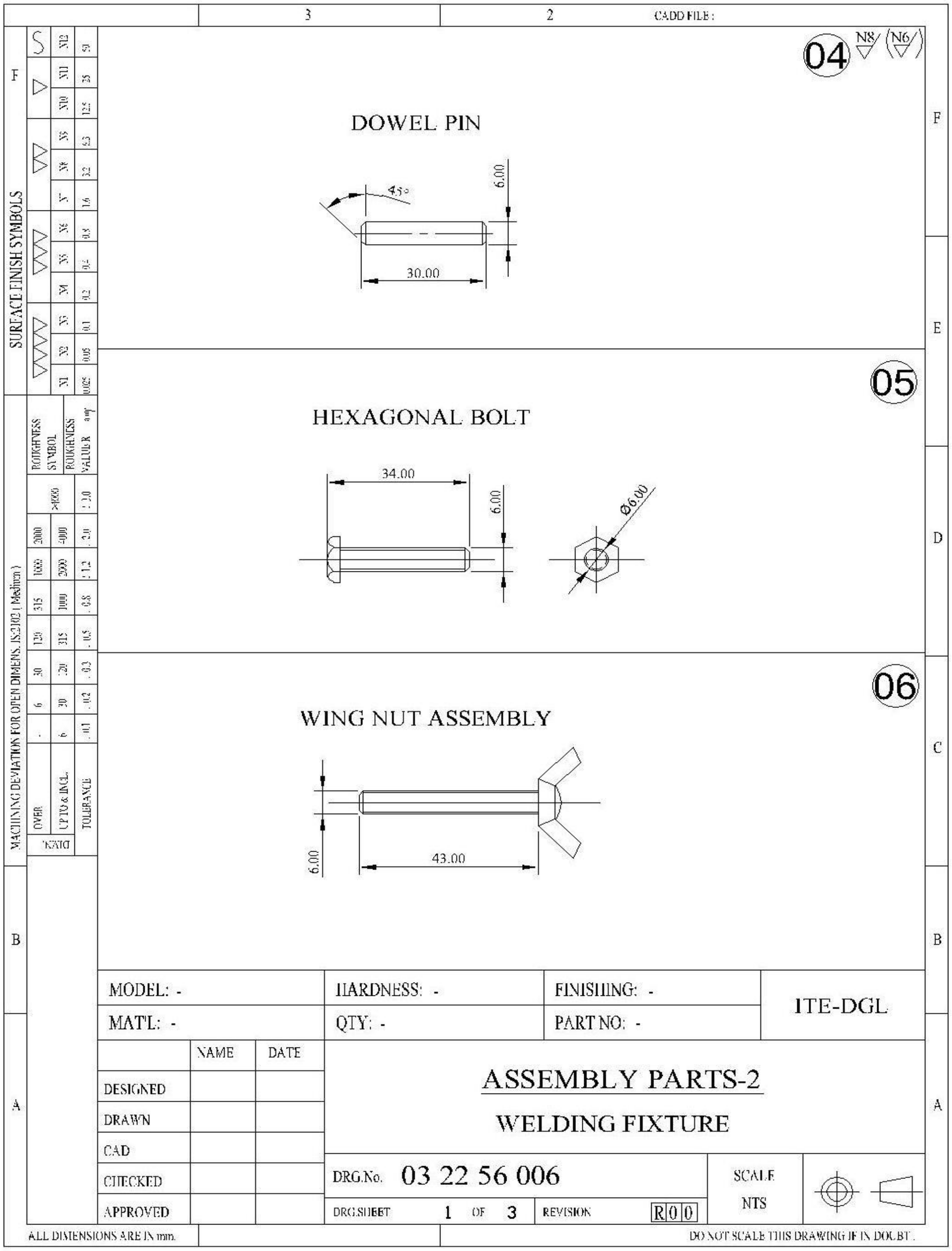


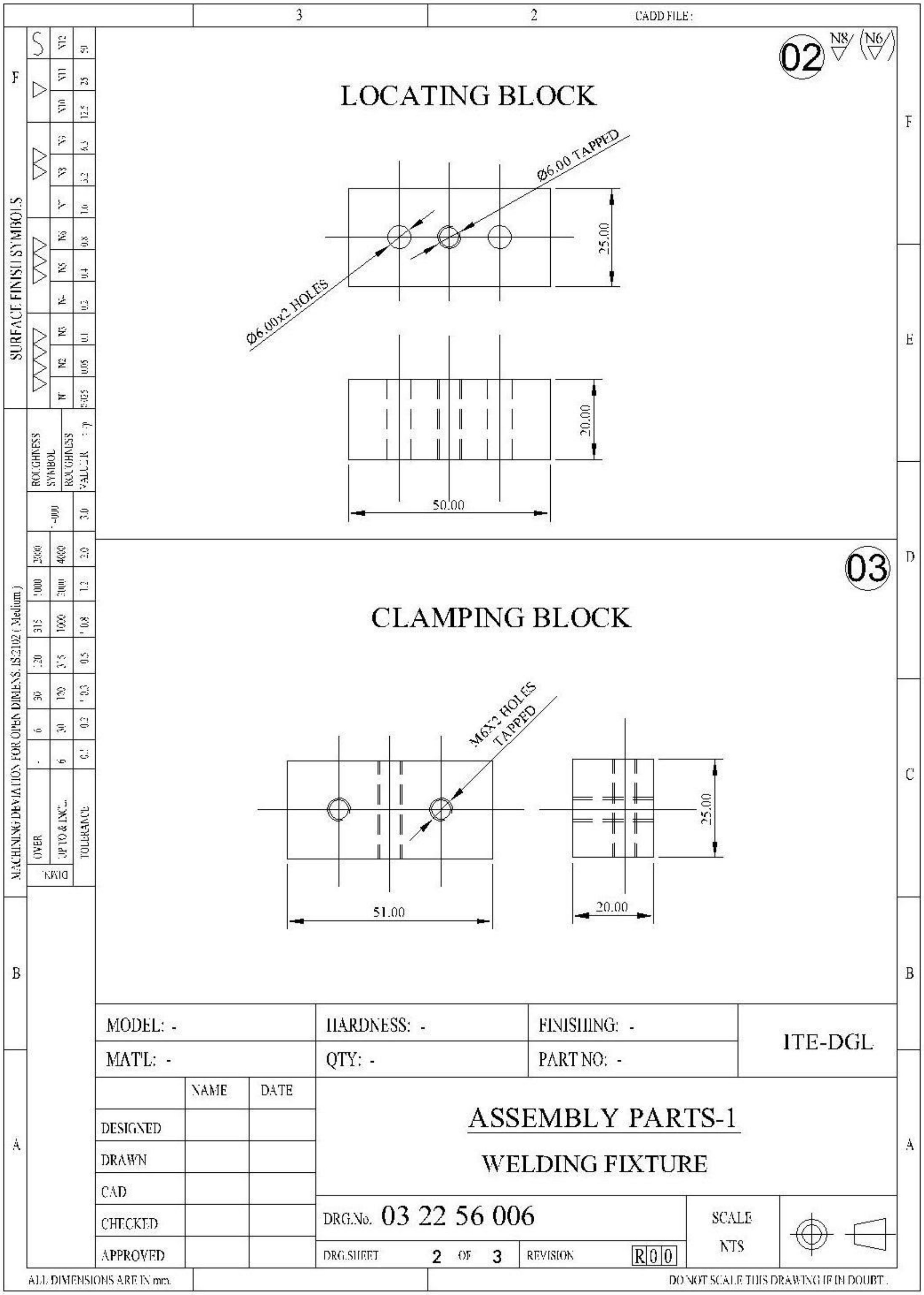

ITE - DGL
FINISHING: 125x100x12
HARDNESS: ---
PART NO: 1
QTY :1 no
MODEL:-
MAT'L : M.S
BASE PLATE
MILLING FIXTURE
DRG.No. 03 22 56 004
SCALE NTS
M8 x 2 HOLES TAPPED FOR TENON BLOCK
M12 FOR CLAMPING
Ø6.00FOR STOPPER
3.80
8.00
125.00
40.00
25.00
50.00
100.00
12.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS



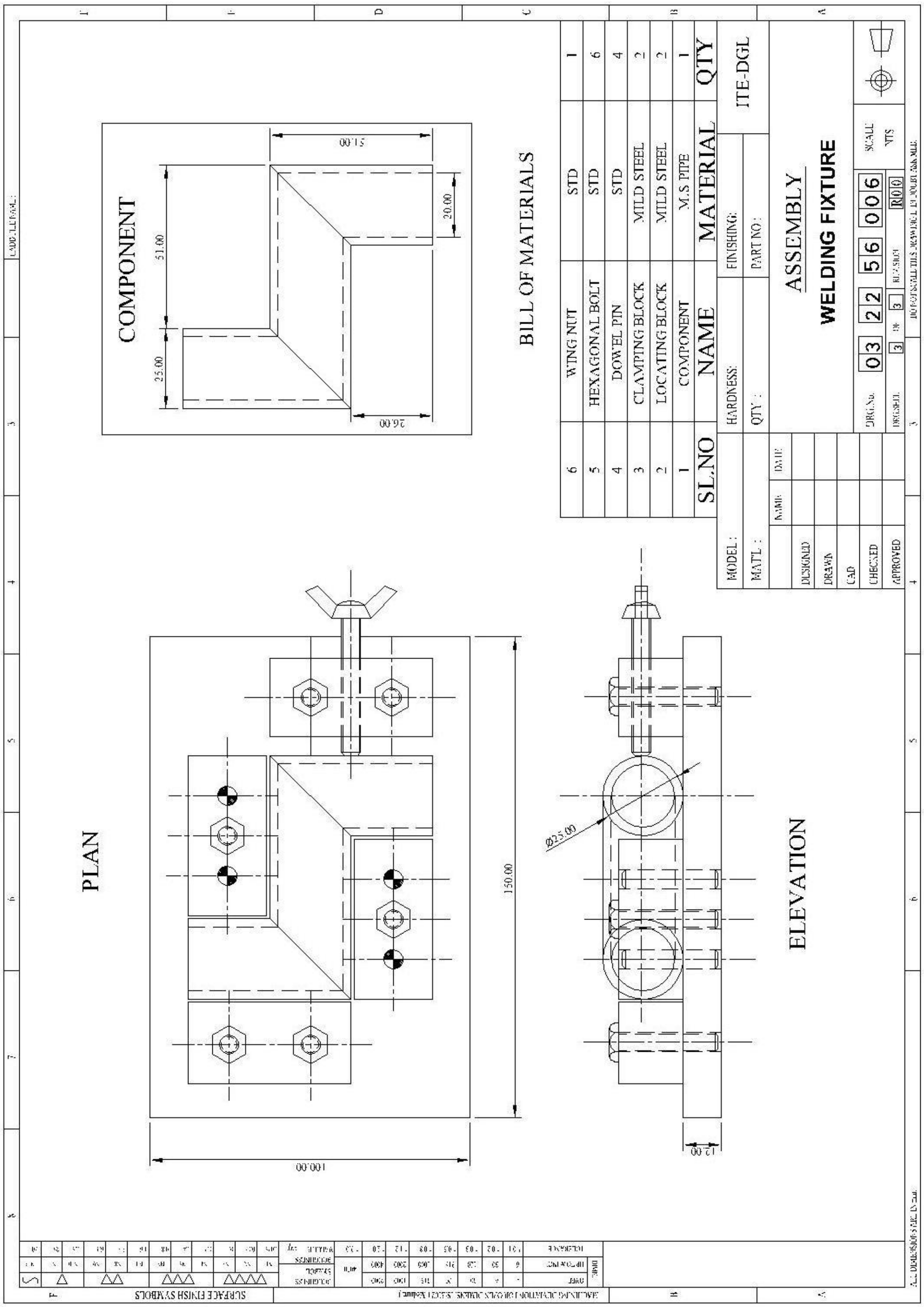
S.NO	DESCRIPTION	MATERIAL	QUANTITY
10	M12 HEXAGONAL BOLT	STD	1
9	M6 HEXAGONAL BOLT	STD	2
8	M5 ALLEN SCREW	STD	2
7	Ø3 DOWEL	STD	2
6	STOPPER	MS	2
5	GAUGE BLOCK (CUTTER SETTING ELEMENT)	MS	1
4	TENON BLOCK	MS	2
3	COMPONENT	MS	2
2	CLAMPING PLATE	M.S	1
1	BASE PLATE	M.S	1

Exercise – II Welding Fixture





CADD FILE :
02
LOCATING BLOCK
Ø6.00 TAPPED
Ø6.00x2 HOLES
25.00
20.00
50.00
03
CLAMPING BLOCK
M6X2 HOLES TAPPED
25.00
51.00
20.00
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
MODEL: -
HARDNESS: -
FINISHING: -
ITE-DGL
MATL: -
QTY: -
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
WELDING FIXTURE
DRG.No. 03 22 56 006
SCALE
NTS
DRG.SHEET 2 OF 3
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.


COMPONENT
51.00
25.00
26.00
20.00
BILL OF MATERIALS
6 WING NUT STD 1
5 HEXAGONAL BOLT STD 6
4 DOWEL PIN STD 4
3 CLAMPING BLOCK MILD STEEL 2
2 LOCATING BLOCK MILD STEEL 2
1 COMPONENT M.S PIPE 1
SL.NO NAME MATERIAL QTY
PLAN
150.00
100.00
ELEVATION
Ø25.00
12.00
MODEL :
MATL :
HARDNESS:
QTY :
FINISHING:
PART NO :
ITE-DGL
ASSEMBLY
WELDING FIXTURE
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
03 22 56 006
R00
SCALE
NTS
SURFACE FINISH SYMBOLS

1220235130	JIGS, FIXTURES AND GAUGES	L	T	P	C
Practicum		3	0	2	4

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1220235210	PLASTIC MOULDING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Introduction:

To be a Mould engineer, it is necessary to understand the various recent technologies that are being used in the process of conversion of raw plastic materials into end products of plastic components. So, it is very essential to learn the basics of various moulding technologies and processes that are available and predominantly used in the industries.

Course Objectives:

- Acquire knowledge about types of moulds and its processes
- Acquire knowledge about various injection moulding processes
- Appreciate the safety practices used in moulding.
- Explain the injection moulding principles and its various operations
- Explain the Semi-Automatic and Automatic injection moulds and its working principles
- Explain the compression moulding machine principles and its various operations
- Explain transfer moulding machines
- Describe the various methods of decoration of plastic products

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Gain knowledge in different plastics materials and various moulding processes

CO2: Understand the various types of injection moulding machines and design of injection

CO3: Gain knowledge in injection mould design and intermediate mould

CO4: Understand the design concept of compression, transfer and blow mould

CO5: Describe the decoration techniques,platingtechniquesusedforplastic components

1220235210	PLASTIC MOULDING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Pre-requisites:

Knowledge Of basic science

1. Awareness of facts or being competent
2. Design, Development, Governance, and application

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	3	2	1
CO2	3	3	2	3	2	3	1
CO3	3	3	2	3	2	2	1
CO4	3	3	2	3	3	2	1
CO5	3	3	2	2	3	2	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- SimulationandReal-WorldPractice:Conductdemonstrationsandhands-onactivitiesinasimulated environment, transitioning to real-world scenarios when possible.

1220235210	PLASTIC MOULDING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

1220235210	PLASTIC MOULDING TECHNOLOGY	L	T	P	C
THEORY		3	0	0	3

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents

Unit I	Plastic Materials and Processing techniques	
Plastics: Introduction – type of Plastics- Thermo Plastic Materials – ThermosettingMaterials–CommodityPlastics–Engineeringmaterials–Density-MeltingTemperature — Shrinkage — Bulk Factor — Moulding Properties — Applications —Additives-Master Batches–Pigments. **Injection Moulding:** Hot Runner Injection Moulding Process, Multi colour and multicomponent Injection Moulding Process, Reaction Injection Moulding Process**.** **Blow Moulding**: concept and working principle only **Compression & Transfer Moulding** — Compression Moulding Procedure-Difference between Injection and Compression moulding.-Transfer Moulding –Advantages and Disadvantages. **Other processes:** Rotational Moulding, Thermoforming, Extrusion-Pipe extrusion, Blown film, Cast film extrusion, Rod Extrusion–Co extrusion		9
Unit II	**Injection Moulding machine, injection mould and its functional systems**	
Injection Moulding Machines: Basic parts and functioning of an injection moulding machine. Types of injection moulding machine (Screw type & Plunger Type) – Single stage and two stage – Clamping unit (Toggle & Hydraulic) - Types of nozzles – Typical injection. Moulding cycle, Cycle time - Machine specifications (Definition only).**Injection Mould: - Terms** used in connection with injection moulds, Classification of moulds, Functions of the injection moulds**. Functional systems of injection mould** – **Sprue and runner system** - Runner, Cross section shape, Runner size, Runner layout – Gates, Necessity, Centre gate, Edge gate, Balanced gating, Types of Gates. **Core and Cavity-** Shrinkage calculation - Core and cavity dimension. **Parting surface:** Flat Parting surface – Non flat parting surface - Venting – Mould clamping - direct, indirect. **Cooling System**–Cooling Integer type cavity plates–Cooling integer type core plate-Cooling bolster–Coolingcavityinserts–Coolingcoreinserts–aterconnectionandseals.(Concept&Descriptionofdesignonly) **Ejectionsystem**:Ejectorgrid-Ejectorplatesassembly–Ejectorrod,EjectorPlateandejectorretainingplate-		9

Methods of Ejection—Ejection from fixed half-Sprue puller.		
Unit III	**Injection Mould Design & Intermediate Moulds**	
Basic procedure for mould design: Determination of mould size–Maximum number of cavities, Clamping force, Maximum clamping area, Required opening stroke. Computation of number of cavities, cavity layouts, number of parting lines, Design of runner and gate. **3.2 Intermediate Moulds:** Moulding external undercuts-Split mould - Finger cam, dog leg cam& track. Hydraulic & spring actuation of split - Side core and side cavity, Methods of actuation - Mould with internal undercut: Form pin, actuation, split core, jumping off - Mould for threaded component: Manual & automaticun screwing methods hand mould for rotating &lose core methods - Multi day light mould — Under feed mould — Tripleday light mould — Hot runner unit mould, Advantages and Limitations, Hot runner nozzles &sprue, runner less mould -Materials for Injection Mould — Standard Mould systems, Advantages and limitations**(**Concept & Description of design only).		9
Unit IV	**Compression, Transfer and Blow moulding**	
4.1 Compression & Transfer Moulding Machines: - Type of compression Moulding Machine – Toggle type mechanical machine – Hydraulically operated Machine – Auxiliary Ram type machines (Vertical Transfer Machine) – Bottom Transfer Machine – Machine Parts – Machine Specifications- Pot and plunger Transfer machines **4.2 Compression mould Design:** Economic determination of no. of cavities, flash thickness allowances, design of mould cavity, design of loading chamber, bulkfactor, loading chamber depth & heat requirement for heating the mould related to –curing time, breathing time. Materials for Compression mould. **4.3 Blow moulding Machines -** Extrusion Blow Moulding Machine (EBM) – Stretch Blow Moulding Machine (SBM) – Injection Blow Moulding Machine (IBM) – Machine Parts—Machine Specifications. **4.4 BlowMouldDesign:**Mouldlayout,pinchoff,venting,Headdiedesign,parison diametercalculation,shrinkagecalculation,designofmouldclampingaccessories		**9**

Unit V	PlasticProductDesign,DecorationofPlasticProductsandMaintenance&Repair of Injection Moulds	
5.1PlasticProductDesign: Wallthickness-Ribsandprofiledstructures—Gussets or support ribs-Bosses-Holes- Radii &Corners- Tolerances - Coring -Undercuts—Draft angle. **5.2 Decoration of Plastic Parts:** Painting and coating (Dipping, Spraying andDepositing)–Metalizing(Vacuummetallization,Vacuumevaporation,sputtering) – Plating (Electroless plating, Electrolytic plating) - Flame and arc spraying - hotfoil stamping — hot transfer — In mold decorating - Water transfer — Printing–Laser Marking, Vapor polishing, Decals- Understanding Recycling Codes. **5.3MaintenanceofInjectionMoulds:** Advantages of Preventive maintenance, Maintenance of - cooling lines, mould surfaces, heating & control systems. Action taken after examination and cleaning. Repair and alterations of injection moulds		**9**
	Total Hours	45
	Test & Model Examinations	10

Suggested List of Students Activity:

- Presentation / Seminars by students on any recent technological development based on the course
- Online MCQ have to be conducted for all the five units

Text and Reference Books:

1. EIRI Board,Introduction To The Injection Moulding Of Plastics,2nd edition, Engineers India Research Institute,2008
2. Jose Valero,Plastics Injection Molding,4th edition,Hanser Publications,2020
3. Phoebe H Kauffer, Injection Molding: Process, Design, & Applications,3rd edition, Nova Science Publishers Inc,2011

Web-based/Online Resources:

1. https://youtu.be/b1U9W4iNDiQ?si=Ch2MHkKCxE-Jtzfc
2. https://youtu.be/dgadvQmCrSE?si=71Fq7zYMyDbjPARc
3. https://youtu.be/dgadvQmCrSE?si=PvH5XmgB1HuB-Afm

ENDSEMESTERQUESTIONPATTERN–Theory Exam

Duration: 3 Hrs. Max. Marks: 100

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

1220235330	**TOOL DESIGN AND DRAWING**	L	T	P	C
PRACTICUM		2	0	2	3

Introduction:

To be a mechanical engineer, it is necessary to understand the various recent technologies that are being used in the process of conversion of raw materials into end products. So, it is very essential to learn the basics of various recent technologies and processes that are available and predominantly used in the industries.

Course Outcomes:

CO1: State the different types of limits, fits, and tolerance

CO2: To be able to understand the design of Press tool-cutting type tools

CO3: To be able to understand the design of Non cutting dies (Bending and drawing dies)

CO4: To be able to understand the design of drill jig

CO5: To be able to understand the design of limit gauges (Plug, Snap& Ring gauge)

Pre-requisites:

Knowledge of basic Science
1. Press Tool Applications
2. Selection of Materials
3. Press Tool Efficiency.

CO/PO Mapping

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	3	3	2	3	2	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2
CO4	2	3	3	2	3	2	2
CO5	3	3	3	3	3	2	2

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

1220235330	**TOOL DESIGN AND DRAWING**	L	T	P	C
PRACTICUM		2	0	2	3

Instructional Strategy:

1. Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
2. Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
3. Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
4. Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
5. Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
6. Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies

Assessment Methodology: Assessment Methodology

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Unit-I)	Written test (Unit- II)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	30	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

1220235330	TOOL DESIGN AND DRAWING	L	T	P	C
PRACTICUM		2	0	2	3

CA1 and CA2: Assessment written test should be conducted for 50 Marks for above mention units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks. CA1and CA2, Assessment test should be conducted for above mention units.Answer One questions (1 X 50 Marks = 50 Marks).

CA3: 30 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept

for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Part A (Unit-I & Unit-II)– 60 Marks questions. (Either or type) (1 X 60 = 60 Marks)

Two questions will be asked, One question from Unit-I & Another question from Unit-II students should write one questions.

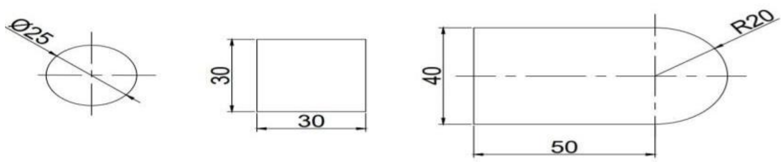
Part B (Unit-III)– 40 Marks questions. (1 X 40 = 40 Marks)

Two questions will be asked from Unit-III, students should write one questions.

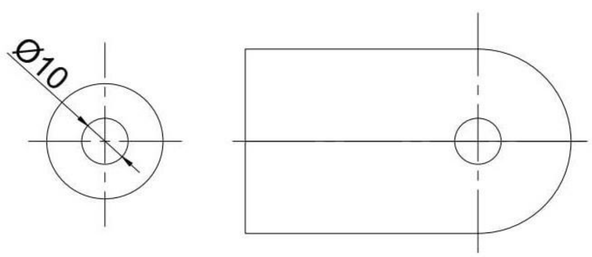
Syllabus Contents

Unit I	DESIGN OF PRESS TOOLS – PART A	
Fourteen steps to design a Die – strip layout types of strip layout – wider win, narrow and other layout – calculating of percentage utilization and percentage stop – method of increasing strip utilization – calculation of cutting force, calculation press capacity – Design of die plate strip; die and punch clearance land, angular clearance – design blanking punches – design piercing punches – method of reducing cutting force in progressive dies – Design punch plate, design plots, Design a stop – finger stop, Automatic stops – Design of strippers, Selection of fasteners and moulds - Selection of die sets drawing – Assembly the pillar draw of dies, Adding plunger of die moulds		40

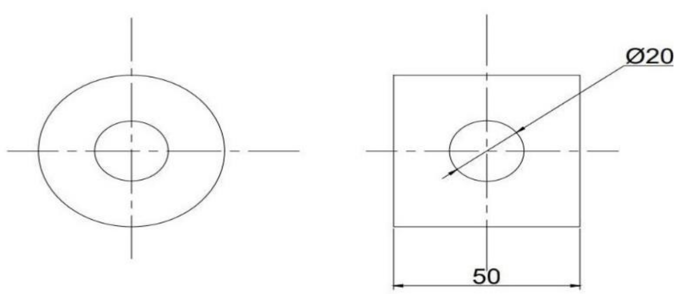
Practical: Design of Blanking Tool



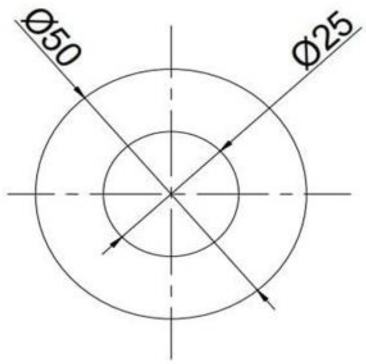
Practical: Design of piercing Tool



Practical: Design of Progressive Tool

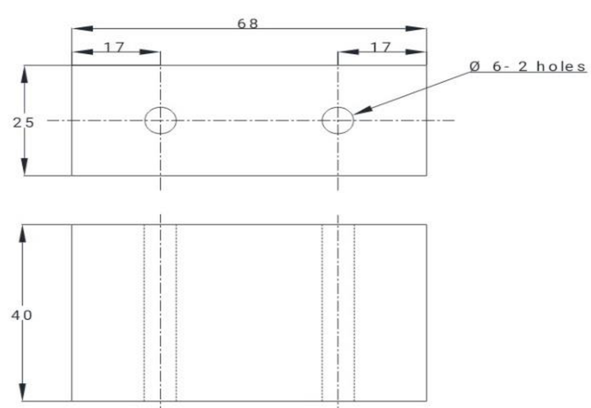


Practical: Design of Compound Tool

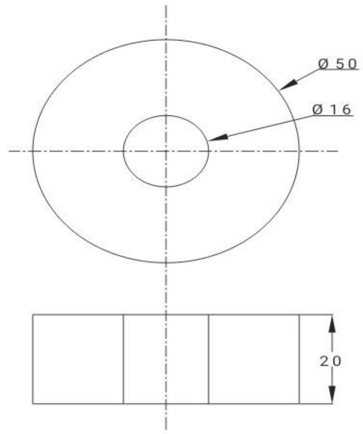


Unit II	**DESIGN OF JIGS AND FIXTURES – PART B**	
Design of Plate jig (turn over type) - Indexing jig - Milling fixture - Grinding fixture		**20**

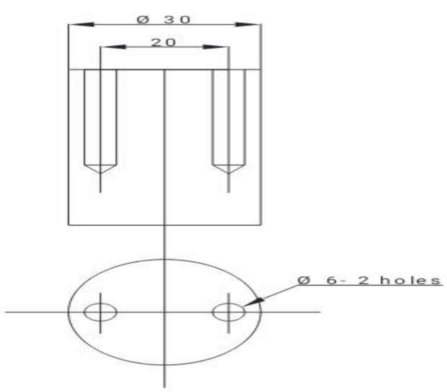
Channel Drill Jig



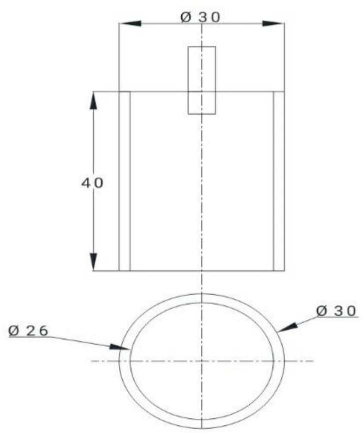
Inspection Fixture



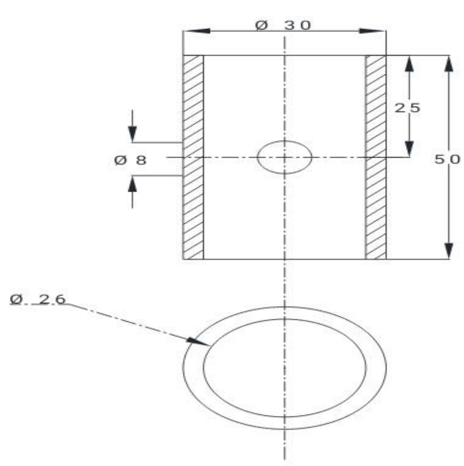
Template Drill Jig

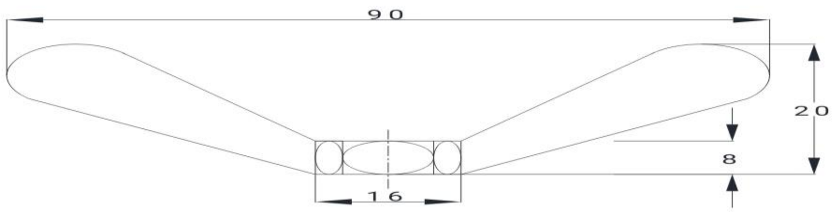


Milling Fixture



Indexing Drill Jig



<table>
<tr><td colspan="2">Welding Fixture

</td><td></td></tr>
<tr><td>Unit III</td><td colspan="2">GAUGE DESIGN</td></tr>
<tr><td colspan="2">1. Design of Plain plug gauge as per IS 3455, IS 6137, IS 6244, IS 6246 and IS 7018 : Part 2
2. Design of snap gauge as per IS 3477
3. Design of plain ring gauges as per IS 3485</td><td>13</td></tr>
<tr><td colspan="2">TEST & MODEL EXAMINATIONS</td><td>07</td></tr>
<tr><td colspan="2">TOTALHOURS</td><td>80</td></tr>
</table>

Text Books & Reference Books:

1. J.R.Paquin, Die design fundamentals, Industrial Press Inc, 1990.
2. Donaldson, Tool Design , Tata McGraw-hill Book company, 23rd edition, 2006
3. Donald F. Eary., Edward A. Reed, Techniques of Press working sheet metal, Prentice-Hall,Inc.,Second Edition, 1974.
4. Indian Standard Specifications **IS 3455, IS 6137, IS 6244, IS 6246 ,IS 7018 : Part 2, IS 3477 and IS 3485.**

1220235330	**TOOL DESIGN AND DRAWING**	L	T	P	C
PRACTICUM		2	0	2	3

Web-based/Online Resources:

1. https://nptel.ac.in/courses/112105206
2. https://nptel.ac.in/courses/112104117
3. https://nptel.ac.in/courses/112103249
4. https://www.classcentral.com/course/youtube-fluid-mechanics-concept-derivation-videos-53034
5. https://fmc-nitk.vlabs.ac.in/fluid-machinery/exp/centrifugal-pump/index.html
6. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/
7. https://eerc03-iiith.vlabs.ac.in/List%20of%20experiments.html
8. https://fm-nitk.vlabs.ac.in/List%20of%20experiments.html

ENDSEMESTERQUESTIONPATTERN–THEORYEXAM

Duration: 3 Hours. **Max. Marks: 100**

Part A (Unit-I & Unit-II)– 60 Marks questions. (Either or type) (1 X 60 = 60 Marks)

Two questions will be asked,One question from Unit-I & Another question from Unit-II students should write one questions.

Part B (Unit-III)– 40 Marks questions. (1 X 40 = 40 Marks)

Two questions will be asked from Unit-III, students should write one questions.

1220235420	**PLASTIC MOULDS PRACTICAL**	L	T	P	C
PRACTICAL		0	0	4	2

Introduction:

Diploma technocrats frequently encounter diverse manufacturing of moulds. This course workshop practice aims to enhance student's comprehension of manufacturing of mouding like injection moulding, compression moulding by using simple machine tools.

Course Objectives:

- Design and fabricate single cavity injection mould
- Design and fabricate multi cavity injection mould
- Design and fabricate blow mould.
- Design and fabricate of compression mould
- Practice on different machining operations
- Use different machine tools in making plastic moulds

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Make plastic moulds using different machine tools such as lathe, milling machine, drilling machine, Grinding machine and EDM

CO2: Design and fabricate single cavity injection mould

CO3: Fabricate a multi cavity injection mould for the given component

CO4: Prepare a Blow mould for the given component

CO5: Design and fabricate of compression mould

Pre-requisites:

Basic Workshop Practices and Basic Engineering Practices.

1220235420	**PLASTIC MOULDS PRACTICAL**	L	T	P	C
PRACTICAL		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	3	2	2	1
CO2	3	2	3	3	3	2	3
CO3	-	-	1	-	3	3	3
CO4	1	-	1	-	3	-	3
CO5	-	3	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies

1220235420	**PLASTIC MOULDS PRACTICAL**	L	T	P	C
PRACTICAL		0	0	4	2

Assessment Methodology:

	Continuous Assessment (40 marks)		End Semester Examination (60 marks)
Mode	Record of Work Done	Model Practical Exam	Practical Examination
Portion	All Exercises	Any one Exercise	04 Exercises
Duration	Regularly	8 Hours	16 Hours
Exam Marks	-	100	100
Converted to	20	20	60
Marks	20	20	60
Internal Marks	40		60

Note:

- Record of work done should be maintained and the same have to be evaluated after completion of each practical exercise for 20 Marks. The total marks awarded should be converted to 20 Marks for the internal assessment
- After completion of all the exercises, Model examination should be conducted as per End Semester Exam question pattern. The marks awarded should be converted to 20 Marks for the internal assessment.

1220235420	PLASTIC MOULDS PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

<table>
<tr><th>Introduction</th><th>Period</th></tr>
<tr><td><u>DETAILED SYLLABUS</u>
<u>i) Design of Plastic Moulds:</u>
1. Injection Mould Design: Methodical approach to mould design.
• Design of Hand injection mould
• Design of three plate mould
2. Design of simple Compression Mould.
3. Design of simple Blow mould.</td><td>12</td></tr>
<tr><td><u>ii) Mould Design and Manufacture Exercises:</u>
1. Design and Fabrication of single cavity hand injection mould with flat parting surface
(To suit to Hand Injection Moulding Machine)
2. Design and fabrication of multi cavity injection mould
(To suit to Hand injection Moulding Machine)
3. Design and fabrication of simple compression mould.
4. Design and fabrication of simple blow mould.</td><td>48</td></tr>
</table>

Note:-

1. Batch size should not be more than 5 students for class work.
2. For examination, exercise should be given to students individually and not in batches.
3. The examination duration is 16 hours.
4. Students should be trained in setting the mould and to make necessary adjustments, trial production using the mould manufactured by them and rectification of mould defects if any.
5. For Board examination any one of the above tool (S.No 1 to 4) is to be manufactured and trial production should be taken. The evaluation of the performance should be based on the component dimensions and finish obtained from the mould manufactured by the student during the 16 hours examination.

Record: Mould drawings for all the exercises should be drawn in A2 sheet Manually, with all calculations filed neatly for Record work. The Design should include the Sectional Elevation, plan view, Bill of materials with all necessary calculation using methodological mould design.

1220235420	**PLASTIC MOULDS PRACTICAL**	L	T	P	C
PRACTICAL		0	0	4	2

Examination:

In the examination students have to Design and fabricate moulds for similar components as practiced in the class work

SCHEME OF EXAMINATION:

Aim & Tools required	-10 marks
Design of Mould	-30 marks
Mould making	-40 marks
Mould setting & trial production	-10 Marks
Viva Voce	-10 Marks
Total	**-100 Marks**
Test & Revision	**- 10 Periods**

Text and Reference Books:

1. Vannessa Goodship, Injection Moulding: A Practical Guide,3rd edition,De Gruyter,2020
2. Jose Valero, Plastics Injection Molding,2nd edition,Hanser Publications,2020
3. Samuel L. Belcher, Practical Guide To Injection Blow Molding,1st edition, CRC Press,2023

Web-based/Online Resources:

4. https://youtu.be/b1U9W4iNDiQ?si=pdAUFCmLJKNfgJ7m
5. https://youtu.be/_ibXqOihtC8?si=5dBfJFrM_5c2fOzW
6. https://youtu.be/AJDXvbAJ3h8?si=ZgYJLzfSO7B0uphT

END SEMESTER EXAMINATION – PRACTICAL EXAM.

Note:

- For examination, exercise should be given to students individually and not in batches.
- **The examination duration is 16 hours.**
- All the exercises have to be completed, any one exercise will be given for examination.
- All the exercises should be given in the question paper. The student is allowed to select by lot or question papers issued by the DOTE Exam section shall be used.
- Record of work done notebook along with the activity report should be submitted for the End Semester Examinations.

1220235420	PLASTIC MOULDS PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

DETAILED ALLOCATION OF MARKS.

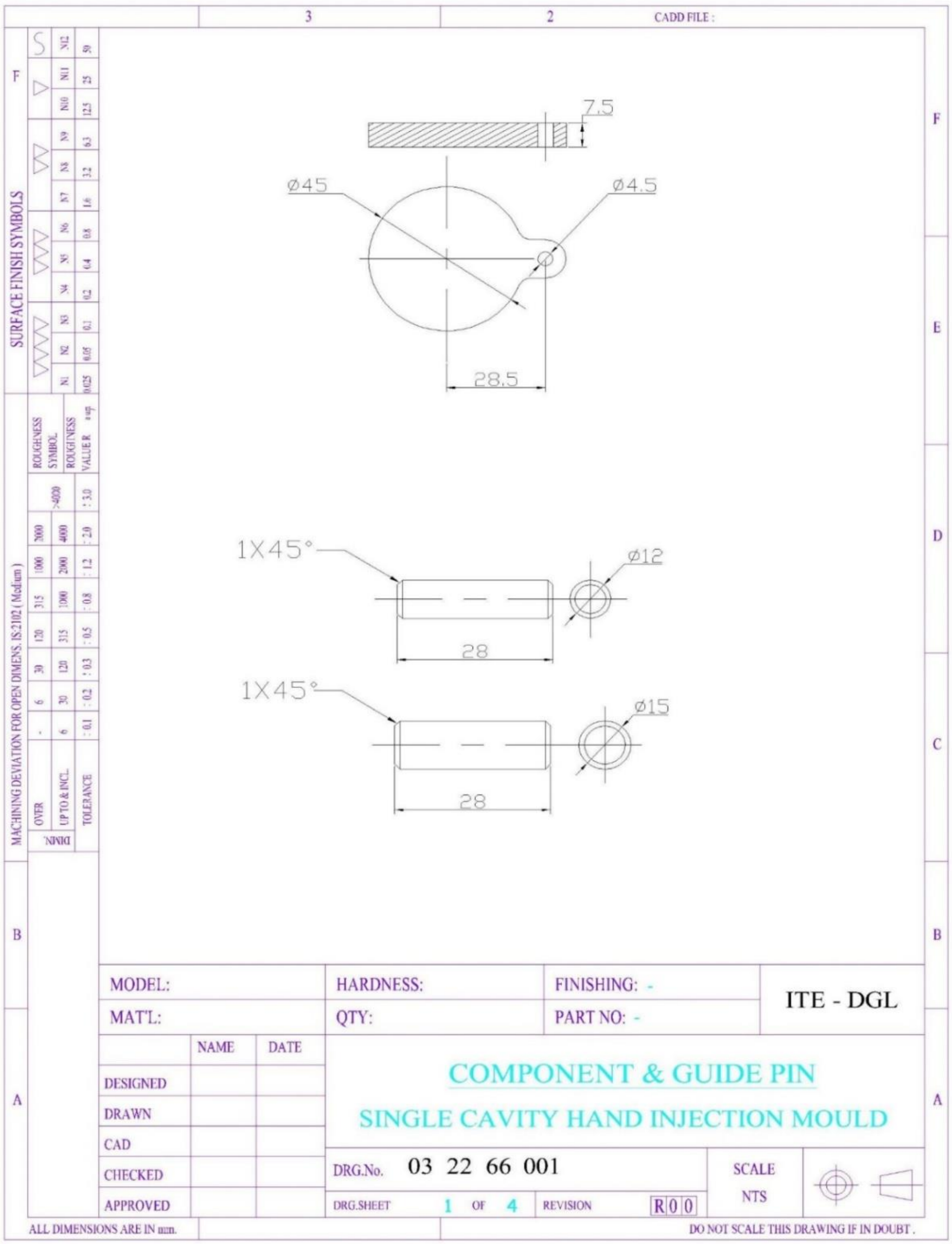
Part	Description	Marks
A	Aim & Tools required	10
B	Design of Mould	30
C	Fabrication of mould	40
D	Mould setting & trial component	10
E	Viva Voce	10
	TOTAL MARKS	**100**

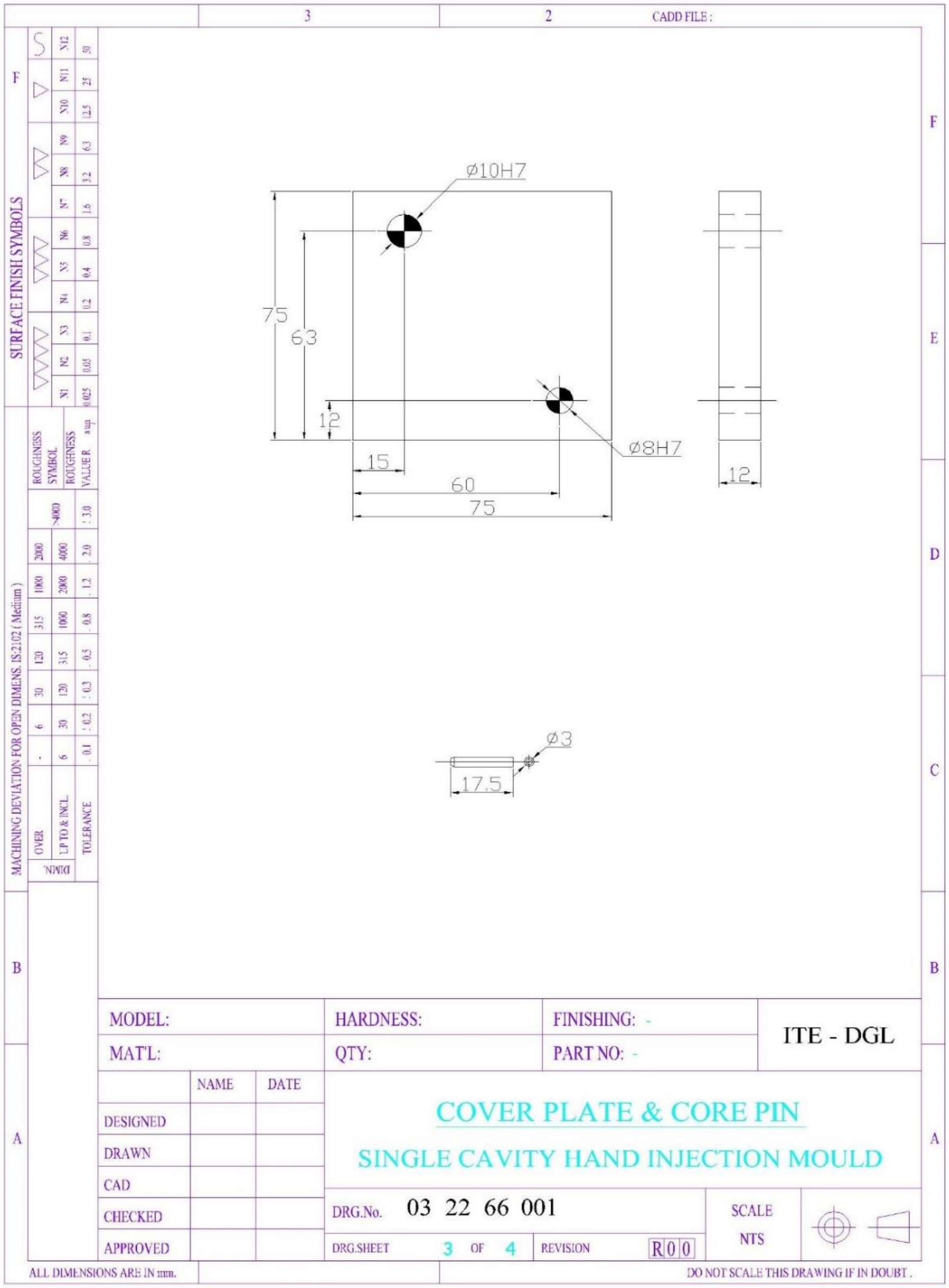
1220235420	PLASTIC MOULDS PRACTICAL	L	T	P	C
PRACTICAL		0	0	4	2

Equipment / Facilities required for conducting the Practical Course.

S.No	Name of the Equipment's	Quantity Required
1.	Centre Lathe, 4 ½' bed length	5
2.	Drilling machine	2
3.	Shaping machine, stroke length 300mm	2
4.	Vertical milling machine	2
5.	Surface grinding machine	2
6.	Hand Injection Moulding Machine – 1 OZ	1
7.	Bench vice	10
8.	Fitting file set	10
9.	Tap set	4
10.	Surface plate	2
11.	Vernier height gauge 0-250mm	2
12.	Dial test indicator with magnetic stand	2
13.	Angle plate	2
14.	Tool maker's straight edge – 150 mm	1
15	Digital Micrometer – 0.-25mm range, 0.001mm least count	3
16	Hand injection moulding machine	1
17	Hand injection Blow moulding machine	1

Exercise–I Single Cavity Injection Mould

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Ø8H7
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15
60
75
12
Ø3
17.5
MODEL:
MAT'L:
HARDNESS:
QTY:
FINISHING: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
COVER PLATE & CORE PIN
SINGLE CAVITY HAND INJECTION MOULD
DRG.No. 03 22 66 001
DRG.SHEET 3 OF 4
REVISION R00
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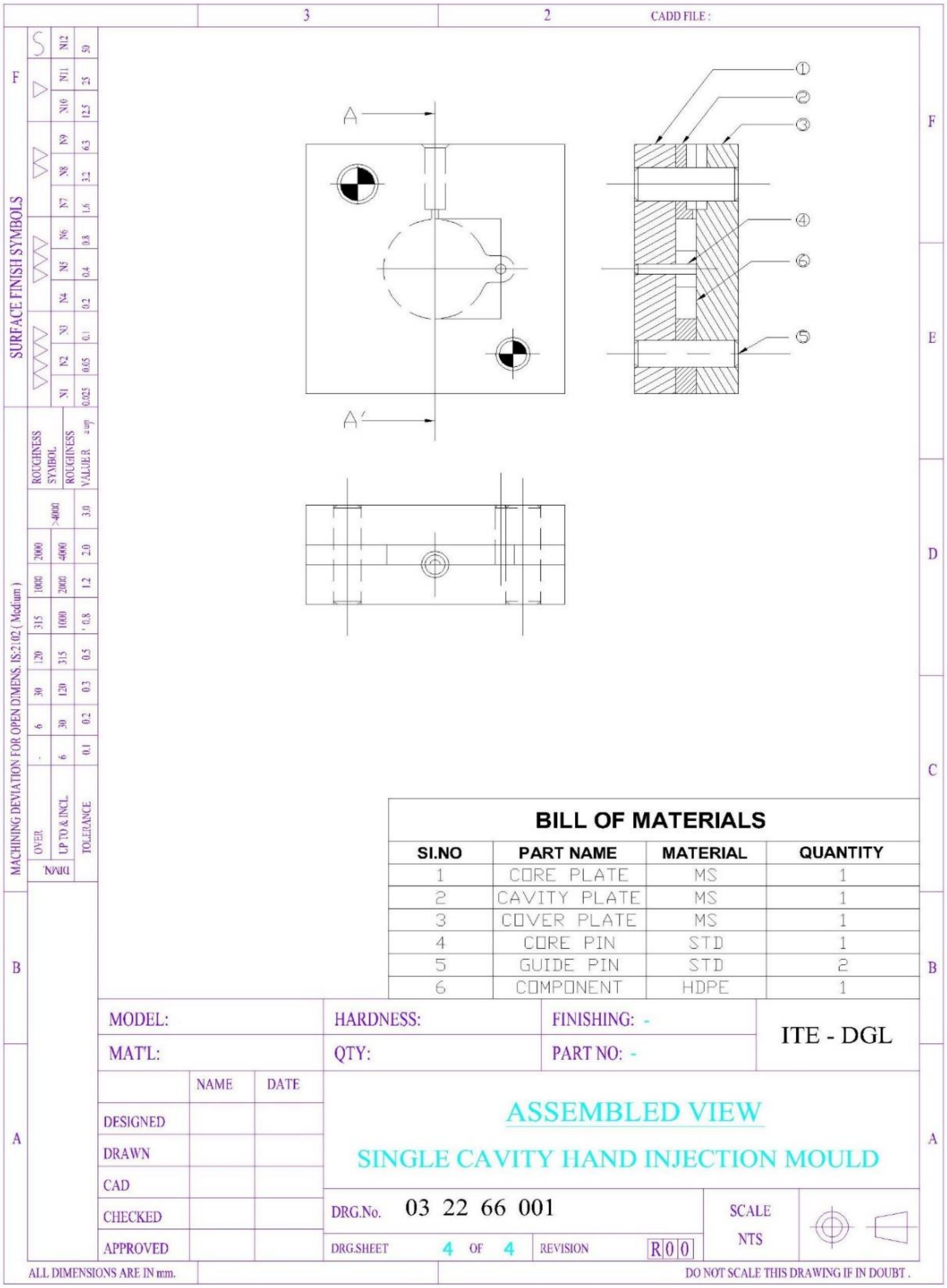
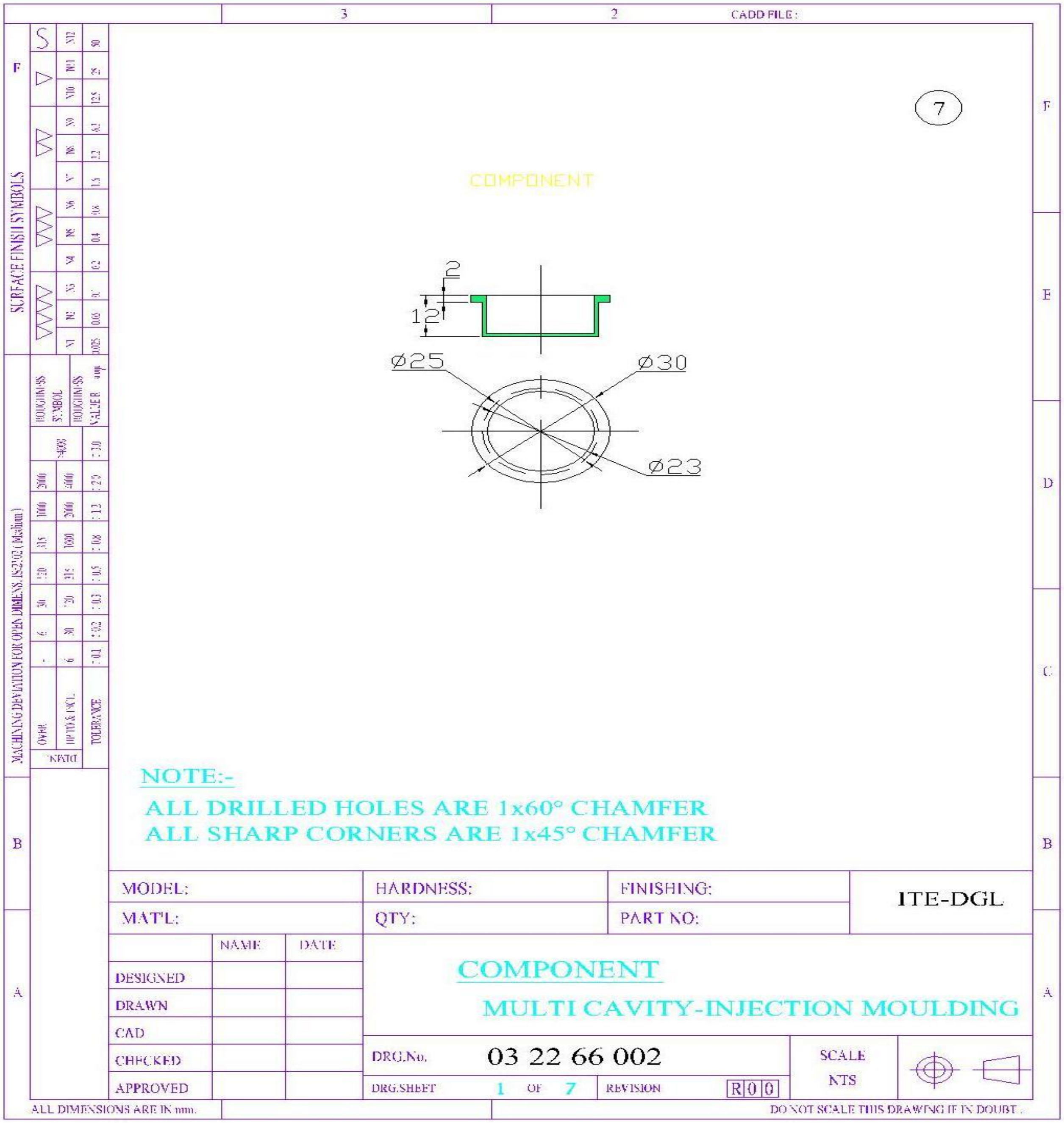
NTS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .



Exercise – II Multi Cavity Injection Mould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7
COMPONENT
2
12
Ø25
Ø30
Ø23
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NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL:
HARDNESS:
FINISHING:
ITE-DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
COMPONENT
MULTI CAVITY-INJECTION MOULDING
DRG.No.
03 22 66 002
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NTS
DRG.SHEET 1 OF 7
REVISION R 0 0
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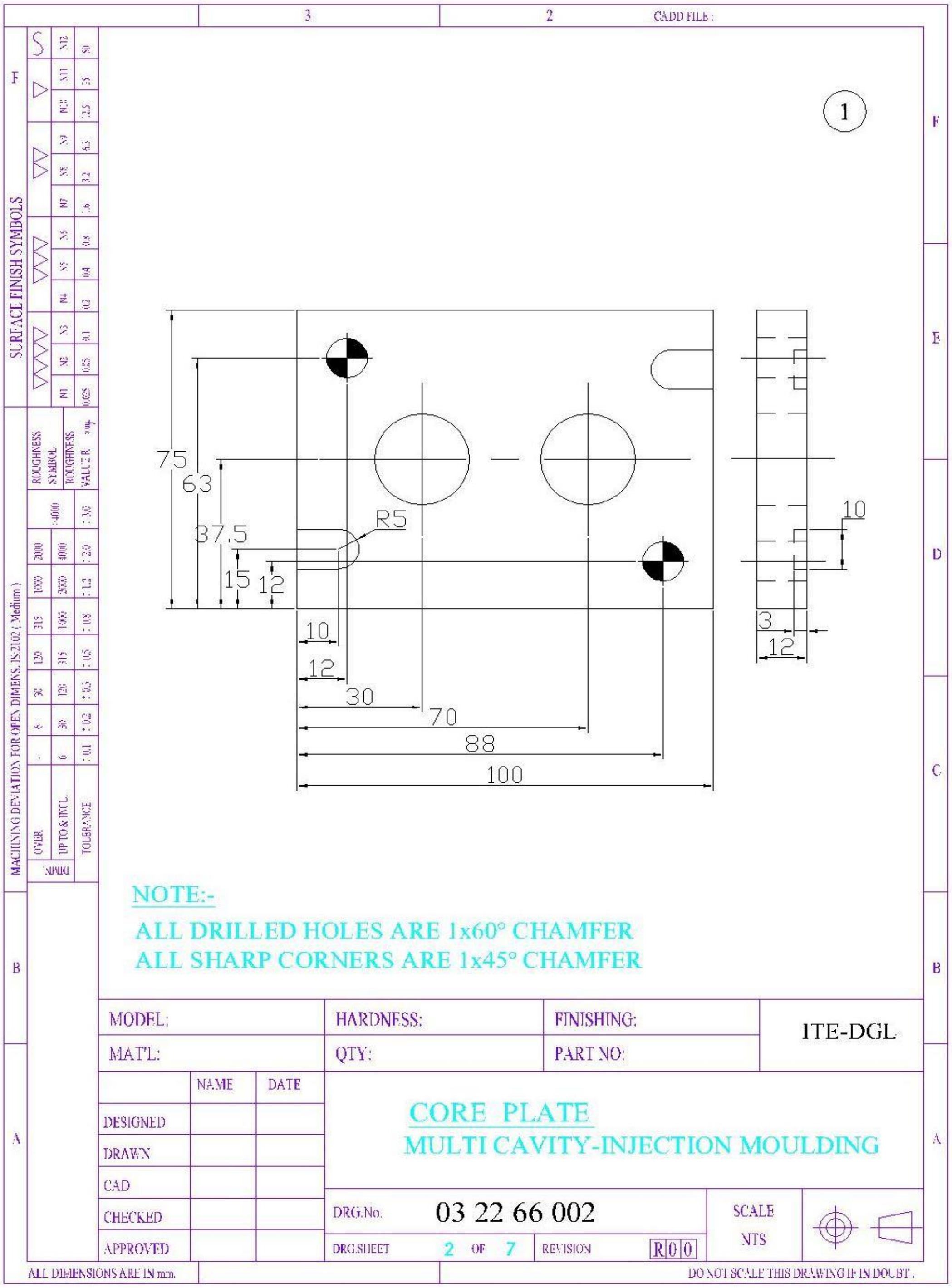
DO NOT SCALE THIS DRAWING IF IN DOUBT .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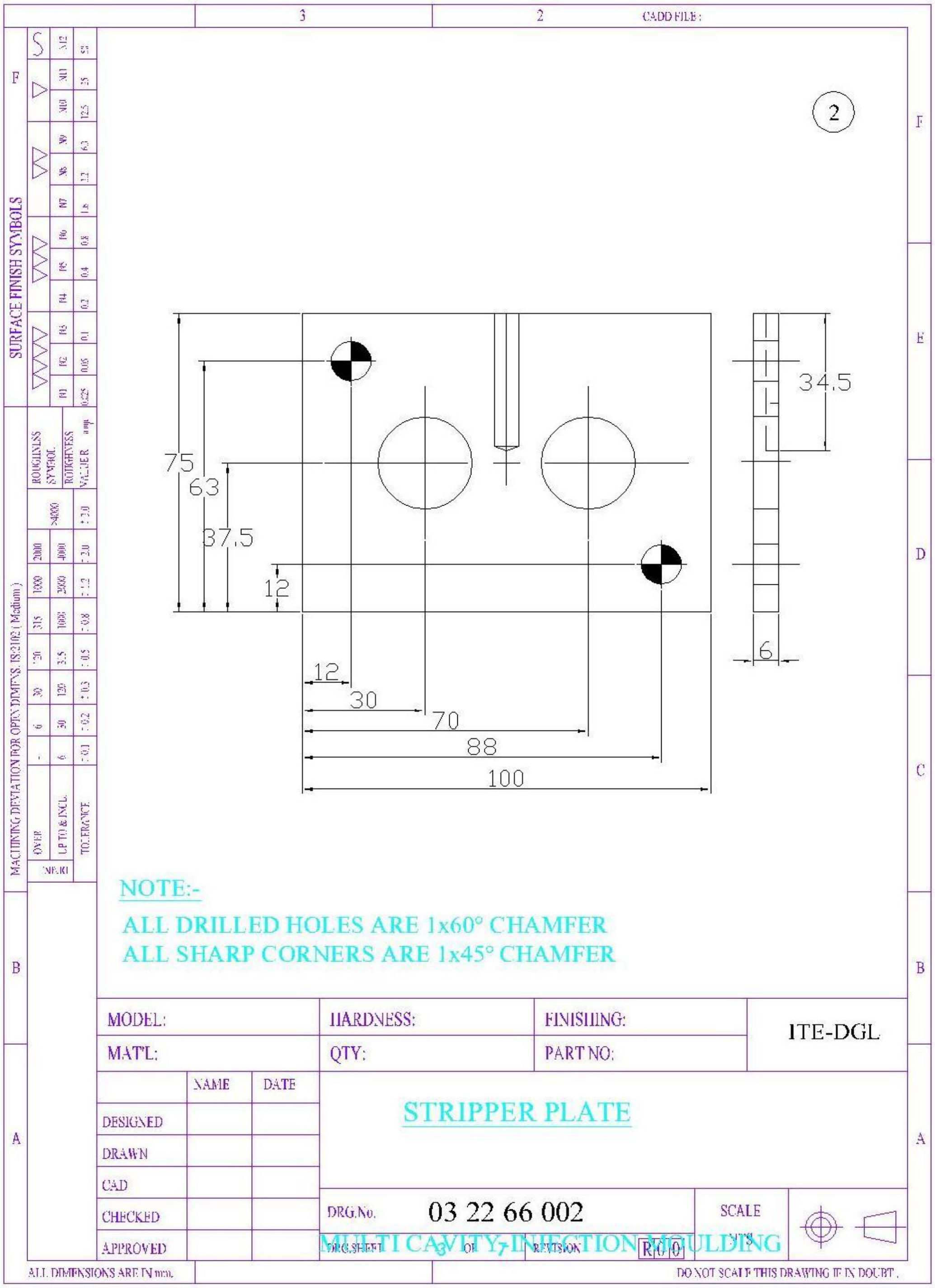
75
63
37.5
R5
15
12
10
12
30
70
88
100
10
3
12
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL:
HARDNESS:
FINISHING:
ITE-DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
CORE PLATE
MULTI CAVITY-INJECTION MOULDING
DRG.No.
03 22 66 002
SCALE
NTS
DRG.SHEET
2 OF 7
REVISION
R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.


2
75
63
37.5
12
34.5
6
12
30
70
88
100
NOTE:-
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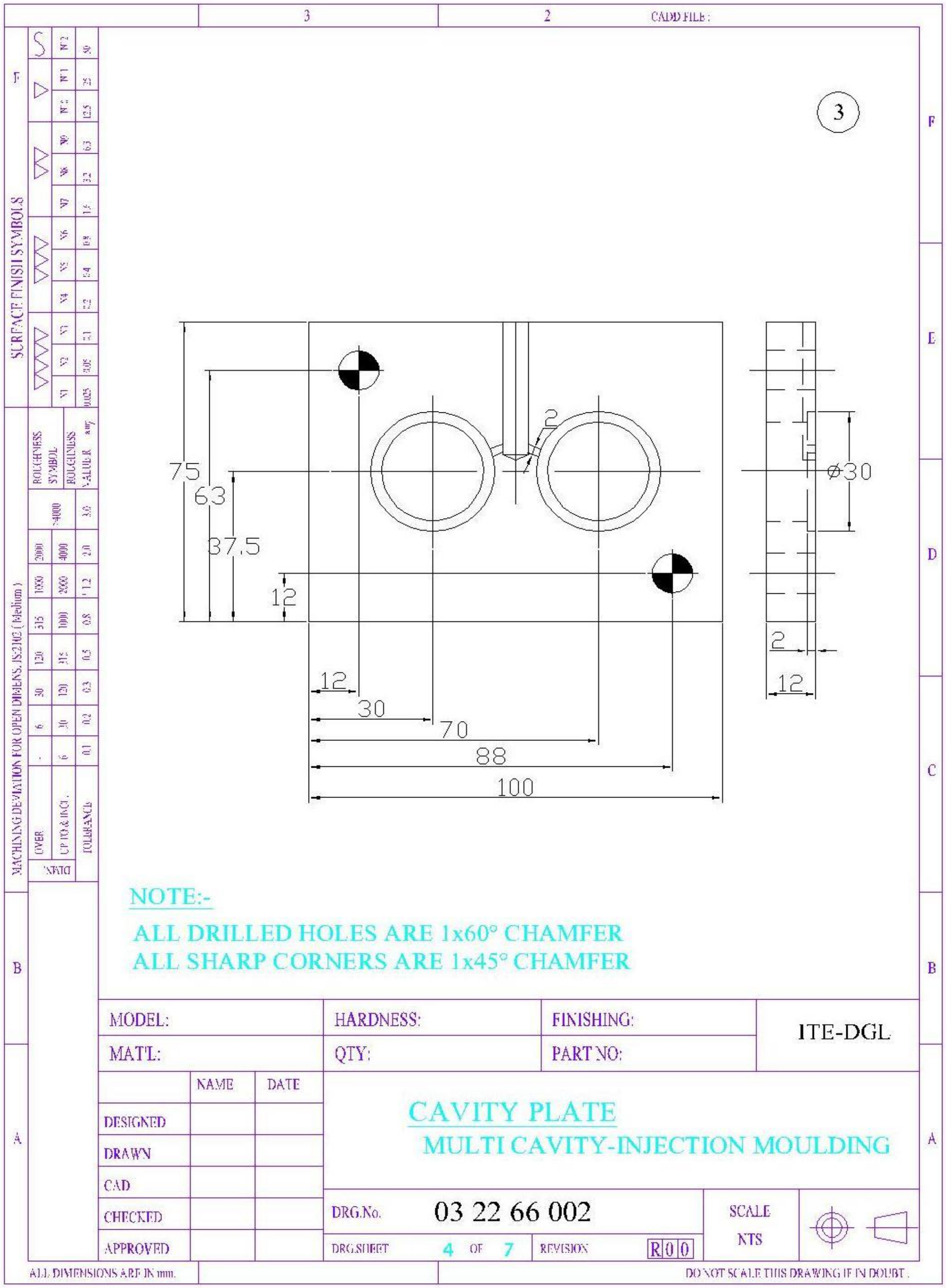
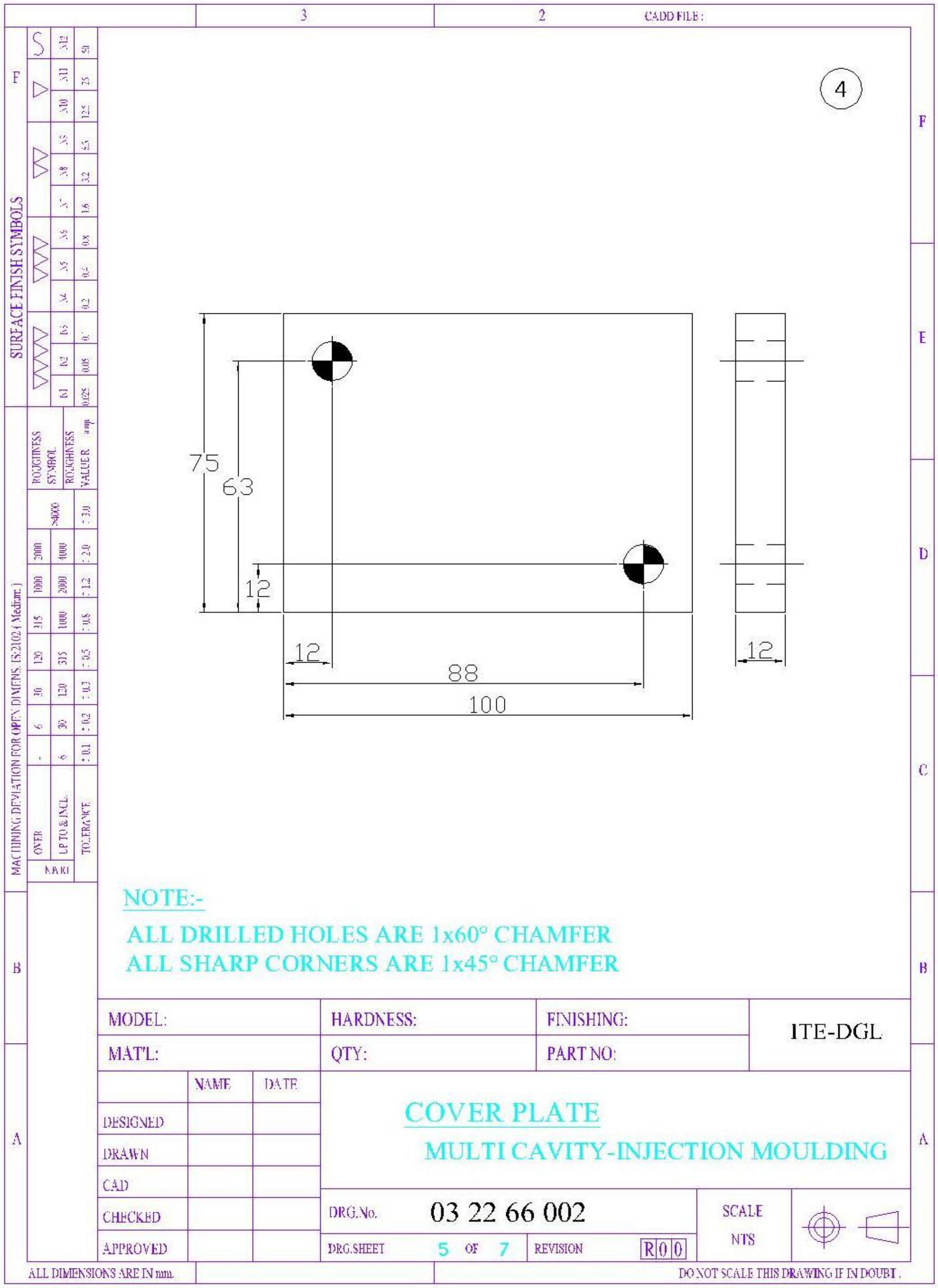
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
MODEL:
HARDNESS:
FINISHING:
ITE-DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
STRIPPER PLATE
DRG.No. 03 22 66 002
SCALE
MULTI CAVITY INJECTION MOULDING
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.



CAVITY PLATE
MULTI CAVITY-INJECTION MOULDING
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL:
HARDNESS:
FINISHING:
ITE-DGL
MATL:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 66 002
SCALE NTS
DRG.SHEET 4 OF 7
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
CADD FILE :
75
63
37.5
12
30
70
88
100
2
ø30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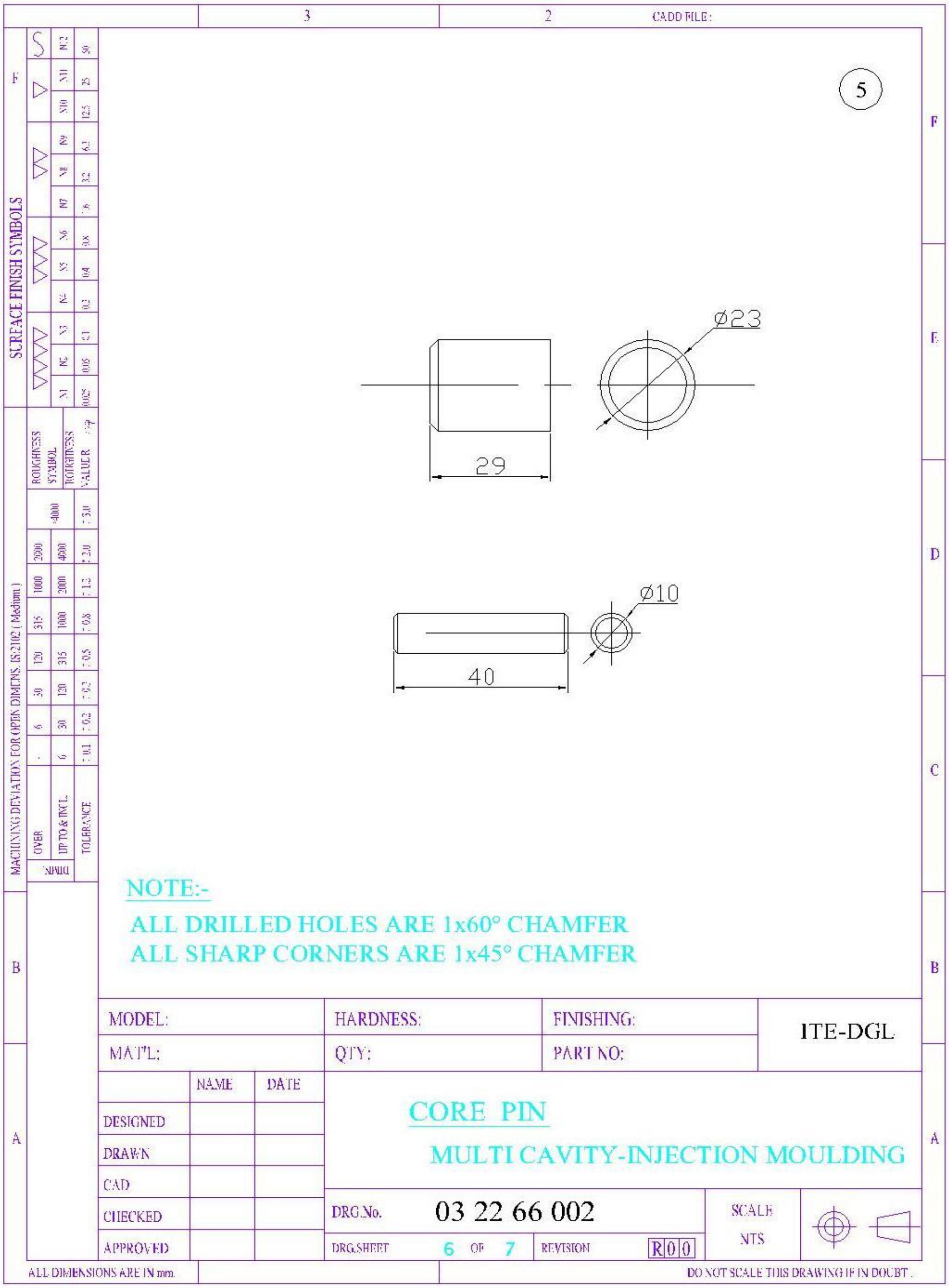
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE R
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
OVER
UP TO & INCL.
TOLERANCE
4
75
63
12
12
88
100
12
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL:
HARDNESS:
FINISHING:
ITE-DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
COVER PLATE
MULTI CAVITY-INJECTION MOULDING
DRG.No.
03 22 66 002
SCALE
NTS
DRG.SHEET 5 OF 7
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .


3
2
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5
Ø23
29
Ø10
40
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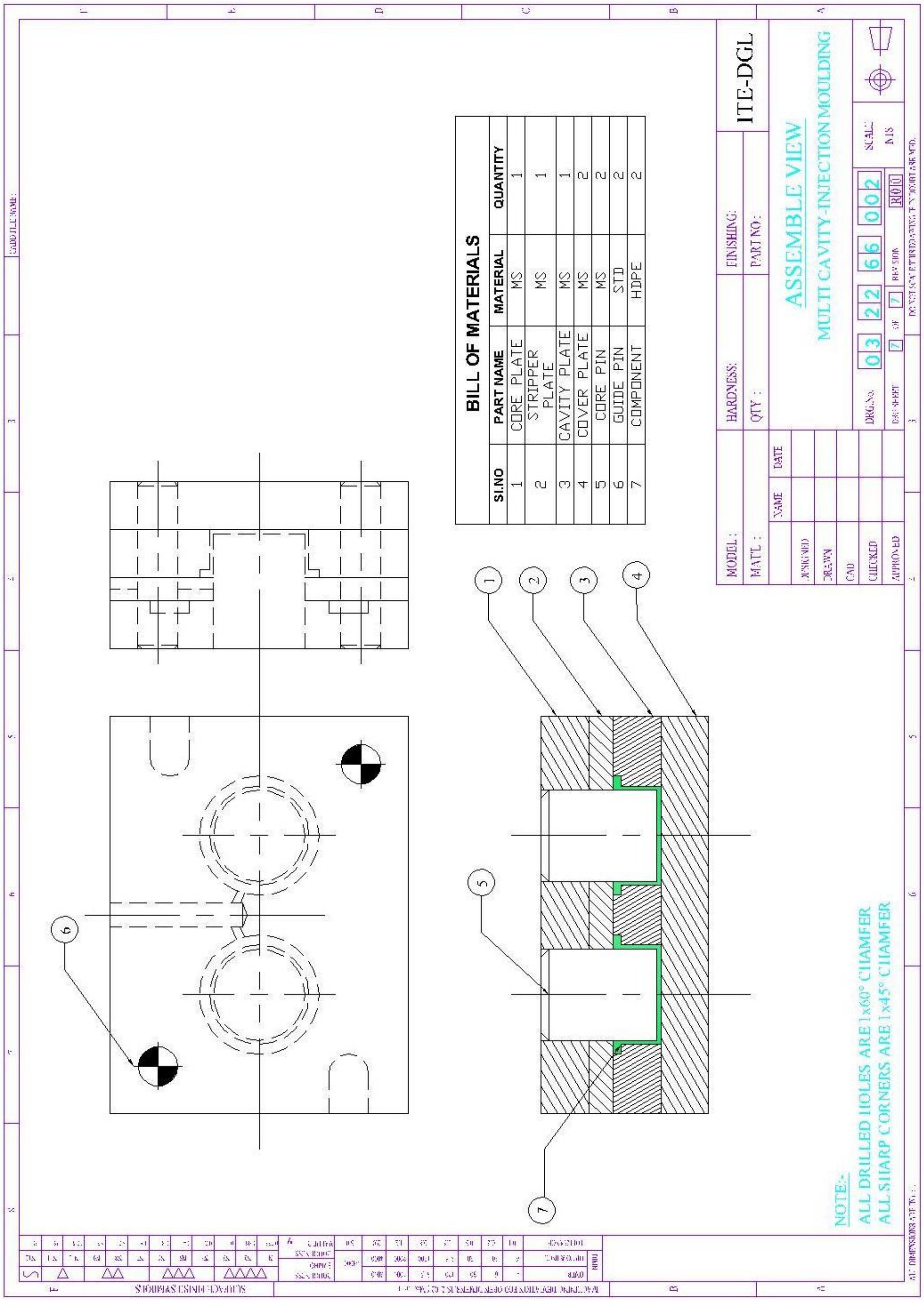
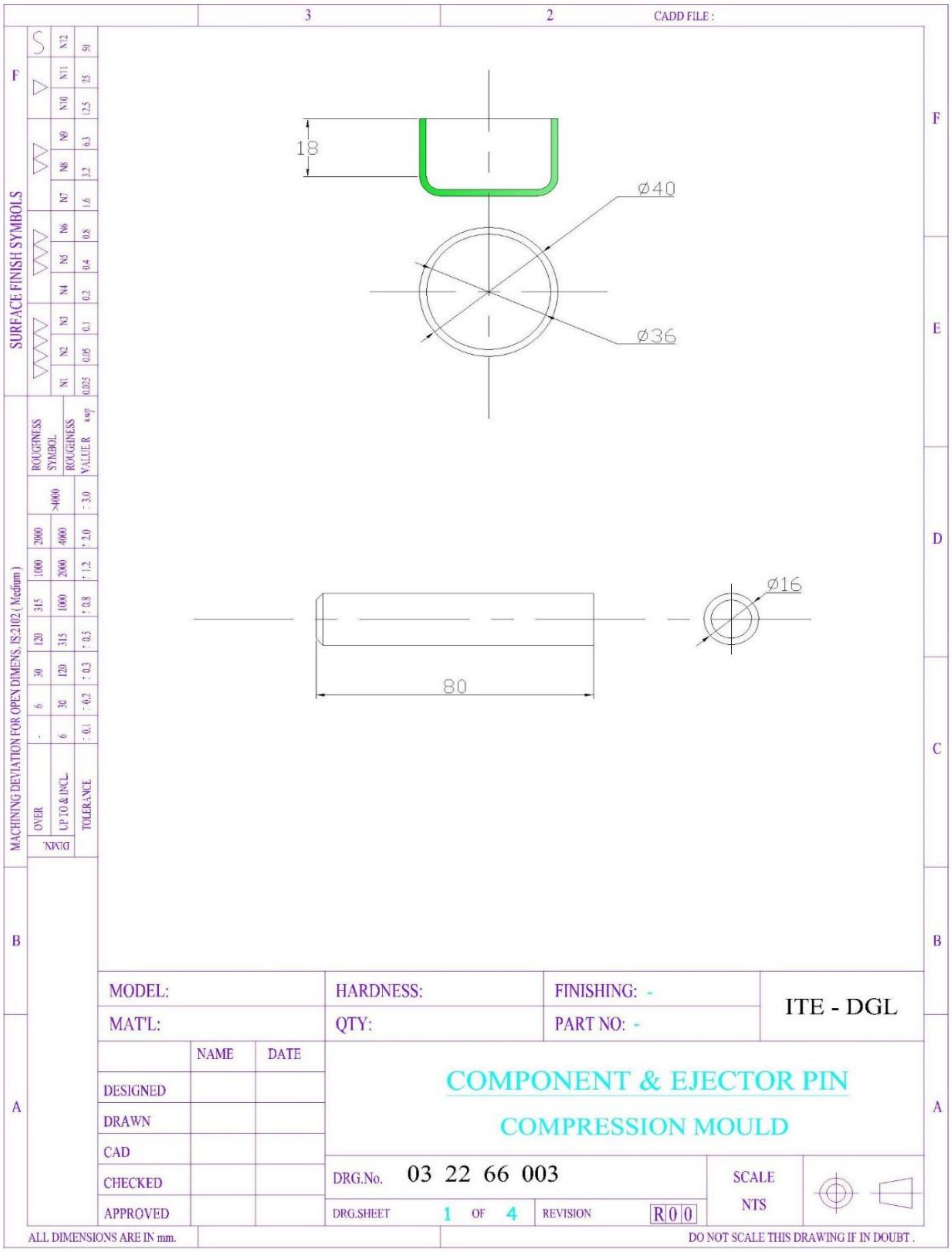
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL:
HARDNESS:
FINISHING:
ITE-DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
CORE PIN
MULTI CAVITY-INJECTION MOULDING
DRG.No.
03 22 66 002
SCALE
NTS
DRG.SHEET
6 OF 7
REVISION
R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .



Exercise Ex– III Compression Mould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18
Ø40
Ø36
Ø16
80
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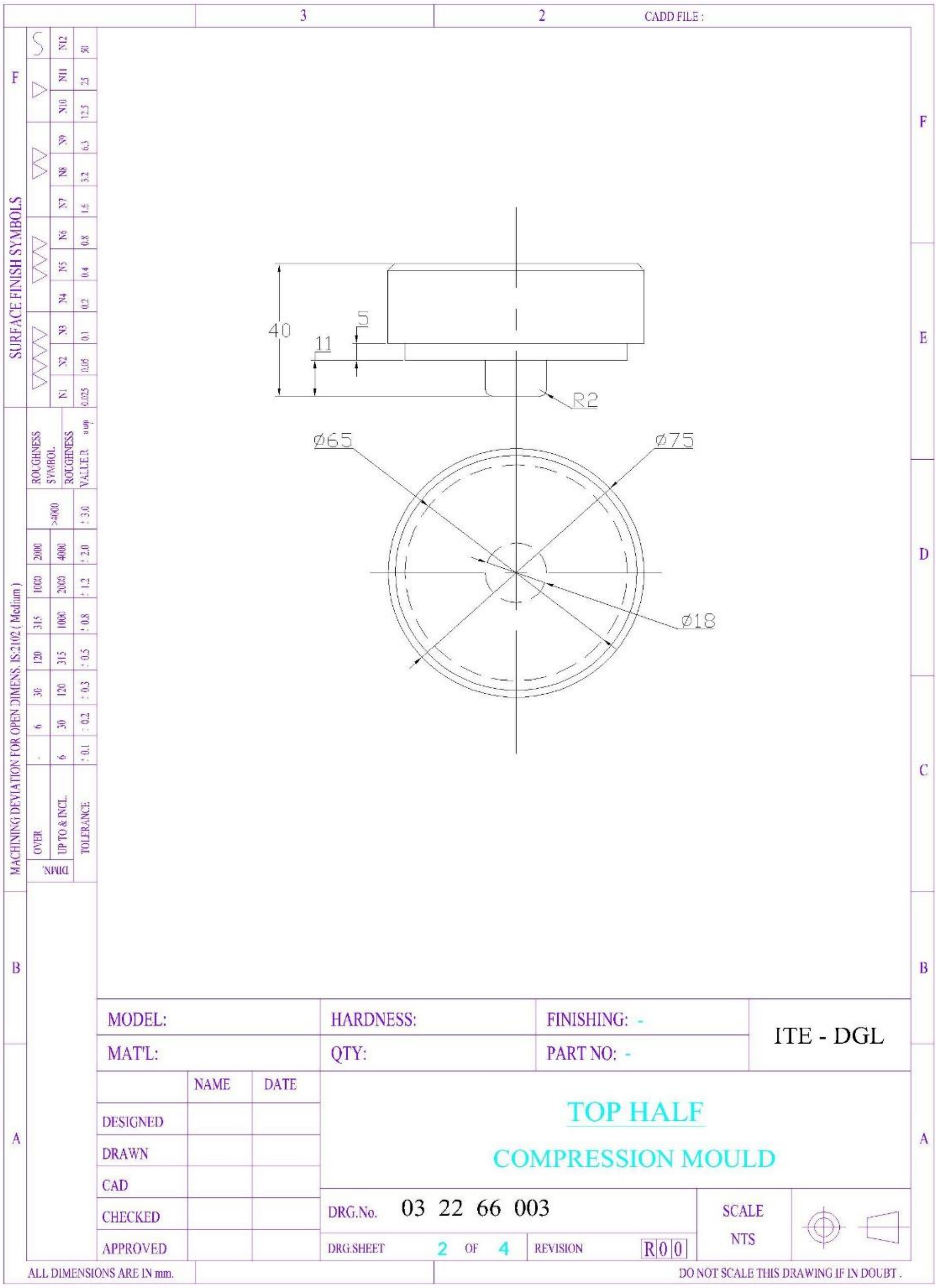
MODEL:
HARDNESS:
FINISHING: -
ITE - DGL
MAT'L:
QTY:
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
COMPONENT & EJECTOR PIN
COMPRESSION MOULD
DRG.No. 03 22 66 003
SCALE
NTS
DRG.SHEET 1 OF 4
REVISION R 0 0
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .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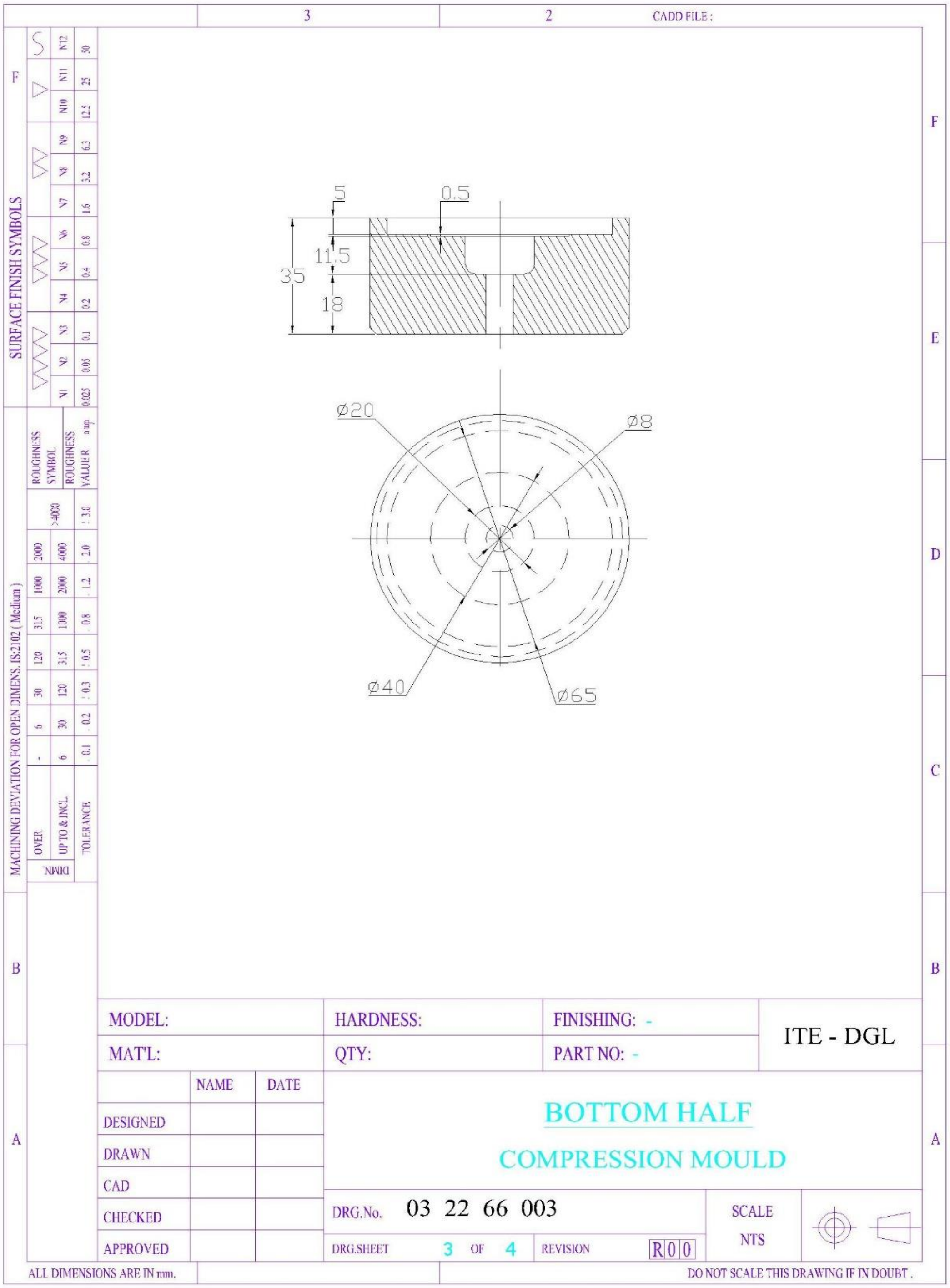
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
40
5
11
R2
Ø65
Ø75
Ø18
MODEL:
HARDNESS:
FINISHING: -
ITE - DGL
MAT'L:
QTY:
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
TOP HALF
COMPRESSION MOULD
DRG.No. 03 22 66 003
SCALE
NTS
DRG.SHEET 2 OF 4
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .



BOTTOM HALF
COMPRESSION MOULD
MODEL:
MAT'L:
HARDNESS:
QTY:
FINISHING: -
PART NO: -
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 66 003
DRG.SHEET 3 OF 4
REVISION R00
SCALE
NTS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .
CADD FILE :
SURFACE FINISH SYMBOLS
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0.5
11.5
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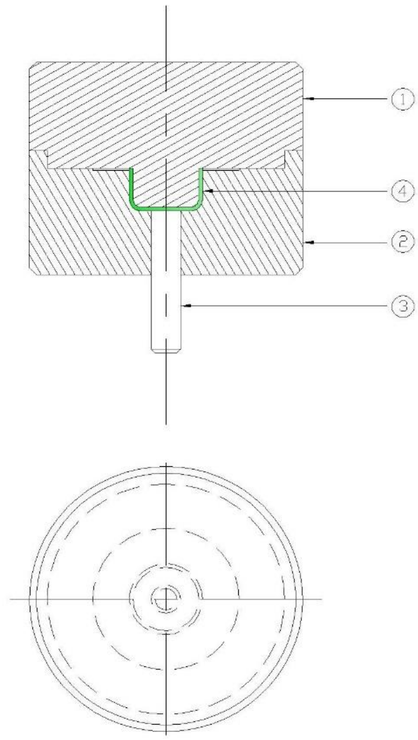
Ø20
Ø8
Ø40
Ø65



BILL OF MATERIALS

SI.NO	PART NAME	MATERIAL	QUANTITY
1	TOP HALF	MS	1
2	BOTTOM HALF	MS	1
3	EJECTOR	STD	1
4	MOULDING	UF	1

MODEL:	HARDNESS:	FINISHING: -	ITE - DGL
MAT'L:	QTY:	PART NO: -	

	NAME	DATE
DESIGNED		
DRAWN		
CAD		
CHECKED		
APPROVED		

ASSEMBLED VIEW

COMPRESSION MOULD

DRG.No. 03 22 66 003

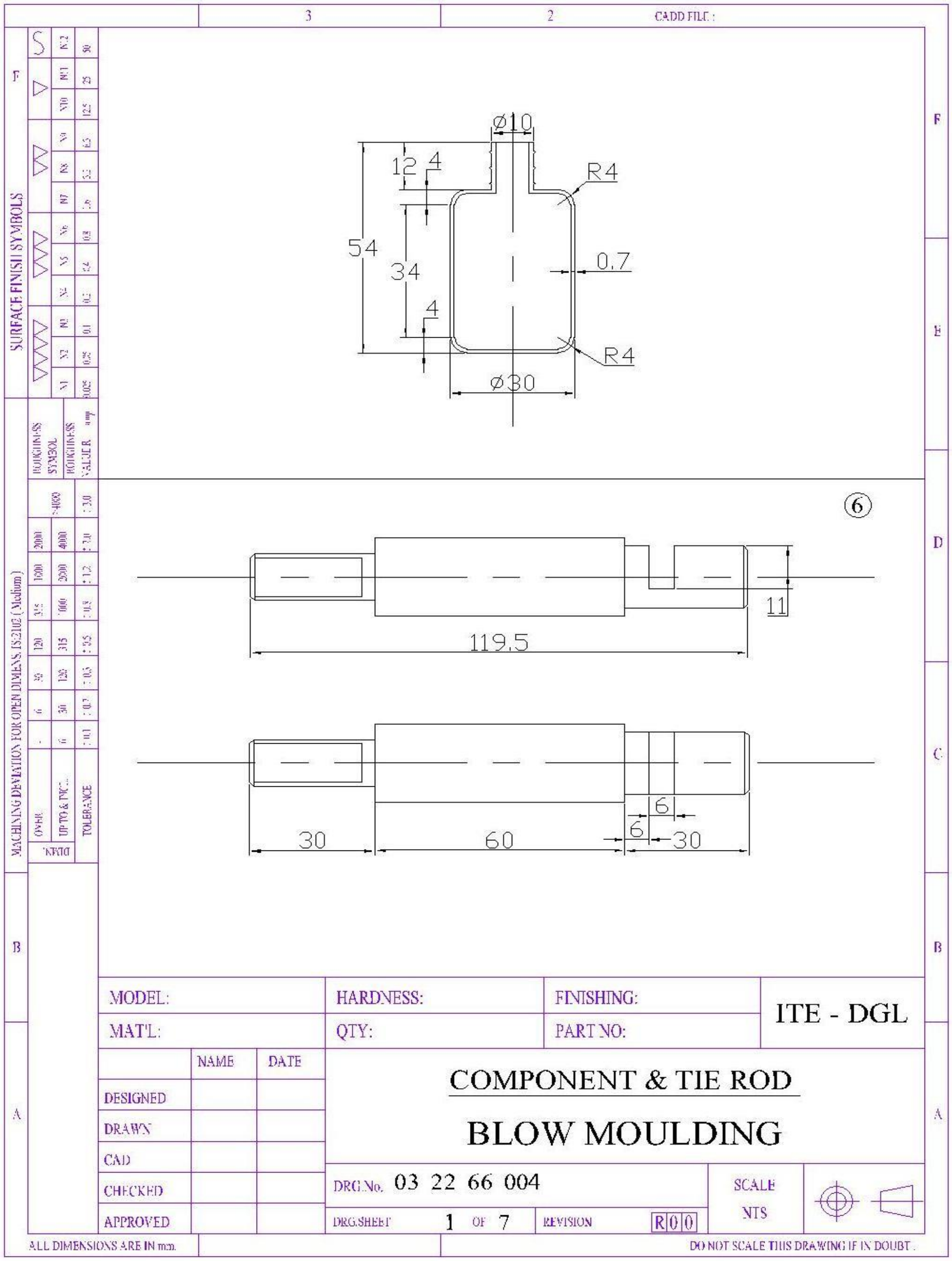
DRG.SHEET 4 OF 4 REVISION R00

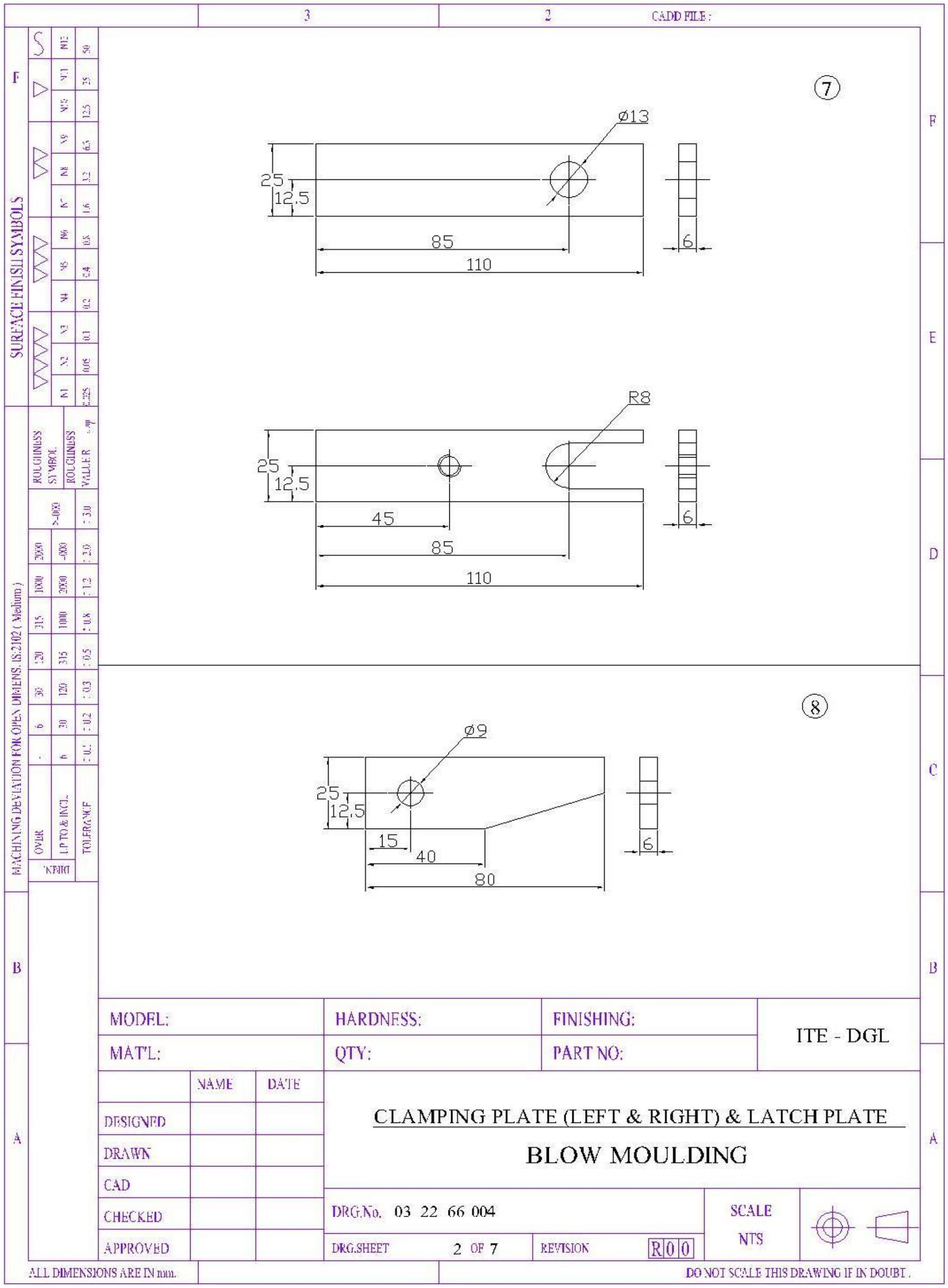
SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT .

Exercise – IV Blow Mould




CADD FILE :
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ROUGHNESS SYMBOL
ROUGHNESS VALUE R
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OVER
UP TO & INCL.
TOLERANCE
⑦
ø13
25
12.5
85
110
6
R8
45
⑧
ø9
15
40
80
MODEL:
HARDNESS:
FINISHING:
ITE - DGL
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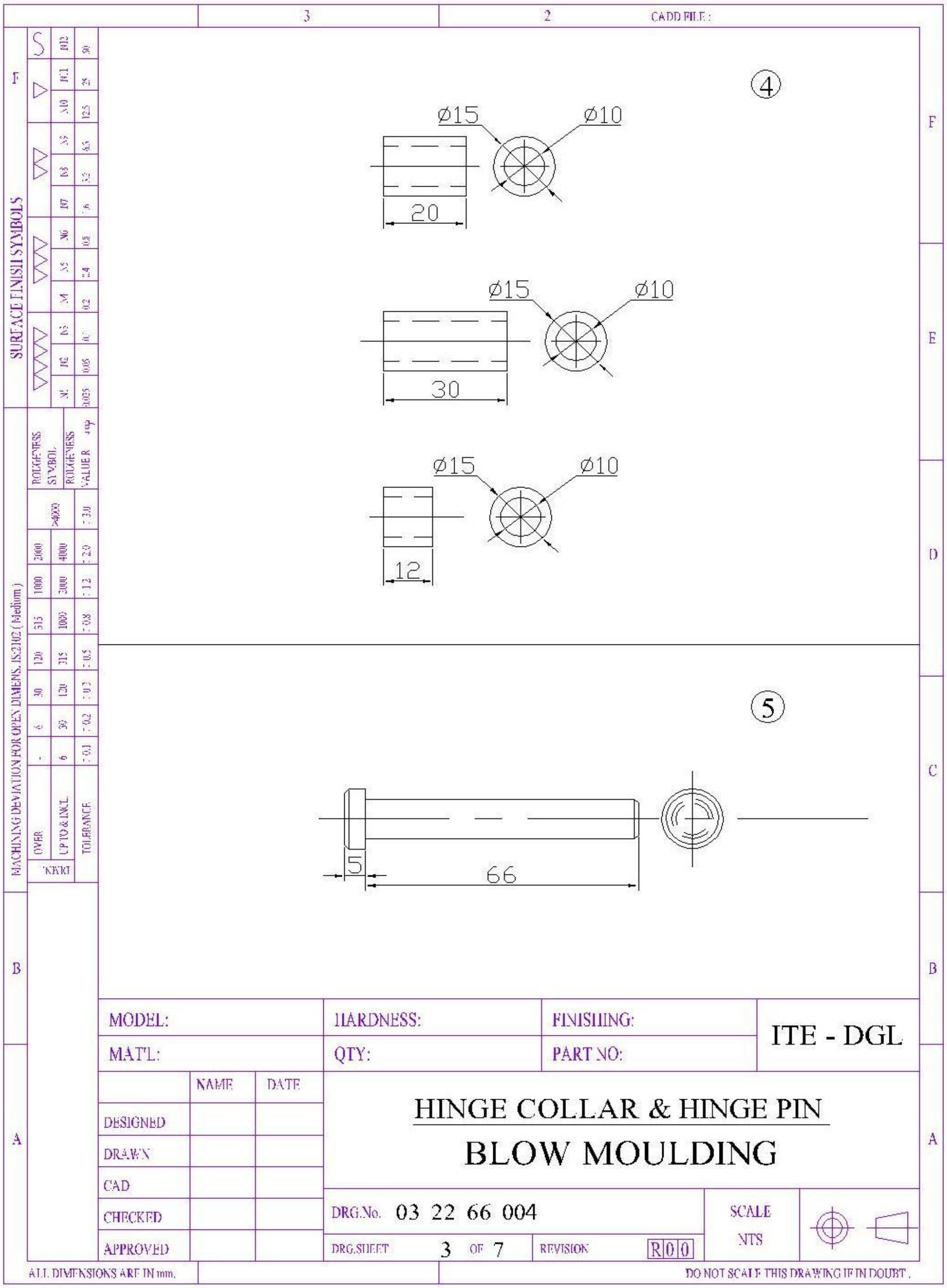

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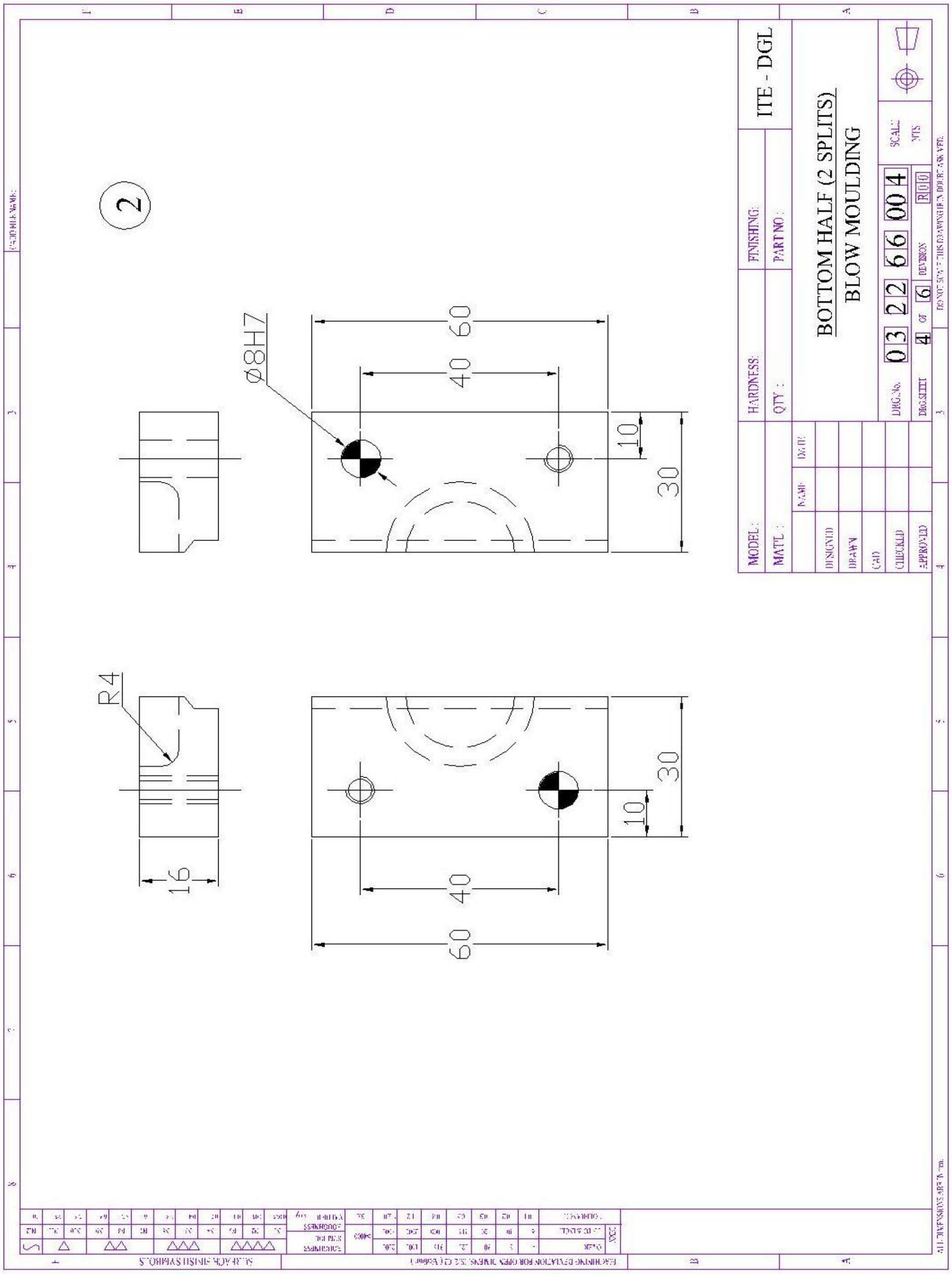
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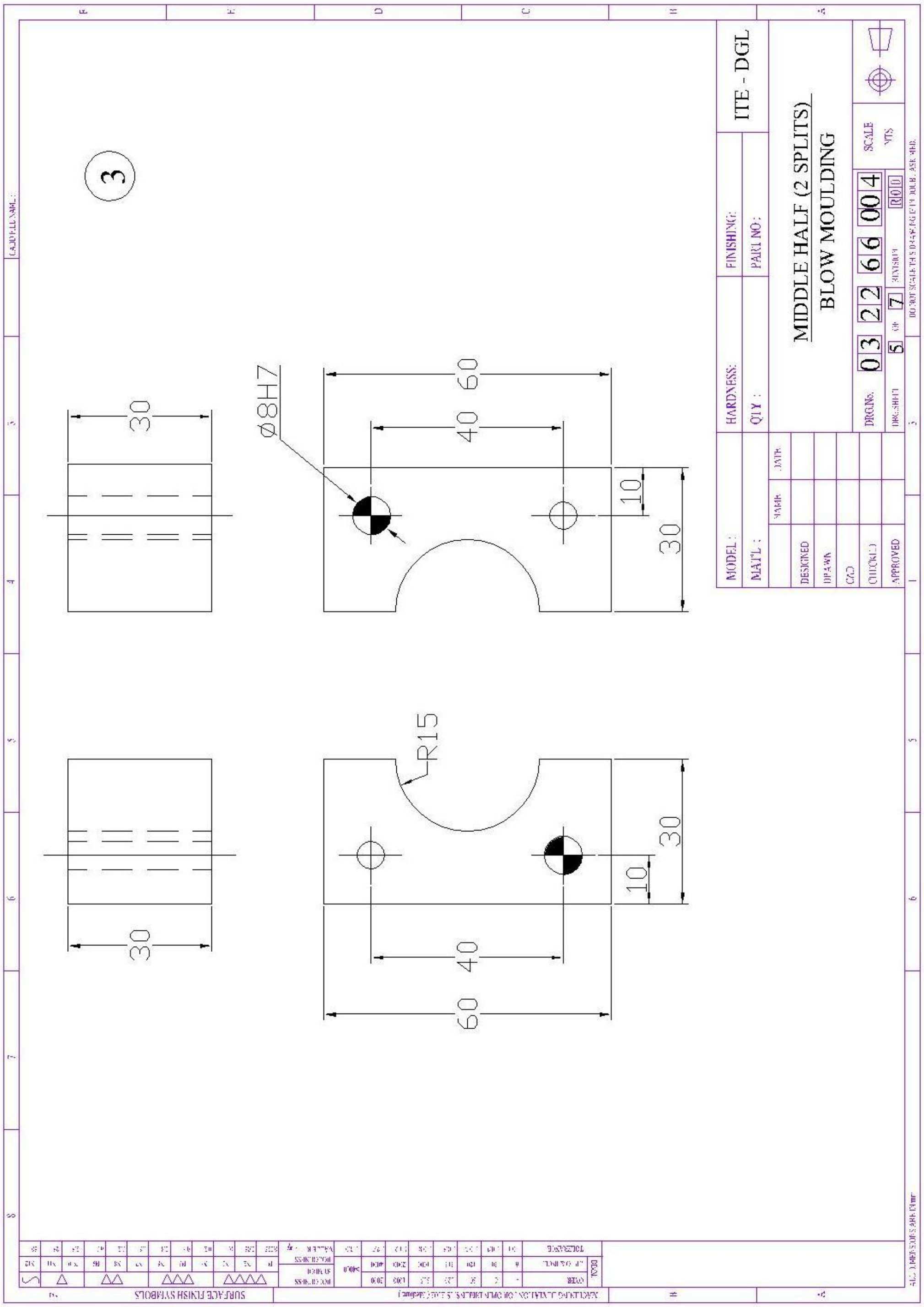
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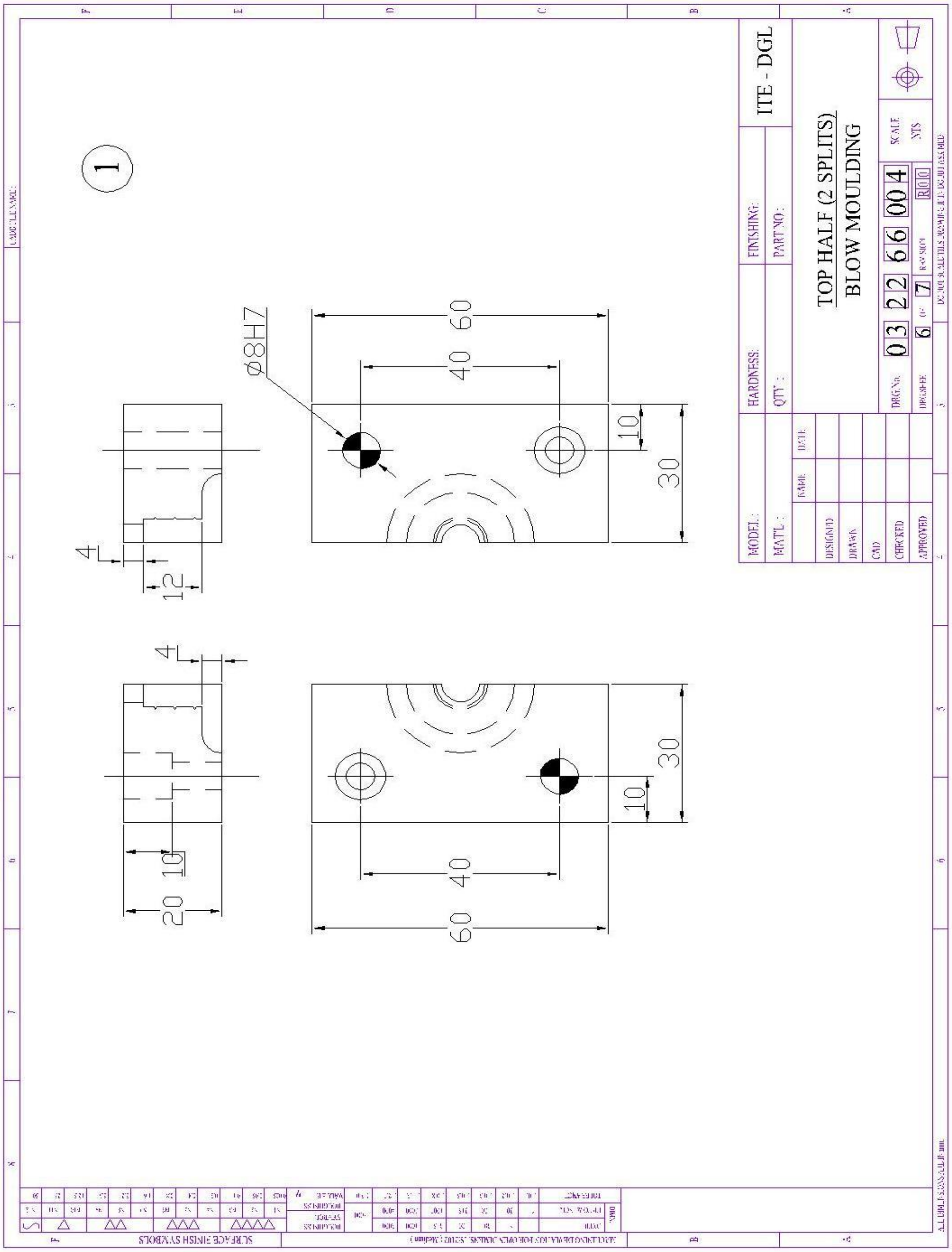
SURFACE FINISH SYMBOLS



ITE - DGL
TOP HALF (2 SPLITS)
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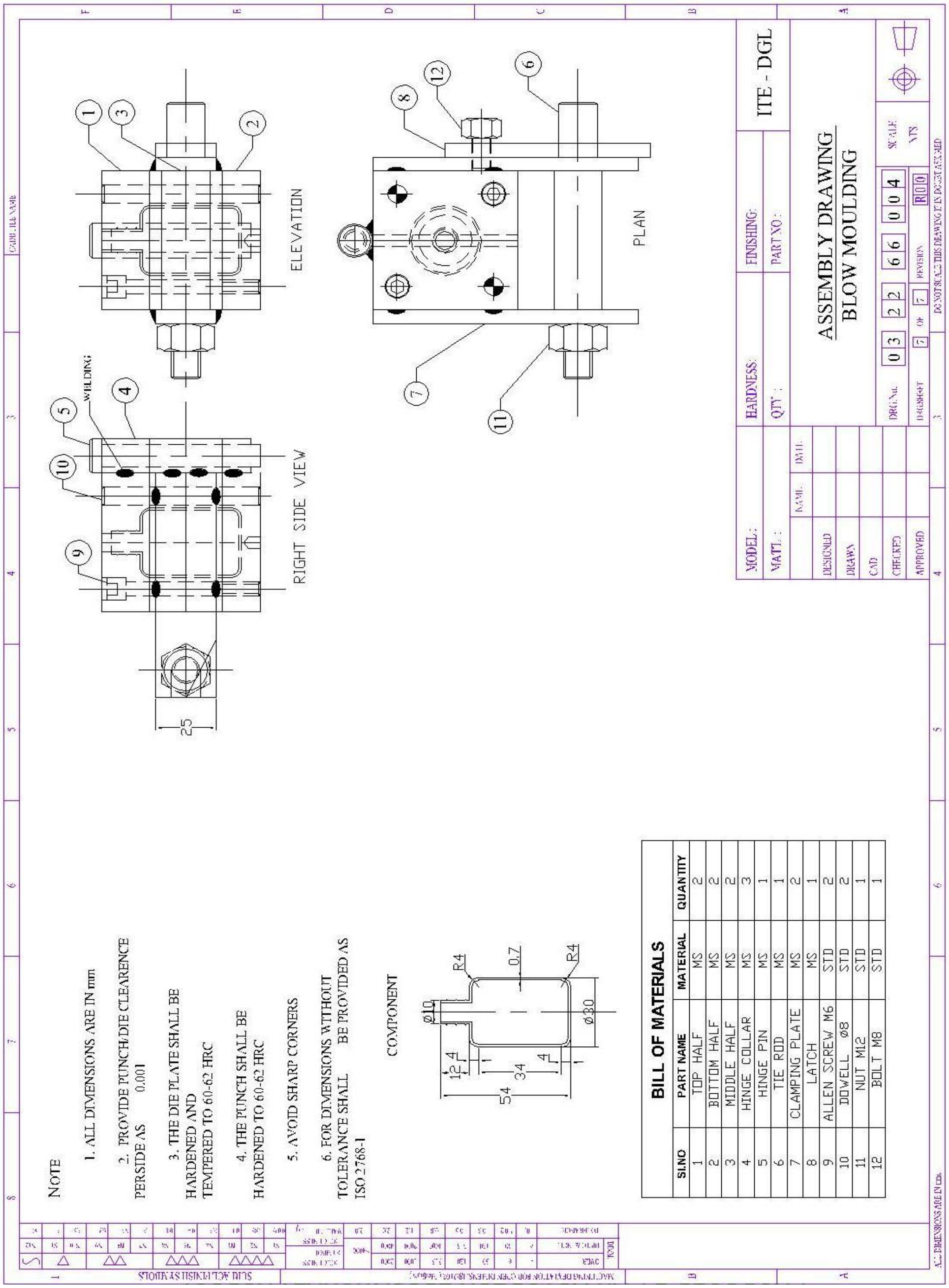
SURFACE FINISH SYMBOLS



BILL OF MATERIALS

Sl.NO	PART NAME	MATERIAL	QUANTITY
1	TOP HALF	MS	2
2	BOTTOM HALF	MS	2
3	MIDDLE HALF	MS	2
4	HINGE COLLAR	MS	3
5	HINGE PIN	MS	1
6	TIE ROD	MS	1
7	CLAMPING PLATE	MS	2
8	LATCH	MS	1
9	ALLEN SCREW M6	STD	2
10	DOWELL Ø8	STD	2
11	NUT M12	STD	1
12	BOLT M8	STD	1

1020235541	CNC Programming	L	T	P	C
PRACTICUM		1	0	4	3

Introduction

Computer Numerical Control (CNC) programming is a vital subject for diploma engineering students, focusing on the automation of machine tools through computer systems. CNC technology is foundational in modern manufacturing, allowing for precision, efficiency, and the ability to produce complex parts with minimal human intervention. Proficiency in CNC programming opens up numerous career opportunities in various industries such as automotive, aerospace, manufacturing, and more. CNC programmers and operators are essential for creating high-quality, precision-engineered products. This course equips students with the knowledge and skills necessary to excel in the dynamic and technologically advanced field of CNC machining, making them valuable assets in the engineering and manufacturing sectors.

Course Objectives

The objective of this course is to prepare the student,

- To understand the fundamentals of CNC
- To explain the construction and tooling of the CNC machine
- To Programme Production Jobs for CNC Turning Centre for different operations
- To Programme production jobs for CNC Vertical Machining Centre for different operations
- To operate a CNC lathe
- To operate a CNC milling machine

Course Outcomes

On successful completion of this course, the student will be able to,

CO1: Recall safety procedure to be followed while working in CNC Machines.

CO2: Create CNC part program for cylindrical components using CNC Turning Centre

CO3: Produce components using CNC Turning centre

CO4: Create CNC part program for rectangular components using CNC Machining Centre

CO5: Produce components using CNC Machining centre

Pre-requisites

Knowledge of CNC Machines, Tools and accessories.

1020235541	**CNC Programming**	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	3	3
CO2	3	2	3	3	2	3	3
CO3	3	3	2	3	1	3	3
CO4	3	2	3	3	1	3	3
CO5	3	2	3	3	2	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to gauge student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible

1020235541	CNC Programming	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Portions	All Exercises	All Exercises Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook or a printed manual or a file with documents. The part program, procedure, sketch and output should be written by the student manually in the documents.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

1020235541	CNC Programming	L	T	P	C
PRACTICUM		1	0	4	3

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Tools Required	10
B	Writing Part Program	20
C	Editing Program in machine and Component	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle I: 1, 2, 3 and 4.

Cycle II: 5, 6, 7, 8 and 9.

-
- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 rks

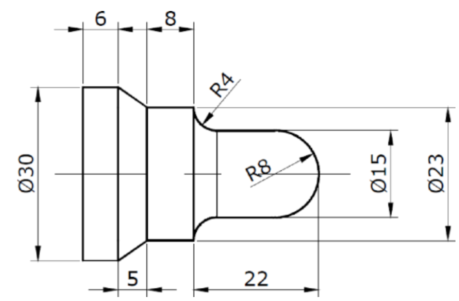
- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

1020235541	CNC Programming	L	T	P	C
PRACTICUM		1	0	4	3

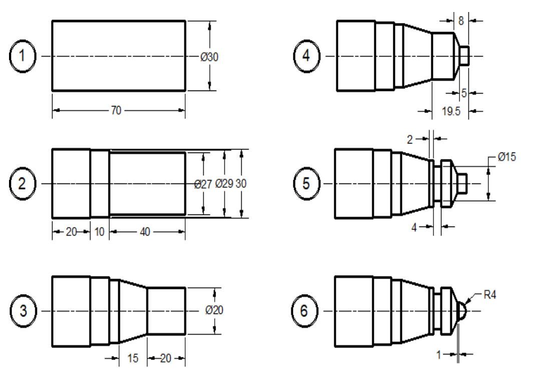
THEORY	
Introduction to NC, CNC and DNC – Components of a CNC system: Program, Machine Control Unit, and Machine Tool – Toolings for CNC – ISO Designation for Tooling – Tool Material Selection – Tool Inserts.Steps involved in CNC Programming: Process Planning, Part Programming, Program Entry, Program Verification, and Production – Manual Part Programming, Data required for Manual Part Programming – Coordinate system – Designation of axes – Datum points and Reference Points – NC Dimensioning: Absolute, and Incremental - CNC Programming procedure – Format of a program.CNC Part Programming for Turning Centres – Axes system used for turning - Preparatory functions (G-Codes) for turning Centres – Auxiliary functions (M-Codes) for turning centres – Tool function codes – Speed function codes– Feed Specification codes - Rapid Positioning – Tool nose radius compensation - Linear Interpolation – Circular Interpolation/Filleting.Canned/Fixed Cycles: Box turning cycle (G90) - Taper turning (G90) – Facing/Taper facing cycle (G94) – Grooving/Parting cycle (G75) – Single threading cycle (G92) and Multiple threading cycle (G76) – Multiple turning cycle or Stock removal cycle (G70 & G71) – Peck drilling cycle (G74) – Boring/Taper Boring cycle (G90) CNC Part Programming for Machining Centres – Axes system used for Machining centres - Preparatory functions (G-Codes) for Machining Centres – Auxiliary functions (M-Codes) for Machining centres – Preset – Cutter radius compensation – Tool length compensation - Linear Interpolation – Circular Interpolation. Canned Cycles: Drilling cycle (G81) – Counter sinking/Counter boring (G82) –Tapping cycle (G84) – Reaming Cycle (G85) – Boring Cycle (G86) – Peck drilling cycle (G83) – Sub Program – Mirroring – Circular Pocketing (G170 & G171) – Rectangular Pocketing (G172 & G173).	15

1020235541	CNC Programming	L	T	P	C
PRACTICUM		1	0	4	3

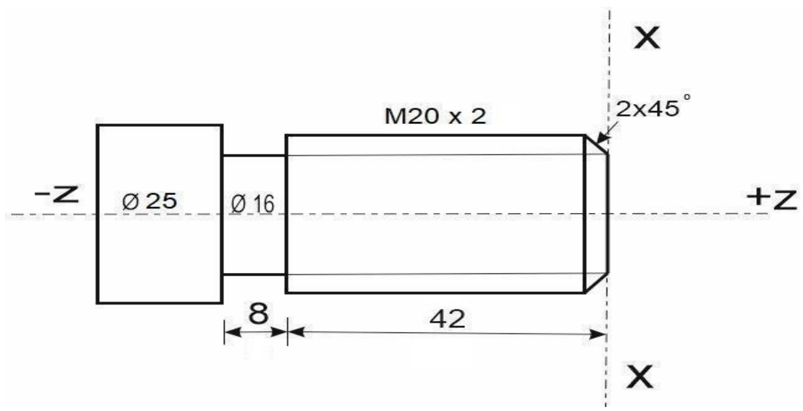
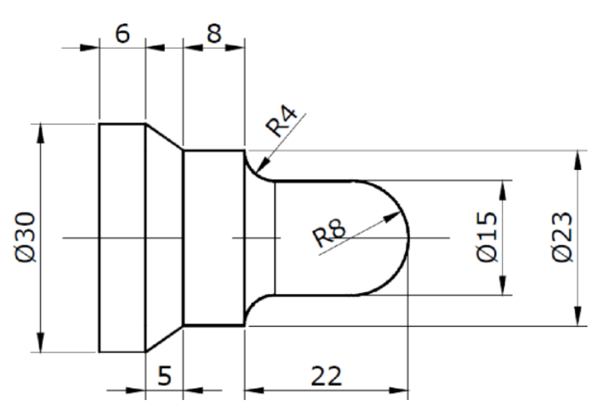
<table>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>1.</td><td>Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using Linear and Circular Interpolation. Raw Material Size: φ 30 mm dia x 41 mm length. Component Diagram:

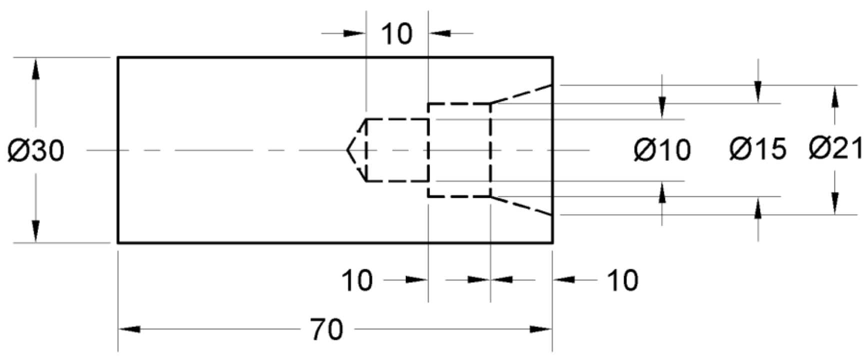
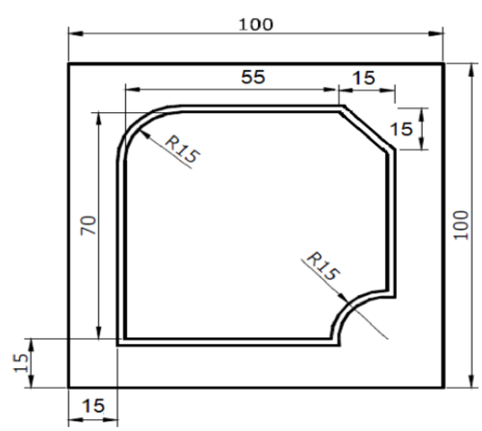


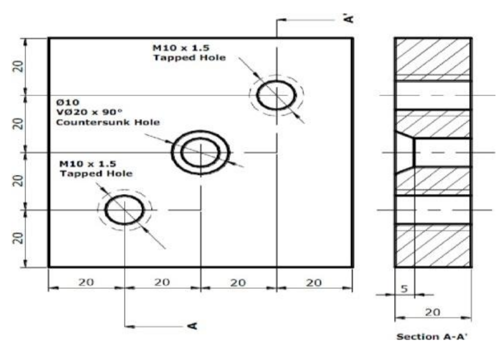
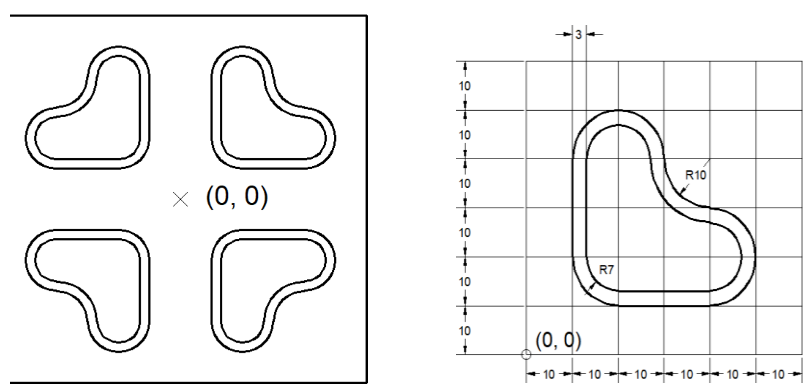
</td><td>5</td></tr>
<tr><td>2.</td><td>Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using Box turning cycle, Facing cycle, and Grooving cycle (G90, G94, and G75). Raw Material Size: φ 30 mm dia x 70 mm length
Component Diagram: Note: Facing 0.5 mm (20 mm to 19.5 mm)</td><td>5</td></tr>
<tr><td colspan="3">

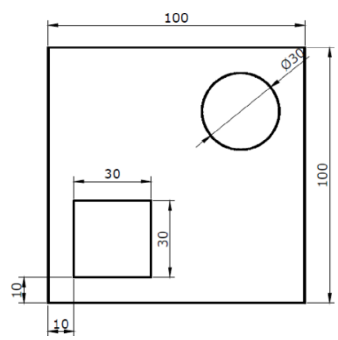


1. Raw Material
2. Box turning Cycle (G90)
3. Taper Turning Cycle (G90)
4. Facing/Taper Facing Cycle (G94)
5. Grooving/Parting Cycle (G75)
6. Circular Interpolation
</td></tr>
</table>

3.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using the threading cycle (G92/G76). Raw Material Size: φ 25 mm dia x 70 mm length Component Diagram:  	5
4.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using multiple turning cycle (G70 & G71). Raw Material Size: φ 30 mm dia x 41 mm length Component Diagram:  	5

5.	Write a Part Program for producing the component shown below in the turning center, simulate it and produce the component – Using Peck drilling and Boring cycles (G74 & G90) Raw Material Size: φ 30 mm dia x 70 mm lengthComponent Diagram: Steps: (1). Pilot Drill – 3 mm dia, (2). Drill 10 mm dia, (3). Boring to 15 mm dia, (4). Taper Boring to 21 mm dia 	5
6.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Linear and Circular Interpolation Raw Material Size: 100 mm x 100 mm x 15 mm Component Diagram: 	5

7.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Peck drilling, Reaming, Tapping and counter-sinking cycles Raw Material Size: 80 mm x 80 mm x 20 mm Component Diagram: 	5
8.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Mirroring function Raw Material Size: 120 mm x 120 mm x 20 mm Component Diagram: 	5

9.	Write a Part Program for producing the component shown below in the Machining center, simulate it and produce the component – Using Circular and Rectangular Pocketing Raw Material Size: 100 mm x 100 mm x 20 mm Component Diagram:  	5
Revision + Test		15
Total		75

Textbook:

1. S.K. Sinha, CNC Programming, Galgotia Publications Pvt Ltd., 2011
2. P. M. Agrawal, and V. J. Patel, CNC Fundamentals and Programming, First Edition, Charotar Publishing House Pvt. Limited, 2009.
3. Pawan Negi, Mangey Ram, and Om Prakash Yadav, Basics of CNC Programming, River Publishers, 2019
4. Peter Smid, CNC Control Setup for Milling and Turning Mastering CNC Control Systems, Industrial Press, 2010.

Website links for reference:

1. https://www.youtube.com/watch?v=_5r2XR1h1aQ
2. https://www.youtube.com/watch?v=eJ432X2dR9A

1020235541	CNC Programming	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises/experiments should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

PART	DESCRIPTIO N	MARKS
A	Aim & Tools Required	10
B	Writing Part Program	20
C	Simulation	10
D	Editing Program in machine and Component	20
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

LIST OF EQUIPMENT

1. CNC Turning centre - 2 No.
2. CNC Milling Centre - 2 No.
3. CNC Simulation Software
4. Computer - 30 Nos.

1020235543	Industrial IoT	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

Industrial Internet of Things or IIoT refers to interconnected instruments, sensors and other devices which can be networked together in an industrial setting. This connectivity enables remote access, efficient monitoring, data acquisition and collection, analysis and exchange of different data sources and a lot more. IIoT solutions have enormous potential for increasing productivity, and are also known for their low cost and quick implementation.

Course Objectives:

The objective of this course is to enable the student to

- Understand the application of IIoT in automation of commercial and real worldapplications.
- Summarize the functions of various types of sensors.
- Understand the Designing Industrial IOT Systems for various applications.
- Facilitate the students to design simple IIoT concepts.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Explain the basic computing features of the Arduino platform and programming.CO2: Adapt to the Arduino platform and display their name in the LCD display.

CO3: Perform LED blinking and LED pattern creation with push button control withArduino.

CO4: Perform IR sensor interfacing, ultrasonic sensor interfacing and soil moisture interfacing with ESP32.

CO5: Design a system that integrates ultrasonic sensors for accurate distancemeasurement.

1020235543	Industrial IoT	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites:

Applied Physics

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	1	3	-	-	-
CO2	3	-	1	3	-	-	-
CO3	3	-	1	3	-	-	-
CO4	3	-	1	3	-	-	-
CO5	3	-	1	3	-	-	-

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to increase the students' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- Incorporate formative and summative assessments to measure student progress and provide targeted feedback.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

1020235543	Industrial IoT	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Portions	All Exercises	All Exercises Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The totalmarks awarded should be converted to 10 Marks for the practical test as per the schemeof evaluation as below.

1020235543	Industrial IoT	L	T	P	C
PRACTICUM		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each experiment should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Program, Procedure, Sketch and Output should be written by the student manually. The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim & Tools Required	10
B	Procedure / Steps	20
C	Execution	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle I: 1, 2, 3 4, and 5.

Cycle II: 6, 7, 8, 9 and 10.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

1020235543	**Industrial IoT**	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	**DESCRIPTION**	**MARKS**
A	Aim & Tools Required	10
B	Procedure / Steps	20
C	Execution	20
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020235543	Industrial IoT	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Theory Portion		
UNIT I: INTRODUCTION TO INDUSTRIAL IOT (IIOT) SYSTEMS		**Period**
The Various Industrial Revolutions, Role of Internet of Things (IoT) & IndustrialInternet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.		7
UNIT II: IMPLEMENTATION SYSTEMS FOR IIOT		
Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.		8
Practical Exercises:		
1	To implement LED Blink and LED pattern with Arduino	5
2	Creating different LED patterns and controlling with push button switches.	5
3	Automated LED light control based on input from IR sensor and LDR	5
4	To display your name in a LCD 16 x2 display with Arduino.	5
5	Controlling servo motors with the help of joystick	5
6	Measurement of temperature and Pressure using ESP32	5
7	Calculate the distance to an object with the help of an Ultrasonic sensor and display it on a LCD	5
8	Design a system that integrates ultrasonic sensors for accurate distance measurement in the identified areas.	5
9	integrate sensors such as GPS, accelerometers, and panic Basic Burglar alert security system with the help of PIR sensor and Buzzer	5
10	Modules and sensor interfacing - Interfacing IR sensor and LED with ESP32	5
	Revision + Continuous Assessment	10
	Total Period	75

1020235543	Industrial IoT	L	T	P	C
PRACTICUM		1	0	4	3

Suggested

List of Students Activity:

1. Each students to write and submit the assignment on the topic 'Contrast IT and OT'
2. Four students can be grouped as a batch and practice an additional experiment to interface any one of the Arduino compatible sensors with Arduino and observe the behaviour of sensors.
3. Introduction to Arduino platform and programming
4. Study on various sensors and actuators.

Text and Reference Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, First Edition, Cambridge University Press, 2022.
2. Alasdair Gil Christ, Industry 4.0: The Industrial Internet of Things, Apress, Publications, 2016.
3. Sudan Jha, Usman Tariq, Gyanendra Prasad Joshi, Vijender Kumar Solanki, Industrial Internet of Things: Technologies, Design, and Applications, CRC Press, 2022.

Web-based/Online Resources:

https://onlinecourses.nptel.ac.in/noc20_cs69/preview

Equipment / Facilities required to conduct the Practical Course.

S.No	Name of the Equipment's	Quantity Required
1.	Arduino UNO set	15
2.	ESP32 set -Type C	15
3.	LED Bulb	15
4.	Resistor	15
5.	Push button	15
6.	Servo motor 5V DC	15
7	DC motor	15
8	5V DC Relay	15

9	Mini Breadboard	15
10	16 X 2 LCD Display with TTL	15
11	Gas sensor MQ2	15
12	IR Sensor	15
13	Temperature sensor DHT11 module	15
14	Ultrasonic sensor HC-SR04	15
15	Joystick module	15
16	Jumper wires - 3 nos.	As Required

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises/experiments should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

PART	DESCRIPTIO N	MARKS
A	Aim & Tools Required	10
B	Procedure / Steps	20
C	Execution	20
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020235544	**Advanced Welding Technologies**	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

This syllabus outlines advanced welding technologies that covers various welding processes and techniques. The course is divided into 3 units that cover topics like introductory welding concepts, common arc and resistance welding processes, welding metallurgy, and weldment inspection and testing. The course aims to impart knowledge of advanced welding practices, welding process parameters, and the comparative merits of different welding methods. Students should learn to select the appropriate welding technique for various joint types and understand how to produce quality weldments.

Course Objectives:

1. To learn various concepts related to welding and its applications.
2. To have practical purview of various welding processes, welding standards, and advanced welding processes.
3. Familiarise with the working of the various welding processes.

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Explain the physics of Welding

CO2: Identify the appropriate Welding technique for the componentsCO3:

Select proper techniques to identify the welding defects

CO4: Acquire skills on advanced welding techniques

CO5: Demonstrate the necessary skills to identify the defects in welding.

Pre-requisites:

Knowledge of metal joining procedure

1020235544	Advanced Welding Technologies	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3			3			
CO2	3			3			
CO3	3			3			
CO4	3			3			
CO5	3			3			

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

1. Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
2. Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
3. Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
4. Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
5. Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
6. Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies

1020235544	Advanced Welding Technologies	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Portions	All Exercises	All Exercises Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.
- Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same
- should be evaluated for 10 Marks for each exercise/experiment. The total
- marks awarded should be converted to 10 Marks for the practical test as per the schemeof evaluation as below.

1020235544	Advanced Welding Technologies	L	T	P	C
PRACTICUM		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each exercise should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Steps, Procedure, Sketch and Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the courselogbook.

The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTIO N	MARKS
A	Joint Preparation	20
B	Procedure	20
C	Weld bead	10
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I Exercise 1, 2, 3, 4, 5 and 6.

Cycle - II Exercise 7, 8, 9, 10, 11 and 12.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.
- **CA 4:** All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

1020235544	Advanced Welding Technologies	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		Marks	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Joint Preparation	20
B	Procedure	20
C	Weld bead	10
D	Finish	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020235544	**Advanced Welding Technologies**	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus contents

Theory Portion	Period
UNIT 1: Introduction and physics of welding Overview of welding processes and their classification, edge preparation, weld symbols – types of joints - weld nomenclature - electrode - codes – flux coating - modes of metal transfer – heat sources – types of welding arc - Arc characteristics - Voltage-current characteristics – welding efficiency - heat affected zone (HAZ) - welding techniques	15
UNIT 2: Arc, Gas and other welding processes Fundamental principles - arc welding – carbon arc welding – shielded metal arc welding – submerged arc welding – TIG – MIG – plasma arc welding – electro slag welding - advantages, limitations and applications; Oxy-acetylene welding – air-acetylene welding – advantages, limitations and applications. LASER beam welding, robot welding, solid state welding - diffusion bonding, explosive welding, ultrasonic welding, friction welding, forge welding - thermit welding - atomic hydrogen welding - electron beam welding - under water welding - electric resistance welding, spot, seam – its advantages, disadvantages and applications.	
UNIT 3: Welding defects and Inspection	
Welding defects – causes and remedies – Weldability test - Weldability of metals like steels, stainless steels, aluminium, copper, nickel and titanium alloys – inspections – purpose – inspection methods – visual inspection - DPT – MPT – radiographic test – ultrasonic test – phased array ultrasonic test (PAUT) - case studies in testing of welded joints - Software in welding and importance.	10
Practice Arc welding basic exercises (for practice) :Lap joint, Butt joint, Corner joint, T-joint Gas welding basic exercises (for practice) : Lap joint, Butt joint, Corner joint, T-joint	

1020235544	Advanced Welding Technologies	L	T	P	C
PRACTICUM		1	0	4	3

Practical Exercises	
Exercises for Practical Exam.: 1. Make a butt and fillet joints by down hand welding (single V) using arc welding. 2. Make a butt and fillet joints by vertical welding using arc welding. 3. Welding of pipes using arc welding 4. Butt welding of thin sheets leftward, rightward and downward using gas welding. 5. Welding of tubes using gas welding. 6. TIG welding practice – butt joint. 7. MIG welding practice – butt joint. 8. Spot welding practice in thin sheets. 9. Inspection of welding – visual and magnetic particle test. 10. Inspection of welding – die penetrant test and ultrasonic test.	40
Revision + Test	10
Total	75

Cycle – I Exercise 1, 2, 3, 4, 5 and 6.

Cycle – II Exercise 7, 8, 9, 10, 11 and 12.

Suggested List of Students Activity:

- Observe the welding machine in the institute and study its specifications. List the possibility of different method of weld joints that can be used.
- Study the type of current used in the welding machine and draw the circuit diagram.
- Study the types of electrode used and its industrial applications.

Text and Reference Books:

1. Advance Welding Technology by S.A. Rizvi , S.K. Kataria & Sons. 4th, reprint 2019.
2. Welding Engineering and Technology by R.S. PARMAR, IIT, Delhi, Kanna Publishers, 1999.
3. Welding principles and practices by Edward R. Bohnart, Mc. Graw Hill Education, 2014.

WEB REFERENCE

- https://archive.nptel.ac.in/courses/112/103/112103263/#
- https://archive.nptel.ac.in/courses/112/103/112103244/
- https://archive.nptel.ac.in/courses/112/107/112107089/
- https://youtube.com/playlist?list=PLwdnzlV3ogoW9g44SFbiiCjyMOMPnNBL8&feature=shared

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises/experiments should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Joint Preparation	20
B	Procedure	20
C	Weld bead	10
D	Finish	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

<table>
<tr><td>1020235545</td><td rowspan="2">Industrial Robotics</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>PRACTICUM</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
</table>

Introduction

It has been realized that rapid industrialization and globalization needs industries to be more competitive and deliver cost effective quality products. This needs industries to implement flexible manufacturing systems where Robotic technology plays a major role. Hence study of robotic technology is very essential, To acquire knowledge about the hydraulic and pneumatic systems and its functions of the components. Understand the control methods of automation.

Course Objectives

The objective of this course is to prepare the student,

- To understand the basics of robot components and process automation.
- To execute the Robot programming using simulation software.
- To execute the Robot programming and Execute.
- To perform the basics of robotics and simulation of software fixtures for material handling and industrial applications.
- To execute program for various applications in manufacturing by using robotprogramming and industrial safety systems.
- To learn about the software and hardware systems for industrial Robotics

Course Outcomes

On successful completion of this course, the student will be able to,

CO1: Describe the components of Robot and its joints & links in Robot configuration, CO2: Classify the robot controller Drives and grippers,

CO3: Explain industrial applications of robot in Manufacturing environment CO4: Generate robot program for material handling applications

CO5: Execute / Simulate programs for various applications in manufacturing by using robot programming.

1020235545	**Industrial Robotics**	L	T	P	C
PRACTICUM		1	0	4	3

Pre-requisites

Knowledge of Basic Robot Engineering, Robot software, Robot programming .

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3			2			1
CO2	3			2			1
CO3	3			2			1
CO4	3			2			1
CO5	3			2			1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

Active Learning: Activities for active learning can include think-pair-share strategies as well askin-esthetic learning environment.Teachers can start a discussion to make sure students take ownership over their own participation and talk through new ideas and skills with peers. Teachers guide students as they construct their own knowledge and understanding.

Hands-on-Training: Conduct demonstrations and hands on training is all about applying the knowledge you have learned in training into practice.

Real time Learning: Instructors encourage the students to implement the techniques in their own place / Lab through the Industry-Institute interactions.

1020235545	**Industrial Robotics**	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Portions	All Exercises	All Exercises Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Internal Marks	40				
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

- **CA1 and CA2:** All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

  Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total

  marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

1020235545	Industrial Robotics	L	T	P	C
PRACTICUM		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each exercise should be completed on the day of practice. The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Steps, Procedure, Sketch and Result should be written by the student manually. The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Step / Procedure	10
B	Write Program	20
C	Edit Program / Simulate / Execution	20
TOTAL		50
D	Practical Documents (As per the portions)	10
		60

Cycle - I Exercise 1, 2, 3, 4 and 5.

Cycle - II Exercise 6, 7, 8, 9, 10 and 11.

- **CA 3:** Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

1020235545	Industrial Robotics	L	T	P	C
PRACTICUM		1	0	4	3

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Step / Procedure	10
B	Write Program	20
C	Edit Program / Simulate / Execution	20
D	Result / Finish / Accuracy	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020235545	Industrial Robotics	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus contents

THEORY	
Introduction – Definitions of Robot -Robot Anatomy – Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors. Mechanical arm – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope, Work Volume. Robot controller – Configuration - Four types of controls – Open loop and closed loop controls – Speed of response and stability – Precision of movements: Spatial resolutions, accuracy and repeatability. Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives –Stepper motors, DC Servo motors and AC Servo motors – Salient features – Applications and Comparisons of Drives. End effecters –Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Two fingered and Three fingered Grippers, Internal and External Grippers,– End Of Arm Tooling (EOAT)- Selection and Design considerations Robot applications – Material handling – Press loading and unloading –Die casting – Machine tool loading and unloading – Spot welding – Arc welding – Spray painting – Assembling – Finishing – Automatic Guided Vehicle – Adopting robots to workstations – Requisite robot characteristics and Non requisite robot characteristics – Stages in selecting robots for industrial applications – Safety considerations for robot operations – Robotics in the future and characteristics task–Economical analysis of robots – Social implications.	15
Practice Study of Robot system, Study and practice in the robot simulation software .	6

1020235545	**Industrial Robotics**	L	T	P	C
PRACTICUM		1	0	4	3

Practical Exercise

Ex.No	Name of the Experiment	
1.	Programming using Position recording using Cartesian co-ordinate system - (No. of positions – 9).	4
2.	Programming using Position recording using Polar co-ordinate system - (No. of positions - 9).	4
3.	Programming using Loops and sub – routine.	4
4.	Pick and place of objects (No. of objects to be specified- 6).	4
5.	Pick and stack of objects (No. of objects to be specified- 6).	4
6.	Arc welding practice(Length. of weld to be specified).	4
7.	Programming using Spot welding practice - (No. of spots Minimum 3).	4
8.	Assembling practice (Simple assembling).	4
9.	Profile cutting practice (combination of lines and arcs).	4
10.	Programming for Spray painting practice - (Area - 300mm x 300mm).	4
11.	Programming using Machine loading and unloading practice with time delay.	4
Revision + Assessment		10
Total		75

Textbook:

1. Mikell P Groover, Mitchell Weiss, Roger N Nagel, Nicholas Odrey, and Ashish Dutta, Industrial Robotics – Technology, Programming and Applications, 2nd Edition, McGraw Hill, 2013.
2. Appuu Kuttan, Robotics, I.K. International Publishing House Pvt. Limited, 2013
3. Ganesh S. Hegde, A Textbook of Industrial Robotics, Second Edition, Laxmi Publications (P) Ltd., 2015
4. Nagarajan Ramachandran, Introduction to Industrial Robotics, Pearson India Education Services Pvt. Ltd., 201

1020235545	Industrial Robotics	L	T	P	C
PRACTICUM		1	0	4	3

Website links for reference:

- https://www.youtube.com/playlist?list=PLyqSpQzTE6M_XM9cvjLLO_Azt1FkgPhpH
- https://www.youtube.com/playlist?list=PLFW6lRTa1g81AGUOky_xVhNVsudGwZxsY

LIST OF EQUIPMENTS

1. Robot simulation software or Robotic arm
2. Computer - 30 Nos.

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises/experiments should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by theDOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Step / Procedure	10
B	Write Program	20
C	Edit Program / Simulate / Execution	20
D	Result / Finish / Accuracy	10
E	Written Test (Theory Portions)	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020235546	HVAC Systems and Components	L	T	P	C
PRACTICUM		1	0	4	3

Introduction:

To impart knowledge about HVAC system components, handling the components and testing the performance is very much needed. This content would be useful to select the various types of components to be used in HVAC systems with different capacities. The knowledge about VFD compressors and capacity calculation of cooling coils is very essential in the present scenario.

Course Objectives:

The objective of this course is to enable the student to

- Practice, set and adjust the LP and HP cut-out, TEV and thermostat in refrigeration systems.
- Test the capacitor and selector switch for its working.
- Test the pumping capacity of sealed compressor.
- Determine the capacity of fan and evaporator coil of window air conditioner.
- Determine the capacity of air cooled condenser of split air conditioner.
- Determine the range, approach and efficiency of cooling tower.

Course Outcomes

After successful completion of this course, the students should be able to,

CO1: Explain the construction and working of compressor and condenser.CO2: Explain the functions of expansion valve and evaporator.

CO3: Describe the different components in the HVAC system.CO4: Demonstrate the various processes of HVAC system.

CO5: Demonstrate the electrical components used in HVAC system.

Pre-requisites:

Basic knowledge of HVAC Components.

1020235546	HVAC Systems and Components	L	T	P	C
PRACTICUM		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3			3			
CO2	3			3			
CO3	3			3			
CO4	3			3			
CO5	3			3			

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- It is advised that teachers take steps to pique pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area,teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientificmindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome and employability based.
- All demonstrations/Hand-on practices are under a simulated environment (may befollowed by a real environment as far as possible).

1020235546	HVAC Systems and Components	L	T	P	C
PRACTICUM		1	0	4	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Exercises	Cycle II Exercises	All Portions	All Exercises	All Exercises Experiments
Duration	2 Periods	2 Periods	3 Hours	3 Hours	3 hours
Exam Marks	60	60	100	100	100
Converted to Marks	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. Best of one will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

1020235546	**HVAC Systems and Components**	L	T	P	C
PRACTICUM		1	0	4	3

The details of the documents to be prepared as per the instruction below.

Each exercise should be completed on the day of practice.

The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.

This documentation can be carried out in a separate notebook / printed manual / file. The Steps, Procedure, Sketch and Result should be written by the student manually.

The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Tools required / Observation	20
C	Diagrams / Tabulation and calculation / Setting / Adjusting	20
	TOTAL	50
D	Practical Documents (As per the portions)	10
		60

Cycle - I **Exercise 1, 2, 3, 4, 5 and 6.**

Cycle - II **Exercise 7, 8, 9, 10, 11 and 12.**

CA 3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

CA 4: All the exercises/experiments should be completed and kept for the practical test.The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

1020235546	**HVAC Systems and Components**	L	T	P	C
PRACTICUM		1	0	4	3

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks
TOTAL			100 Marks

SCHEME OF EVALUATION

Model Practical Examination - Practical Exam

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Tools required / Observation	20
C	Diagrams / Tabulation and calculation / Setting / Adjusting	20
D	Result / Report	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

1020235546	HVAC Systems and Components	L	T	P	C
PRACTICUM		1	0	4	3

Syllabus Contents

Unit 1	**Compressor**	
Compressor – Introduction - functions of a compressor – Classification - open type reciprocating compressor – Hermetically sealed compressors – construction and working		3

Unit II	**Condenser**	
Condenser - Introduction – Functions —Classification of condensers – Air cooled condenser, Water cooled condenser - Construction and Working		3
Unit III	**Expansion device**	
3.1 Expansion devices- Introduction – Functions – Types of expansion devices –Capillary tube, Automatic expansion valve, Thermostatic expansion valve – Construction and working only.		3
Unit IV	**Evaporator**	
Evaporator - Introduction – Functions - Types of evaporators – Bare tube coilevaporators- Finned evaporators – Construction and working only.		3
Unit V	**HVAC System Controls and Fans**	
Motor Operating Components: Selector switch – OLP – Relay – Capacitor – Starting, Running. System Controls: LP, HP cutout — Humidity control – Thermostat switch – Solenoid valve. Fans – Introduction - function of fans - Types of fans - centrifugal fans - Axial flow fan – Propeller fan, Tube axial fan and vane axial fan – Construction and workingonly.		3

1020235546	**HVAC Systems and Components**	L	T	P	C
PRACTICUM		1	0	4	3

Practical Exercise

Ex. No	**Name of the Exercise**	**Periods**
1	Charging of Refrigerant in a refrigeration System	4
2	Pump down of refrigerant from the refrigeration System	4
3	Find out the leak in the refrigeration System and rectify the defect	4
4	Charging of oil in the refrigeration System	4
5	Setting and Adjusting the thermostat.	4
6	Setting and Adjusting of low pressure and High pressure cut out in VCR system.	4
7	Setting and Adjusting of thermostatic expansion valve.	4
8	Testing the pumping capacity of a sealed compressor.	4
9	Testing and Replacement of faulty capacitor and selector switch.	4
10	Determination of capacity of fan.	4
11	Determination of capacity of evaporator coil of window / Split Air conditioner	4
12	Determination of capacity of air cooled condenser of a Window / Split Air conditioner	4
	Revision + Test	12
	Total	75

Suggested List of Students Activity:

1. Prepare/Download a specification of the following:
2. Various tools, Equipment's and controls used in HVAC systems
3. Presentation / seminar by students on HVAC systems

1020235546	HVAC Systems and Components	L	T	P	C
PRACTICUM		1	0	4	3

TEXT BOOKS and REFERENCES

1. ASHRAE Hand Book Heating, ventilating and Air-conditioning systems and equipment.
2. The Institute of Plumbing - Plumbing Engineering Services Design Guide.
3. Principles of Electrical and Engineering and Electronics by V.K.Mehta and Rohit Mehta.

Web-based/Online Resources:

- https://youtu.be/IKn3c7Sup9k?si=eWDXDgmNGB-RnGs7
- https://youtu.be/PjcdqAkP0UA?si=Ik-us0HFvDgver4M
- https://youtu.be/QgVnRsdoxwQ?si=uf3JHI_hqwK2nkRR
- https://youtu.be/6YiCjnjLKH8?si=SSc125M7ZlDARi9t

1020235546	HVAC Systems and Components	L	T	P	C
PRACTICUM		1	0	4	3

END SEMESTER EXAMINATIONS – PRACTICAL EXAM

Note:

All the exercises/experiments should be completed before the Board Practical Examinations. End Semester Practical examination should be conducted for all the exercises / experiments for 100 Marks. Students will be permitted to select any one exercise by lot or question paper supplied by the DOTE Exam section shall be used. The practical document prepared by the student should be submitted with a Bonafide Certificate.

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim / Procedure	10
B	Tools required / Observation	20
C	Diagrams / Tabulation and calculation / Setting / Adjusting	20
D	Result / Report	10
E	Written Test	30
F	Viva Voce	10
	TOTAL	100

Note: For the written test 30 MCQ shall be asked from the theory portions.

Equipment / Facilities required to conduct the Practical Course.

Sl.No	Equipment's	Nos
01	VCR experimental setup with thermostat, LP HP cutouts and TEV	1
02	Sealed compressor and gauge manifold set	1
03	Experimental setup for testing capacitor and selector switch	1
04	Experimental setup for determining capacity of fan and anemometer	1
05	Window air conditioner experimental setup for finding the capacity of evaporator	1
06	Split air conditioner experimental setup for finding the capacity of air cooled condenser	1
07	Cooling tower experimental setup	1

1220236110	Forging Dies, Die Casting Dies & Die Maintenance	L	T	P	C
Theory		3	0	0	3

Introduction

Development and use of Forging & Die casting products is high in industries and requires more knowledge on Forging dies and Die Casting Dies and understand of its processes and the operations. This subject will develop the basic knowledge on Forging and Die casting Dies with the process and the basic operations.

Course Objectives

- Explain the fundamentals of forgings, and forging processes.
- Compare the different types of forging
- Design Drop Forging dies.
- Design press forging and Machine forging dies.
- Explain the basics of Die casting process.
- Explain the working of die casting machines.
- Design die casting die
- State the characteristics of the die steel
- Explain the causes and remedies of die casting defects.
- Practice on estimation and costing of dies
- Estimate the cost of dies
- Understand the necessity & importance of die maintenance

Course Outcomes

On successful completion of this course, the student will be able to

- CO1: Explain the fundamentals of forging and forging processes
- CO2: Compare the different types of forging
- CO3: Illustrate the basics of Die casting Process
- CO4: Design a Die casting Die and identify the causes & remedies of die casting defects
- CO5: understand the Die maintenance

Pre-requisites

Basic knowledge of industries (through Industrial Visits)

1220236110	Forging Dies, Die Casting Dies & Die Maintenance	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3			3	3	3	3
CO2		3				3	1
CO3	1	3				3	3
CO4	3	3	3	3	3		
CO5	2	2	2	2	3		

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

1220236110	Forging Dies, Die Casting Dies & Die Maintenance	L	T	P	C
Theory		**3**	**0**	**0**	**3**

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

syllabus Contents

Unit I	**FORGING PROCESS AND FORGING MACHINES**	
Introduction to Forgings: Uses and advantages of forgings, forged parts Vs cast parts, Forging Temperatures, annealing of forgings, forging properties. forge ability and forgeable metals Forging processes: Hot-working and cold-working – Advantages – comparison – hot-working operations: rolling, forging, smith forging, drop forging, upset forging press forging – roll forging – Roll die forging, , skew rolling, ring rolling - power required calculations for rolling and forging operations. Forging dies– drop hammers- board hammers, air lift hammers, power drop hammers, capacity of drop hammers. Press forging – Mechanical forging presses, Hydraulic press. Comparison of press forging Vs hammer forging. Machine or upset forgings. Heat treatment of forged parts Heating devices–Box or batch type furnaces, rotary hearth furnaces, continuous or conveyor furnaces, induction furnaces, resistance furnaces. Open fire and stock fire.		9

1220236110	Forging Dies, Die Casting Dies & Die Maintenance	L	T	P	C
Theory		3	0	0	3

Unit II	DESIGN OF DROP FORGING, PRESS FORGING AND MACHINE FORGING DIES	
DROP FORGING DIE DESIGN: Hammer dies for preparatory work – fullering dies – edging dies – flattening dies – Drawing down dies – bending die. Essential features of forging dies – generous radii, parting line position, flash gutter, webs and panels, draft, air vents. Flash areas and gutters in finishing dies. Elements of multi impression die block, effect of grain flow. PRESS FORGING DIES: Rating of forging press, steps in press forging dies, design of press forgings, design of press forging dies. MACHINE FORGING DIES:- General characteristics, techniques used in making these forgings, machine forging description and range, machine forging tools and operation, design of dies for forging machines Laws governing forging machine die design, Examples of forgings produced on forging machines, forging defects – causes and remedies. FORGING DIE BLOCKS AND DIES: Materials and grade of die blocks, applications of various grades of steel used for die blocks and dies-Die insert-Re-sinking of dies- IS code for tool and die steels		9
Unit III	**DIE CASTING MATERIALS , MACHINES, DIE MATERIALS AND TREATMENTS**	
DIE CASTING MATERIALS: Types of die casting alloys –metallurgy, melting & casting procedure and application of zinc based die casting alloys, Aluminum base alloys, Magnesium base alloys, magnesium base alloys, Copper base alloys, Lead base alloys and Tin base alloys. DIE CASTING MACHINES: Plunger machine, air machine, modern cold chamber machines. Die locking methods, injection systems, automatic cycle control, and interlock and safety devices in die casting machines. Operation of hot chamber and cold chamber die casting machines. Machine specifications, process parameters and their effect on product quality. Effect of die casting machine on the process – accumulator pressure, injection line pressure, intensification, plunger diameter, locking force, mode of injection, plunger diameter, casting cycle, lubrication. DIE MATERIALS AND TREATMENTS: Characteristics of Tool and Die steels – Choosing of Tool Steels – Heat treatment of die steels – Tool steel production methods – Die surface coatings and treatments – wrought low carbon steels and Cast irons – Nonferrous and non-metallic die materials.		9

1220236110	Forging Dies, Die Casting Dies & Die Maintenance	L	T	P	C
Theory		3	0	0	3

Unit IV	DIE CASTING DIE DESIGN, DEFECTS AND FINISHING OF DIE CASTING DIES	
	DIE CASTING DIE DESIGN: Flow system – Importance, metal flow systems in die casting dies, goose neck, nozzle, sprue, runners systems, shock absorbers, gate, gate area, gate velocity, air vent, overflow, determination of gate area. Procedure to calculate runner and gating dimensions using PQ^2 diagram, calculating runner and gating dimensions without PQ^2 diagram. Consideration of specification of die casting machines. Ejection systems – need and working of ejection system, Types of ejection system – sleeve, ring, blade DIE CASTING DEFECTS: Definition, causes and remedies of defects – Shrink holes, Gas holes, Segregation, Shrink cracks, Porosity, Cold shuts, Flow lines & Blooms, Foliations, Hard spots, Surface draws and Depressions, Soldering, sink mark and excessive flash. FINISHING OF DIE CASTING DIES: Trimming and piercing of die casting dies- comparison die casting dies with other products	9
Unit V	**DIE MAINTENANCE**	
	DIE MAINTENANCE Good Maintenance Practice – Good grinding practice – Stress relieving cutting tools – shimming die components – ball lock punches and die buttons. Die maintenance documentation and tracking – Die maintenance team – Systematic die maintenance system – Request for maintenance form – Continuous improvement. Trouble Shooting Large Panel Stamping Dies – Die Bolting – Nitrogen Pressure Systems – Systematic Approach To Die Tryout – Draw Beads – Double Action Press Operations – Dirt Problems – Forming Ribs And Embossments – Knockout Bars.	9
	TOTAL	**45**

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based onthe course
- Online MCQ have to be conducted for all the five units.
- Blended learning activities to explore the recent trends and developments in the field.

Reference Books:-

1. Chester L Lucas, Drop-Forging Dies and Die-Sinking,2^{nd}edition, Forgotten Books,2016
2. Douglas T Hamilton, Machine Forging,3^{rd}edition, Forgotten Books,2018
3. Chester L Lucas, Die Casting: Dies--machines—methods,3^{rd}edition, Legare Street Press,2022

1220236110	Forging Dies, Die Casting Dies & Die Maintenance	L	T	P	C
Theory		3	0	0	3

Web-based/Online Resources

1. https://youtu.be/6IxJ8vcad3w?si=RPUwxMHaMZYyn2fn
2. https://youtu.be/JjdkBKXQh6Y?si=W8sUgyRv6Ma2GH7o
3. https://youtu.be/AGZnxHalu8c?si=IYMhsSnSRN7YHERy

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1220236211	INDUSTRIAL ENGINEERING	L	T	P	C
THEORY		3	0	0	3

Introduction

In the Indian Economy, Industries and enterprises always find a prominent place. After globalization, the government of India has announced a liberalization policy of starting an enterprise which resulted in the mushroom growth of industries. The present day students should be trained not only in manufacturing processes but also in managing activities of industries. Training must be imparted to students not only to shape them as technicians but also as good managers. The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries. Due to the presence of such personalities the industries will leap for better prosperity and development.

Course Objectives

The objective of this course is to enable the student to

To study the different types of layout.

To study the safety aspects and its impacts on an organization.

To study different work measurement techniques.

To study the staff selection procedure and training of them.

To study capital and resources of capital.

To study inventory control system.

To study engineering ethics and human values.

Course Outcomes

On successful completion of this course, the student will be able to

CO1: Understand about plant, plant layout, maintenance and importance of plant safety

CO2: Understand about method study charts and work measurement techniques

CO3: Understand management principles, personnel management and modern techniques in managements

CO4: Understand share market, fixing the selling prices and stock control systems

CO5: Understand about engineering ethics, human values, stress Management.

1220236211	INDUSTRIAL ENGINEERING	L	T	P	C
THEORY		3	0	0	3

Pre-requisites

Basic knowledge of industries (through Industrial Visits)

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3		3	3	3	3
CO2	3	3	3				3
CO3	3	3		3	3	3	3
CO4	3	3		3	3	3	3
CO5	2	2	2	2	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Assessment Methodology

	Continuous Assessment (40 marks)				**End Semester Examination (60 marks)**
	CA1	**CA2**	**CA3**	**CA4**	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

1220236211	INDUSTRIAL ENGINEERING	L	T	P	C
THEORY		3	0	0	3

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Syllabus Contents.

Unit I	**PLANT ENGINEERING AND PLANT SAFETY**	
Plant Engineering: Plant – Selection of site of industry – Plant layout – types – process, product and fixed position – Plant maintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance. Plant Safety: Importance – Industrial safety and procedure-Improper handling- accident - causes and cost of an accident - accident proneness - prevention of accidents-Settlement of industrial disputes - Indian Factories Act 1948 and its provisions related to health, welfare and safety.		9
Unit II	**METHOD STUDY AND WORK MEASUREMENT**	
Method Study: Definition – Ergonomics-Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart- Man machine chart. Work Measurement: Definition – Basic procedure in making a time study – Cycle time and Total Time-Techniques of work measurement - Ratio delay study, Synthesis from standard data, analytical estimating, Predetermined Motion Time System(PMTS)		9

1220236211	INDUSTRIAL ENGINEERING	L	T	P	C
THEORY		3	0	0	3

Unit III	PRINCIPLES OF MANAGEMENT AND MODERN MANAGEMENT TECHNIQUES	
Principles of Management: Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's Principles of Management - Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training - wages and salary administration – Components of wages. Modern Management Techniques: Industry 4.O – Internet of things(IoT)-Cloud computing-AI and Machine Learning-Management Information System(MIS)-5S concept - Just in Time(JIT) - ERP - Kanban - SQC - SPC - PPC - TPM - TQM - Quality tools - PDCA act - Six sigma - Q7 tools - Planning and Scheduling – Corrective and preventive action.		9
Unit IV	**FINANCIAL AND MATERIAL MANAGEMENT**	
Financial Management: Resources of capital – shares-preference and equity shares – debentures-Factory costing – direct cost – indirect cost – Factory overhead – Selling price of a product – Profit – Problems. Depreciation – Causes –Methods - Straight line, sinking fund and percentage on diminishing value method-Packaging and Transportation costing-Low cost industrial machines. Material Management: Objectives of good stock control system – ABC analysis of inventory – Procurement and consumption cycle – Minimum Stock, Lead Time, Reorder Level - Economic order quantity – problems –Supply chain-Storage methods-Material inward and outward-logistics Kaizan-Purchasing Procedure- Bin card.		9
Unit V	**ENGINEERING ETHICS AND HUMAN VALUES**	
Engineering Ethics: Definition - engineering ethics - personal and business ethics - duties and rights– environment and their impact - - Kohlberg's stages of moral development –environmental ethics - computer ethics - Intellectual Property Rights (IPRs). Human values : Morals – values – integrity – service learning - civic virtue - respect for others - living peacefully-commitments - caring – sharing – honesty - courage - valuing time cooperation – empathy –self-confidence– stress management.		9
	TOTAL	**45**

1220236211	INDUSTRIAL ENGINEERING	L	T	P	C
THEORY		3	0	0	3

Suggested List of Students Activity

Presentation/seminars by the students on modern management techniques.

Explore various plants during industrial visits.

Find the selling price of a product using ladder diagrams.

Find depreciation values of vehicles.

Find standard time for a particular job (in lathe) using stop watch time study methods.

Reference

1. Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications (P) Ltd – 2004, 67/4 Madras House, Daryaganj, New Delhi– 110002.
2. Engineering Economics and Management, T.R. Banga& S.C. Sharma, McGraw Hill Editiion. 2 – 2001, New Delhi.
3. Herald Koontz and Heinz Weihrich, Essentials of Management, McGraw Hill Publishing Company, Singapore International Edition. Latest

Web-based/Online Resources

https://www.youtube.com/live/nLyfI65bL78?si=P_ZB42eSo9FoTyb6

https://youtu.be/PRI0wNoUfqk?si=qgf6Ek5Qh3PjMUM2

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1220236212	Total Quality Management	L	T	P	C
THEORY		3	0	0	3

Introduction:

Total Quality Management is a customer-oriented process and aims for continuous improvement of business operations. It ensures that all allied works (particularly work of employees) are toward the common goals of improving product quality or service quality, as well as enhancing the production process or process of rendering of services. However, the emphasis is put on fact-based decision making, with the use of performance metrics to monitor progress.

Course Objectives:

1. To get familiarized with the basic concept and framework of Total Quality management
2. To understand the contribution of Quality Gurus in TQM Journey
3. To grasp the nature and importance of various components that constitute TQM
4. To describe and discuss the role of techniques used in TQM
5. To meet customer expectations by providing high quality products and services
6. To encourage improvements in all organizational processes, products and services

Course Outcomes:

On successful completion of this course, the student will be able to

CO1 - Understand the dimension of quality, characteristics of TQM and ISO 9001:2008 QMS

CO2 - Apply various concepts of QC Tools and Control charts for Continuous process improvement

CO3 - Explain the various statistical data and comparison of frequency distribution statistical analysis functions of production planning and control, total quality management and implement OC and SQC tools in personal and professional career.

CO4 - Understand and construct the various control charts for variable and attributes

CO5- Understand the various Management Planning Tools and apply for Quality & production improvement

1220236212	Total Quality Management	L	T	P	C
THEORY		3	0	0	3

Pre-requisites:

Quality control, Quality assurance, Control charts, Process Management, Customer focus, Continuous Improvement

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1			2	3	2	3	3
CO2	3	2	2			2	
CO3	3				1	3	
CO4	3		1		2	2	3
CO5	3	3	2	2	3	2	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy:

- Engage and Motivate: Teachers should actively engage students to boost their learning confidence
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1220236212	Total Quality Management	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write five questions. Each unit four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries 10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1220236212	Total Quality Management	L	T	P	C
THEORY		3	0	0	3

Syllabus Contents

UNIT – I BASIC CONCEPTS OF TOTAL QUALITY MANAGEMENT	
Quality-Definitions - Dimensions of quality - Brainstorming and its objectives – Introduction to TQM – Characteristics – Basic concepts – Elements – Pillars – Principles - Obstacles to TQM implementation – Potential benefits of TQM – Quality council – Duties – Responsibilities – Quality statements – Vision – Mission – Quality policy statements – Strategic planning – Seven steps to strategic planning – Deming philosophy- Customer delight - ISO 9001:2008 Quality Management System requirements and implementation	9
UNIT – II CONTINUOUS PROCESS IMPROVEMENT – Q7 TOOLS	
Input / Output process model – Juran Trilogy – PDCA (Deming Wheel) cycle – 5S Concepts – SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE – needs and objectives – effective implementation of 5S concepts in an organization - Housekeeping – Kaizen. Seven tools of quality control (Q-7 tools) – Check sheet – Types of check sheet –Histogram – Cause and effect diagram - Pareto diagram – Stratification Analysis – Scatter diagram Graph/run charts – Control charts - Construction of above diagrams. Quality circle - concept of quality circle - Organisation of Quality circle and objectives of Quality circle.	9
UNIT – III STATISTICAL FUNDAMENTALS	
Types of Data – Collection of Data – Classification of Data – Tabular presentation of Data – Graphical representation of a frequency distribution – Comparison of Frequency distribution – Mean – Median – Mode – Comparison of measures of central tendency – Introduction to measures of dispersion – Sample – sampling - Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.	9

1220236212	Total Quality Management	L	T	P	C
THEORY		3	0	0	3

UNIT – IV CONTROL CHARTS	
Control chart – Types of control charts – Control chart for variables – Construction of X and R charts – control limits Vs specification limits – Process capability – Method of doing	
process capability Analysis – Measures of process capability – Problems. Attributes – Control charts – P chart – np chart – c chart – u chart – Construction of above diagrams – Problems - Comparison between variable chart and Attribute chart.	9
UNIT – V MANAGEMENT PLANNING TOOLS & BENCH MARKING	
Affinity diagram – Radar Diagram - Inter Relationship diagram (Inter Relationship diagram) – Tree diagram - Prioritization matrix – Matrix diagram – Decision tree – Arrow diagram – Matrix data analysis diagram - Construction of above diagrams. Bench marking –	
Objectives of bench marking – Types – Bench marking process - Benefits of Bench marking – Pit falls of Bench marking-Just In Time (JIT) concepts and its objectives – Total Productive Maintenance(TPM) - Introduction, Objectives of TPM – steps in implementing TPM.	9
TOTAL HRS.	45

Suggested List of Students Activity:

- Presentation/Seminars by students on any recent technological developments based onthe course
- Online MCQ have to be conducted for all the five units.
- Blended learning activities to explore the recent trends and developments in the field.

1220236212	Total Quality Management	L	T	P	C
THEORY		3	0	0	3

Text and Reference Books:

1) Total Quality Management, Date H.Besterfiled, Pearson Education Asia.
2) Total Quality Management, V.Jayakumar, Lakshmi Publications.(reprint 2005)
3) Training manual on ISO 9001 : 2000 & TQM, Girdhar J.Gyani, Raj Publishing House, Second Edition 2001

Reference Book:

1) Total Quality Management, Oakiand.J.S. Butterworth Heinemann Ltd. Oxford 1989.
2) Quality Management – Concepts and Tasks- Narayana.V and Sreenivasan.N.S., New Age International 1996.
3) Total Quality Management for engineers, Zeiri. Wood Head Publishers. 1991.

Web based online resources

1. https://www.techtarget.com/searchcio/definition/Total-Quality-Management
2. https://www.edrawmax.com/total-quality-management/
3. https://archive.nptel.ac.in/courses/110/104/110104080/ You tube:

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Introduction

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspirations of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promote concern for excellence. In this context the course on entrepreneurship and startups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs relevant to social prosperity and thereby ensuring good means of living for every individual, providing jobs and developing the Indian economy.

Course Objectives

After completing this subject, the student will be able to

- Acquire entrepreneurial spirit and resourcefulness
- Familiarize Acquire knowledge about the business idea and product selection
- Analyze the banking and financial institutions
- Understand the pricing policy and cost analysis

Course Outcomes

CO1: Explain the process of entrepreneurship

CO2: Analyse the importance of generation of ideas and product selection

CO3: Familiarization of various financial and non financial schemes

CO4: Acquire various cost components to arrive pricing of the product

CO5: Learn the preparation of project feasibility report

Pre-requisites

Knowledge of basics of Engineering and Industrial engineering

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	3	1	3
CO2	-	-	-	-	3	3	3
CO3	-	-	-	1	-	3	2
CO4	-	1	3	3	2	3	2
CO5	-	2	3	3	3	3	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice- activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real- world scenarios when possible.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Unit I	**Entrepreneurship – Introduction and Process**	
Concept of entrepreneurship - Importance, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, , Competencies and characteristics of an entrepreneur -, Ethical Entrepreneurship, Entrepreneurial Values and Attitudes, Creativity, Innovation and entrepreneurship- Entrepreneurs - as problem solvers, Mindset of an employee and an entrepreneur, - Risk Taking-Concepts		7
Unit II	**Business Idea**	
Types of Business: Manufacturing, Trading and Services, Stakeholders: sellers, vendors and consumers and Competitors, E- commerce Business Models, business idea generation - Types of Resources - Human, Capital and Entrepreneurial tools and resources, etc.,- setting business goals- Patent, copyright and Intellectual property rights, Customer Relations and Vendor Management, -Business Ideas vs. Business Opportunities, Opportunity – SWOT ANALYSIS of a business idea - Business Failure – causes and remedies.- Types of business risks,		7
Unit III	**Banking**	
Size and capital based classification of business enterprises- Role of financial institutions, Role of Government policy, Entrepreneurial support systems, Incentive schemes for state government, and Incentive schemes for Central governments.		7
Unit IV	**Pricing and Cost Analysis**	
Types of Costs - Variable - Fixed- Operational Costs - Break Even Analysis - for single product or service, -financial Business Case Study, Understand the meaning and concept of the term Cash Inflow and Cash Outflow- Pricing- Calculate Per Unit Cost of a single product, , Understand the importance and preparation of Income Statement, Prepare a Cash Flow Projection- Factors affecting pricing.- GST.		7

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Unit V	Business Plan Preparation	
Feasibility Report – Technical analysis, financial analysis- Market Research - Concept, Importance and Process- tools for market research- Market Sensing and Testing, Marketing and Sales strategy, Digital marketing, Branding - Business name, logo, tag line, Promotion strategy, Business Plan Preparation, -Concept and Importance, , Execution of Business Plan.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity.

1. Students can explore app development or web design. They'll learn about technology, user experience, and marketing.
2. Hosting events, workshops, or conferences allows students to practice project management, networking, and marketing skills.
3. Encourage students to address social or environmental issues through innovative business solutions. This fosters empathy and creativity.
4. Part of entrepreneurship clubs or organizations provides networking opportunities, mentorship, and exposure to real-world challenges.
5. Competitions like business plan contests or pitch events allow students to showcase their ideas and receive feedback.
6. Students can create and sell handmade crafts, artwork, or other products. This teaches them about production, pricing, and customer relations.
7. Students can provide consulting services in areas they're knowledgeable about, such as social media marketing or financial planning.
8. Encourage students to create and manage their own small business or offer freelance services. This hands-on experience helps them understand various aspects of entrepreneurship.

6000236112	Entrepreneurship	L	T	P	C
THEORY		3	0	0	3

Text and Reference Books:

1. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra., 2019.
2. H.Nandan, Fundamentals of Entrepreneurship, Prentice Hall India Learning Private Limited, Third Edition, 2013.
3. R.K. Singal, Entrepreneurship Development & Management, S K Kataria and Sons, 2013.

Web Reference:

- https://ocw.mit.edu/courses/15-390-new-enterprises-spring-2013/resources/lecture-1/
- https://onlinecourses.nptel.ac.in/noc20_ge08/preview

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Introduction

Project management is the systematic application of knowledge, skills, tools, and techniques to project activities to meet specific project requirements. It involves planning, organizing, and managing resources to achieve project goals within defined scope, time, and budget constraints. Project management encompasses several key processes and phases, including initiation, planning, execution, monitoring and controlling, and closing. It is essential across various industries to ensure projects are completed successfully, efficiently, and effectively, aligning with organizational objectives and stakeholder expectations. Project managers play a crucial role in leading teams, managing risks, ensuring quality, and communicating with stakeholders to drive project success.

Course Objectives

After completing this subject, the student will be able,

- To understand the concept, characteristics and elements of projects.
- To understand the stages in Project Life Cycle.
- To appreciate the need for Project Portfolio Management System.
- To know the considerations in choosing appropriate project management structure.
- To understand the components of techno-economic feasibility studies.
- To know about the detailed project report
- To learn about project constraints.
- To understand the techniques of evaluation.
- To get insight into the Social Cost Benefit Analysis Method.
- To know how to construct project networks using PERT and CPM.
- To learn how to crash project networks
- To understand the meaning of project appraisal.
- To understand the meaning of project audits.
- To know the qualities of an effective project manager.
- To understand the stages in the Team Development model.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Course Outcomes

CO 1: Explain the principles of Project Management

CO 2: Create and manage project schedules.

CO 3: Create structure and manage the project commitments.

CO 4: Acquire to Gain enterprise support.

CO 5: Prepare a Detailed Project Report (DPR).

Pre-requisites
Basic Knowledge.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	3	1
CO2	3	-	-	-	1	3	1
CO3	3	-	-	1	1	3	1
CO4	3	-	-	-	1	3	1
CO5	3	-	-	1	1	3	1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

Unit	Content	Hours
Unit I	**Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays**	
	Project – Classification – Importance of Project Management – An Integrated Approach – Project Portfolio Management System – The Need – Choosing the appropriate Project Management Structure: Organizational considerations and project considerations – steps in defining the project – project Rollup – Process breakdown structure – Responsibility Matrices – External causes of delay and internal constraints.	7
Unit II	**Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints**	
	Project feasibility studies - Opportunity studies, General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study – components of project feasibility studies – Managing Project resources flow – project planning to project completion: Pre-investment phase, Investment Phase and operational phase – Project Life Cycle – Project constraints.	7
Unit III	**Project Evaluation under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis**	
	Project Evaluation under certainty - Net Present Value (Problems - Case Study), Benefit Cost Ratio, Internal Rate of Return, Urgency, Payback Period, ARR – Project Evaluation under uncertainty – Methodology for project evaluation – Commercial vs. National Profitability – Social Cost Benefit Analysis, Commercial or National Profitability, social or national profitability.	7

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Unit IV	Developing Project Network using PERT and CPM, Project Appraisal and Control Process.	
Developing a Project Plan - Developing the Project Network – Constructing a Project Network (Problems) – PERT – CPM – Crashing of Project Network (Problems - Case Study) – Resource Levelling and Resource Allocation – how to avoid cost and time overruns – Steps in Project Appraisal Process – Project Control Process – Control Issues – Project Audits – the Project Audit Process – project closure – team, team member and project manager evaluations.		7
Unit V	Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls.	
Managing versus leading a project - managing project stakeholders – social network building (Including management by wandering around) – qualities of an effective project manager – managing project teams – Five Stage Team Development Model – Situational factors affecting team development – project team pitfalls.		7
Revision + Test		10
TOTAL HOURS		45

Suggested list of Students Activity,

Project Simulation and Role-Playing:

- Activity: Participate in simulated project scenarios where students take on different roles within a project team (e.g., project manager, team member, stake holder).
- Purpose: This helps students understand the dynamics of project management, including leadership, communication, and team collaboration.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Case Study Analysis:

- Activity: Analyze real-world case studies of successful and failed projects.
- Purpose: This activity enables students to apply theoretical knowledge to practical situations, identify best practices, and learn from the challenges and solutions implemented in real projects.

Group Project:

- Activity: Work in teams to manage a project from initiation to closure, simulating a real project environment.
- Purpose: Group projects help students learn how to work collaboratively, manage group dynamics, and apply project management tools and techniques in a team setting.

Project Management Software Training:

- Activity: Gain hands-on experience with project management software such as Microsoft Project, Asana, or Trello.
- Purpose: This activity equips students with practical skills in using technology to plan, track, and manage project tasks and resources efficiently.

Reference Books:

1. Clifford F. Gray And Erik W. Larson, Project Management – The Managerial Process, Tata Mcgraw Hill.
2. Dragan Z. Milosevic, Project Management Toolbox: Tools And Techniques For The Practicing Project Manager,
3. Gopalakrishnan, P/ Ramamoorthy, V E, Textbook Of Project Management, Macmillan India. Ltd.

6000236113	Project Management	L	T	P	C
THEORY		3	0	0	3

Web Reference

https://youtu.be/pc9nvBsXsuM

NPTEL Courses

https://youtu.be/PqQqTAu_FiM

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

Note: Answer Ten questions by selecting Two questions from each unit. Each question carries 10 marks.

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

1020236115	Industry 4.0	L	T	P	C
THEORY		3	0	0	3

Introduction

Industry 4.0, also known as the Fourth Industrial Revolution, represents the current trend of automation and data exchange in manufacturing technologies. It integrates advanced technologies such as artificial intelligence (AI), the Internet of Things (IoT), cloud computing, and big data analytics to create "smart factories" that are highly efficient and adaptive.

Industry 4.0 is transforming the manufacturing landscape by leveraging advanced technologies to create more efficient, flexible, and intelligent production processes. For diploma engineering students, understanding these concepts is crucial as they will play a key role in the future of engineering and manufacturing. Learning Industry 4.0 will not only enhance your technical skills but also prepare you for the evolving job market in the digital age.

Course Objectives

The objective of this course is to prepare the student,

- To understand the basics of Technology of Industry 4.0 and IoT
- To learn about the Artificial Intelligence and Application Domains
- To study Robotic Process Automation and programming.
- To understand the Augmented & Virtual Reality and its applications

To learn and evolution of IoT, Sensors, and Actuators

Course Outcomes

On successful completion of this course, the student will be able to,

CO1: Describe the Industry 4.0 technology and Industrial Internet of Things

CO2: Explain the Artificial Intelligence (AI) and Future Prospects of AI.

CO3: Explain Robotic Process Automation (RPA) for Manufacturing Industry

CO4: Describe Augmented & Virtual Reality and its aapplication.

CO5: Explain the applications of IoT, Sensors, and Actuators in industries

Pre-requisites

Basic Knowledge of Industry 4.0 and its Applications

1020236115	Industry 4.0	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3				1		1
CO2	3				1		1
CO3	3				1		1
CO4	3				1		1
CO5	3				1		1

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13-14th Week	16th Week	

1020236115	Industry 4.0	L	T	P	C
THEORY		3	0	0	3

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best of one will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below.

Answer five questions (5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

A3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

Question Pattern:

Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1020236115	Industry 4.0	L	T	P	C
THEORY		3	0	0	3

Unit I:	**Introduction to Industry 4.0**	
Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.		7
Unit II:	**Artificial Intelligence**	
Artificial Intelligence: Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI - Environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI.		7
Unit III:	**Robotic Process Automation (RPA)**	
Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA – Robots and Softbots – RPA architecture and process methodologies - Industries best suited for RPA - Risks & Challenges with RPA.		7
Unit IV:	**Augmented & Virtual Reality**	
Augmented Reality: Definition - Tools for Augmented Reality – Hololens - Advantages and Challenges of AR - Applications of AR in Education, Industries - Mixed Reality. Virtual Reality: Definition – Types of Head Mounted Displays – Tools for Virtual Reality – Applications of VR in Education, Industries - Difference between VR and AR.		7
Unit V:	**IoT, Sensors and Actuators**	
Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.		7
Assessment Test and Revision with Student activity		10
Total		45

1220236351	Industry 4.0	L	T	P	C
THEORY		3	0	0	3

Textbook:

1. Sudip Misra, Chandana roy, and Anandarup Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0, Taylor & Francis India, 2021.
2. Dr Anand Kumar Singh and Dr. Manish Gangil, INDUSTRY 4.0, Shashwat Publication, 2022.
3. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017.
4. Dr Kamlesh Lakhwani, Dr Hemant Kumar Gianey, Joseph Kofi Wireko, and Kamal Kant Hiran, Internet of Things (IoT), First Edition, BPB Publications, 2020.

Website links for reference:

- https://www.youtube.com/playlist?list=PLbRMhDVUMngdcLdH4-YF1uJI4IuhcDZPR

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hrs. **Max. Marks: 100**

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks each.

Instruction to the Question Setters

Four questions will be asked from every unit, students should write any two questions for 10 marks. The question may have two subdivisions only.

1220236351	Internship	540 Periods	C
PROJECT			12

Introduction

Internships in educational institutions are designed to provide students with practical experience in their field of study and to bridge the gap between academic knowledge and professional practice.

Objectives

After completing Internship, Interns will be able to,

- Apply the theoretical knowledge and skill during performance of the tasks assigned in internship.
- Demonstrate soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship.
- Document the Use case on the assigned Task.
- Enable interns to apply theoretical knowledge gained in the classroom to real-world practical applications.
- Provide hands-on experience in the industrial practices.
- Develop essential skills such as communication, organization, teamwork, and problem-solving.
- Enhance specific skills related to the intern's area of focus.
- Offer a realistic understanding of the daily operations and responsibilities.
- Provide opportunities to work under the guidance of experienced supervisors and administrators.
- Allow interns to explore different career paths.
- Help interns make informed decisions about their future career goals based on first-hand experience.
- Facilitate the establishment of professional relationships with supervisor, administrators, and other professionals in the field.
- Provide access to a network of contacts that can be beneficial for future job opportunities and professional growth.

1220236351	Internship	540 Periods	C
PROJECT			12

- Foster personal growth by challenging interns to step out of their comfort zones and take on new responsibilities.
- Build confidence and self-efficacy through successful completion of internship tasks and projects.
- Give insight into the policies, regulations, and administrative practices.
- Allow interns to observe and understand the implementation of standards and policies in practice.
- Provide opportunities for constructive feedback from supervisors and mentors, aiding in the intern's professional development.
- Enable self-assessment and reflection on strengths, areas for improvement, and career aspirations.
- Encourage sensitivity to the needs and backgrounds of different groups, promoting inclusive and equitable industrial practices.

Course Outcomes

CO1: Demonstrate improved skills.

CO2: Exhibit increased professional behaviour.

CO3: Apply theoretical knowledge and principles in real-world practices.

CO4: Develop and utilize assessment tools to evaluate the learning and practices.

CO5: Engage in reflective practice to continually improve their learning and professional growth.

1220236351	**Internship**	**540 Periods**	**C**
PROJECT			**12**

Facilitating the Interns by an Internship Provider.

Orient intern in the new workplace. Give interns an overview of the organization, Explain the intern's duties and introduce him or her to co-workers.

Develop an internship job description with clear deliverables and timeline.

Allow the interns in meetings and provide information, resources, and opportunities for professional development.

The interns have never done this kind of work before, they want to know that their work is measuring up to organizational expectations, hence provide professional guidance and mentoring to the intern.

Daily progress report of Intern is to be evaluated by industry supervisor. examine what the intern has produced and make suggestions. Weekly supervision meetings can help to monitor the intern's work.

Duties Responsibilities of the Faculty Mentor

To facilitate the placement of students for the internship

To liaison between the college and the internship provider

To assist the Industrial Training Supervisor during assessment

Instructions to the Interns

- Students shall report to the internship provider on the 1st day as per the internship schedule.
- Intern is expected to learn about the organization, its structure, product range, market performance, working philosophy etc.
- The interns shall work on live projects assigned by the internship provider.

1220236351	Internship	540 Periods	C
PROJECT			12

- The Intern shall record all the activities in the daily log book and get the signature of the concerned training supervisor.
- Intern shall have 100% attendance during internship programme. In case of unavoidable circumstances students may avail leave with prior permission from the concerned training supervisor of the respective internship provider. However, the maximum leave permitted during internship shall be as per company norms where they are working and intern shall report the leave sanctioned details to their college faculty mentor.
- The interns shall abide all the Rules and Regulations of internship provider
- Intern shall follow all the safety Regulations of internship provider.
- On completion of the internship, the intern shall report to the college and submit the internship certificate mentioning duration of internship, evaluation of interns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly reports in the form of a diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal

1220236351	Internship	540 Periods	C
PROJECT			12

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organisation where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant/product/process/construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training.Any data, drawings etc. should be incorporated with the consent of the Organisation.

Scheme of Evaluation

Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during 8th Week and 15th Week. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
Total		50

1220236351	**Internship**	540 Periods	C
PROJECT			12

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of internship period (Dec - May). The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	**Description**	**Marks**
A	Daily Activity Report.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
Total		100

1220236353	**Fellowship**	540 Periods	C
PROJECT			12

Introduction

The Fellowship in the Diploma in Engineering program is designed to provide aspiring engineers with a comprehensive educational experience that combines theoretical knowledge with practical skills. This fellowship aims to cultivate a new generation of proficient and innovative engineers who are equipped to meet the challenges of a rapidly evolving technological landscape.

Participants in this fellowship will benefit from a robust curriculum that covers core engineering principles, advanced technical training, and hands-on projects. The program emphasizes interdisciplinary learning, encouraging fellows to explore various branches of engineering, from mechanical and civil to electrical, electronics & communication and computer engineering. This approach ensures that graduates possess a versatile skill set, ready to adapt to diverse career opportunities in the engineering sector.

In addition to academics, the fellowship offers numerous opportunities for professional development. Fellows will engage with industry experts through seminars, workshops, and internships, gaining valuable insights into real-world applications of their studies. Collaborative projects and research initiatives foster a culture of innovation, critical thinking, and problem-solving, essential attributes for any successful engineer.

By offering this fellowship, participants become part of a vibrant community of learners and professionals dedicated to advancing the field of engineering. The program is committed to supporting the growth and development of each fellow, providing them with the tools and resources needed to excel both academically and professionally.

The Fellowship in the Diploma in Engineering is more than just an educational endeavor; it is a transformative journey that equips aspiring engineers with the knowledge, skills, and experiences necessary to make significant contributions to society and the engineering profession.

1220236353	Fellowship	540 Periods	C
PROJECT			12

Objectives

After completing students will be able to,

- Provide fellows with a solid foundation in core engineering principles and advanced technical knowledge across various engineering disciplines.
- Equip fellows with hands-on experience through laboratory work, projects, and internships, ensuring they can apply theoretical knowledge to real-world scenarios.
- Promote interdisciplinary understanding by encouraging exploration and integration of different engineering fields, fostering versatility and adaptability in fellows.
- Encourage innovation and creativity through research projects and collaborative initiatives, enabling fellows to develop new solutions to engineering challenges.
- Facilitate professional growth through workshops, seminars, and interactions with industry experts, preparing fellows for successful careers in engineering.
- Develop critical thinking and problem-solving skills, essential for tackling complex engineering problems and making informed decisions.
- Strengthen connections between academia and industry by providing opportunities for internships, industry visits, and guest lectures from professionals.
- Foster leadership qualities and teamwork skills through group projects and collaborative activities, preparing fellows for leadership roles in their future careers.
- Instill a sense of ethical responsibility and awareness of the social impact of engineering practices, encouraging fellows to contribute positively to society.
- Promote a culture of lifelong learning, encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to work in a global engineering environment by exposing them to international best practices, standards, and cross-cultural experiences.

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Course Outcomes

CO 1: Demonstrate a strong understanding of core engineering principles and possess the technical skills necessary to design, analyze, and implement engineering solutions across various disciplines.

CO 2: Apply theoretical knowledge to practical scenarios, effectively solving engineering problems through hands-on projects, laboratory work, and internships.

CO 3: Exhibit the ability to conduct research, develop innovative solutions, and contribute to advancements in engineering through critical thinking and creative approaches to complex challenges.

CO 4: Understand and adhere to professional and ethical standards in engineering practice, demonstrating responsibility, integrity, and a commitment to sustainable and socially responsible engineering.

CO 5: Enhance strong communication skills, both written and verbal, and be capable of working effectively in teams, demonstrating leadership and collaborative abilities in diverse and multidisciplinary environments.

Important points to consider to select the fellowship project.

Selecting the right fellowship project is crucial for maximizing the educational and professional benefits of a Diploma in Engineering program.

- **Relevance to Future Plans**: Choose a project that aligns with your long-term career aspirations and interests. This alignment will ensure that the skills and knowledge you gain will be directly applicable to your desired career path.
- **Industry Relevance**: Consider the current and future relevance of the project within the industry. Opt for projects that address contemporary challenges or emerging trends in engineering.

- **Access to Facilities**: Ensure that the necessary facilities, equipment, and materials are available to successfully complete the project. Lack of resources can hinder the progress and quality of your work.
- **Mentorship and Guidance**: Select a project that offers strong mentorship and support from experienced faculty members or industry professionals. Effective guidance is crucial for navigating complex problems and achieving project objectives.
- **Project Scope**: Assess the scope of the project to ensure it is neither too broad nor too narrow. A well-defined project scope helps in setting clear objectives and achievable milestones.
- **Feasibility**: Evaluate the feasibility of completing the project within the given timeframe and with the available resources. Consider potential challenges and ensure you have a realistic plan to address them.
- **Technical Skills**: Choose a project that allows you to develop and enhance important technical skills relevant to your field of study. Practical experience in using specific tools, technologies, or methodologies can be highly beneficial.
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- **Soft Skills**: Consider projects that also offer opportunities to develop soft skills such as teamwork, communication, problem-solving, and project management.
- **Innovative Thinking**: Select a project that encourages creativity and innovative problem-solving. Projects that push the boundaries of traditional engineering approaches can be particularly rewarding.
- **Societal Impact**: Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

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Guidelines to select Fellowship

- Ensure the program is accredited by a recognized accrediting body and has a strong reputation for quality education in engineering.
- Ensure it covers core engineering principles that align with your interests and career goals.
- Investigate the qualifications and experience of the faculty mentor. Look for programs with faculty who have strong academic backgrounds, industry experience, and active involvement in research.
- Check if the program provides adequate hands-on training opportunities, such as laboratory work, workshops, and access to modern engineering facilities and equipment.
- Assess the program's connections with industry. Strong partnerships with companies can lead to valuable internship opportunities, industry projects, and exposure to real-world engineering challenges.
- Explore the availability of research opportunities. Participation in research projects can enhance your learning experience and open doors to innovative career paths.
- Look for programs that offer professional development resources, such as workshops, seminars, and networking events with industry professionals and alumni.
- Ensure the program provides robust support services, including academic advising, career counseling, mentorship programs, and assistance with job placement after graduation.
- Consider the cost of the program and available financial aid options, such as scholarships, grants, and fellowships. Evaluate the return on investment in terms of career prospects and potential earnings. Research the success of the program's alumni. High employment rates and successful careers of past graduates can indicate the program's effectiveness in preparing students for the engineering field.

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Duties Responsibilities of the Faculty Mentor

Each student should have a faculty mentor for the Institute.

- Get the approval from the Chairman Board of Examinations with the recommendations of the HOD/Principal for the topics.
- Provide comprehensive academic advising to help fellows select appropriate specializations, and research projects that align with their interests and career goals.
- Guide fellows through their research projects, offering expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Offer career advice and support, helping fellows explore potential career paths, prepare for job searches, and connect with industry professionals and opportunities.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between fellows and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure fellows have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of fellows, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging fellows to practice integrity and responsibility in their work.
- Assist with administrative tasks related to the fellowship program, such as preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development of fellows.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

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<tr><td>1220236353</td><td rowspan="2">Fellowship</td><td rowspan="2">540 Periods</td><td>C</td></tr>
<tr><td>PROJECT</td><td>12</td></tr>
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Instructions to the Fellowship Scholar

- Regularly meet with your faculty mentor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your mentor.
- Develop strong organizational skills. Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in research projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

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Documents to be submitted by the student to offer fellowship.

- **Completed Application Form**: This is typically the standard form provided by the institution or fellowship program that includes personal information, educational background, and other relevant details.
- **Detailed CV/Resume**: A comprehensive document outlining your educational background, knowledge experience, interest in research experience, publications, presentations, awards, and other relevant achievements if any.
- **Personal Statement**: A document explaining your motivation for applying to the fellowship, your career goals, how the fellowship aligns with those goals, and what you intend to achieve through the program.
- **Recommendation Letters**: Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.
- **Proposal/Description**: A detailed proposal or description of the fellowship project or study you plan to undertake during the fellowship. This should include objectives, methodology, expected outcomes, and significance of the project.
- **Enrollment Verification**: Documentation verifying your current acceptance status in the academic institution or industry where the fellowship will be conducted.
- **Funding Information**: Details about any other sources of funding or financial aid you are receiving, if applicable. Some fellowships may also require a budget proposal for the intended use of the fellowship funds.
- **Samples of Work**: Copies of the relevant work that demonstrates your capabilities and accomplishments in your field.
- **Endorsement Letter**: A letter from your current academic institution endorsing your application for the fellowship, if required.
- **Ethical Approval Documents**: If your research involves human subjects or animals, you may need to submit proof of ethical approval from the relevant ethics committee.
- **Additional Documents**: Any other documents requested by the fellowship program required by the institution.

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Attendance Certification

Every month students have to get their attendance certified by the supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the faculty mentor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Rubrics for Fellowship. Review I & II.

Sl. No.	Topics	Description
1	Alignment with Objectives	Assess how well the project aligns with the stated objectives and requirements. Determine if the student has addressed the key aspects outlined in the project guidelines.
2	Depth of Research:	Evaluate the depth and thoroughness of the literature review. Assess the student's ability to identify and address gaps in existing research.
3	Clarity of Objectives:	Check if the student has clearly defined and articulated the objectives of the project. Ensure that the objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
4	Methodology and Data Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and their relevance to the research questions.

5	Analysis and Interpretation:	Examine the quality of data analysis techniques used. Assess the student's ability to interpret results and draw meaningful conclusions.
6	Project Management:	Evaluate the project management aspects, including adherence to timelines and milestones. Assess the student's ability to plan and execute the project effectively.
7	Documentation and Reporting:	Check the quality of documentation, including code, experimental details, and any other relevant materials. Evaluate the clarity, structure, and coherence of the final report.
8	Originality and Creativity:	Assess the level of originality and creativity demonstrated in the project. Determine if the student has brought a unique perspective or solution to the research problem.
9	Critical Thinking:	Evaluate the student's critical thinking skills in analyzing information and forming conclusions. Assess the ability to evaluate alternative solutions and make informed decisions.
10	Problem-Solving Skills:	Evaluate the student's ability to identify and solve problems encountered during the project. Assess adaptability and resilience in the face of challenges.

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INTERNAL MARKS - 40 Marks

As per the rubrics each topic should be considered for the Review I and Review II. Equal weightage should be given for all the topics. It should be assessed by a faculty mentor and the industrial professional or research guide.

Review 1 shall be conducted after 8th week and Review 2 shall be conducted after 14th week in the semester. Average marks scored in the reviews shall be considered for the internal assessment of 30 Marks.

Scheme of Evaluation

PART	DESCRIPTION	MARKS
A	Assessment as per the rubrics.	30
B	Attendance	10
Total		**40**

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END SEMESTER EXAMINATION - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of fellowship. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report.	20
B	Comprehensive report of the Fellowship Work.	30
C	Presentation by the student.	30
D	Viva Voce	20
Total		100

1220236374	**In-house Project**	**540 Periods**	**C**
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Introduction

Every student must do one major project in the Final year of their program. Students can do their major project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfilment for the award of Diploma in Engineering.

For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.

If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.

For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.

The final examination for project work will be evaluated based on the final report submitted by the project group **of not exceeding four students**, and the viva voce by an external examiner.

Objectives

Academic project work plays a crucial role in the education of Diploma in engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

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- **Integration of Knowledge**: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development**: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities**: Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management**: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
- **Teamwork and Collaboration**: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.

Research Skills: Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.

- **Innovation and Creativity**: Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills**: Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations**: Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development**: Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

CO1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

CO5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

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Important points to consider to select the In-house project.

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.
- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.
- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.
- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.
- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.
- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.
- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.
- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.
- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.
- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.

- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.
- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor.

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The in-house project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.
- The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.
- Provide comprehensive academic advising to help in the selection of appropriate in-house project that align with their interests and career goals.
- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.
- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of the in-house project, providing constructive feedback and guidance to help them stay on track and achieve their goals.

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- Instil and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.
- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students.

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.
- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.
- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.

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- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mind-set of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for an in-house project.

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.

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5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project.Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Marks (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

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END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the project supervisor and an internal examiner.

End Semester (100)#			
Record (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)	Model / Analysis Report (40 Marks)
External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 20 Internal: 10 Supervisor: 10

 # The marks scored will be converted to 60 Marks.