DIPLOMA IN ENGINEERING AND TECHNOLOGY

# 1220 DEPARTMENT OF MECHANICAL ENGINEERING (TOOL & DIE)

SEMESTER PATTERN

## N – SCHEME

IMPLEMENTED FROM 2020 - 2021

CURRICULUM DEVELOPMENT CENTRE

**DIRECTORATE OF TECHNICAL EDUCATION**
**CHENNAI-600 025, TAMIL NADU**

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**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N SCHEME**

(Implemented from the Academic Year 2020 -2021 onwards)

**Chairperson**

**Tmt G.LAXMI PRIYA I.A.S.**
**Director**

Directorate of Technical Education, Guindy, Chennai.

**Co-ordinator**

**Thiru R.KANAGARAJ** Principal

Government Polytechnic College, Purasaiwakam, Chennai.

| **1220 DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)** | |
|---|---|
| **Convener** | |
| **Dr. S.SELVARAJ**<br>HOD( I/C)<br>Dept. of Tool & Die Making<br>Murugappa Polytechnic College<br>S.M Nagar, Chennai- 600 062 | |
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**DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY**
**(SEMESTER SYSTEM)**

**(To be implemented for the students admitted from the year 2020 – 21 onwards)**

**N – SCHEME**

# R E G U L A T I O N S*

**Applicable to the Diploma Courses other than Diploma in Hotel Management & Catering Technology.*

## 1. Description of the Course:

### a. Full Time (3 years)

The Course for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters* and the First Year is common to all Engineering Branches.

### b. Sandwich (3½ years)

The Course for the Sandwich Diploma in Engineering shall extend over a period of three and half academic years, consisting of 7 semesters* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience.

During $4^{th}$ and/or during $7^{th}$ semester the students undergo industrial training for six months / one year. Industrial training examination will be conducted after completion of every 6 months of industrial training.

### c. Part Time (4 years)

The course for the Part Time Diploma in Engineering shall extend over a period of 4 academic years containing of 8 semesters*, the subjects of 3-year full time diploma courses being regrouped for academic convenience.

* ***Each Semester will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Courses and 18 hrs. / Week for Part-Time Diploma Courses.***

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses Viz. Textile Technology, Leather Technology, Printing Technology, Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2020 – 2021 academic year onwards.

**2. Condition for Admission:**

Condition for admission to the Diploma courses shall be required to have passed in the S.S.L.C Examination of the Board of Secondary Education, Tamil Nadu.

(Or)

The Anglo-Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examinations recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

Note: In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

**3. Admission to Second year (Lateral Entry):**

A pass in HSC (academic) or (vocational) courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for University Courses of study or equivalent examination & Should have studied the following subjects.

A pass in 2 Years ITI with appropriate Trade or Equivalent examination.

| Sl. No | Courses | H.Sc Academic | H.Sc Vocational | | Industrial Training Institutes Courses |
|---|---|---|---|---|---|
| | | | Subjects Studied | | |
| | | Subjects Studied | Related subjects | Vocational subjects | |
| 1. | All the Regular and Sandwich Diploma Courses | Physics and Chemistry as compulsory along with Mathematics / Biology | Maths / Physics / Chemistry | Related Vocational Subjects Theory& Practical | 2 years course to be passed with appropriate Trade |
| 2. | Diploma Course in Commercial Practice | English & Accountancy<br><br>English & Elements of Economics<br><br>English & Elements of Commerce | English & Accountancy,<br><br>English & Elements of Economics,<br><br>English & Management Principles & Techniques,<br><br>English & Typewriting | Accountancy & Auditing,<br><br>Banking, Business Management,<br><br>Co-operative Management, International Trade,<br><br>Marketing & Salesmanship, Insurance & Material Management, Office Secretary ship. | - |

- For the Diploma Courses related with Engineering/Technology, the related / equivalent subjects prescribed along with Practical's may also be taken for arriving the eligibility.
- Branch will be allotted according to merit through counseling by the respective Principal as per communal reservation.
- For admission to the Textile Technology, Leather Technology, Printing Technology, Chemical Technology and Commercial Practice Diploma courses the candidates studied the related subjects will be given first preference.
- *Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.*

**4. Age Limit: No Age limit.**

**5. Medium of Instruction: English**

**6. Eligibility for the Award of Diploma:**

**No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3 academic years in any institution affiliated to the State Board of Technical Education and Training,Tamil Nadu, when joined in First Year and two years if joined under Lateral Entry scheme in the second year and passed the prescribed examination.**

**The minimum and maximum period for completion of Diploma Courses is as given below:**

| Diploma Course | Minimum Period | Maximum Period |
|---|---|---|
| Full Time | 3 Years | 6 Years |
| Full Time (Lateral Entry) | 2 Years | 5 Years |
| Sandwich | 3½ Years | 6½ Years |
| Part Time | 4 Years | 7 Years |

This will come into effect from N Scheme onwards i.e., from the academic year 2020-2021.

**7. Subjects of Study and Curriculum outline:**

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical subjects.

The curriculum outline is given in Annexure – I.

**8. Examinations:**

Board Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester.

The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment. Board Examinations are conducted for 100 marks and reduced to 75.

The total marks for result are 75 + 25 = 100 Marks.

## 9. Continuous Internal Assessment:

### A. <u>For Theory Subjects:</u>

**The Internal Assessment marks for a total of 25 marks, which are to be distributed as follows:**

**i) Subject Attendance** **5 Marks**

(Award of marks for subject attendance to each subject Theory/Practical will be as per the range given below)

| | | | |
|---|---|---|---|
| 80% | - | 83% | 1 Mark |
| 84% | - | 87% | 2 Marks |
| 88% | - | 91% | 3 Marks |
| 92% | - | 95% | 4 Marks |
| 96% | - | 100% | 5 Marks |

**ii) Test #** **10 Marks**

| | |
|---|---|
| 2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of these two test marks will be taken and the marks to be reduced to: | 05 Marks |
| The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to: | 05 Marks |

| TEST | UNITS | WHEN TO CONDUCT | MARKS | DURATION |
|---|---|---|---|---|
| **Test I** | Unit – I & II | End of 6th week | 50 | 2 Hrs |
| **Test II** | Unit – III & IV | End of 12th week | 50 | 2 Hrs |
| **Test III** | **Model Examination:** Covering all the 5 Units. (Board Examinations-question paper-pattern). | End of 16th week | 100 | 3 Hrs |

# From the Academic Year 2020 – 2021 onwards.

Question Paper Pattern for the Test - I and Test – II is as follows. The tests should be conducted by proper schedule. Retest marks should not be considered for internal assessment.

**Without Choice**:

| | | |
|---|---|---|
| Part A Type questions: | 6 Questions × 1 mark | 06 marks |
| Part B Type questions: | 7 Questions × 2 marks | 14 marks |
| Part C Type questions: | 2 Questions × 15 marks | 30 marks |
| | **Total** | **50 marks** |

**iii) Assignment** **5 Marks**

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 5 marks.

**iv) Seminar Presentation** **5 Marks**

The students have to select the topics either from their subjects or general subjects which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present seminar (For First and Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member of the group should participate in the presentation. For the Third Year, the students should present the seminar individually.) The seminar presentation is mandatory for all theory subjects and carries 5 marks for each theory subject. The respective subject faculty may suggest topics to the students and will evaluate the submitted materials and seminar presentation. (2 ½ marks for the material submitted in writing and 2 ½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 5 marks.

All Test Papers, Assignment Papers / Notebooks and the seminar presentation written material after getting the signature with date from the students must be kept in safe custody in the department for verification and audit. It should be preserved for one semester after publication of Board Exam results and produced to the flying squad and the inspection team at the time of inspection/verification.

**B. *<u>For Practical Subjects:</u>***

The Internal Assessment mark for a total of 25 marks which are to be distributed as follows: -

a) Attendance : **5 Marks**

(Award of marks same as theory subjects)

b) Procedure/ observation and tabulation/
Other Practical related Work : **10 Marks**

c) Record writing : **10 Marks**

**TOTAL** : **25 Marks**

- *All the Experiments/Exercises indicated in the syllabus should be completed and the same to be given for final Board examinations.*
- **<u>The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.</u>**
- **<u>The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks for each exercise as per the above allocation.</u>**
- **<u>At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks (including Observation and Record writing) and the marks awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)</u>**
- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

*All the marks awarded for Assignments, Tests, Seminar presentation and Attendance should be entered periodically in the Personal Theory Log Book of the staff, who is handling the theory subject.*

*The marks awarded for Observation, Record work and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical subject.*

**10. Communication Skill Practical, Computer Application Practical and Physical Education:**

**The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to increase the Communication skill and ICT skill of students.**

As per the recommendation of MHRD and under Fit India scheme, the Physical education is introduced to encourage students to remain healthy and fit by including physical activities and sports.

**11. Project Work and Internship:**

**<u>The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.</u>**

**a) Internal assessment mark for Project Work & Internship:**

| | | |
|---|---|---|
| Project Review I | … | **10 marks** |
| Project Review II | … | **10 marks** |
| Attendance | … | **05 marks** (Award of marks same as theory subject pattern) |
| Total | … | **25 marks** |

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

**b) Allocation of Marks for Project Work & Internship in Board Examinations:**

| | |
|---|---|
| Demonstration/Presentation | 25 marks |
| Report | 25 marks |
| Viva Voce | 30 marks |
| Internship Report | 20 marks |
| **Total** | **100* marks** |

*Examination will be conducted for 100 marks and will be converted to 75 marks.

**c) Internship Report:**

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year "Project Work & Internship" for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centres / Institutions / Schemes.

**A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work & Internship Board examination.**

**12. Scheme of Examinations:**

The Scheme of examinations for subjects is given in Annexure - II.

**13. Criteria for Pass:**

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.

2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than *40% in theory subjects* and *50% in practical subjects* out of the total prescribed maximum marks including both the Internal Assessment and the Board Examinations marks put together, subject to the condition that he/she secures at least a minimum of 4*0 marks out of 100 marks in the Board Theory Examinations and a minimum of 50 marks out of 100 marks in the Board Practical Examinations.*

14. **Classification of successful candidates:**

Classification of candidates who will pass out the final examinations from April 2023 onwards (Joined first year in 2020 -2021) will be done as specified below.

**First Class with Superlative Distinction:**

A candidate will be declared to have passed in **First Class with Superlative Distinction** if he/she secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time (lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

**First Class with Distinction:**

A candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

**First Class:**

A candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time (lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

**Second Class:**

All other successful candidates will be declared to have passed in **Second Class.**

The above classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021)

**15. Duration of a period in the Class Time Table:**

The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

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# ANNEXURE – I

## STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

## DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) SYLLABUS

## N SCHEME

**(To be implemented for the students admitted from the year 2020 – 21 onwards)**

## CURRICULUM OUTLINE

**THIRD SEMESTER**

| Col. No. | Subject Code | SUBJECT | HOURS PER WEEK | | | |
|---|---|---|---|---|---|---|
| | | | Theory Hours | Tutorial / Drawing | Practical hours | Total Hours |
| 1 | 4020310 | Strength of Materials @@ | 5 | - | - | 5 |
| 2 | 4022320 | Manufacturing Technology | 5 | - | - | 5 |
| 3 | 4022330 | Engineering Metrology | 5 | - | - | 5 |
| 4 | 4022340 | Computer Aided Machine and Tool Drawing | | 1 | 3 | 4 |
| 5 | 4022350 | Engineering Metrology Practical | - | - | 4 | 4 |
| 6 | 4022360 | Manufacturing Technology Practical | - | - | 5 | 5 |
| 7 | 4022370 | Basic Engineering Practical | - | - | 4 | 4 |
| TOTAL | | | 15 | 1 | 16 | 32 |
| Extra / Co-curricular activities | | Physical Education | - | - | - | 2 |
| | | Library | - | - | - | 1 |
| GRAND TOTAL | | | | | | **35** |

**FOURTH SEMESTER**

| Col. No. | Subject Code | SUBJECT | HOURS PER WEEK | | | |
|---|---|---|---|---|---|---|
| | | | Theory Hours | Tutorial / Drawing | Practical hours | Total Hours |
| 1 | 4022410 | Engineering Materials and Metallurgy | 5 | - | - | 5 |
| 2 | 4022420 | Fluid Power and Thermal Engineering | 5 | - | - | 5 |
| 3 | 4022430 | Tool Room Special Machines | 5 | - | - | 5 |
| 4 | 4022440 | Forging dies, Die casting Dies and Die Maintenance | 5 | - | - | 5 |
| 5 | 4022450 | Mechanical Material Testing Practical | - | - | 4 | 4 |
| 6 | 4022460 | Hydraulics and Pneumatics Practical | - | - | 4 | 4 |
| 7 | 4022470 | Tool Room Special Machines Practical | - | - | 4 | 4 |
| TOTAL | | | 20 | - | 12 | 32 |
| Extra / Co-curricular activities | | Physical Education | - | - | - | 2 |
| | | Library | - | - | - | 1 |
| GRAND TOTAL | | | | | | **35** |

## CURRICULUM OUTLINE (N SCHEME)

**FIFTH SEMESTER**

| Col. No. | Subject Code | SUBJECT | HOURS PER WEEK | | | |
|---|---|---|---|---|---|---|
| | | | Theory Hours | Tutorial / Drawing | Practical hours | Total Hours |
| 1 | 4022510 | Jigs, Fixtures and Gauges | 5 | - | - | 5 |
| 2 | 4022520 | Press Tools | 5 | - | - | 5 |
| 3 | - | Elective I Theory | 5 | - | - | 5 |
| 4 | - | Elective I Practical | - | - | 4 | 4 |
| 5 | 4022550 | Jigs and Fixtures Practical | - | - | 4 | 4 |
| 6 | 4022560 | Press Tools Practical | - | - | 5 | 5 |
| 7 | 4020570 | Entrepreneurship and Start up | - | - | 4 | 4 |
| TOTAL | | | 15 | - | 17 | 32 |
| Extra / Co-curricular activities | | Physical Education | - | - | - | 2 |
| | | Library | - | - | - | 1 |
| GRAND TOTAL | | | | | | **35** |

**SIXTH SEMESTER**

| Col. No. | Subject Code | SUBJECT | HOURS PER WEEK | | | |
|---|---|---|---|---|---|---|
| | | | Theory Hours | Tutorial / Drawing | Practical hours | Total Hours |
| 1 | 4022610 | Tool Design and Drawing | 5 | - | - | 5 |
| 2 | 4022620 | Plastic Moulding Technology | 5 | - | - | 5 |
| 3 | - | Elective II Theory | 5 | - | - | 5 |
| 4 | - | Elective II Practical | - | - | 5 | 5 |
| 5 | 4022650 | Plastic Moulds Practical | - | - | 6 | 6 |
| 6 | 4022660 | Project Work and Internship | - | - | 6 | 6 |
| TOTAL | | | 15 | - | 17 | 32 |
| Extra / Co-curricular activities | | Physical Education | - | - | - | 2 |
| | | Library | - | - | - | 1 |
| GRAND TOTAL | | | | | | **35** |

@@ - Common subject with Mechanical Engineering
$$ - Common subject to all Department

## LIST OF ELECTIVE SUBJECTS

Note: Select **one Elective I Theory subject** and **one Related Elective I Practical** subject from the below table

**FIFTH SEMESTER**

| | | | | | |
|---|---|---|---|---|---|
| **Elective I Theory** | | | | | |
| 4020531 | Computer Integrated Manufacturing @@ | 5 | - | - | 5 |
| 4020533 | Mechatronics@@ | 5 | - | - | 5 |
| 4020440 | Process Planning and Quality Control @@ | 5 | - | - | 5 |
| **Elective I Practical** | | | | | |
| 4020561 | Computer Integrated Manufacturing Practical @@ | - | - | 4 | 4 |
| 4020563 | Mechatronics Practical @@ | - | - | 4 | 4 |
| 4020540 | Process Automation Practical @@ | - | - | 4 | 4 |

Note: Select **one Elective II Theory subject** and **one Related Elective II Practical** subject from the below table

**VI SEMESTER**

| | | | | | |
|---|---|---|---|---|---|
| **Elective II Theory** | | | | | |
| 4020610 | Industrial Engineering & Management @@ | 5 | - | - | 5 |
| 4020631 | Industrial Robotics and 3D Printing@@ | 5 | - | - | 5 |
| 4020620 | E Vehicle Technology & Policy @@ | 5 | | | 5 |
| **Elective II Practical** | | | | | |
| 4020640 | Solid Modelling Practical @@ | - | - | 5 | 5 |
| 4020651 | Industrial Robotics and 3D Printing Practical @@ | - | | 5 | 5 |
| 4020550 | Thermal Engineering Practical @@ | - | - | 5 | 5 |

@@ - Common subject with Mechanical Engineering
$$ - Common subject to all Department

# ANNEXURE – II

## STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

## DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) SYLLABUS

## N SCHEME

## (To be implemented for the students admitted from the year 2020 – 21 onwards)

## SCHEME OF THE EXAMINATION

**THIRD SEMESTER**

| Subject Code | SUBJECT | Examination Marks | | | Minimum for pass | Duration of Exam Hours |
|---|---|---|---|---|---|---|
| | | Internal assessment Marks | * Board Exam. Marks | Total Mark | | |
| 4020310 | Strength of Materials@@ | 25 | 100 | 100 | 40 | 3 |
| 4022320 | Manufacturing Technology | 25 | 100 | 100 | 40 | 3 |
| 4022330 | Engineering Metrology | 25 | 100 | 100 | 40 | 3 |
| 4022340 | Computer aided Machine and Tool Drawing | 25 | 100 | 100 | 40 | 3 |
| 4022350 | Engineering Metrology Practical | 25 | 100 | 100 | 50 | 3 |
| 4022360 | Manufacturing Technology Practical | 25 | 100 | 100 | 50 | 3 |
| 4022370 | Basic Engineering Practical | 25 | 100 | 100 | 50 | 3 |
| | | **175** | **700** | **700** | | |

**FOURTH SEMESTER**

| Subject Code | SUBJECT | Examination Marks | | | Minimum for pass | Duration of Exam Hours |
|---|---|---|---|---|---|---|
| | | Internal assessment Marks | * Board Exam. Marks | Total Mark | | |
| 4022410 | Engineering Materials and Metallurgy | 25 | 100 | 100 | 40 | 3 |
| 4022420 | Fluid Power and Thermal Engineering | 25 | 100 | 100 | 40 | 3 |
| 4022430 | Tool Room Special Machines | 25 | 100 | 100 | 40 | 3 |
| 4022440 | Forging Dies, Die casting Dies & Die Maintenance | 25 | 100 | 100 | 40 | 3 |
| 4022450 | Mechanical Material Testing Practical | 25 | 100 | 100 | 50 | 3 |
| 4022460 | Hydraulics and Pneumatics Practical | 25 | 100 | 100 | 50 | 3 |
| 4022470 | Tool Room Special Machines Practical | 25 | 100 | 100 | 50 | 3 |
| **TOTAL** | | **175** | **700** | **700** | | |

* Examinations will be conducted for 100 Marks and will be converted 75 Marks

## SCHEME OF THE EXAMINATION

**FIFTH SEMESTER**

| Subject Code | SUBJECT | Examination Marks | | | Minimum for pass | Duration of Exam Hours |
|---|---|---|---|---|---|---|
| | | Internal assessment Marks | * Board Exam. Marks | Total Mark | | |
| 4022510 | Jigs, Fixtures and Gauges | 25 | 100 | 100 | 40 | 3 |
| 4022520 | Press Tools | 25 | 100 | 100 | 40 | 3 |
| - | Elective I Theory | 25 | 100 | 100 | 40 | 3 |
| - | Elective I Practical | 25 | 100 | 100 | 50 | 3 |
| 4022550 | Jigs and Fixtures Practical | 25 | 100 | 100 | 50 | 16 |
| 4022560 | Press Tools Practical | 25 | 100 | 100 | 50 | 16 |
| 4020570 | Entrepreneurship and Start up | 25 | 100 | 100 | 50 | 3 |
| | | **175** | **700** | **700** | | |

**SIXTH SEMESTER**

| Subject Code | SUBJECT | Examination Marks | | | Minimum for pass | Duration of Exam Hours |
|---|---|---|---|---|---|---|
| | | Internal assessment Marks | * Board Exam. Marks | Total Mark | | |
| 4022610 | Tool Design and Drawing | 25 | 100 | 100 | 40 | 3 |
| 4022620 | Plastic Moulding Technology | 25 | 100 | 100 | 40 | 3 |
| - | Elective II Theory | 25 | 100 | 100 | 40 | 3 |
| - | Elective II Practical | 25 | 100 | 100 | 50 | 3 |
| 4022650 | Plastic Moulds Practical | 25 | 100 | 100 | 50 | 16 |
| 4022660 | Project Work and Internship | 25 | 100 | 100 | 50 | 3 |
| | | **150** | **600** | **600** | | |

* Examinations will be conducted for 100 Marks and will be converted 75 Marks

@@ - Papers Common with Diploma in Mechanical Engineering Branch
$$- Papers common with other branches of Engineering

## Diploma in Mechanical Engineering (Tool & Die)

### List of Equivalent Subjects for M & N-Scheme subjects

**III SEMESTER**

| M-SCHEME | | | N-SCHEME | |
|---|---|---|---|---|
| **S.No** | **Subject Code** | **Name of the Subject** | **Subject Code** | **Name of the Subject** |
| 1 | 32031 | Strength of Materials @@ | 4020310 | Strength of Materials@@ |
| 2 | 32232 | Manufacturing Technology | Not Equivalent | |
| 3 | 32233 | Engineering Metrology | 4022330 | Engineering Metrology |
| 4 | 32234 | Machine & Tool Drawing | | Not Equivalent |
| 5 | 32235 | Engineering Metrology Practical | 4022350 | Engineering Metrology Practical |
| 6 | 32236 | Manufacturing Technology Practical | Not Equivalent | |
| 7 | 30001 | Computer Applications Practical $$ | Not Equivalent | |

**IV SEMESTER**

| M-SCHEME | | | N-SCHEME | |
|---|---|---|---|---|
| **S.No** | **Subject Code** | **Name of the Subject** | **Subject Code** | **Name of the Subject** |
| 1 | 32241 | Engineering Materials and Metallurgy | 4022410 | Engineering Materials and Metallurgy |
| 2 | 32242 | Fluid Power and Thermal Engineering | Not Equivalent | |
| 3 | 32243 | Tool Room Special Machines | 4022430 | Tool Room Special Machines |
| 4 | 32244 | Computer Aided Machine & Tool Drawing Practical | 4022340 | Computer Aided Machine & Tool Drawing Practical |
| 5 | 32245 | Mechanical Material Testing Practical | 4022450 | Mechanical Material Testing Practical |
| 6 | 32246 | Hydraulics and Pneumatics Practical | 4022460 | Hydraulics and Pneumatics Practical |
| 7 | 32247 | Tool Room Special Machines Practical | 4022470 | Tool Room Special Machines Practical |

**V SEMESTER**

| M – SCHEME | | | N - SCHEME | |
|---|---|---|---|---|
| S.N | Subject Code | Name of the Subject | Subject Code | Name of the Subject |
| 1 | 32251 | Jigs, Fixtures and Gauges | 4022510 | Jigs, Fixtures and Gauges |
| 2 | 32252 | Press Tools | 4022520 | Press Tools |
| 3 | 32253 | Forging Dies, Die casting Dies & Die Maintenance | Not Equivalent | |
| 4 | 32254 | Tool Design and Drawing | 4022610 | Tool Design and Drawing |
| 5 | 32255 | Press Tools - I Practical | Not Equivalent | |
| 6 | 32256 | Jigs and Fixtures Practical | 4022550 | Jigs and Fixtures Practical |
| 7 | 30002 | Life and Employability skill Practical $$ | Not Equivalent | |

**VI SEMESTER**

| M – SCHEME | | | N -SCHEME | |
|---|---|---|---|---|
| S.N | Subject Code | Name of the Subject | Subject Code | Name of the Subject |
| 1 | 32061 | Industrial Engineering & Management @@ | 4020610 | Tool Design and Drawing |
| 2 | 32062 | Computer Aided Design and Manufacturing @@ | 4020531 | Computer Integrated Manufacturing @@ |
| 3 | 32263 | Plastic Moulding Technology | 4022620 | Plastic Moulding Technology |
| 4 | 32064 | Computer Aided Design and Manufacturing Practical @@ | 4020561 | Computer Integrated Manufacturing Practical @@ |
| 5 | 32265 | Press tools – II Practical | Not Equivalent | |
| 6 | 32266 | Plastic Moulds Practical | 4022650 | Plastic Moulds Practical |
| 7 | 32067 | Project Work @@ | Not Equivalent | |

@@ - Papers Common with Diploma in Mechanical Engineering Branch

# <u>Board Examination-Question Paper Pattern (Theory)</u>

**(Common to all Theory subjects except 4020610 Tool Design & Drawing)**

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

| | |
|---|---|
| PART - A | Five questions will be asked covering all units. All questions are to be answered. Each question carries 1 mark. |
| PART- B | Fifteen questions will be asked covering all the units. Three questions from each unit. Answer any ten questions. Each question carries 2 marks. |
| PART-C | Five questions will be asked either or type. One question from every unit. Answer either A or B. Each question carries 15 marks. A and B have subdivisions. (7 + 8) |

**The questions are to be numbered from 1 to 25. All the units are to be covered with equal weightage.**

| | |
|---|---|
| **PART A**<br>Definitions and Statements.<br>Question Number 1 to 5 | 5 X 1 = 5 Marks |
| **PART B**<br>Short answer type questions<br>Question Number 6 to 20 | 10 X 2 = 20 Marks |
| **PART C**<br>Descriptive answer type questions<br>(Either A or B)<br>Question number 21 to 25 | 5 X15 = 75 Marks |
| TOTAL | 100 Marks |

Note: Board Examinations will be conducted for 100 Marks and converted to 75 Marks.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

(TOOL& DIE)

II YEAR

N – SCHEME

III SEMESTER

2020 – 2021 onwards

# 4020310 –STRENGTH OF MATERIALS

CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL&DIE)

Subject Code : 4020310

Semester : III

Subject Title : **STRENGTH OF MATERIALS**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| STRENGTH OF MATERIALS | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**Topics and Allocation of Hours**

| Unit No | Topics | Hours |
|---|---|---|
| I | Engineering Materials | 15 |
| II | Deformation of Metals | 15 |
| III | Geometrical Properties of Sections and Thin Shells | 15 |
| IV | Theory of Torsion and Springs | 14 |
| V | SFand BM Diagrams of Beams and Theory of Bending | 14 |
| | Test & Model Examinations | 7 |
| | **Total** | **80** |

**RATIONALE:**

Day by day, engineering and technology experience tremendous growth. Design plays a major role in developing engineering and technology. Strength of material is backbone for design. The strength of material deals generally with the behaviour of objects, when they are subject to actions of forces. Evaluations derived from these basic fields provide the tools for investigation of mechanical structure.

**OBJECTIVES**

- Acquire knowledge about materials properties.
- Calculate the deformation of materials, which are subjected to axial load and shear.
- Determine the moment of Inertia of various sections used in industries.
- Estimate the stresses induced in thin shells.
- Draw the shear force and bending moment diagram of the beam for different load.

## DETAILED SYLLABUS

### 4020310 STRENGTH OF MATERIALS

**Contents: Theory**

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **ENGINEERING MATERIALS** | |
| | **Chapter: 1.1: Engineering materials:** Classification - definition of Mechanical properties - ferrous metals - cast iron - uses - advantages - types of cast iron - properties and applications - effect of impurities on cast iron. steel - classification - alloying elements - purpose of alloying - effect of alloying elements on steel - uses of steels - properties of mild steel - defects in steel - applications - properties of hard steel - market forms of steels – nonferrous metals - properties and uses. | **7** |
| | **Chapter: 1.2: Mechanical testing of materials:** | |
| | Compression test - bend test - hardness test - Brinell hardness test, Vickers hardness test, Rockwell hardness test - impact test - fatigue test - creep test. 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 - problems. | **6** |
| | **Chapter: 1.3: Friction** | |
| | Introduction - definition - force of friction - limiting friction - static friction - dynamic friction - angle of friction - coefficient of friction - laws of static and dynamic friction. Description only. | **2** |

| | | |
|---|---|---|
| II | **DEFORMATION OF METALS** | |
| | **Chapter: 2.1: Simple stresses and strains** | **4** |
| | Definition - load, stress and strain - classification of force systems: tensile, compressive and shear force systems. Hooke's law - definition Young's modulus - working stress, factor of safety, load factor, shear stress and shear strain - modulus of rigidity. Linear strain - deformation due to tension and compressive forces - simple problems in tension, compression and shear forces. | |
| | **Chapter: 2.2:Elastic constants** | **7** |
| | Definition - lateral strain – poison's ratio - volumetric strain - bulk modulus - volumetric strain of rectangular and circular bars - problems connecting linear, lateral and volumetric deformations - elastic constants and their relationship - problems on elastic constants. Composite bar - definition - problems in composite bars subjected to tension and compression. Temperature stresses and strains - simple problems. | |
| | **Chapter: 2.3 Strain Energy** | **4** |
| | Definition – proof resilience – modulus of resilience – the expression for strain energy stored in a bar due to axial load – instatntaneous stresses due to gradual, sudden, impact and shock loads – problems computing instantaneous stress and deformation in gradual, sudden, impact and shock loadings. | |
| III | **GEOMETRICAL PROPERTIES OF SECTIONS AND THIN SHELLS** | |
| | **Chapter: 3.1: Properties of sections** | **8** |
| | Definition – center of gravity and centroid - position of centroids of plane geometrical figures such as rectangle, triangle, circle and trapezium- problems to determine the centroid of angle, channel, T and I sections only – Definition - centroidal axis - Axis of symmetry. Moment of Inertia – parallel axis theorem and perpendicular axis theorem (statement only). Moment of Inertia of lamina of rectangle, circle, triangle, I and channel sections – Definition - Polar moment of Inertia - radius of gyration – Problems computing moment of inertia and radius of gyration for angle, T, Channel and I sections. | |
| | **Chapter: 3.2:Thin Shells** | **7** |
| | Definition – Thin and thick cylindrical shell – Failure of thin cylindrical shell subjected to internal pressure – Derivation of Hoop and longitudinal stress causes in a thin cylindrical shell subjected to internal pressure – simple problems – change in dimensions of a thin cylindrical shell | |

| | | |
|---|---|---|
| | subjected to internal pressure – problems – Derivation of tensile stress induced in a thin spherical shell subjected to internal pressure – simple problems – change in diameter and volume of a thin spherical shell due to internal pressure – problems. | |
| IV | **THEORY OF TORSION AND SPRINGS**<br>**Chapter: 4.1: Theory of Torsion**<br>Assumptions – torsion equation $\frac{T}{J}=\frac{f_s}{R}=\frac{C\theta}{l}$ - Strength of solid and hollow shafts – power transmitted – Definition – Polar 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 – Problems.<br>**Chapter: 4.2:Springs**<br>Types of springs – Laminated and coiled springs and applications –– Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – problems to determine shear stress, deflection, stiffness and resilience of closed coiled helical springs. | **7**<br>**7** |
| V | **SF AND BM DIAGRAMS OF BEAMS AND THEORY OF BENDING**<br>**Chapter: 5.1: SF and BM diagrams**<br>Classification of beams – Definition – shear force and Bending moment – sign conventions for shear force and bending moment – types of loadings – Relationship between load, force and bending moment at a section – shear force diagram and bending moment diagram of cantilever and simply supported beam subjected to point load and uniformly distributed load (UDL) – Determination of Maximum bending moment in cantilever beam and simply supported beam when they are subjected to point load and uniformly distributed load.<br>**Chapter: 5.2:Theory of bending**<br>Theory of simple bending – Assumptions – Neutral axis – bending stress distribution – moment of resistance – bending equation – M/I=f/y=E/R – Definition – section modulus - rectangular and circular sections – strength of beam – simple problems involving flexural formula for cantilever and simply supported beam. | **7**<br>**7** |

**Reference Books:**


1. Strength of Materials, R. S. Khurmi, S.Chand & Co., Ram Nagar, New Delhi.
2. Strength of Materials, S. Ramamrutham, 15th Edition 2004, DhanpatRai Pub. Co., New Delhi.
3. Strength of Materials, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 3rd Edition, 2010.
4. Strength of materials, S.S.Rattan, Tata Mcgraw hill, New Delhi,2008, ISBN 9780070668959,
5. Strength of Materials, B K Sarkar, I Edition, 2003Tata Mcgraw hill, New Delhi.
6. Engineering mechanics, R.K. Bansal, Laxmi Publications Pvt. Ltd., New Delhi, 2nd Edition, 2007.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

(TOOL& DIE)

II YEAR

N – SCHEME

III SEMESTER

2020 – 2021 onwards

# 4022320 – MANUFACTURING TECHNOLOGY

CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4022320

Semester : III

Subject Title : **MANUFACTURING TECHNOLOGY**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| MANUFACTURING TECHNOLOGY | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Casting Processes | 15 |
| II | Metal Joining Processes | 15 |
| III | Centre Lathe, Semi-Automatic and Automatic Lathe | 15 |
| IV | Drilling, Grinding and Broaching Machines | 14 |
| V | Planner, Shaper, Slotter Machines | 14 |
| | Test & Model Examinations | 07 |
| | **Total** | **80** |

**RATIONALE:**

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.

**OBJECTIVES:**

- Acquire knowledge about types of patterns, types of moulding and casting processes
- Acquire knowledge about various metal joining processes
- Appreciate the safety practices used in welding
- Explain the lathe working principles and its various operations
- Explain the Semi-Automatic and Automatic lathe working principles
- Explain the drilling and drilling machine principles and its various operations
- Explain the grinding machine and types of grinding wheels
- Explain the vertical and Horizontal broaching machines
- Describe the working of planer, shaper and slotter

# DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hrs |
|---|---|---|
| I | <u>**Casting Processes**</u><br><u>**Chapter: 1.1:**</u> **Patterns:** Definition-Pattern materials-factors for selecting pattern materials-single piece solid, split patterns-pattern allowances-core prints-color coding patterns. 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-greensand-dry sand-machine moulding-top and bottom squeezer machines-jolting machines-sand slinger-CO2 process core making-types of core-core boxes<br><u>**Chapter: 1.2:**</u>**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. | **8**<br><br>**7** |
| II | <u>**Metal Joining Processes**</u><br><u>**Chapter: 2.1:**</u> **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<br><u>**Chapter: 2.2:**</u> **Gas welding:** Definition-Gas welding equipment-Oxy and acetylene welding-Three types of flame.<br><u>**Chapter: 2.3:**</u> **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.<br><u>**Chapter: 2.4:**</u> **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 | **4**<br><br>**2**<br><br>**5**<br><br>**4** |
|  | <u>**Centre Lathe, Semi-Automatic and Automatic Lathe**</u><br><u>**Chapter: 3.1:**</u>**Centre Lathe:** Theory of Lathes-specifications-simple sketches-principal parts and its functions-tumbler gear mechanism-quick change gear |  |

| | | |
|---|---|---|
| III | 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. | **8** |
| | <u>**Chapter: 3.2:**</u> **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 | **3** |
| | <u>**Chapter: 3.3:**</u> **Automatic Lathe:** Classification of single spindle automatic lathe – principle of automatic lathe – automatic screw cutting machine – multi spindle automatic lathes | **4** |
| IV | <u>**Drilling, Grinding and Broaching Machine**</u> | |
| | <u>**Chapter: 4.1:**</u> **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-drilling parameters of various materials-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 | **7** |
| | <u>**Chapter:4.2:**</u> **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. | **5** |
| | <u>**Chapter: 4.3:**</u> **Broaching:** Broaching Machine – Basic Process – Vertical broaching Machine – Horizontal Broaching machine – Double cut broaching – Key way Broaching | **2** |
| V | <u>**Planner, Shaper and Slotter Machine**</u> | |
| | <u>**Chapter: 5.1:**</u> **Planner**: Types of Planner-specifications-principles of operation-quick return mechanism-feed mechanism-work holding devices-types of planner operation | **5** |
| | <u>**Chapter: 5.2:**</u> **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 | **5** |
| | <u>**Chapter: 5.3:**</u> **Slotter: Types** of slotter-specifications-principle of operation-Whitworth quick return mechanism-feed mechanism-work holding devices | **4** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text Books**

1. Hajra Chowdry & Bhattacharaya, Elements of workshop Technology Volume I & II, Media Promoters & Publishers Pvt. Ltd., Noshir Bharucha Marg, Mumbai
2. WAJ Chapman, Workshop Technology, Volume I, II, & III, Vima Books Pvt. Ltd., ND

**Reference Books:**

1. Raghuwanshi, Workshop Technology, Khanna Publishers. Jain & Gupta, Production Technology, Edn. XII, Khanna Publishers, 2-B, North Market, NAI Sarak, New Delhi
2. P. C. SHARMA, Production Technology, Edn. X, S.Chand & Co. Ltd.,
3. HMT, Production Technology, Edn. 18, published by Tata McGraw Hill publishing Co. Ltd., 7 West Patel Nagar, New Delhi 110 008.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

### N – SCHEME

### III SEMESTER

### 2020 – 2021 onwards

# 4022330 – ENGINEERING METROLOGY

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220:DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022330 |
| Semester | : | III |
| Subject Title | : | **ENGINEERING METROLOGY** |

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| ENGINEERING METROLOGY | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

### TOPICS AND TIME ALLOCATION

| UNIT | TOPIC | TIME (Hrs) |
|---|---|---|
| I | Introduction to Metrology and Linear Measurement | 15 |
| II | Angular Measurement, Measurement of Gears and Threads | 15 |
| III | Measurement of Geometric Parameters and Surface Finish | 15 |
| IV | Comparators and Measurement by Light Wave Interference | 14 |
| V | Measuring Machines and Recent Trends in Metrology | 14 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | Total | 80 |

**Rationale: -**

The modern industries demand wide knowledge in the understanding and use of conventional and advanced digital measuring instruments that are being used in the process of manufacture of goods. Hence it is essential to have better understanding of the various measuring techniques and the technology that are being used in the various measuring instruments. The fundamentals of various measuring technique needs to be known to understand the modern measuring equipment's that are being used in Industries.

**OBJECTIVES**

**The objective of this course is to make the Student:**

- 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 Measure Force, Torque and temperature.
- To know about the measuring machines.
- To acquire Knowledge about Recent Trends in Metrology.

# DETAILED SYLLABUS

## 4022330 - ENGINEERING METROLOGY

Contents: Theory

| Unit No. | Name of the Topics | Hours |
|---|---|---|
| I | **Introduction to Metrology and Linear Measurement:**<br>**1.1 Introduction:** Metrology, objectives of metrology, Precision vs Accuracy. Repeatability, calibration, sensitivity and readability, classification of methods of measurement, general care of equipments. | 3 |
| | **1.2 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. | 5 |
| | **1.3 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, cylinder gauges, Keilpart gauge, slip gauges. | 7 |
| II | **Angular Measurement, Measurement of Gears and Threads:**<br>**2.1 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. | 3 |
| | **2.2 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. | 5 |
| | **2.3 Measurement of Gears:** Gear tooth terminology, Gear tooth vernier caliper. | 2 |
| | **2.4 Thread Measurements**: Screw thread projection, Tool Maker's Microscope, Measurement of Effective Diameter, one wire, Two wire and Three wire Methods using floating carriage micrometer. | 5 |

| | | |
|---|---|---|
| III | **Measurement of Geometric Parameters and Surface Finish:**<br>**3.1 Straightness, Flatness, Parallelism and squareness:** - Definition of straightness, straight edge and its uses, test for straightness by using spirit level and Autocollimator, Flatness definition, flatness testing, procedure for determining flatness, laser equipment for alignment testing. Parallelism definition, various cases of parallelism of lines and planes, measurement of equidistance, checking of coincidence or alignment. Squareness definition, measurement of squareness of lines and planes, checking the perpendicularity of motion, squareness testing methods – indicator method, Engineer's square tester, optical tests for squareness.<br>**3.2 Circularity and Rotation:** - Circularity definition, measurement of circularity, Different types of irregularities of a circular part – ovality, lobbing, irregularities of non-specific form. Roundness and circularity. Devices for measuring circularity error – V block, precision measuring instruments. Tests for checking Rotation – Run out, measurement of run out, Periodical axial slip, camming.<br>**3.3 Surface Finish:** - Surface roughness – definition, terminologies as per BIS, Methods of measuring Surface finish, surface finish parameters – Surface inspection by comparison methods, Direct measurement methods. Analysis of surface traces. | **7**<br>**6**<br>**2** |
| IV | **Comparators and Measurement By Light Wave Interference:**<br>**4.1 Comparators:** Characteristics and uses of comparators, Working principle, advantages and disadvantages of various types of comparators– Mechanical comparators, optical comparators, Electrical comparators, pneumatic comparators, Fluid displacement comparators, optical Projectors.<br>**4.2 Measurement by light wave interference:** Interferometry, interference of two rays, light source for interferometry, interferometry applied to flatness testing, Interferometers.<br>**4.3 Testing and Calibration of Gauges:** - Calibration of linear and angular measuring instruments – General metrological instrument, optical measuring instruments, Measurement of limit gauges. | **6**<br>**4**<br>**4** |
| V | **Measuring Machines and Recent Trends In Metrology:**<br>**5.1 Measuring Machines:** Optical profile projector – working principle, use, precaution in use. Coordinate Measuring Machine – Types, uses, advantages, possible source of error in CMM. Electronic Inspection and measuring machines. | **7** |

| | | |
|---|---|---|
| | **5.2 Trends in Metrology:** Laser Telemetric system, Feeler microscope, Isometric viewing of surface defects. optoelectronic dimensional gauging, computers in metrology, Computer Aided dimensional analysis and reporting system, In process probing, contact less 3D measurements by Laser based system. | **7** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**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. ASTME, Hand book of Industrial Metrology, Prentice Hall
2. A.J.T Scarr, Metrology and Precision Engineering, McGraw Hill Book company.
3. J.Johnson, Precision Measurement, Pitman publishers
4. R.L.Murty, Precision Engineering in Manufacturing, New Age International Publishers (P)

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

**N – SCHEME**

**III SEMESTER**

**2020 – 2021 onwards**

## 4022340 – COMPUTER AIDED MACHINE & TOOL DRAWING

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**
**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022340 |
| Semester | : | III |
| Subject Title | : | **COMPUTER AIDED MACHINE & TOOL DRAWING** |

## TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 16 Weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| COMPUTER AIDED MACHINE & TOOL DRAWING | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours:**

| Unit No | Topics | Hours |
|---|---|---|
| I | Introduction to CAD software | 2 |
| II | Drawing aids and editing commands | 4 |
| III | Basic dimensioning, hatching, blocks and views | 5 |
| IV | Isometric drawing, printing and plotting | 4 |
| V | Cad Drawing Practice<br>Detailed drawings of following machine parts are given to students to assemble and draw the sectional or plain elevations / plans / and side views with dimensioning and bill of materials using cad software – 10 Exercises: Sleeve & Cotter Joint, Screw Jack, Foot Step Bearing, Universal Coupling, Plummer Block, Machine Vice, Drill Jig, Welding Fixture, Blanking Tool, Injection Moulding Tool. | 65 |
| | TOTAL | 80 |

**RATIONALE:**

The contemporary progressing world is fast with the latest production systems. The advanced manufacturing of products is developed instantly using CAD Software. Even a small-scale industry is now using a CAD software as it has become the heart of the Design department. So, CAD has now become inevitable in industries. Accuracy and Precision are the two important things that decide the quality of a product to survive its competitors in the market. Using CAD software design, the uniform accuracy, multiples of copies and storing in a small space for long time are assured.

The CAD software considerably improves the creativity and flexibility of a designer. The syllabus here enables a candidate to draw an industrial drawing within the optimum reach of a diploma cadre.

**OBJECTIVES:**

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

# DETAILED SYLLABUS
## 4022340 - COMPUTER AIDED MACHINE AND TOOL DRAWING PRACTICAL

Contents: Theory

| Unit | Name of the Topic | Hours |
|---|---|---|
| I | **INTRODUCTION TO CAD SOFTWARE**<br>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. | **2** |
| II | **DRAWING AIDS AND EDITING COMMANDS**<br>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. | **4** |
| III | **BASIC DIMENSIONING, HATCHING, BLOCKS AND VIEWS**<br>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. | **5** |
| IV | **ISOMETRIC DRAWING, PRINTING AND PLOTTING**<br>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<br>3D Drawing: 3D Primitives-Extrude – Revolve-Slice-Section, Surface 3D Mesh-3D - Surface-3D Operation-Solid Editing | **4** |
| V | **CAD DRAWING PRACTICE**<br>Detailed drawings of following machine parts are given to students to | **65** |

| | | | |
|---|---|---|---|
| | assemble and draw the sectional or plain elevations / plans / and side views with dimensioning and bill of materials using CAD Software | | |
| | **MACHINE DRAWING**<br>1. Sleeve & Cotter joint<br>2. Screw Jack<br>3. Foot step bearing<br>4. Universal Coupling<br>5. Plummer Block<br>6. Machine Vice | **TOOL DRAWING**<br>7. Drill jig<br>8. Welding fixture<br>9. Press tool assembly- Blanking tool<br>10. Plastic moulding tool assembly- Injection moulding tool | |

**Reference Books:**


1) Inside AutoCAD - D. Raker and H. Rice - BPB Publications, NewDelhi
2) Engineering Drawing and Graphics + AutoCAD – K.Venugopal, - New Age International Publications
3) CAD/CAM/CIM - P. Radhakrishnan, S. Subramaniyan and V.Raju - New Age International Publications.
4) AutoCAD 2002 with Applications - Sham Tickoo - Tata Mcgraw Hill.
5) Computer Graphics, Prentice – Donald Hearn, M. Pauline Baker - Hall of India Pvt. Limited, New Delhi.


**List Of Equipment’s (for a batch of 30 students)**

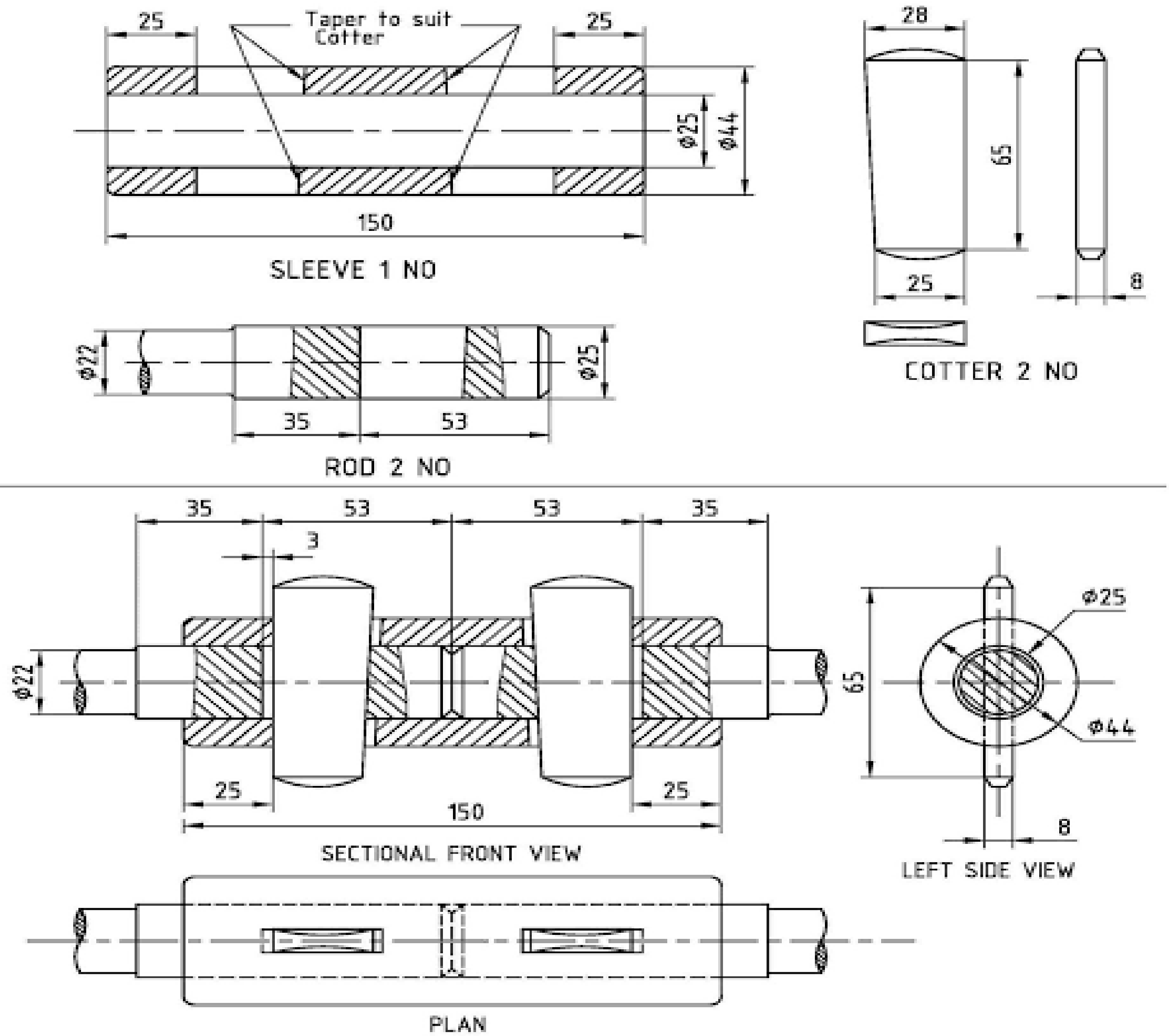
1. Personal computer (With latest processor to suit Auto CAD) – 30 No’s
2. MS Windows OS – 30 No’s
3. AutoCAD software (release 2000 or above) – 30 Users

# MACHINE DRAWING

## Exercise – 1 Sleeve & Cotter Joint

## PART & ASSEMBLY DRAWING

SLEEVE AND COTTER JOINT

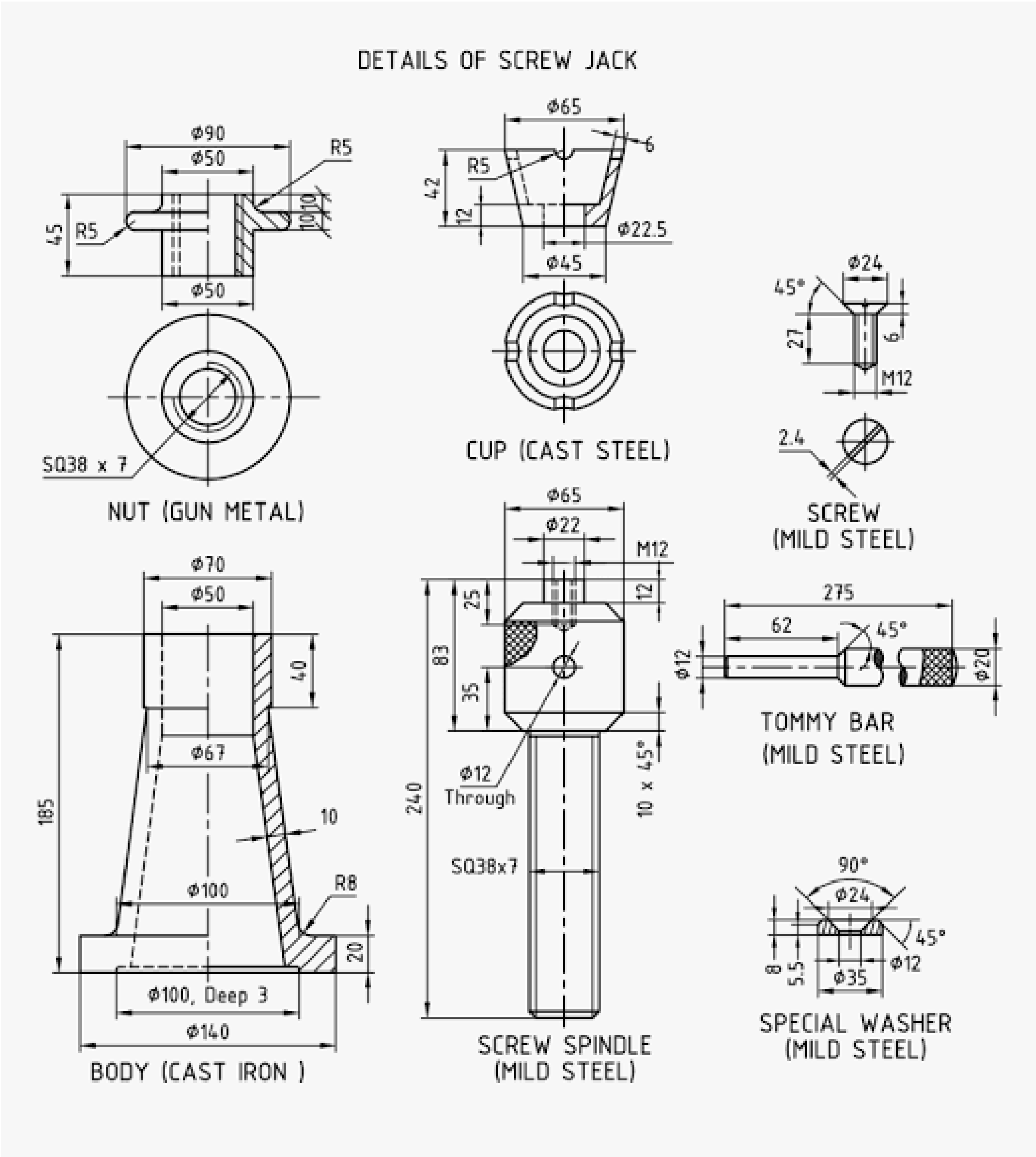



BILL OF MATERIALS

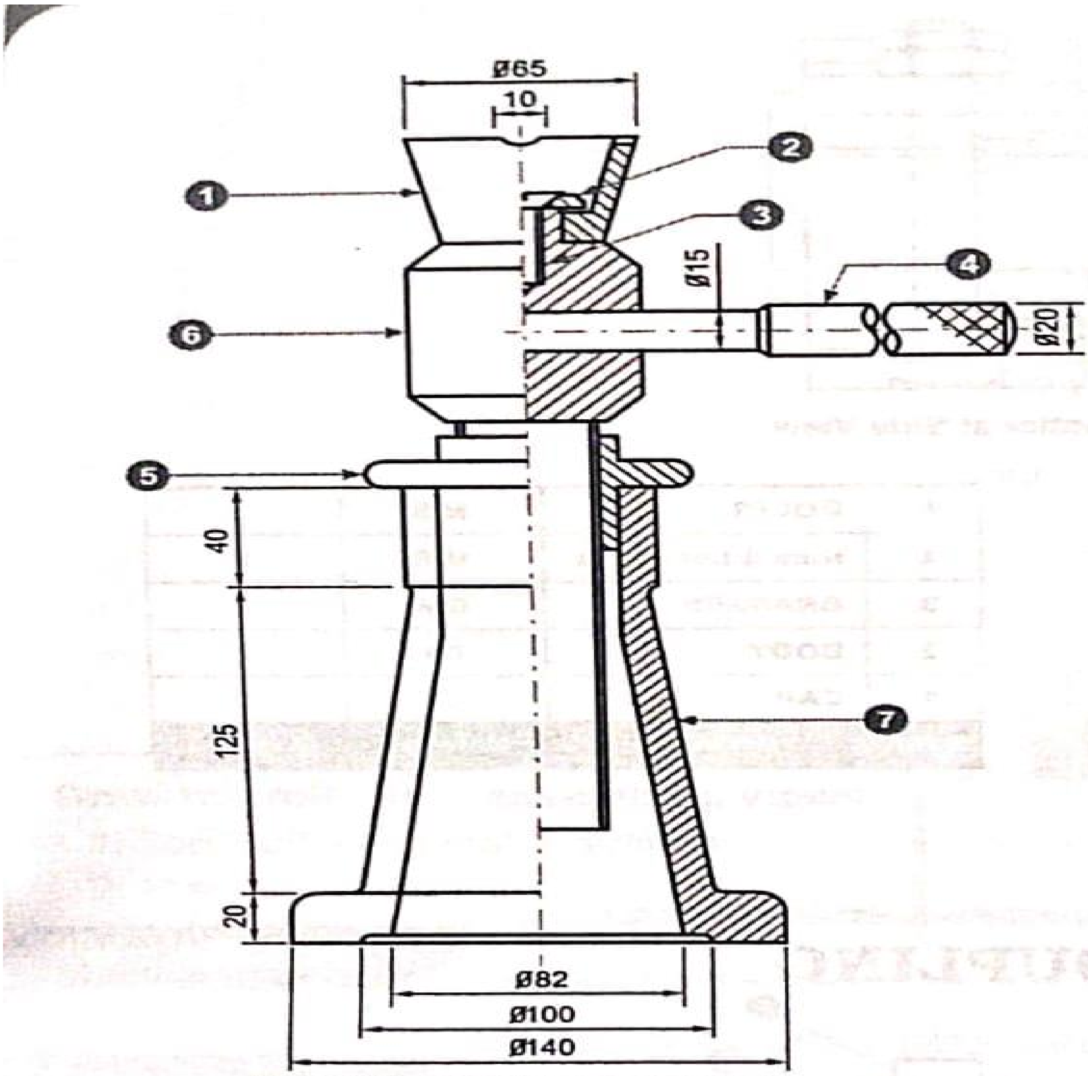
| S.No. | PART NAME | MATERIAL | NO.OFF |
|---|---|---|---|
| 1. | SLEEVE | MILD STEEL | 1 |
| 2. | RODS | MILD STEEL | 2 |
| 3. | COTTER | STEEL | 2 |

**Exercise – 2 Knuckle Joint**

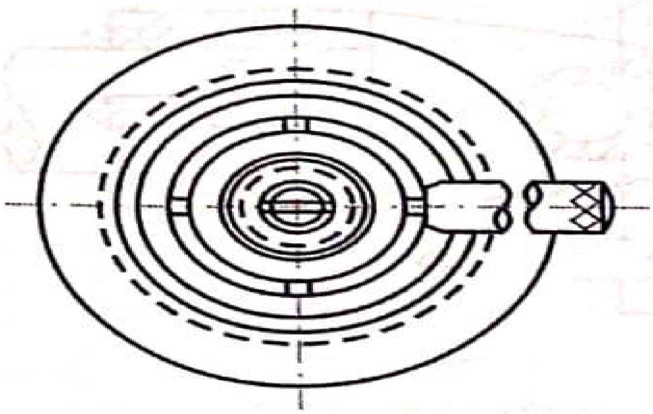
**PART DRAWING**



## ASSEMBLY DRAWING




HALF SECTIONAL ELEVATION

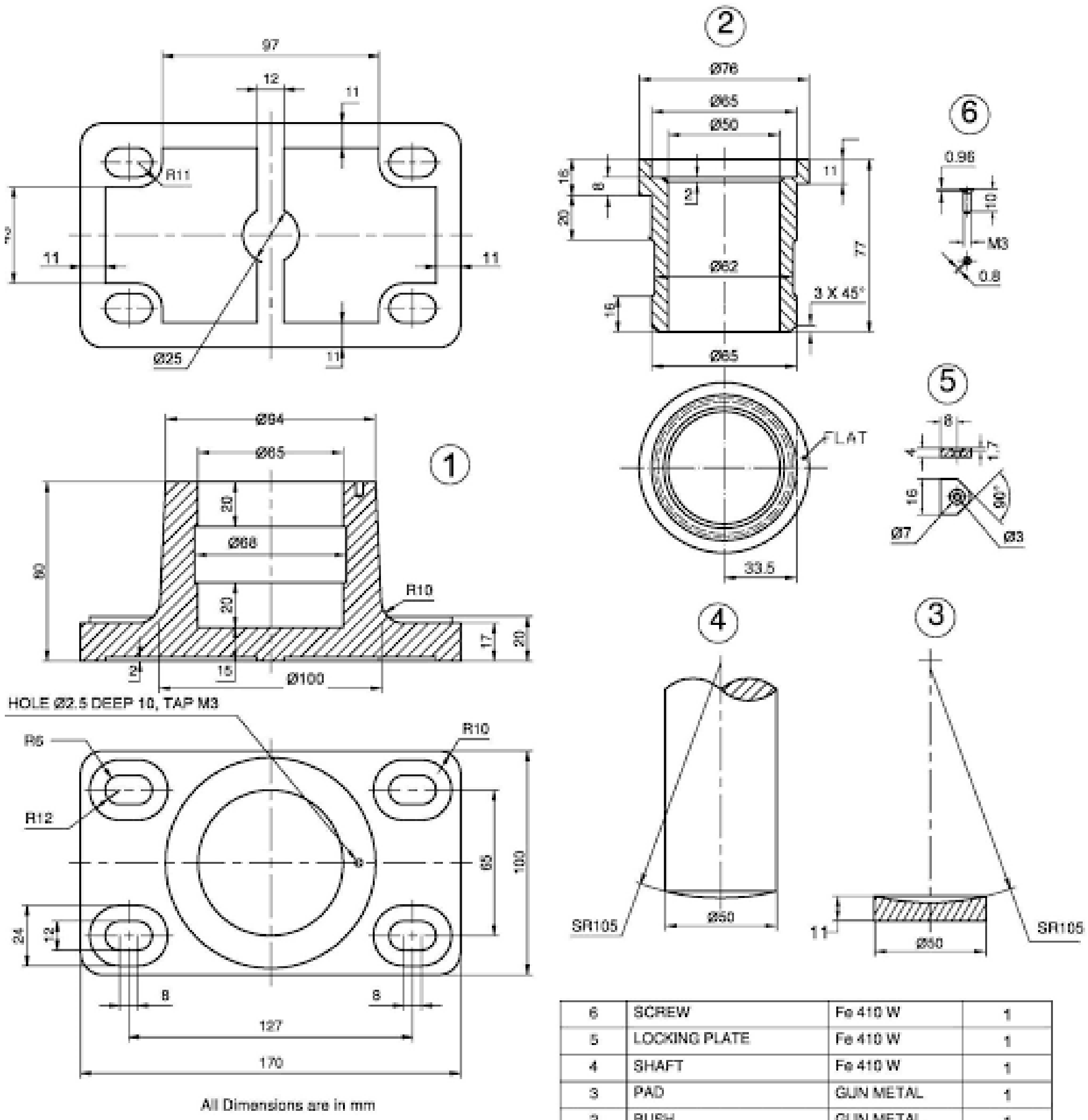


PLAN

## Exercise – 3 FOOT STEP BEARING

## PART DRAWING

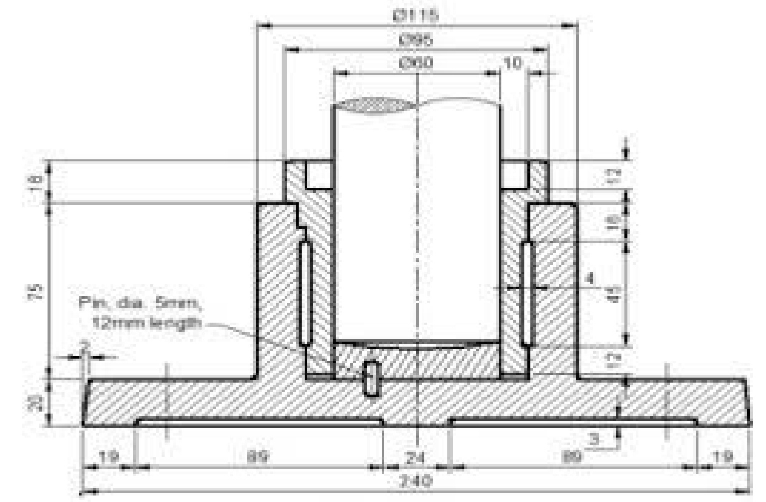
FOOTSTEP BEARING



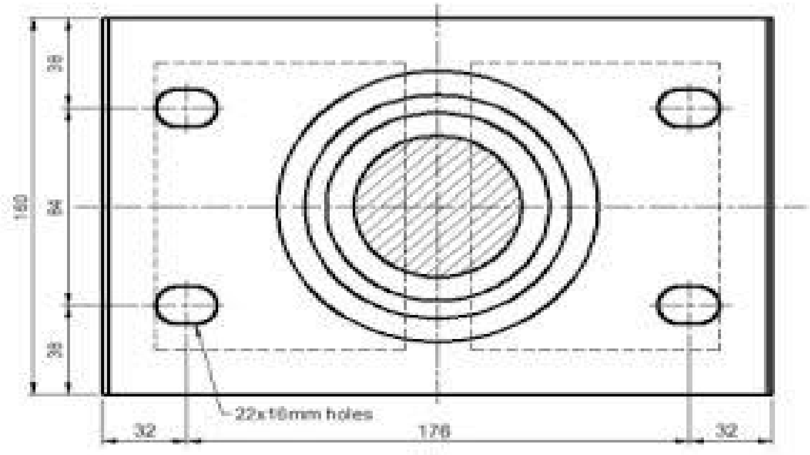

| 6 | SCREW | Fe 410 W | 1 |
|---|---|---|---|
| 5 | LOCKING PLATE | Fe 410 W | 1 |
| 4 | SHAFT | Fe 410 W | 1 |
| 3 | PAD | GUN METAL | 1 |
| 2 | BUSH | GUN METAL | 1 |
| 1 | SUPPORTING BRACKET | CAST IRON | 1 |
| ITEM NO | DESCRIPTION | MATERIAL | NO OFF |

# ASSEMBLY DRAWING





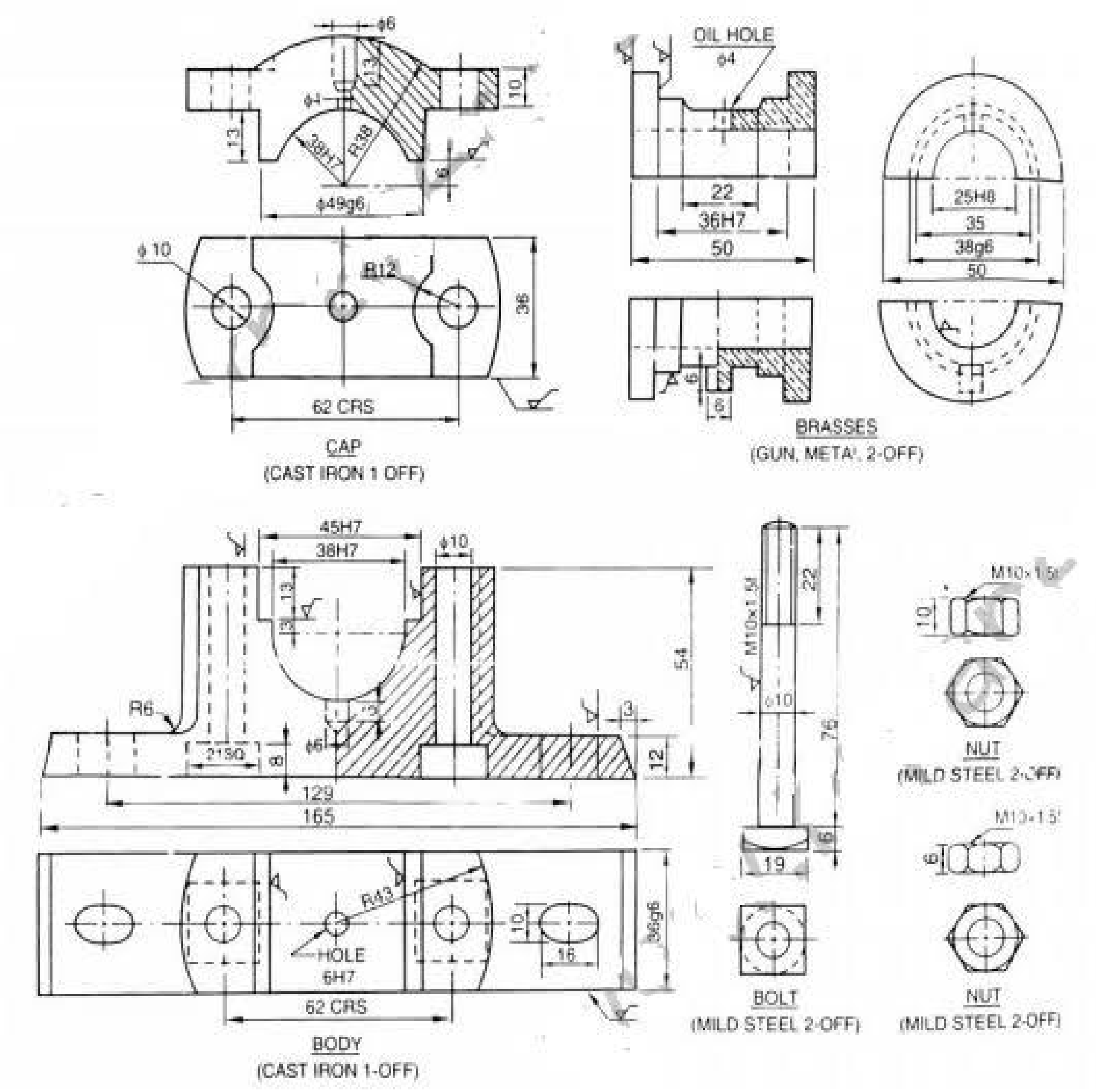
Full sectional front view



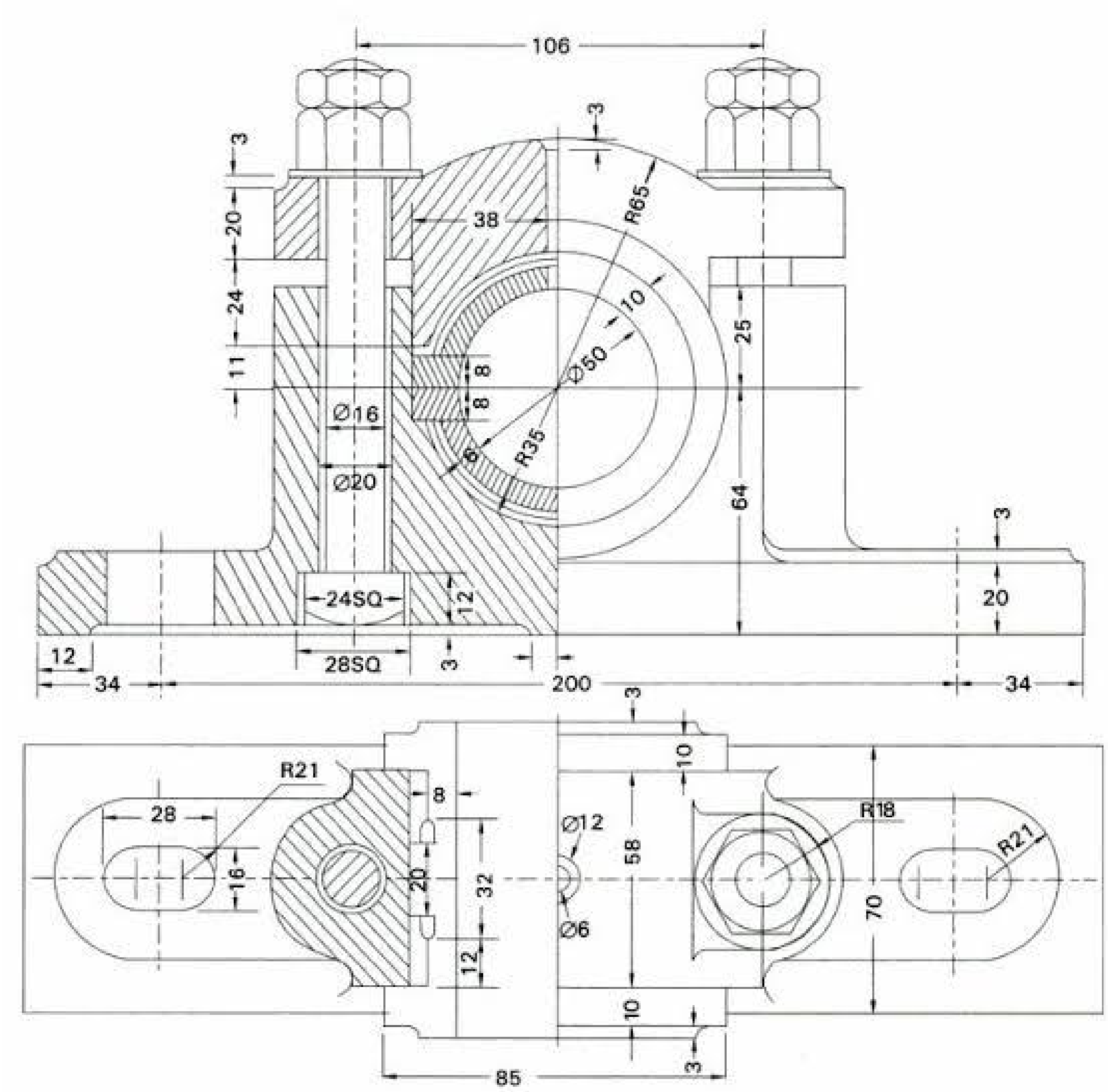
Plan

## Exercise – 4 PLUMMER BLOCK

### PART DRAWING

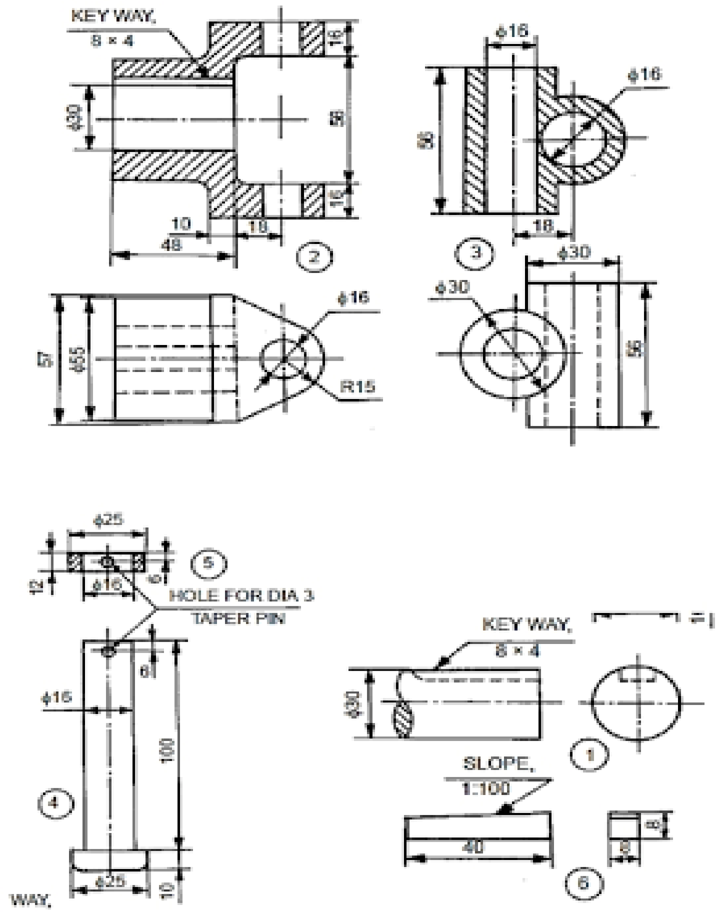


## ASSEMBLY DRAWING



## Exercise – 5 Universal Coupling

## PART DRAWING

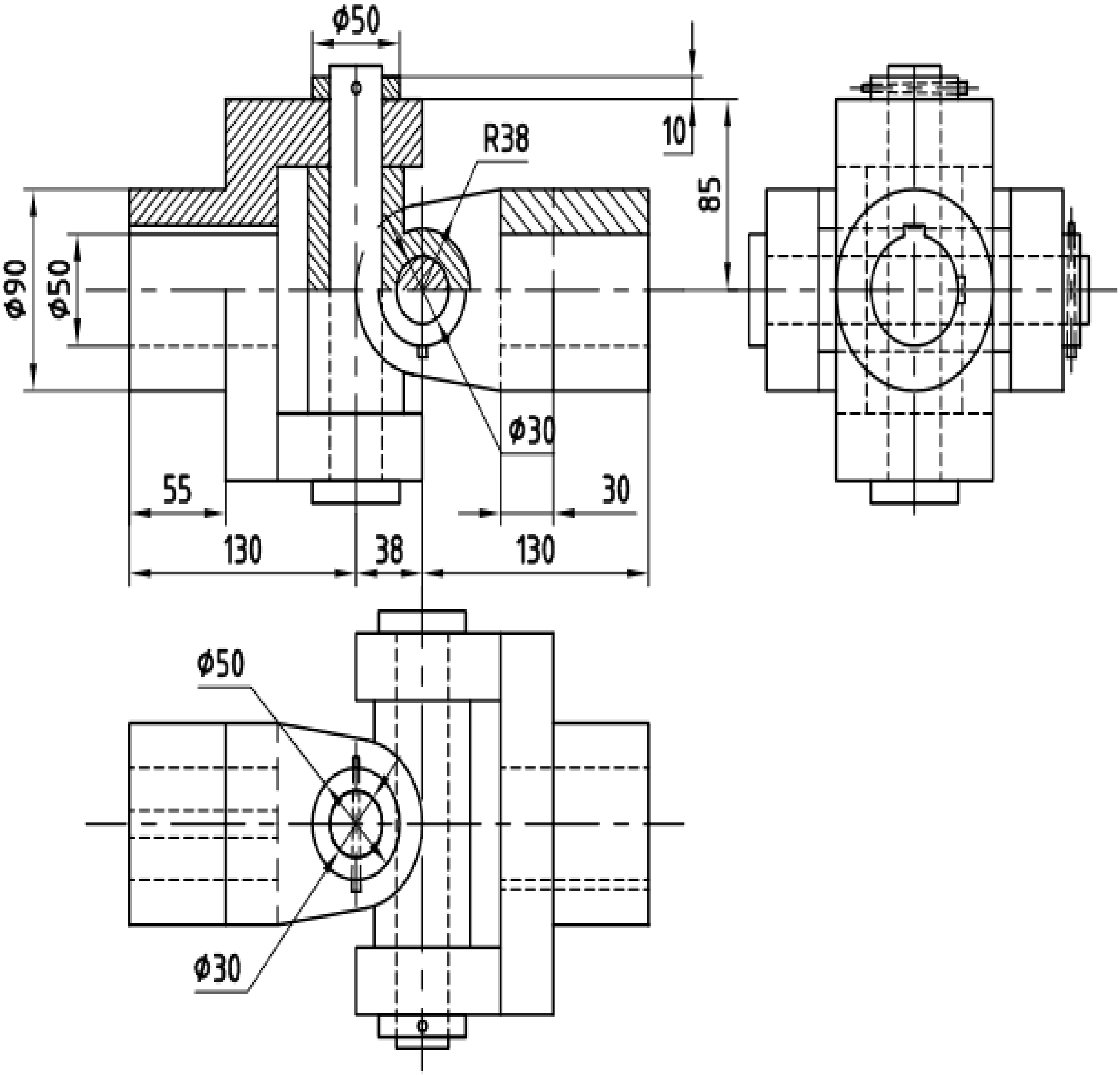



Parts list

| 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 |

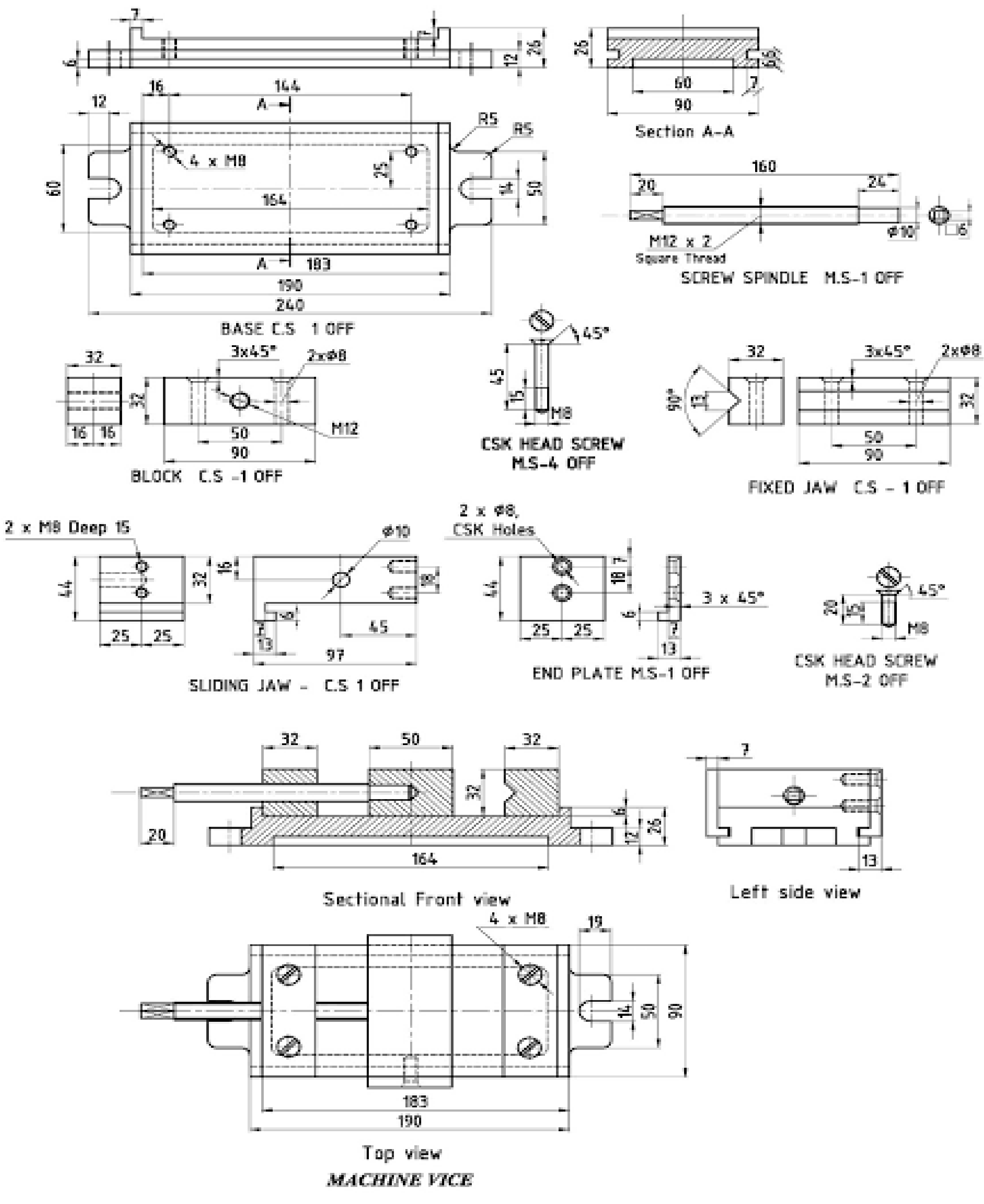
**Fig. 2: Details of a Universal Coupling**

**ASSEMBLY DRAWING**

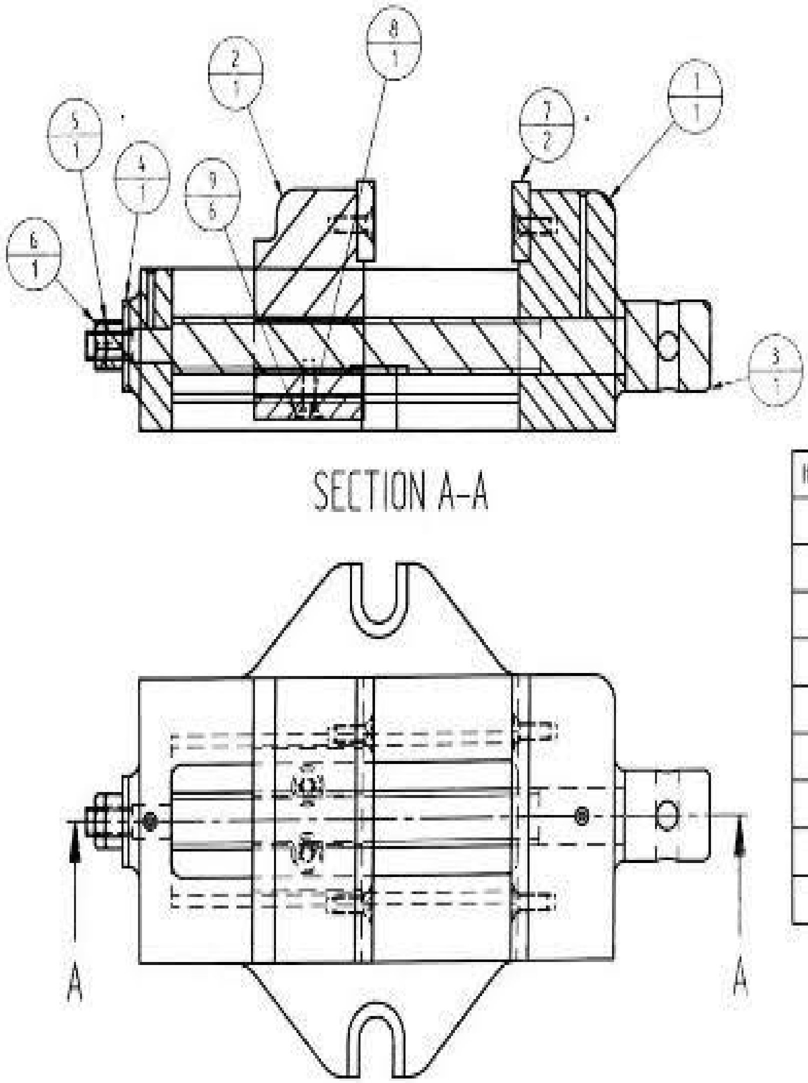


## Exercise – 6 Machine Vice

## PART DRAWING



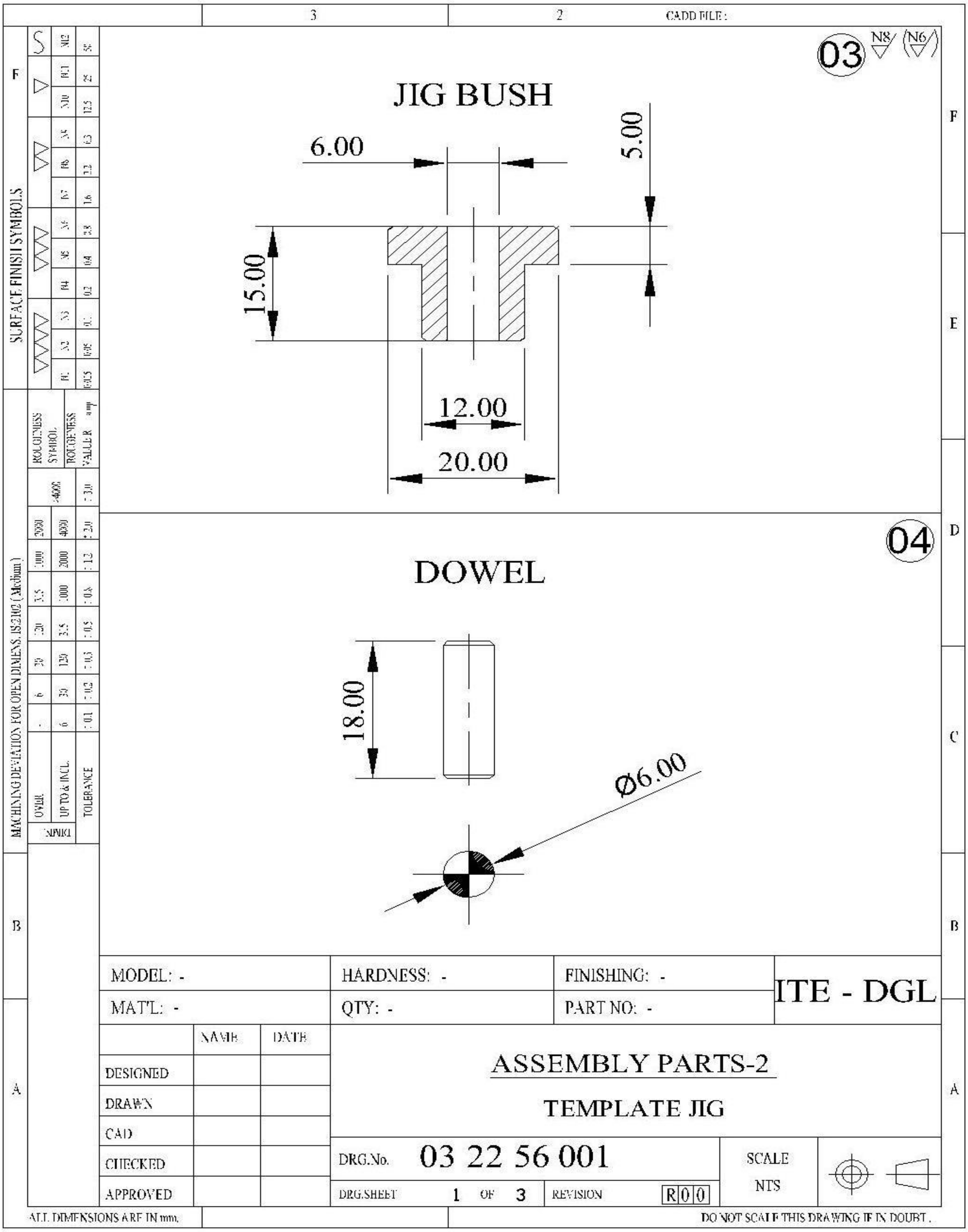
# ASSEMBLY DRAWING

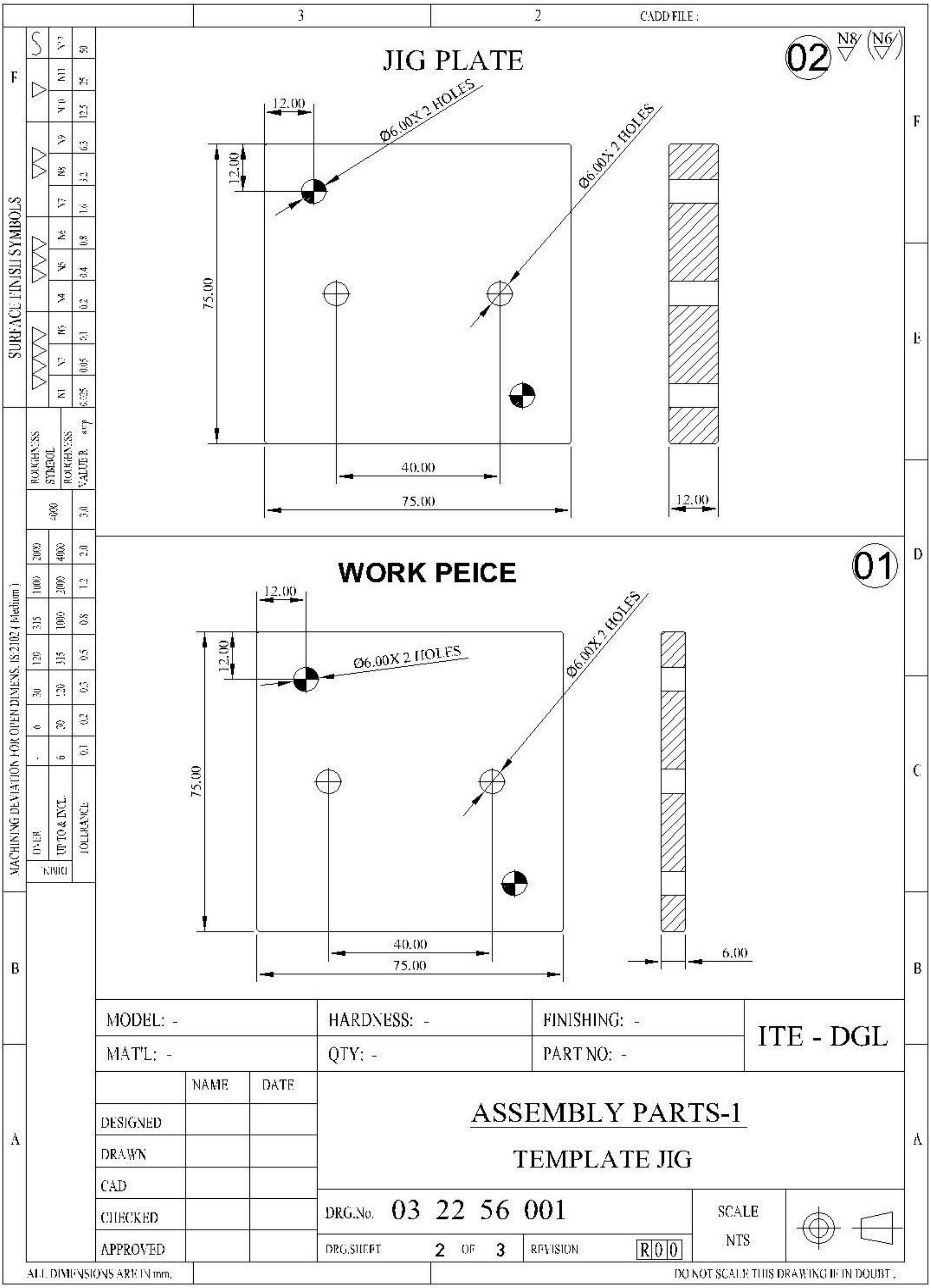


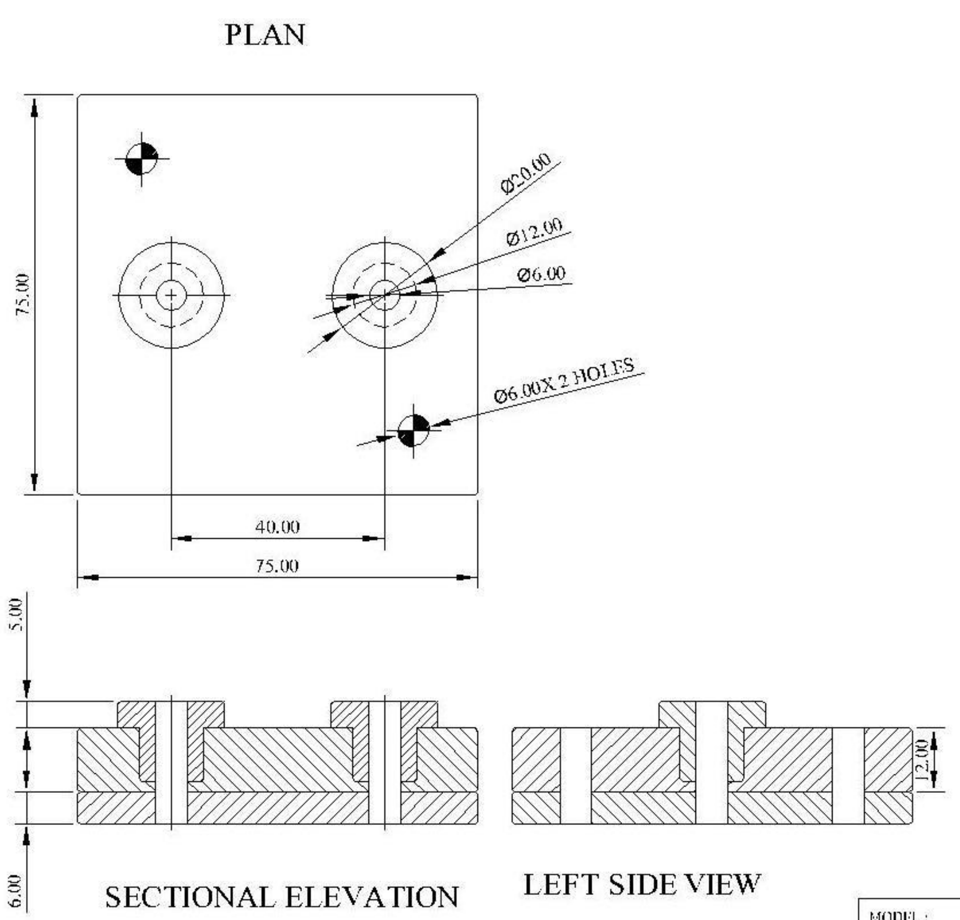

## MACHINE VICE

| 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 |

## Exercise – 7 Drill Jig(Template Jig)




JIG PLATE
02
N8 (N6)
12.00
Ø6.00X 2 HOLES
Ø6.00X 2 HOLES
12.00
75.00
40.00
75.00
12.00
WORK PEICE
01
12.00
Ø6.00X 2 HOLES
Ø6.00X 2 HOLES
12.00
75.00
40.00
75.00
6.00
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
OVER
UP TO & INCL.
TOLERANCE
CADD FILE :
MODEL: -
HARDNESS: -
FINISHING: -
ITE - DGL
MAT'L: -
QTY: -
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
TEMPLATE JIG
DRG.No. 03 22 56 001
DRG.SHEET 2 OF 3
REVISION R00
SCALE
NTS
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.




BILL OF MATERIALS

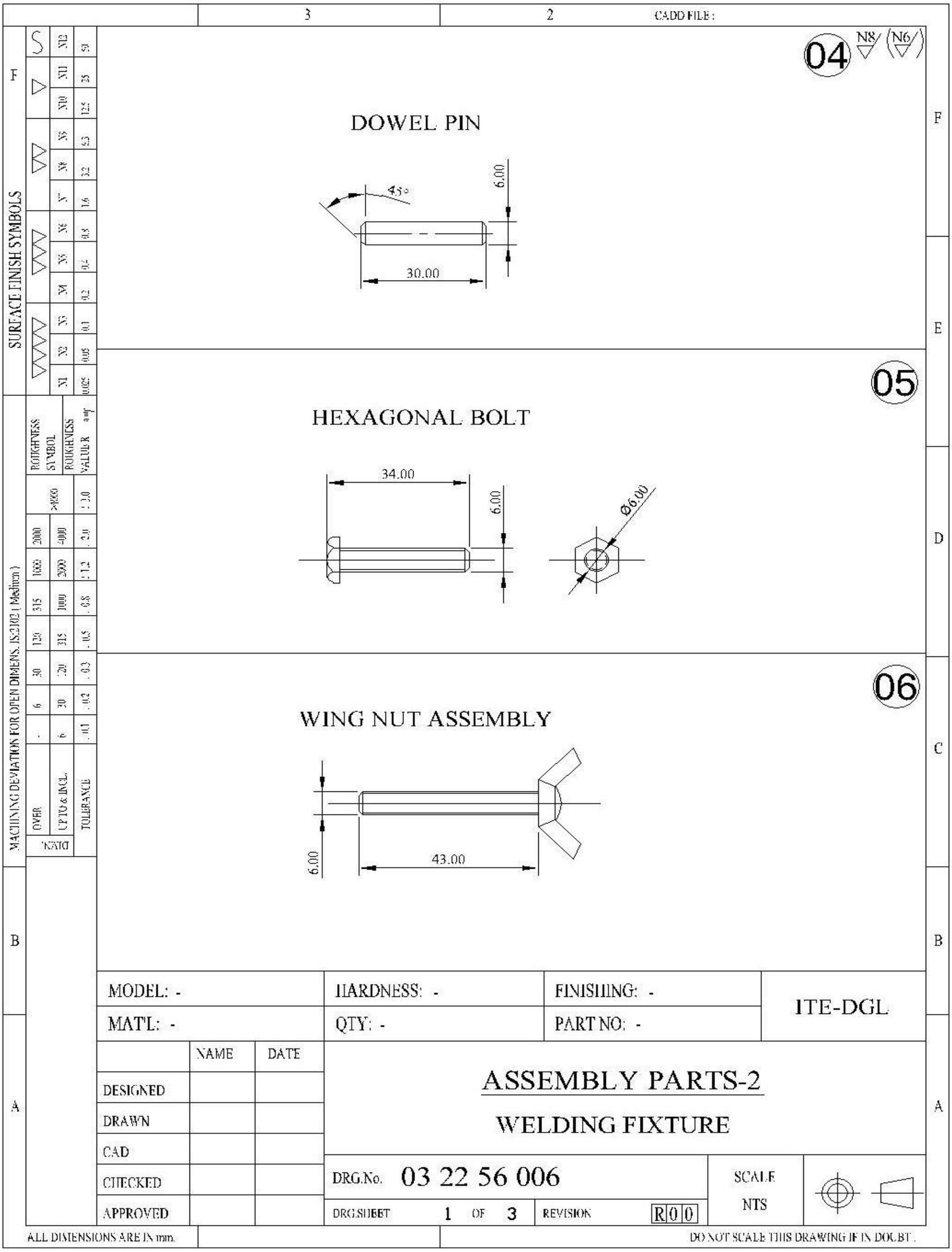
| S.NO | NAME | MATERIAL | QUANTITY |
|---|---|---|---|
| 1 | WORK PEICE | MILD STEEL | 1 |
| 2 | JIG PLATE | MILD STEEL | 1 |
| 3 | JIG BUSH | MILD STEEL | 2 |
| 4 | DOWEL | STD | 2 |

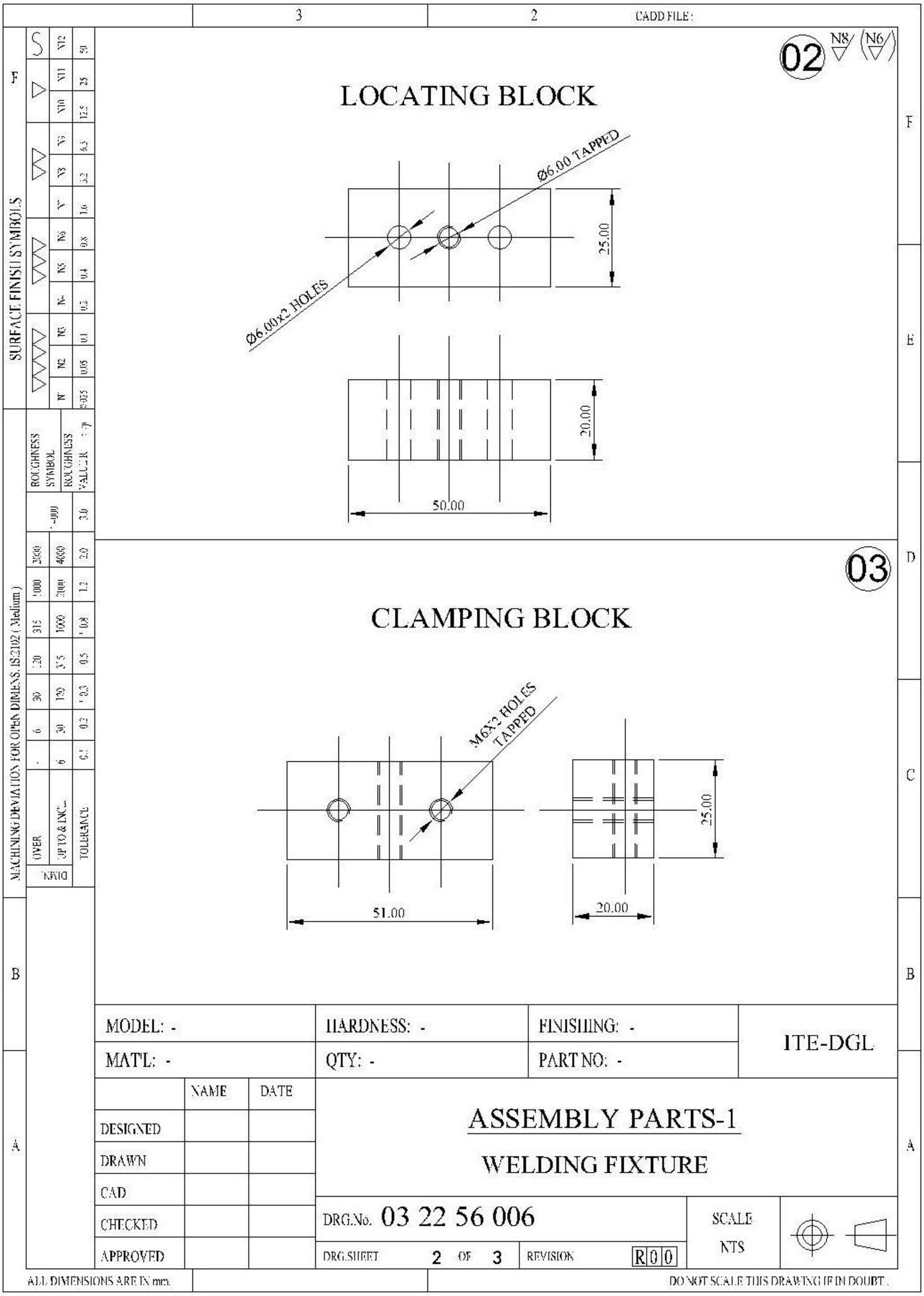
| | | | | | |
|---|---|---|---|---|---|
| MODEL : | | HARDNESS: | FINISHING: | ITE - DGL | |
| MATL : | | QTY : | PART NO : | | |
| | NAME | DATE | ASSEMBLY | | |
| DESIGNED | | | TEMPLATE JIG | | |
| DRAWN | | | | | |
| CAD | | | | | |
| CHECKED | | | DRG.No. 03 22 56 001 | SCALE NTS | |
| APPROVED | | | DRG SHEET 3 OF 3 REVISION R00 | | |

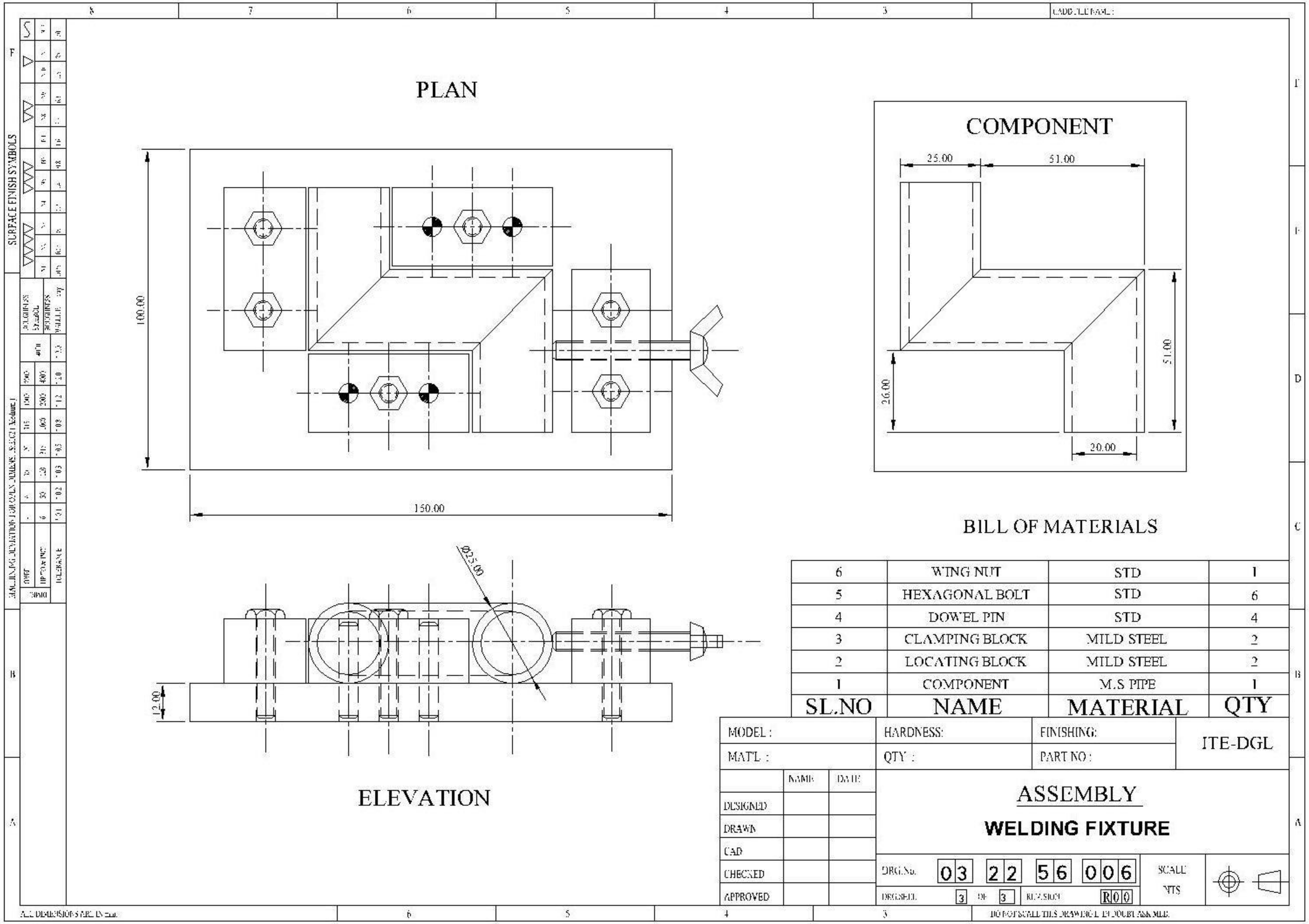
ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MLD.

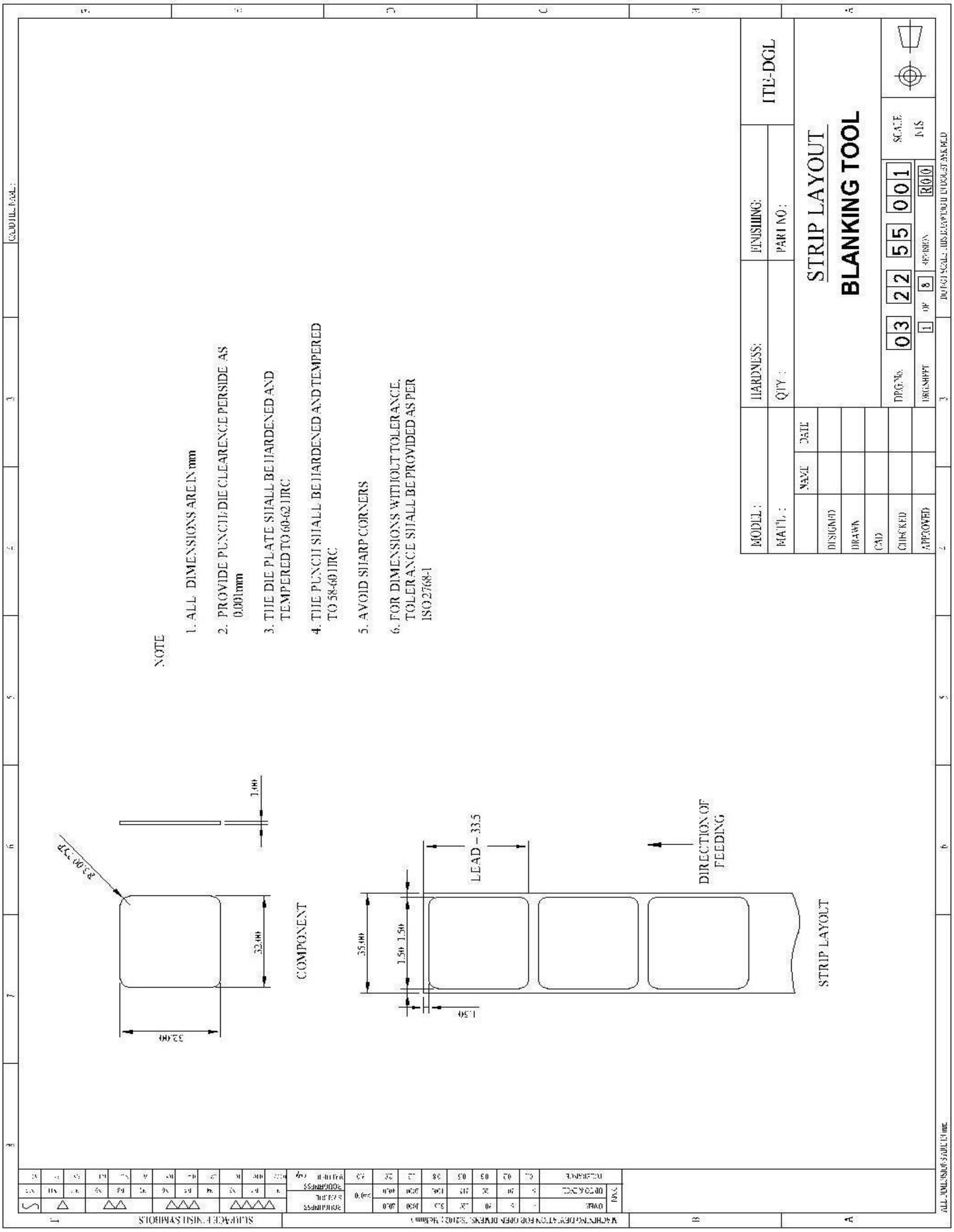
## Exercise –8 Welding Fixture

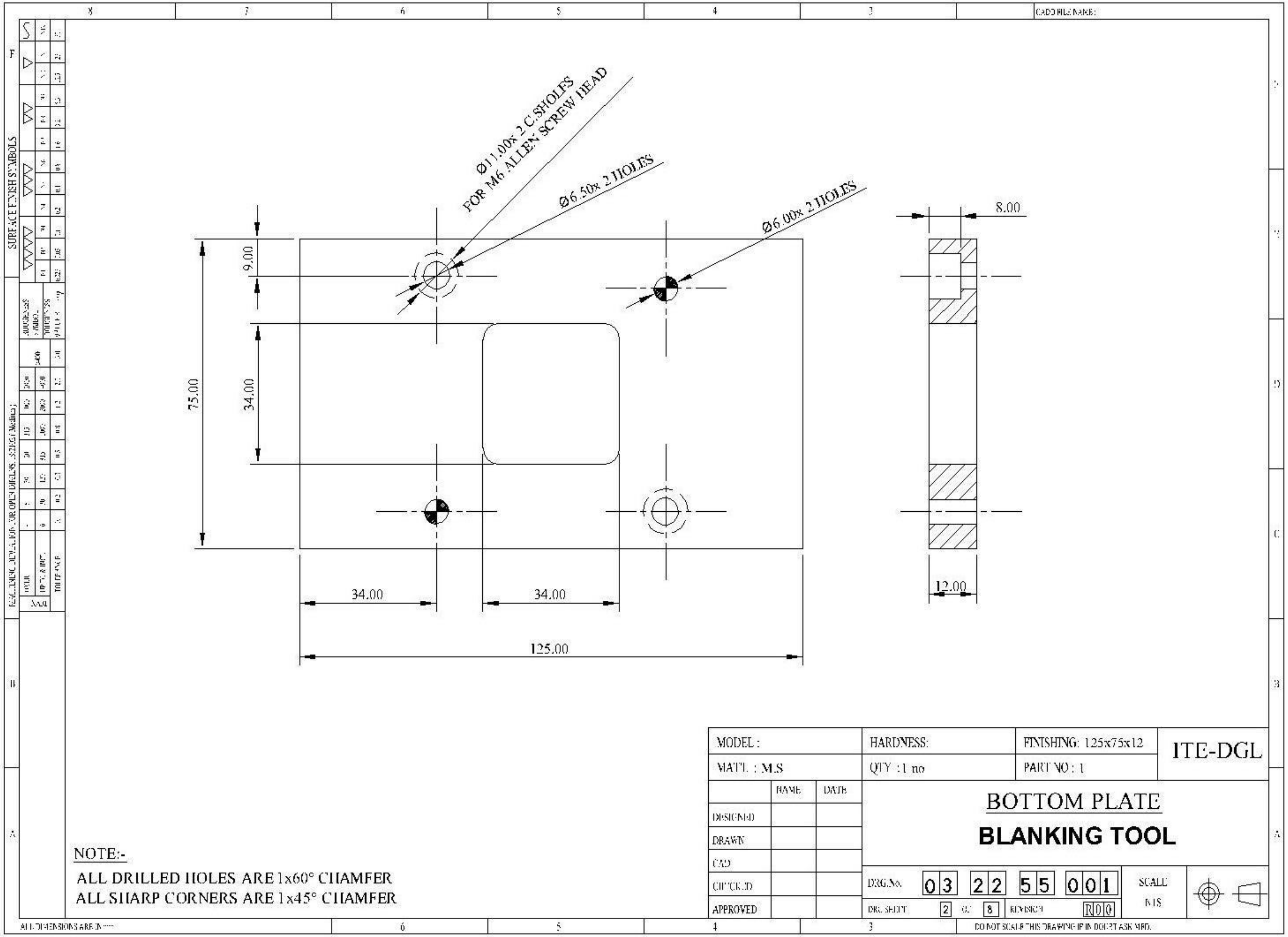



CADD FILE :
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
02
LOCATING BLOCK
Ø6.00 TAPPED
Ø6.00x2 HOLES
25.00
20.00
50.00
03
CLAMPING BLOCK
M6X2 HOLES TAPPED
25.00
51.00
20.00
MODEL: -
HARDNESS: -
FINISHING: -
ITE-DGL
MATL: -
QTY: -
PART NO: -
NAME
DATE
DESIGNED
DRAWN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

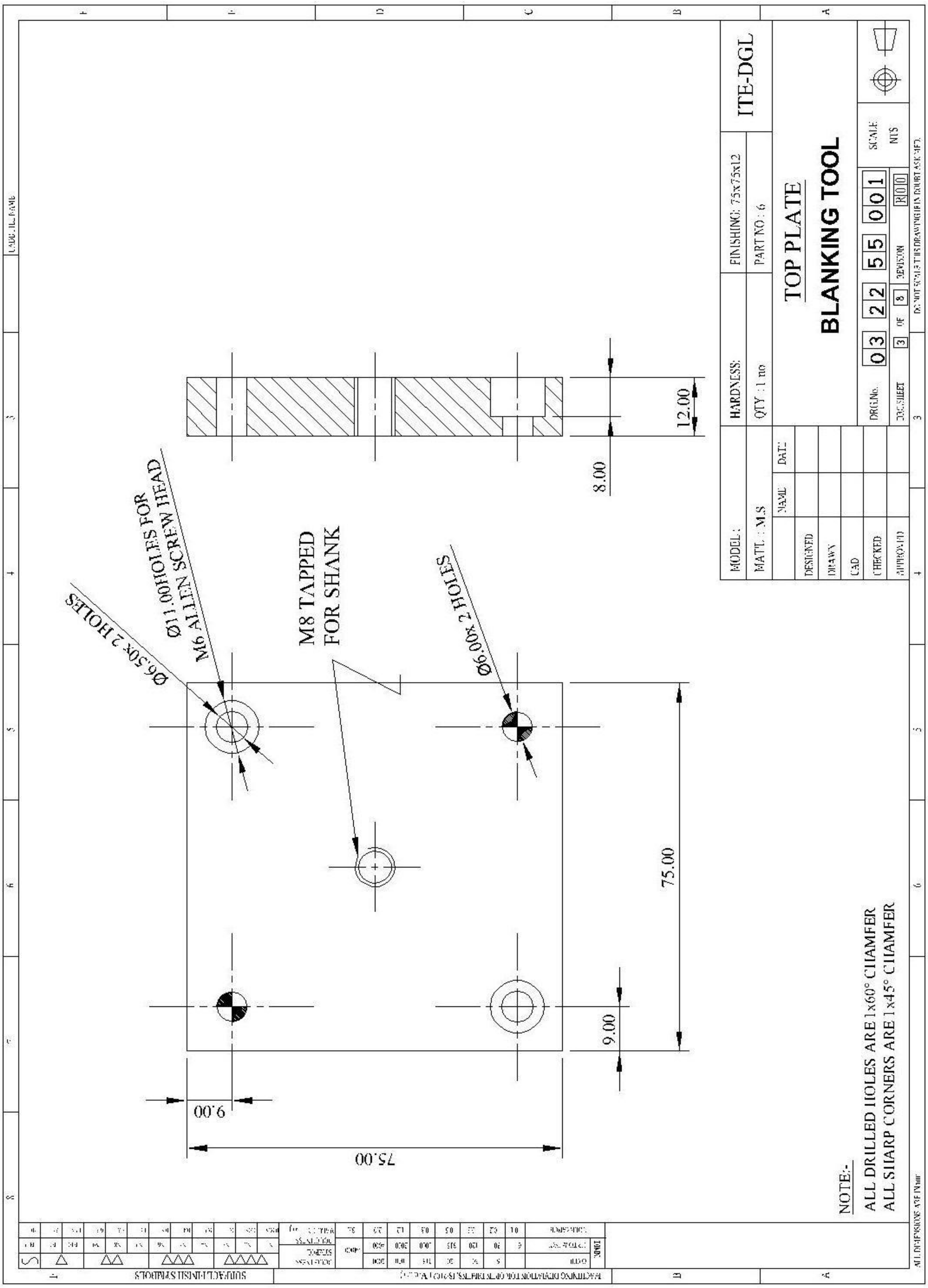

PLAN
COMPONENT
25.00
51.00
26.00
20.00
100.00
150.00
ELEVATION
Ø25.00
12.00
BILL OF MATERIALS
6 WING NUT STD 1
5 HEXAGONAL BOLT STD 6
4 DOWEL PIN STD 4
3 CLAMPING BLOCK MILD STEEL 2
2 LOCATING BLOCK MILD STEEL 2
1 COMPONENT M.S PIPE 1
SL.NO NAME MATERIAL QTY
MODEL :
MAT'L :
HARDNESS:
QTY :
FINISHING: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

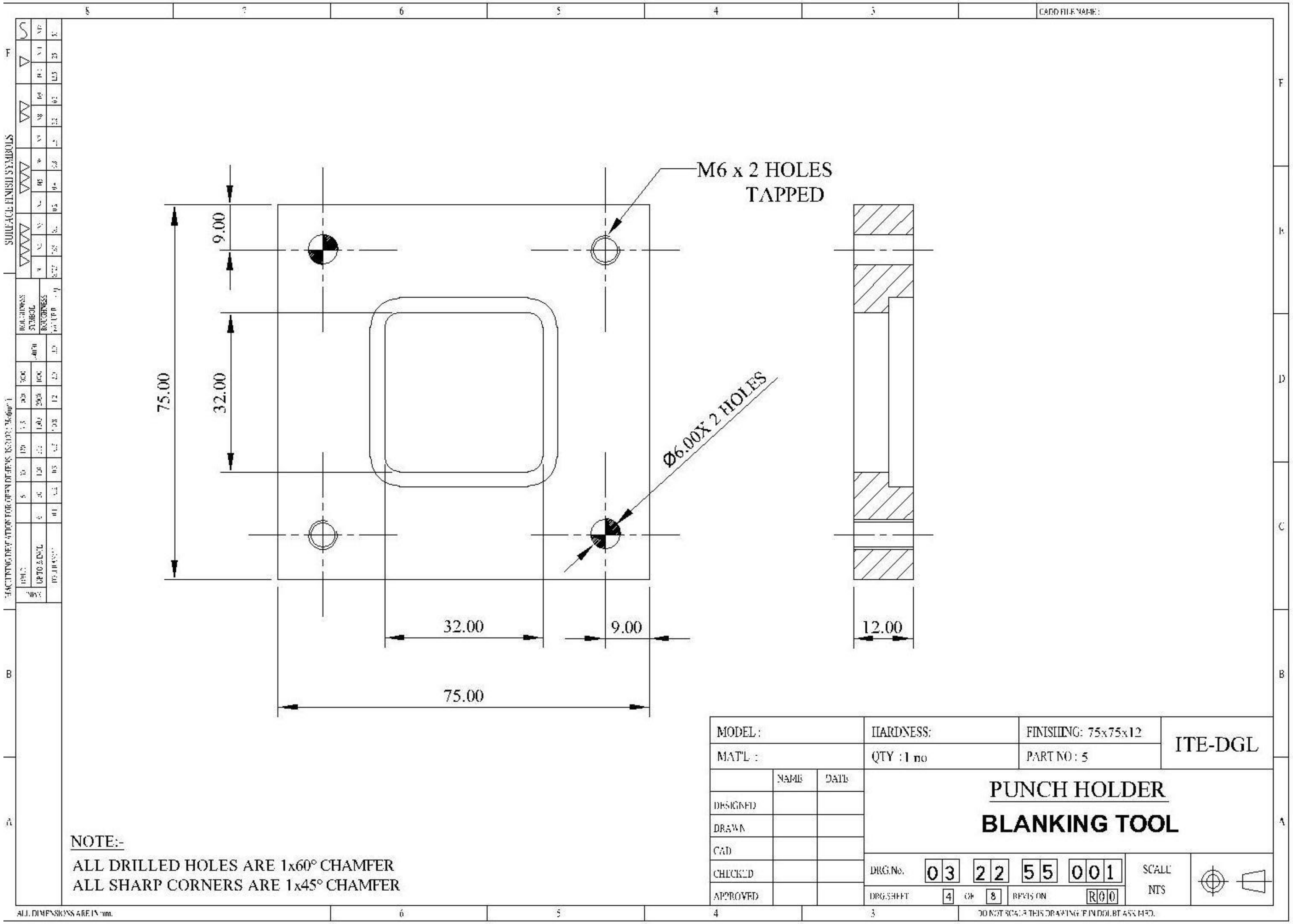
## Exercise- 9 Blanking Tool – Drop through type

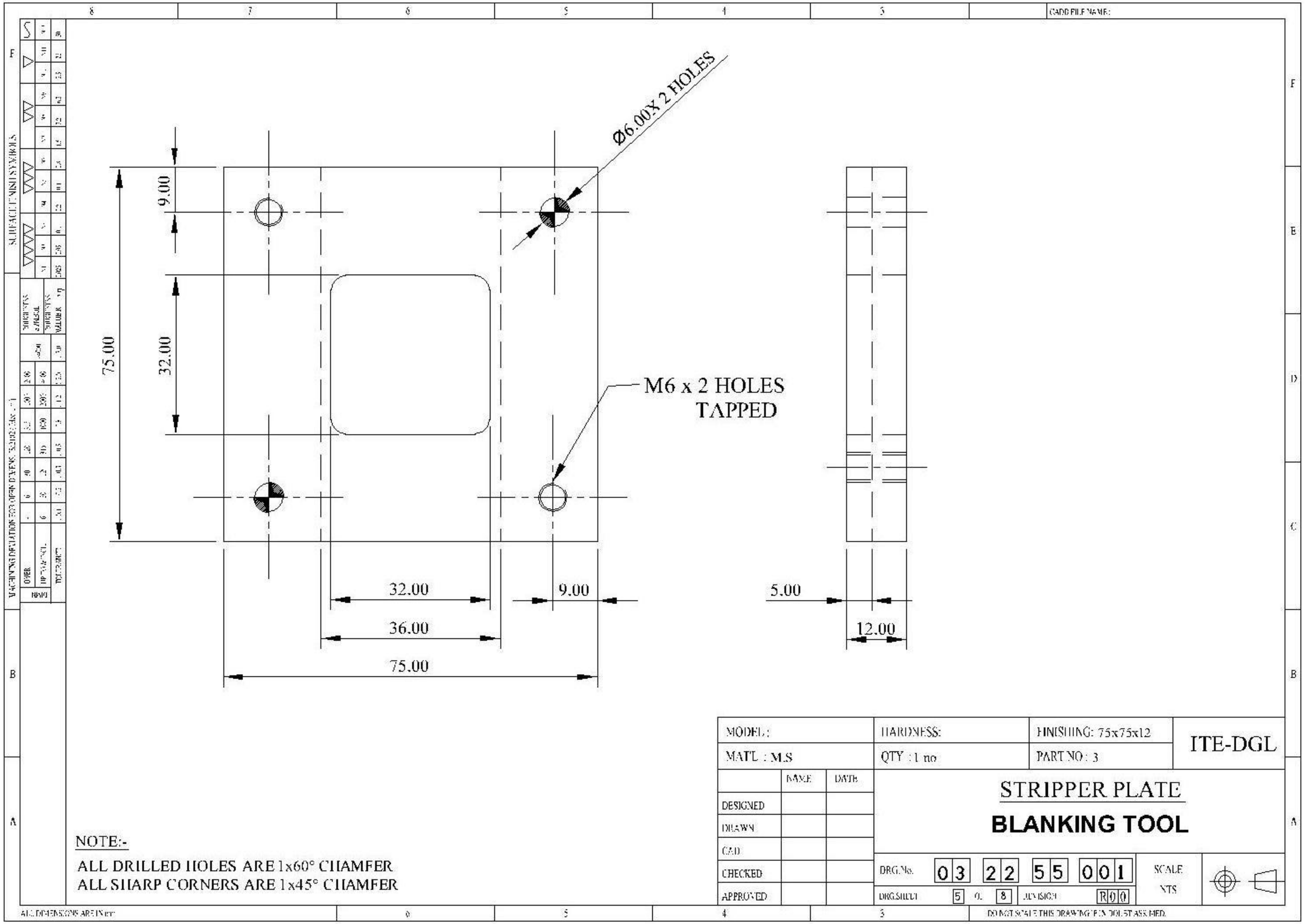


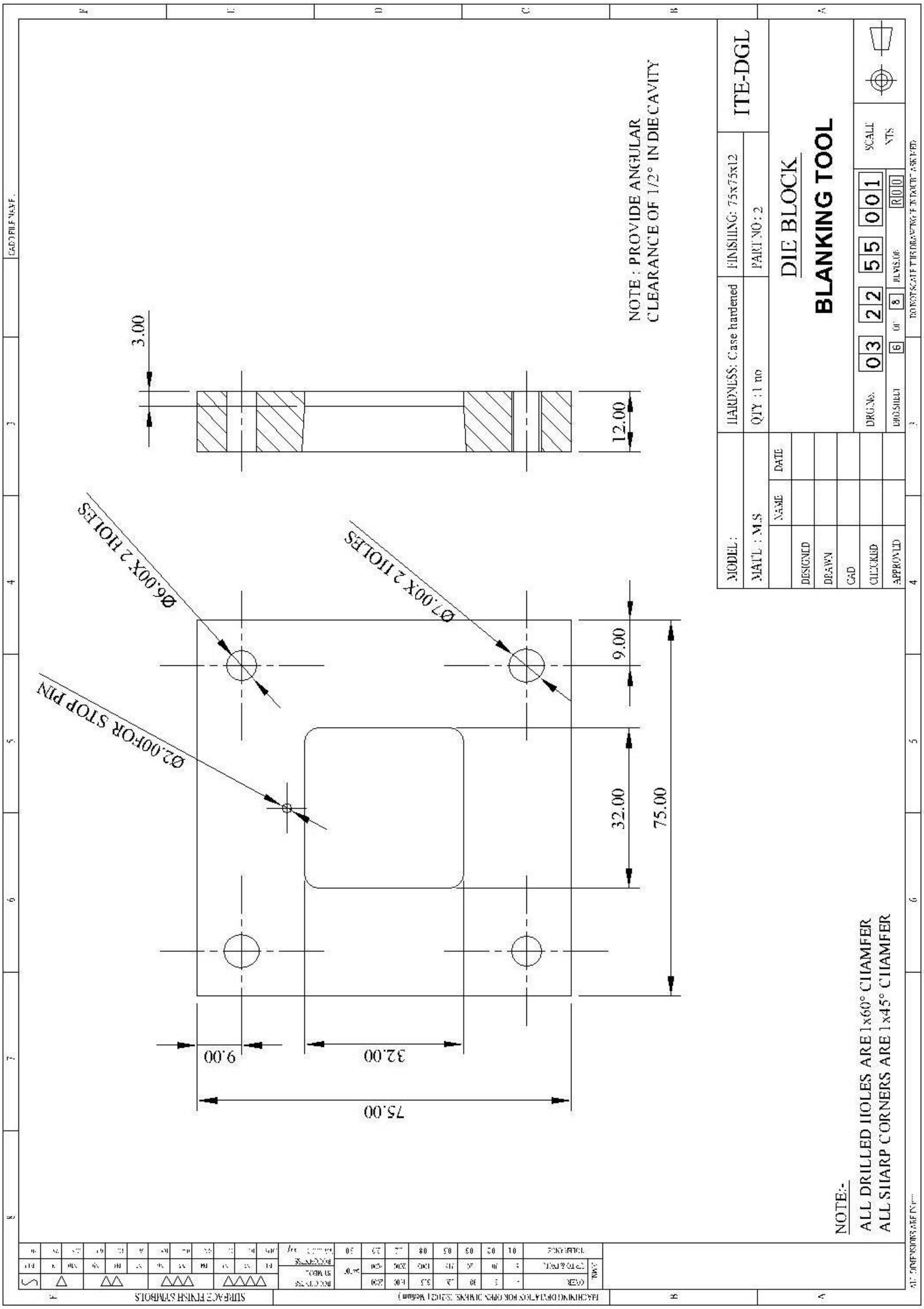


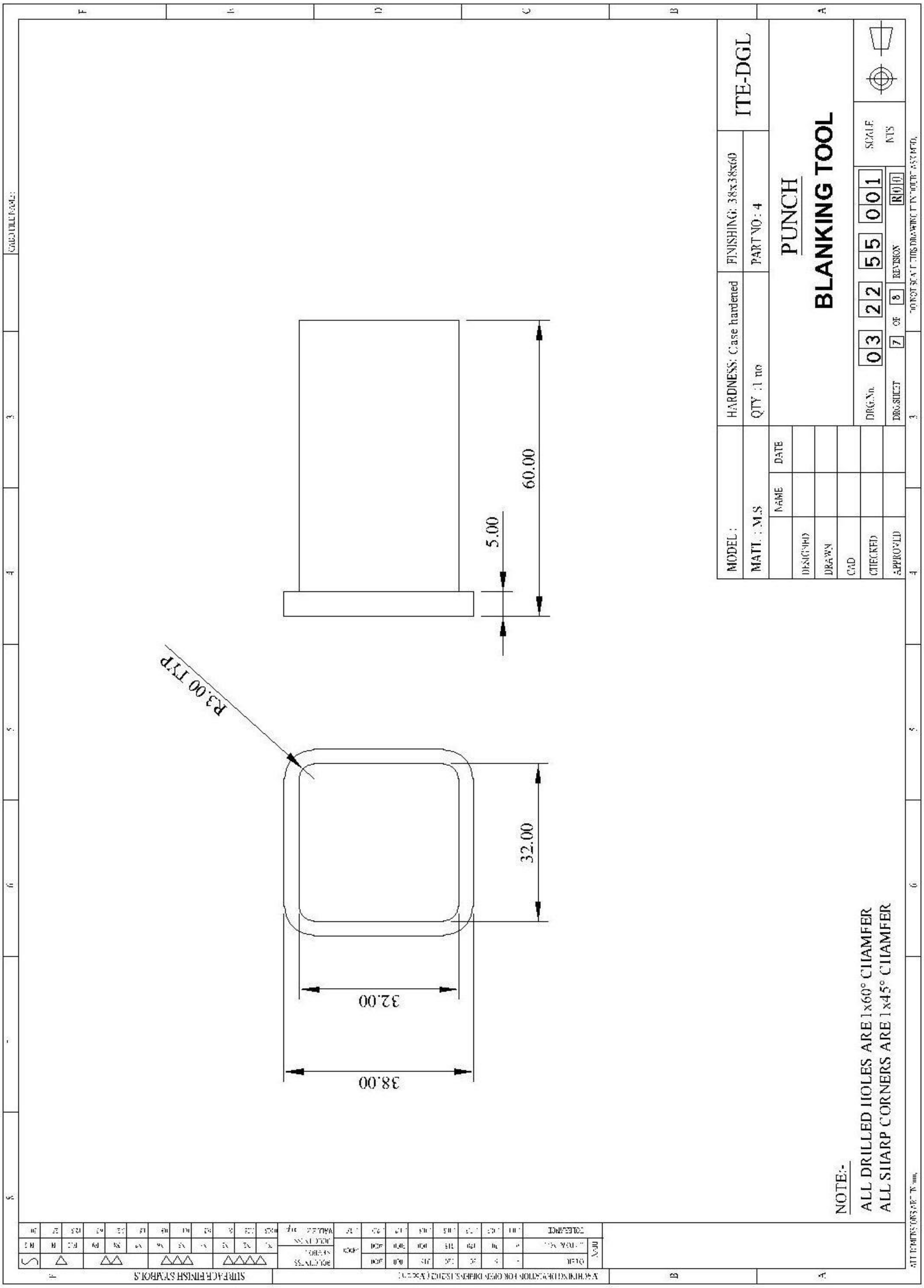
Ø11.00x 2 C.SHOLES
FOR M6 ALLEN SCREW HEAD
Ø6.50x 2 HOLES
Ø6.00x 2 HOLES
8.00
9.00
75.00
34.00
34.00
34.00
125.00
12.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL :
MATL : M.S
HARDNESS:
QTY :1 no
FINISHING: 125x75x12
PART NO : 1
ITE-DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
BOTTOM PLATE
BLANKING TOOL
DRG.No. 03 22 55 001
SCALE
N.S
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MFD.
SURFACE FINISH SYMBOLS
CADD FILE NAME:

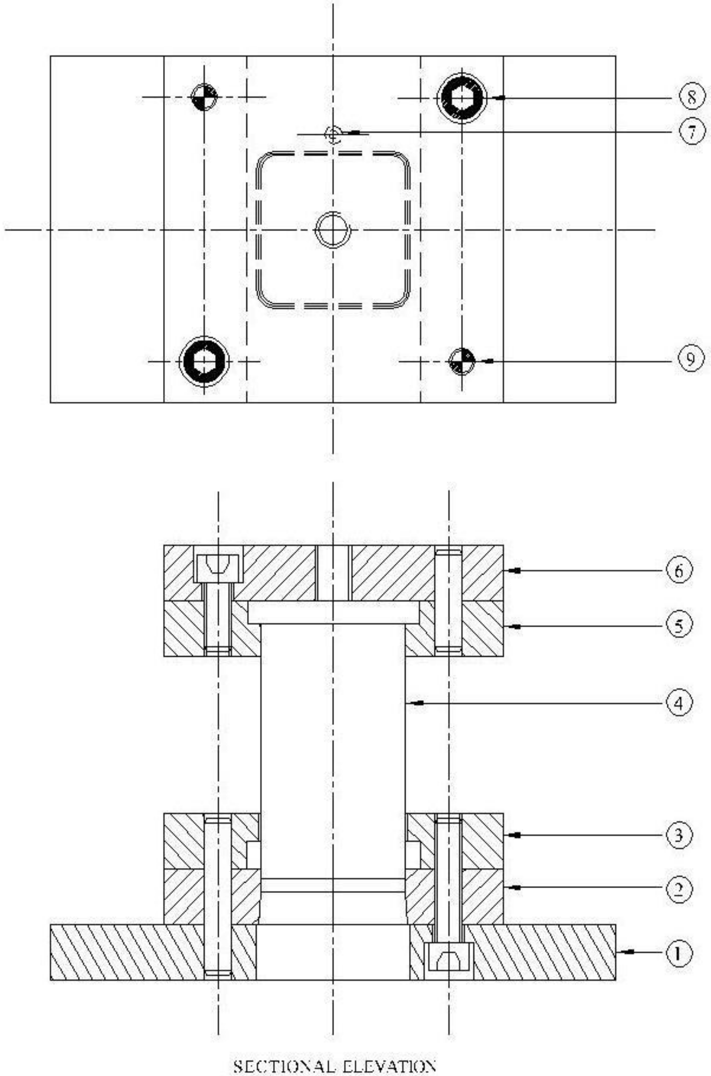

ITE-DGL
FINISHING: 75x75x12
PART NO : 6
HARDNESS:
QTY : 1 no
MODEL :
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
TOP PLATE
BLANKING TOOL
DRG.No. 03 22 55 001
SHEET 3 OF 8
REVISION R0 0
SCALE
NTS
Ø6.50x 2 HOLES
Ø11.00HOLES FOR
M6 ALLEN SCREW HEAD
M8 TAPPED
FOR SHANK
Ø6.00x 2 HOLES
12.00
8.00
75.00
9.00
9.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


M6 x 2 HOLES
TAPPED
Ø6.00X 2 HOLES
9.00
32.00
75.00
12.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS
MODEL :
MAT'L :
HARDNESS:
QTY : 1 no
FINISHING: 75x75x12
PART NO : 5
ITE-DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
PUNCH HOLDER
BLANKING TOOL
DRG.No. 03 22 55 001
SCALE
NTS
DRG.SHEET 4 OF 8
REVISION R00
CADD FILE NAME :
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK HOD.


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


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
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
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 |

MODEL : HARDNESS: FINISHING:
MATL : QTY : PART NO :
ITE-DGL

| | NAME | DATE |
|---|---|---|
| DESIGNED | | |
| DRAWN | | |
| CAD | | |
| CHECKED | | |
| APPROVED | | |

**ASSEMBLY**

**BLANKING TOOL**

DRG.No. 03 22 55 001 SCALE NTS
DRG.SHEET 8 OF 8 REVISION R00

SURFACE FINISH SYMBOLS

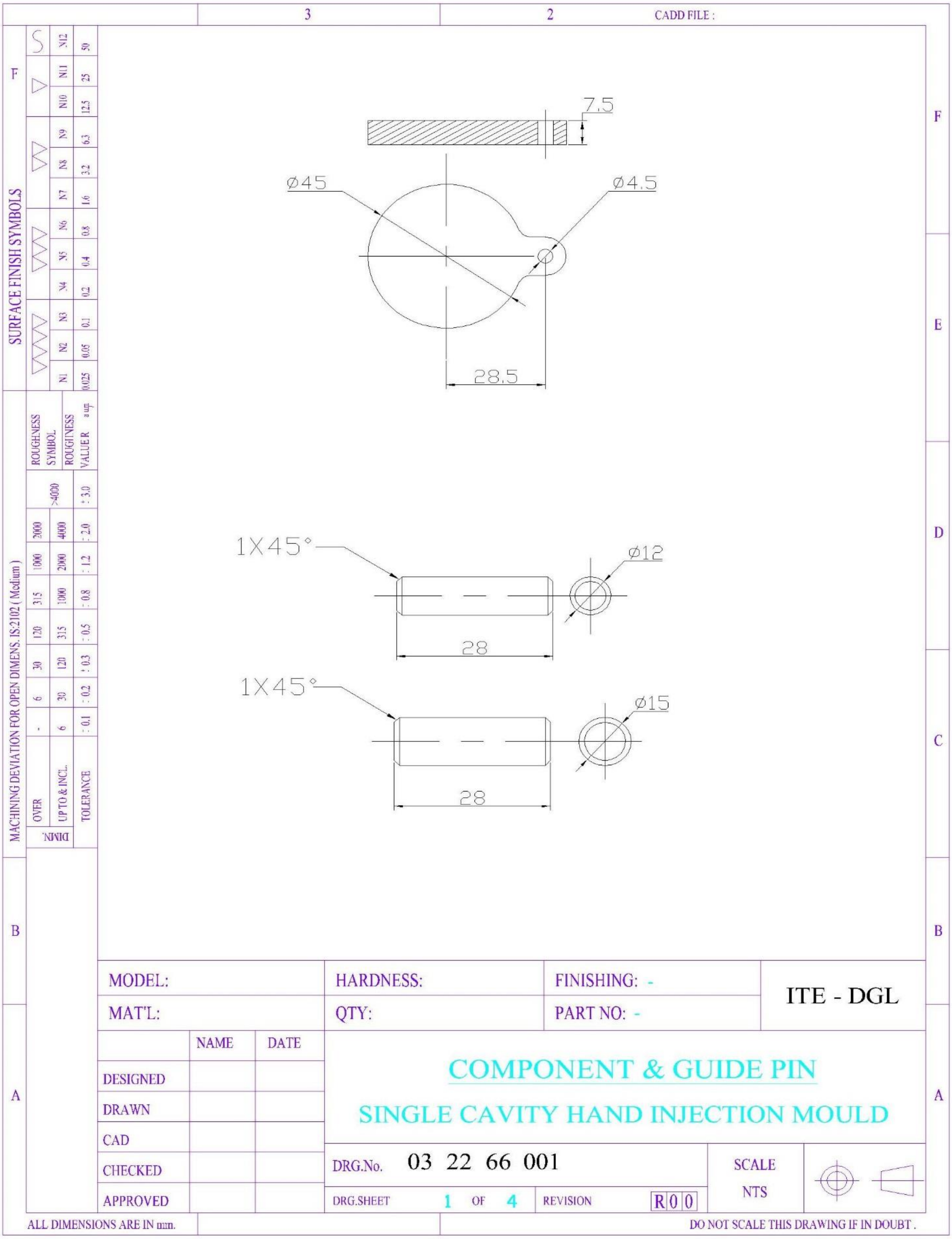
MACHINING DEVIATION FOR OPEN DIMENSIONS (Medium)

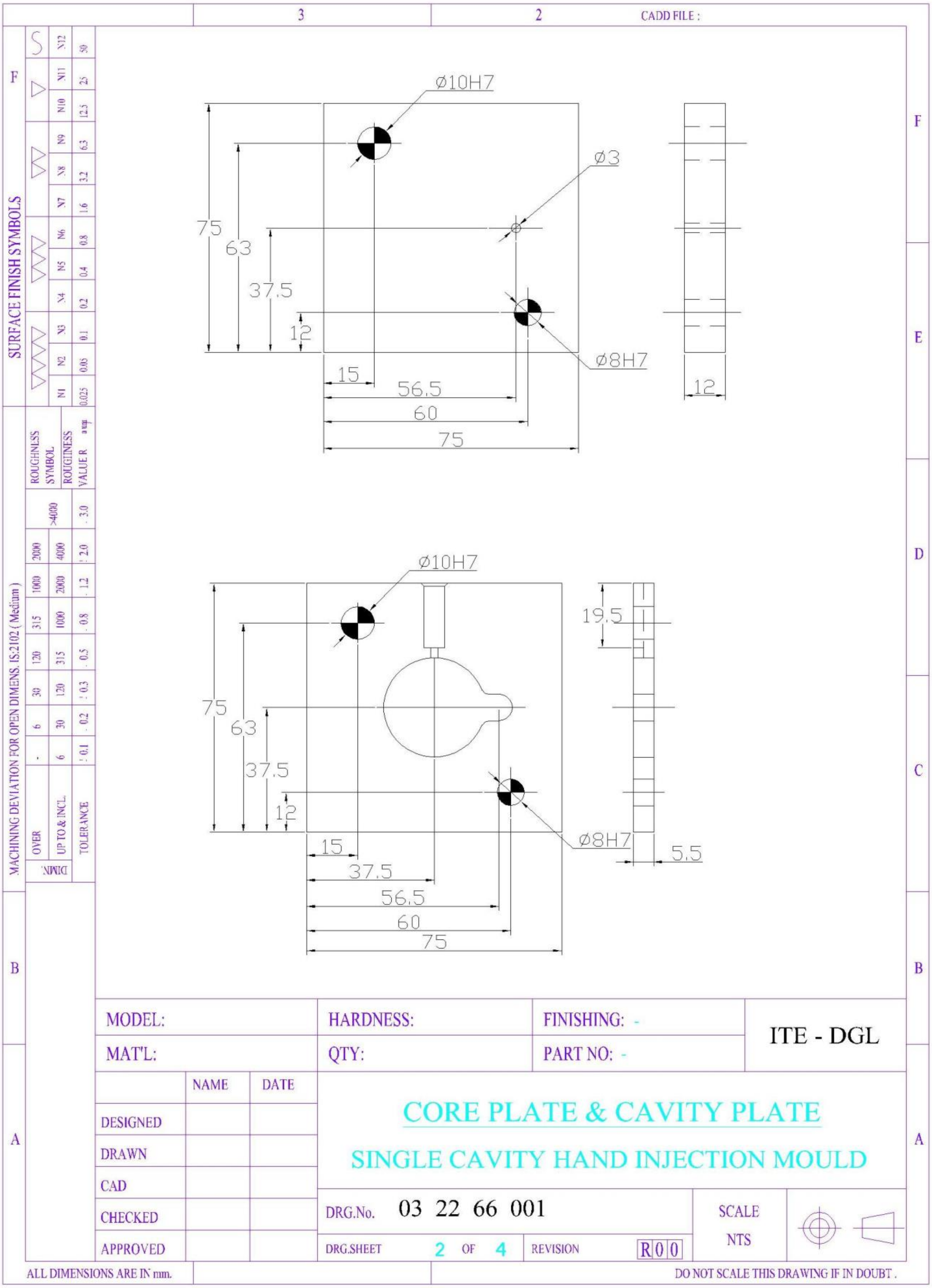
ALL DIMENSIONS ARE IN mm.

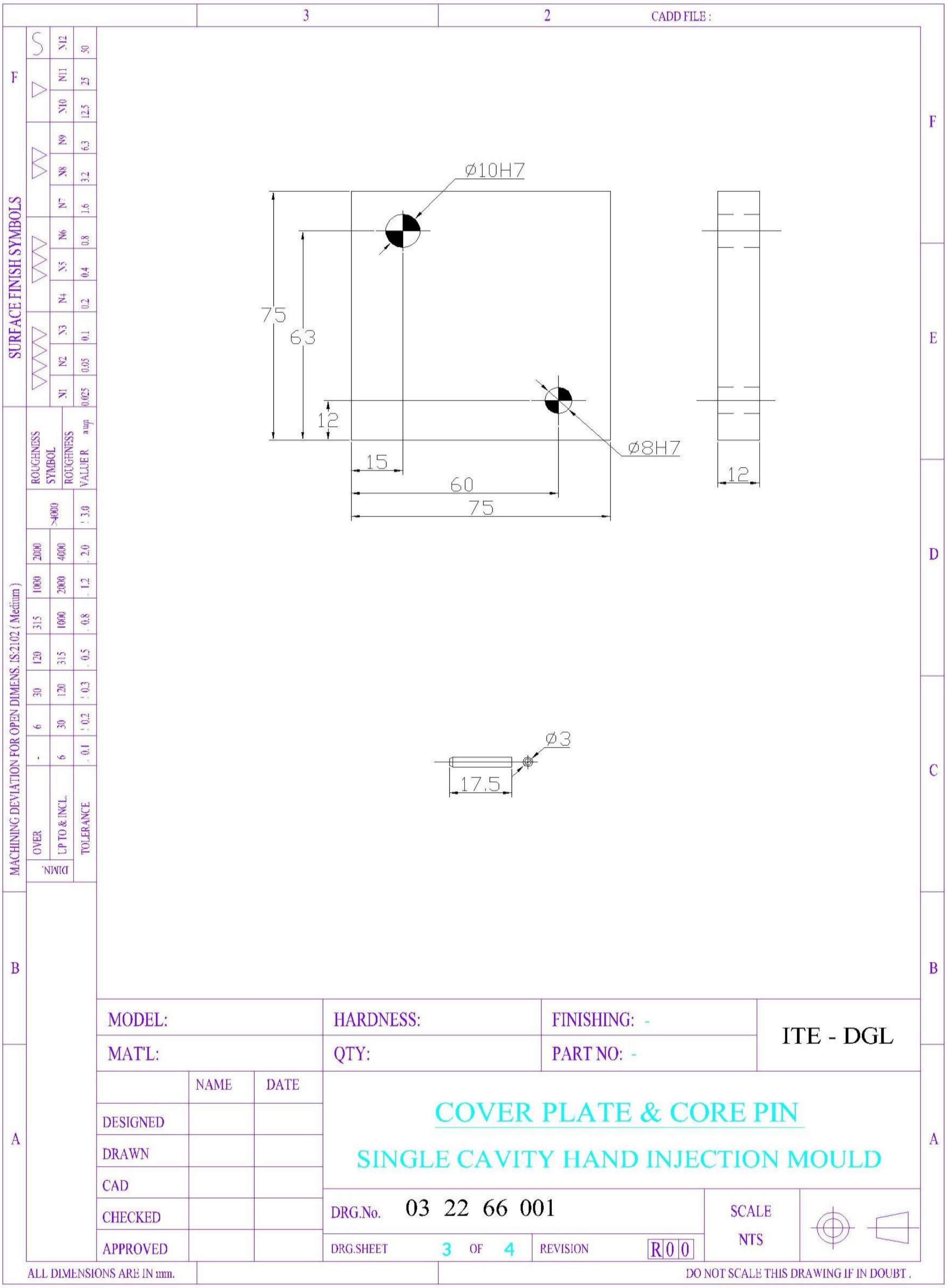
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MFD.

CADD FILE NAME :

## Exercise –10 Single Cavity Injection Mould




CADD FILE :
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE R
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
DIMN.
OVER
UP TO & INCL.
TOLERANCE
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:
HARDNESS:
FINISHING: -
ITE - DGL
MAT'L:
QTY:
PART NO: -
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 .

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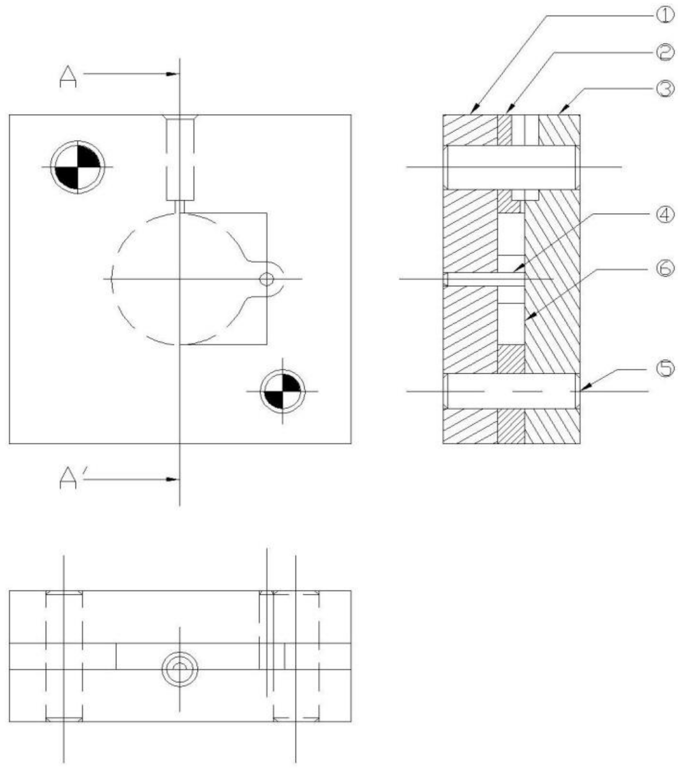
SURFACE FINISH SYMBOLS

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




| 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 |

| 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 .

## Board of Examination

**Part A (I** to IV units)

Answer any 10 two mark questions (10 x 2) = 20 Marks

**Part B** – V Unit

1. Assembled view of a given drawing (2 Views only) = 60(30+30) Marks
   a) Question from Machine drawing
   (or)
   b) Question from Tool Drawing
2. Bill of Materials, Dimensioning, Notes = 10 Marks

**Viva voce** = 10 Marks

**Total** **= 100 Marks**

**<u>Note to the examiner:</u>**

**Part A**

- Answer any 10 questions out of 15 questions.
- Fifteen questions should cover the complete syllabus (UNIT I to IV)

**Part-B**

- Answer should be evaluated from the print out for the Part-B questions
- Examiner should set the question paper to cover the complete syllabus of Unit-V.
- Examiner has to ask the student to answer any one question from the lot of 10 drawings with either or choice as detailed above.
- Examiner has to set the no. of questions minimum 10 , even one batch of students contains less than 10.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

(TOOL& DIE)

II YEAR

N – SCHEME

III SEMESTER

2020 – 2021 onwards

# 4022350 – ENGINEERING METROLOGY PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**
**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022350 |
| Semester | : | III |
| Subject Title | : | **ENGINEERING METROLOGY PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 16 Weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| ENGINEERING METROLOGY PRACTICAL | 3 | 48 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES**

- To practice linear and angular measurements
- To Use vernier caliper, vernier height gauge and micrometer
- To Use slip gauges to make standard dimensions
- To Measure angle of surface using sine bar
- To Use dial indicator to measure geometrical parameters
- To Demonstrate parallelism, squareness and circularity
- To Check the perpendicularity and squareness of a surface
- To Calibrate vernier caliper and micrometer using slip gauges

# Detailed Syllabus

## 4022350 - ENGINEERING METROLOGY PRACTICAL

**I. LINEAR MEASUREMENT:**

1(a). Vernier caliper – 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 in the give work piece.

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.

**II. ANGULAR MEASUREMENT:**

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.

**III. MEASUREMENT OF GEOMETRIC PARAMETERS AND CALIBRATION OF INSTRUMENTS:**

10. Straightness – Measurement of concavity / convexity in a surface using Toolmaker's straight edge and feeler gauge.

11. Checking the parallelism of two planes using dial indicator.

12. Testing circularity of die set pillars using v-block and dial indicators.

13. Measurement of Run-out on
    i) External cylindrical surface
    ii) External conical surface using dial gauge
    iii) Checking of Perpendicularity of drill head guide
    iv) Checking of squareness of clamping surface of table to its axis.
14. Measurement of axial slip using dial indicators.
15. Calibration and adjusting of micrometers/ Vernier caliper using slip gauges

**SCHEME OF EXAMINATION:**

| | Duration | Max. Marks |
|---|---|---|
| I) <u>Part – A</u> | | |
| a) Linear Measurement or b) Angular Measurement | 1 ½ Hrs. | 45 |
| II) <u>Part – B</u> | | |
| c) Measurement of Geometrical Parameters & calibration. | 1 ½ Hrs. | 45 |
| III) Viva – Voce | | 10 |
| | **Total** | **100** |

**SCHEME OF VALUATION:**

Observation / Reading - 20 marks

Tabulation / Formula - 10 marks

Calculation & Result - 15 marks

## Details of The Equipment's (for a batch of 30 students)

| | |
|---|---|
| **NAME OF THE BRANCH / COURSE** | MECHANICAL ENGINEERING (TOOL & DIE) |
| **YEAR** | SECOND |
| **SEMESTER** | III |
| **NAME OF THE LABORATORY** | 4022350 ENGINEERING METROLOGY PRACTICAL |

| 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 | Gear tooth vernier | 2 |
| 9 | Universal bevel protractor | 3 |
| 10 | Combination set | 1 |
| 11 | Sine bar 200mm | 1 |
| 12 | Tool makers straight edge | 2 |
| 13 | Feeler gauge | 2 |
| 14 | Dial test indicator with magnetic stand | 3 |
| 15 | V-block | 1 |
| 16 | Surface plate | 1 |
| 17 | Spirit level | 2 |
| 18 | Go & No Go gauges set | 1 |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

### N – SCHEME

### III SEMESTER

### 2020 – 2021 onwards

## 4022360 – MANUFACTURING TECHNOLOGY PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**
**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022360 |
| Semester | : | III |
| Subject Title | : | **MANUFACTURING TECHNOLOGY PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| MANUFACTURING TECHNOLOGY PRACTICAL | 5 | 80 | 25 | 100* | 100 | 3hrs |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES:**

- Identify the parts of a centre lathe & Drilling machine
- Identify the work holding devices
- Set the tools for various operations
- Operate the lathe and Machine a component using lathe
- Operate the Drilling machine and produce different sizes of holes.

**DETAILED SYLLABUS**

Contents: Practical

**Name of the Topics:**

**1. Lathe**
**Syllabus**

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
10. Drilling, Tapping, Counter Boring, Countersinking and Reaming

**Exercises :**

1. Plain turning
2. Step turning
3. Taper turning
4. Thread cutting
5. Knurling
6. Bushing
7. Eccentric Turning
8. Drilling
9. Tapping
10. Counter Boring
11. Countersinking
12. Reaming

**Lathe Works**

Manufacture and estimate the cost of the following exercises by assuming the suitable raw material for the final size of the components.

**BOARD EXAMINATION**

**Note of the Faculty :** Last job of the raw material(MS Rod Ǿ32x77mm and MS Rod Ǿ25x77mm ) to be retained in student wise or batch wise (Maximum Two Students per batch).This may be verifiable at the time of Board Practical Examination by the external examiner

**Board Examination-Question Paper Pattern**

1. Two questions should be asked in such way that one from Lathe and one from drilling
2. Dimensions can be altered with the consent of External Examiner

## MODEL QUESTION PAPER

1. Machine the component as per the given sketch 60 Marks
   Any one of the exercises in Lathe
2. Make the component as per the given sketch 30 Marks
   Any one of the exercises in Drilling

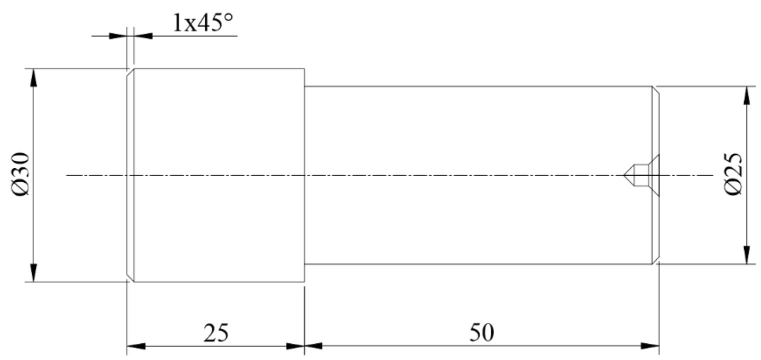
## DETAILED ALLOCATION OF MARKS

| | | | |
|---|---|---|---|
| **Lathe Work** | **-** | **60 Marks** | |
| | Preparation | - | 10 |
| | Dimensions | - | 40 |
| | Finishing | - | 10 |
| **Drilling** | **-** | **30 Marks** | |
| | Marking | - | 15 |
| | Finishing | - | 15 |
| | Viva – Voce | - | 10 Marks |
| **Total** | **-** | **100 Marks** | |

Any one of the exercise from Drilling

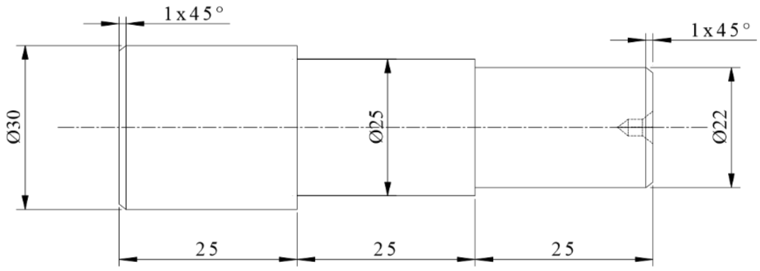
**Exercise No:1 –Plain turning .**

Raw Material: MS Rod Ǿ32x77mm



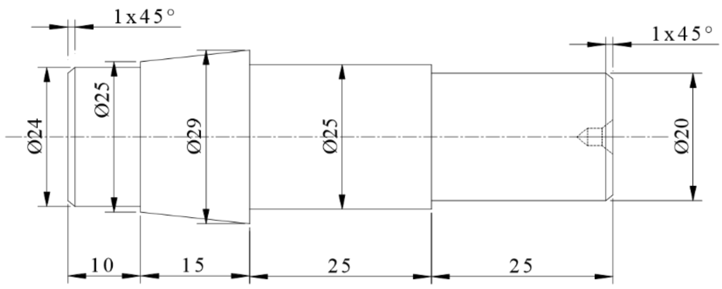
**Exercise No:2-Step turning**

Raw Material: Exercise No:1



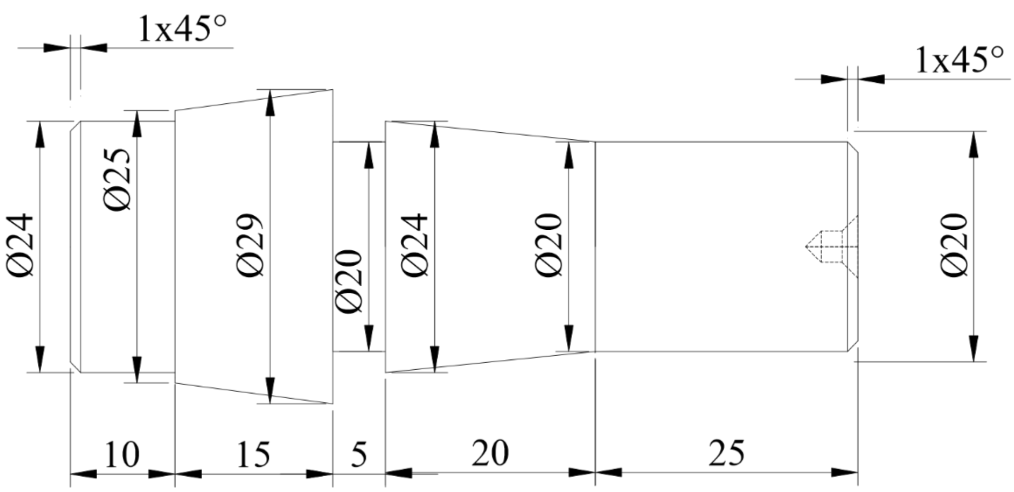

**Exercise No:3-Step and taper turning**

Raw Material: Exercise No:2



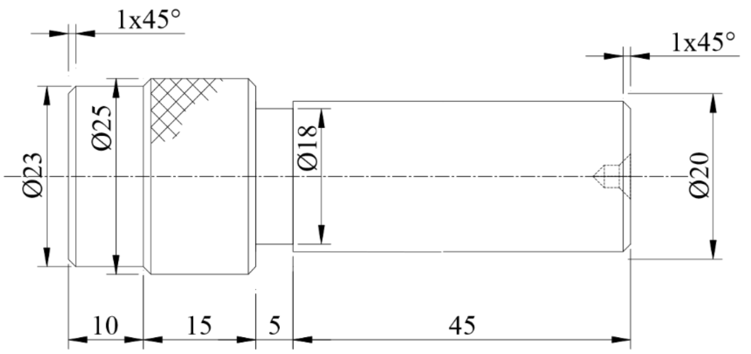

**Exercise No: 4 -Step and taper turning**

Raw Material: Exercise No: 3



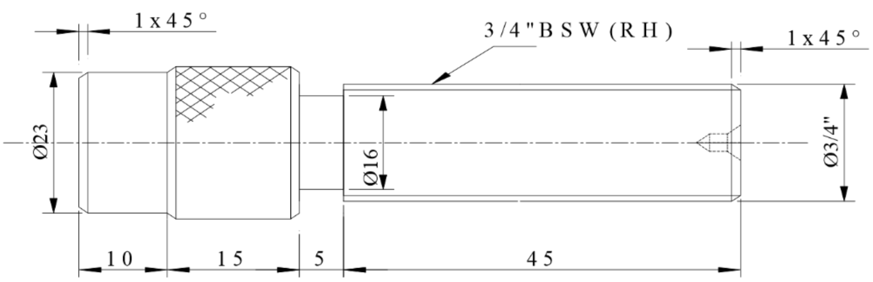
**Exercise No: 5 Knurling and step turning**

Raw Material: Exercise No:4



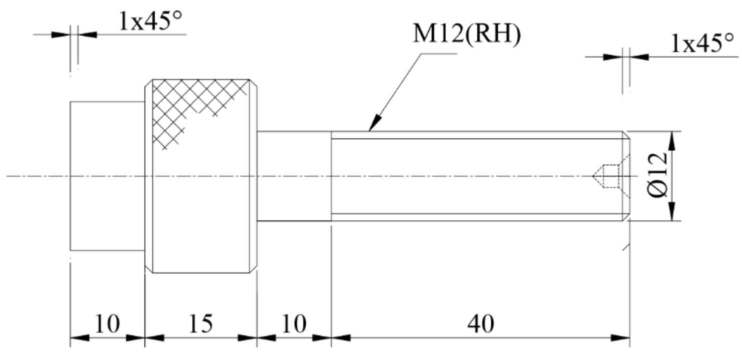

**Exercise No:6 BSW Thread cutting**

Raw Material: Exercise No:5



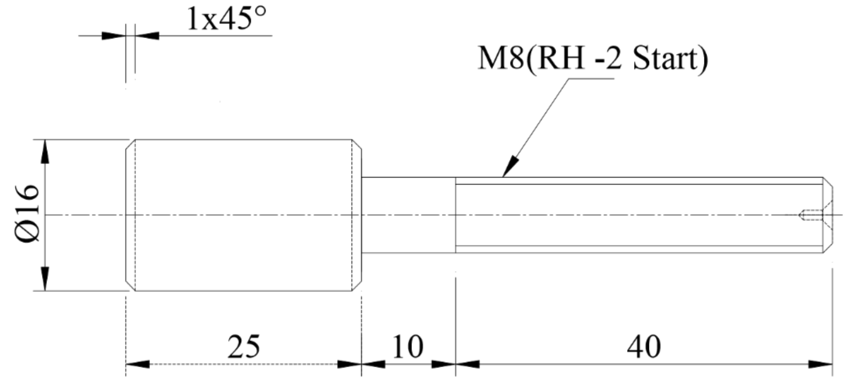

**Exercise No:7 – Metric thread cutting**

Raw Material: Exercise No:6



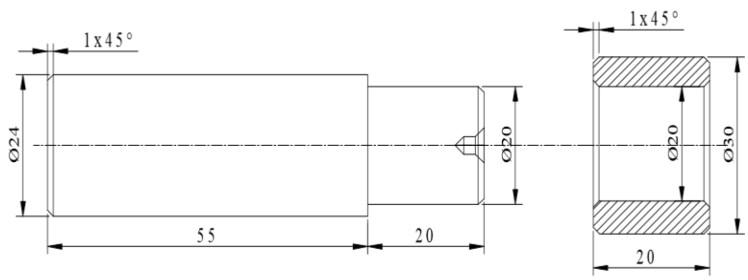
**Exercise No:8- Metric thread cutting**

Raw Material: Exercise No:7




**Exercise No: 9 -Shaft and bush mating**

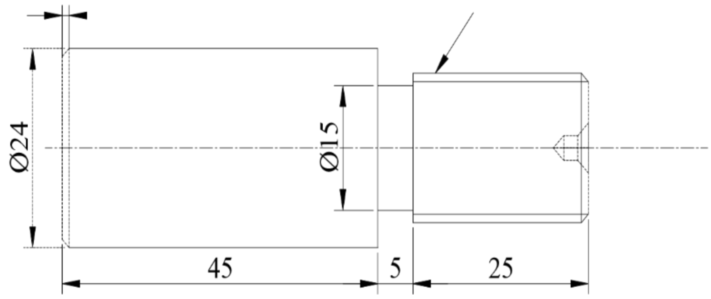
Raw Material: MS Rod Ǿ25x77mm and Ǿ32x30mm



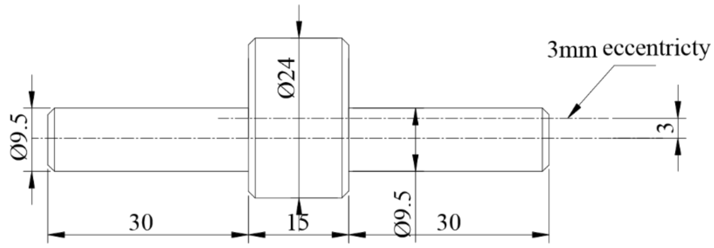

**Exercise No: 10- Thread cutting**

Raw Material: Exercise No:9

.1x45°M20(RH)(OR)3/4"BSW



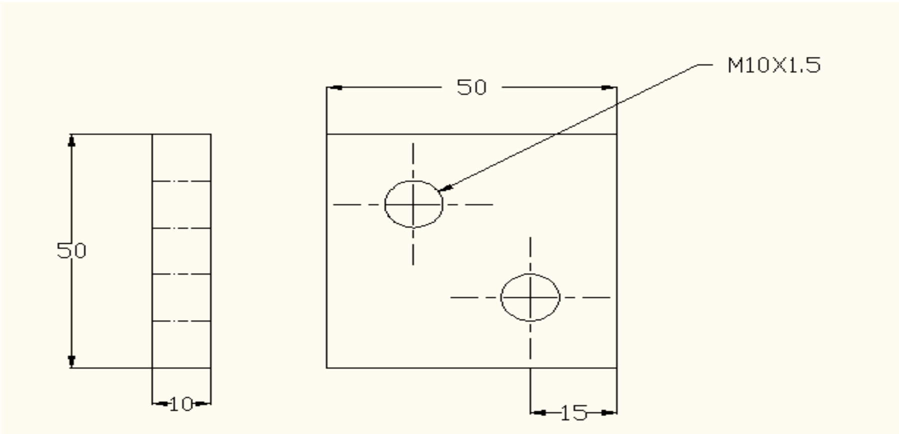
**Exercise No:11-Eccentric Turning**
Raw Material: Exercise No:10




**Make the following jobs using drilling machine.**

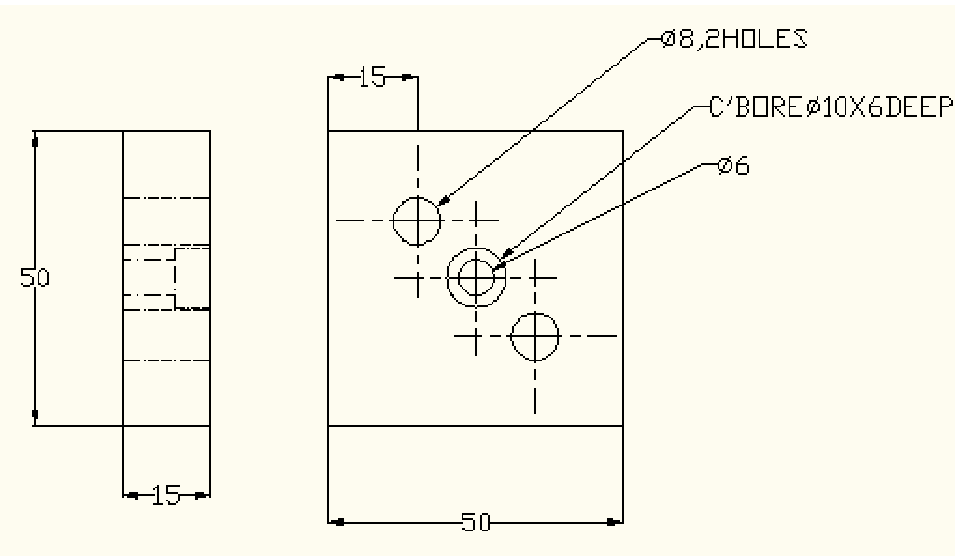
**Exercise No:1 Drilling & Tapping**

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



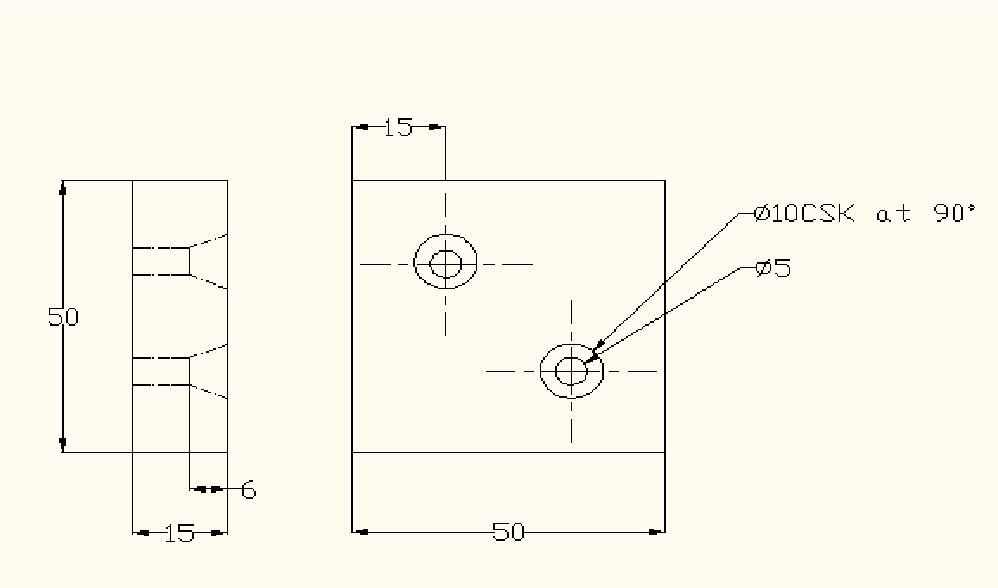

**Exercise No:2 Drilling & Counter boring**

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



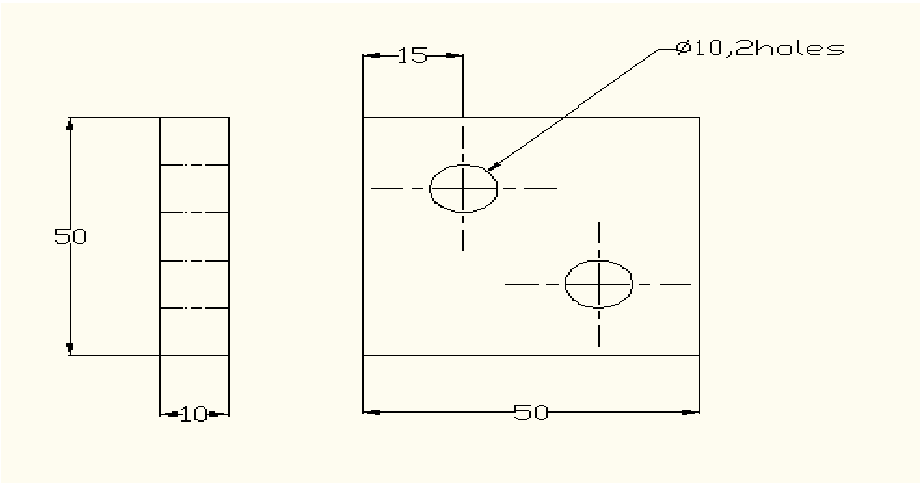
**Exercise No :3 Drilling & Counter sinking**

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




**Exercise No:4 Drilling and Reaming**

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



## List of Equipment's (for a batch of 30 students)

**Turning:**

| | | |
|---|---|---|
| 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 nos 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. |

**Drilling:**

| | | |
|---|---|---|
| 1. Upright drilling machine | - | 2 Nos. |
| 2. Radial drilling machine | - | 1 No. |
| 3. Drill bit & Tap set | - | Sufficient quantity |
| 4. Reaming bit | - | Sufficient quantity |
| 5. Counter sinking bit | - | Sufficient quantity |
| 6. Counter boring bit | - | Sufficient quantity |
| 7. Plug gauges | - | Sufficient quantity |
| 8. Vernier Height Gauge | - | 1 No. |
| 9. Surface plate | - | 2 Nos. |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

### N – SCHEME

### III SEMESTER

### 2020 – 2021 onwards

# 4022370 – BASIC ENGINEERING PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022370 |
| Semester | : | III |
| Subject Title | : | **BASIC ENGINEERING PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| BASIC ENGINEERING PRACTICAL | 4 | 64 | 25 | 100* | 100 | 3hrs |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES:**

- Identify the tools and equipment's used in Foundry & welding
- Prepare sand moulds for different patterns.
- Perform welding operation to make different types of joints.
- Identify the different welding defects.
- Appreciate the safety practices used in welding
- Study of two and four stroke engine and its parts
- performance test on two and four stroke engines

**1. Foundry (25 Hrs)**

**Syllabus**

1. Introduction of tools and equipment's
2. Types of patterns
3. Types of sand
4. Preparation of sand moulds
5. Furnaces – crucible furnace and tilting furnace
6. Core sands, preparation of cores

**Exercises :**

Preparation of sand mould:

1. Solid pattern
    a. Stepped pulley
    b. Bearing top
    c. Gear Wheel
    d. T-pipe
2. Split pattern
    a. Bent Pipe
    b. Tumbles
3. Loose Piece Pattern – Dove tail
4. Cylindrical core making
5. Melting and casting – (not for Examination, only for class exercises)

**2. Welding (18 Hrs)**

**Syllabus**

1. Introduction of Safety in welding shop
2. Introduction to hand tools and equipment's
3. Arc and gas welding equipment's
4. Types of joints

**Exercises :**

1. **Arc welding**
    - Lap joint (Material : 25 mm x 3mm Ms flat)
    - Butt joint (Material : 25mm x 6mm Ms flat)
    - T- joint (Material : 25mm x 3mm Ms flat)
    - Corner joint (Material : 25mm x 3mm Ms flat)
2. **Gas Welding**
    - Lap joint (Material : 25mm x 3mm Ms flat)
    - Butt joint (Material : 25mm x 6mm Ms flat)
3. **Gas cutting : Profile cutting**
4. **Spot welding – Lap joint (18/20swg)**
5. **Demonstration of Soldering and brazing**

**3. Thermal Engineering Lab (15 Hrs)**
**Syllabus**

1. Introduction of two stroke and four stroke engine and its parts.
2. Determine the valve and port timing diagram of SI and CI engine.
3. Analyse the influence of variations in TDC and BDC operation
4. Calculate the performance characteristics of SI and CI Engine

**Exercises:**

1. Construction of valve timing diagram for four stroke engine.
2. Construction of port timing diagram for two stroke engine.
3. IC engine performance test for four stroke SI engine
4. IC engine performance test for four stroke CI engine

**MODEL EXAM:7 Hrs**

## List Of Equipment's (for a batch of 30 students)

**Welding:**

1. Arc welding booth - 2 No's with oil /air cooled Welding transformer with accessories
2. Gas welding unit (Oxygen and acetylene cylinder) – 1 Set
3. Flux – 500grams
4. Electrode 10 SWG – 200 No's
5. Face shield – 3 No's
6. Gas welding goggles – 2 No's
7. Leather Glows 18'' – 4 Set
8. Flux chipping hammer – 4 No's
9. Spot welding machine - 1 No

**Foundry:**

1. Crucible furnace - 1 No
2. Tilting furnace - 1 No
3. Shovel - 20 Nos
4. Rammer set - 30 Nos
5. Slick - 30 Nos
6. Strike-off bar - 30 Nos
7. Riddle - 15 Nos
8. Trowl - 30 Nos
9. Lifter - 30 Nos

| | | |
|---|---|---|
| 10. Sprue pin | - | 60 Nos |
| 11. Brush | - | 20 Nos |
| 12. Vent rod | - | 30 Nos |
| 13. Draw spike | - | 30 Nos |
| 14. Gate cutter | - | 30 Nos |
| 15. Cope box | - | 30 Nos |
| 16. Drag box | - | 30 Nos |
| 17. Core box | - | 10 Nos |
| 18. Runner & riser | - | 60 Nos |
| 19. Moulding board | - | 30 Nos |
| 20. Patterns | - | 15 Nos each |

**Thermal Engineering Lab:**

| | |
|---|---|
| 1. Two stroke petrol engine cut section model | - 1 No |
| 2. Four stroke diesel engine cut section model | - 1 No |
| 3. Four stroke petrol engine with belt /lamp load assembly | - 1 No |
| 4. Four stroke Diesel engine with belt /lamp load assembly | - 1 No |

## Scheme of Examination:

| | |
|---|---|
| For Board practical examination two exercises(ie one question from each chapter) should be asked in the any of following combination<br>• Foundry & Welding<br>Or<br>• Welding & Thermal Lab<br>Or<br>• Thermal lab & Foundry | 45X2=90marks |
| Viva Voce | 10 marks |
| Total | 100 marks |

## Scheme of Valuation:

| | | |
|---|---|---|
| **Foundry** | : Mould Preparation | - 30 marks |
| | Gate cutting | - 15 marks |
| **Welding** | : Weld run | - 30 marks |
| | Finish | - 15 marks |
| **Thermal Engg Lab** | : Observation/ Reading | - 30 marks |
| | Calculation | - 15 marks |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR / III YEAR

### N – SCHEME

### IV SEMESTER

### 2020 – 2021 onwards

## 4022410 – ENGINEERING MATERIALS AND METALLURGY

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022410 |
| Semester | : | IV |
| Subject title | : | **ENGINEERING MATERIALS AND METALLURGY** |

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| ENGINEERING MATERIALS AND METALLURGY | 5 | 80 | 25 | 100* | 100 | 3hrs |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**TOPICS AND TIME ALLOCATION:**

| UNIT | TOPIC | TIME (Hrs) |
|---|---|---|
| I | Metallurgy and Material Structure | 15 |
| II | Phase diagrams and Iron Carbon equilibrium diagram | 15 |
| III | Heat Treatment and Properties of Engineering Materials | 15 |
| IV | Ferrous and Non – Ferrous Metals and their Alloys | 14 |
| V | Metallographic, Surface Treatment and Non Destructive Testing | 14 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | Total | 80 |

**Rationale:-**

The knowledge about the various types of Engineering Materials, their properties and applications are required for proper selection and use of materials in Tool Design and design of mechanical engineering components. Thorough understanding of the methods of heat treatment, their effect and applicability is essential to ensure the full service life of the tools and components. The knowledge on various metallographic and non destructive testing methods is necessary to verify the properties, condition and nature of various materials.

**OBJECTIVES**

**The objective of this course is to make the Student:**

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

# DETAILED SYLLABUS

## 4022410- ENGINEERING MATERIALS AND METALLURGY

| Unit No. | NAME OF THE TOPICS | Hours |
|---|---|---|
| I | <u>**METALLURGY AND MATERIAL STRUCTURE:**</u><br>1.1 **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). | **7** |
| | **1.2Bonding 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 | **4** |
| | **1.3Deformation of metals:** Elastic deformation, plastic deformation, elastic after effect. Deformation by slip, ideal plastic body. Plastic deformation of a single crystal – slip, twinning. cold working and effect of cold working on metals. Hot working of metals, advantages and disadvantages of hot working. | **4** |
| **II** | <u>**PHASE DIAGRAMS AND IRON CARBON EQUILIBRIUM DIAGRAM:**</u><br>**2.1 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. | **8** |
| | **2.2 Heat Treatment and Transformation Diagram:** Purpose of Heat Treatment, Heat treatment cycle, Time-Temperature-Transformation | **7** |

| | | |
|---|---|---|
| | (TTT) diagram – importance of T.T.T diagram, steps to construct T.T.T diagram, T.T.T diagram for eutectoid steel, T.T.T diagram and cooling curves. | |
| **III** | **<u>HEAT TREATMENT, PROPERTIES OF ENGINEERING MATERIALS:</u>**<br>**3.1 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. | **8** |
| | **3.2 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 – Introduction, Diamagnetism, Para Magnetism, and Ferromagnetism, Influence of Temperature on Magnetic Behavior. Superconductivity. | **7** |
| **IV** | **<u>FERROUS AND NON – FERROUS METALS AND THEIR ALLOYS:</u>**<br>**4.1 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 | **7** |
| | **4.2 Non – Ferrous Metals & its Alloys:** Aluminum & its alloys – types, properties and applications. Designation system of aluminum and its alloys as per BIS .Copper & its Alloys – Types , Brass, Gunmetal – Composition, properties & applications, Zinc – Composition , properties & applications. | **7** |

| | | |
|---|---|---|
| V | <u>**Metallography, Surface Treatment and Non Destructive Testing**</u><br>**5.1 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, photoelectron spectroscopy. | **5** |
| | **5.2 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, painting, powder coating, blackening, vacuum Metalizing, Physical vapour deposition, chemical vapour deposition. | **5** |
| | **5.3 Non Destructive Testing:** Magnetic particle inspection, X-Ray inspection, Gamma radiography, Ultrasonic Inspection, Electrical methods, Damping test, Non-magnetic methods of crack detection. | **4** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text Books:**

1. Dr . O.P.Khanna , Material science and Metallurgy, Dhanpat Rai & Sons

2. Material Science and Engineering ,William .D.Callister JR , Sixth Edition

**References Books**

1. ASM Hand book, Vol.1, ASM International, Materials Park, Ohio, U.S.A,

2. S.K.Hajra Choudhury and A.K.Hajra Choudhury, Elements of Workshop Technology, Media Promoters and publishers pvt. Ltd

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

### N – SCHEME

### IV SEMESTER

### 2020 – 2021 onwards

# 4022420 – FLUID POWER AND THERMAL ENGINEERING

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022420 |
| Semester | : | IV |
| Subject Title | : | **FLUID POWER AND THERMAL ENGINEERING** |

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| FLUID POWER AND THERMAL ENGINEERING | 5 | 80 | 25 | 100* | 100 | 3hrs |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Time allocation**

| UNIT | TOPIC | TIME (Hrs) |
|---|---|---|
| I | PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS | 15 |
| II | PNEUMATIC SYSTEM | 14 |
| III | HYDRAULIC SYSTEM | 14 |
| IV | THERMODYNAMICS ,INTERNAL COMBUSTION ENGINES & HEAT EXCHANGERS | 15 |
| V | E- VEHICLES | 15 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | Total | 80 |

**RATIONALE:**

The growth of Engineering and Technology is associated with fluid power applications and heat & work transfer. Low cost Automation using Pneumatics and Hydraulic machines and presses are very common in Automobile and Die casting industries. Hence studying the fundamentals of Pneumatics, Hydraulics and Heat transfer facilitates better understanding of their applications in the area of Tool & Die Making and widens the employment opportunities.

**OBJECTIVES**

At the end of the study of this subject the student will be able to:

- 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 fluid power circuits for industrial applications
- Explain the concept and types of thermodynamic systems
- Explain the working of IC engines & heat exchangers
- Concept of E vehicle, drives and its importance
- Objectives of E V policy & recycling Ecosystem

# DETAILED SYLLABUS

## 4022420 - FLUID POWER AND THERMAL ENGINEERING

Contents: Theory

| UNIT NO | NAME OF THE TOPIC | Hrs |
|---|---|---|
| I | **PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS**<br>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.<br>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. | 7 |
| | 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-Bourdan tube pressure gauge-Diaphragm pressure gauge-Dead weight pressure gauge. | 8 |
| II | **PNEUMATIC SYSTEM**<br>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. | 7 |
| | 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. | 7 |
| III | **HYDRAULIC SYSTEM**<br>Hydraulic system and its elements-Merits, Demerits and applications of hydraulic system. | 2 |
| | 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. | 5 |

| | | |
|---|---|---|
| | Hydraulic accumulator and its uses-Types-Gravity type accumulator, spring loaded accumulator, Gas loaded accumulator-Pressure intensifier.<br>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. | **2**<br><br>**5** |
| IV | **THERMODYNAMICS**<br>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.<br>Laws of perfect gases- -Equation of state-Universal gas constant-Relationship between the specific heats and gas constants.<br>**INTERNAL COMBUSTION ENGINES**<br>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.<br>**HEAT EXCHANGERS**<br>Heat transfer in engineering –Modes of heat transfer-Conduction, Convection and Radiation.<br>Heat transfer by conduction-Fourier law of heat conduction-Thermal conductivity of engineering materials-Heat conduction through plane wall-Heat conduction through composite wall-Simple problems.<br>Newton's law of cooling-Stefan Boltzmann law of radiation.<br>Heat exchanger-types, parallel flow heat exchanger, counter flow heat exchangers-Application of heat exchangers. | **6**<br><br>**3**<br><br>**6** |

| | | |
|---|---|---|
| V | **E-VEHICLES**<br>Environmental impact and history: Air pollution – Petroleum resources – History of Electric vehicles -History of Fuel Cell Vehicles Battery Electric Vehicle (BEV) – Fuel Cell Electric Vehicle (FCEV) – Description. | **4** |
| | Electric Vehicles: Configurations of Electric Vehicle – Performance of Electric Vehicles – Tractive Effort in Normal Driving – energy consumption. Hybrid Electric Vehicles: Concept of Hybrid electric drive trains – Architecture of Hybrid Electric Drive trains. Electric Propulsion Systems: Drive Systems: DC motor drives - Principle of operation – Induction Motor drives - Basic operation principles Energy Storages: Electrochemical Batteries – Battery Technologies – Lead Acid Batteries – Nickel Based Batteries – Lithium Based Batteries – Charging system – DC charging – Wireless charging | **7** |
| | Tamilnadu E-vehicle Policy 2019: Vehicle Population in Tamilnadu – Need of EV Policy – Advantage of EV Eco system – Scope and Applicability of EV Policy – Objectives of EV Policy – Policy Measures Recycling Ecosystem – Battery and EVs. | **4** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text Books:**


1. Sundaramurthy, Fluid Mechanics and Fluid Power, Narayana publications.
2. Nag.P.K., Engineering Thermodynamics, Tata Mc Graw Hill.
3. R.Srinivasan, Hydraulic and Pneumatic controls, Vijay Nicole Imprints PVT.LTD, second edition, Chennai.
4. Modern electric, Hybrid electric & Fuel cells vehicles –Mehrdad ehsani ,Yimin Gao, Stefano Longo & Kambiz Ebrahimi.


**Reference Books:**


1. Khurmi.R.S, A Test book of Hydraulics, Fluid Mechanics and Hydraulic Machines, S Chand & CO.
2. Khurmi R.S and Gupta.K, A Text book of Thermal Engineering, S Chand & CO.
3. Ballaney.B.L., Applied Thermodynamics , Khanna publishers.
4. Bansal.R.K, Fluid Mechanics and Hydraulic Machines .
5. Electric Vehicles and the end ICE age-Anupam Singh.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

(TOOL& DIE)

II YEAR

N – SCHEME

IV SEMESTER

2020 – 2021 onwards

# 4022430 – TOOL ROOM SPECIAL MACHINES

CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| **Course Name** | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL&DIE) |
| **Subject Code** | : | 4022430 |
| **Semester** | : | IV |
| **Subject Title** | : | **TOOL ROOM SPECIAL MACHINES** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| TOOL ROOM SPECIAL MACHINES | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours**

| UNIT | Topic | Hrs. |
|---|---|---|
| I | Cutting Tools and Mechanics of Metal Cutting | 15 |
| II | Boring, Jig Boring, Jig grinding, Tool and Cutter Grinder and Cylindrical Grinder | 14 |
| III | Milling Machines and Gear Generation Processes | 14 |
| IV | CNC Machine and its Components | 15 |
| V | Un-Conventional Machining | 15 |
| | Test & Model Examinations | 07 |
| | **Total** | **80** |

**RATIONALE:**

Globalization and technological advances making tremendous growth in industrial activities, which in turn needs tool and die makers for most of the engineering products manufacturing industries. To meet out such demand and to sustain we have to explore the knowledge about tool room special machines covering the various operations and skill set required for the development of nation and its people.

**OBJECTIVES:**.

**At the end of the study of this subject the student will be able to:**

- 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 and jig grinding
- Explain about 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
- Appreciate the use of un-conventional machining processes.
- Distinguish between EDM and Wire-cut EDM machine operation
- Describe about various types of CNC machines, operations and its components.

# DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **Cutting Tools and Mechanics of Metal Cutting**<br>**Chapter: 1.1:** Cutting tools-properties of cutting tool materials-cutting tool materials; High carbon steels, high speed steel, carbides, ceramics. types of cutting tools<br>**Chapter: 1.2:** 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 | **5**<br><br>**10** |
| II | **Boring, Jig Boring, Jig grinding, Tool and Cutter Grinder and Cylindrical Grinder**<br>**Chapter: 2.1:** 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<br>**Chapter: 2.2: Jig grinding** Introduction- construction- operation techniques- setting up and clamping- wheel travel- wheel selection- wheel dressing. optical profile grinding- basic principle and operations<br>**Chapter: 2.3: 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<br>**Chapter: 2.4: Cylindrical Grinding Machine**<br>Centre Type Cylindrical Grinding Machine – Centre less Grinding Machine – Through feed Grinding – In feed Grinding | **3**<br><br>**3**<br><br>**5**<br><br>**3** |
| III | **Milling Machines and Gear Generation Processes**<br>**Chapter: 3.1:** 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 – | **7** |

| | | |
|---|---|---|
| | 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.<br>**Chapter: 3.2: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 ,nylons | **7** |
| **IV** | **CNC Machine and its Components**<br>**Chapter: 4.1: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 centre- machine axes conventions turning centre and machining centre. | **8** |
| | **Chapter: 4.2: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. | **7** |
| **V** | **Un-Conventional Machining**<br>**Chapter: 5.1: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 | **7** |
| | **Chapter: 5.2: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. | **8** |
| | **TEST & MODEL EXAMINATION** | **07** |

**TEXT BOOKS**

1. Hajra choudhry, “Work shop Technology", Vol. II, Media Promoters and Publishers Pvt. Ltd.
2. Chapman.WAJ., “Work shop Technology", Vol. II & III, ELBS

**REFERENCE BOOKS :**

1. Paul De Garmo.E., & Others, "Materials and Processes in Manufacturing", Macmillan Publishing Company
2. Jain & Gupta, Production Technology, Khanna Publishers, 2-B, North Market, Naisarak, new Delhi
3. MOORE AND VICTORY, “ Holes, Contour And Surfaces”
4. HMT, “Production Technology”
5. BATTACHARYA, “Workshop Technology”, P.C.SHARMA, “A Text Book of Production Engineering”, S.Chand & Co

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

### N – SCHEME

### IV SEMESTER

### 2020 – 2021 onwards

# 4022440 – Forging Dies, Die Casting Dies and Die Maintenance

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

**Course Name** : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

**Subject Code** : 4022440

**Semester** : IV

**Subject Title** : **FORGING DIES, DIE CASTING DIES AND DIE MAINTENANCE**

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester**:** 16weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| FORGING DIES, DIE CASTING DIES AND DIE MAINTENANCE | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Allocation of Hours:**

| Unit. No. | TOPIC | TIME (Hrs.) |
|---|---|---|
| I | Forging Process and Forging Machines | 15 |
| II | Design Of Drop Forging, Press Forging and Machine Forging Dies | 15 |
| III | Die Casting Materials , Machines, Die Materials And Treatments | 14 |
| IV | Die Casting Die Design, Defects And Finishing Of Die Casting Dies | 15 |
| V | Die Maintenance | 14 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | Total | 80 |

**RATIONALE:**

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.

**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

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topic | Hours |
|---|---|---|
| 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 | 4 |
| | **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 | 7 |
| | **Heating devices**–Box or batch type furnaces, rotary hearth furnaces, continuous or conveyor furnaces, induction furnaces, resistance furnaces. Open fire and stock fire. | 4 |
| 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. | 6 |
| | **PRESS FORGING DIES:** Rating of forging press, steps in press forging dies, design of press forgings, design of press forging dies. | 3 |
| | **MACHINE FORGING DIES**:- General characteristics, techniques used in making these forgings, machine forging description and range, | 3 |

| | | |
|---|---|---|
| | 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.<br>**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 | **3** |
| **III** | **DIE CASTING MATERIALS , MACHINES, DIE MATERIALS AND TREATMENTS**<br>**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. | **4** |
| | **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. | **6** |
| | **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 nonmetallic die materials. | **4** |
| **IV** | **DIE CASTING DIE DESIGN, DEFECTS AND FINISHING OF DIE CASTING DIES**<br>**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 | **6** |

| | | |
|---|---|---|
| | 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. | **6** |
| | **FINISHING OF DIE CASTING DIES:** Trimming and piercing of die casting dies- comparison die casting dies with other products | **3** |
| **V** | **DIE MAINTENANCE**<br>**Good Maintenance Practice –** Good grinding practice – Stress relieving cutting tools – shimming die components – ball lock punches and die buttons. | **3** |
| | **Die maintenance documentation and tracking** – Die maintenance team – Systematic die maintenance system – Request for maintenance form – Continuous improvement. | **3** |
| | **Effective Die Maintenance Program Strategy –** Understanding The Die Maintenance Facility – Addressing Production- Scheduling Programs – Planning Die Maintenance – Tracking The Cost Of Maintenance And Down Time | **4** |
| | **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. | **4** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text books:**

1. S.K.Hajra Choudhury and A.K.Hajra Choudhury, Elements of Workshop Technology, Media Promoters and publishers pvt. Ltd
2. Ivana Suchy, Hand book of Die Design, McGraw-Hill Book company, Second edition

**Reference Books:-**

1. Meswani., and R.H.Dattani, Design and Manufacture of forging dies
2. Kamenshichikov, S.Koltun and V.Naumov, Forging Practice, MIR publishers.
3. J.C.Sharman, Drop, Press and Machine Forgings, The machinery publishing co ltd.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

**II YEAR**

**N – SCHEME**

**IV SEMESTER**

**2020 – 2021 onwards**

# 4022450 – MECHANICAL MATERIAL TESTING PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022450 |
| Semester | : | IV |
| Subject title | : | **MECHANICAL MATERIAL TESTING PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| MECHANICAL MATERIAL TESTING PRACTICAL | 4 | 64 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES**

**The objective of this course is to make the Student:**

- Able to determine various strengths of Different Materials.
- To calculate the Young's modulus and Shear modulus of the given material.
- To conduct Bend Test using the given specimen.
- To differentiate hardness and toughness of the given Ductile and Brittle Materials.
- To detect cracks on the given specimen
- To handle Rockwell & Brinell hardness tester to determine the Hardness of the given material.
- To observe the microstructure of ferrous and nonferrous metal using metallurgical microscope.

# DETAILED SYLLABUS

**Part – A (30 Hrs)**

1. Estimation of Tensile Strength of the ductile material –Mild steel
2. Estimation of Tensile Strength of Brittle material - Cast Iron
3. Estimation of compressive Strength of the following materials
   a) Ductile material (Mild Steel or Al)
   b) Brittle material (Cast Iron or Bronze)
4. Estimation of shear strength of Mild steel specimen under (i) Single shear and (ii) Double shear condition
5. Estimation of Toughness of mild steel specimen using (i) Izod impact test (ii) Charpy impact test
6. Torsion test on mild steel – relation between torque and angle of twist, determination of shear modulus and determination of elastic constants for mild steel.
7. Determination of stiffness, modulus of rigidity, strain energy stored and shear stress by load deflection method on the coil springs.
8. Determination of Young's modulus of steel by deflection test.
9. Determine the ductility of the given specimen using Bend Test.

**Part – B (27 Hrs)**

10. Determination of hardness of Mild steel, copper, aluminum using Rockwell hardness tester
11. Determination of hardness of OHNS and HCHCr using Rockwell harness tester.
12. Determination of hardness of Mild steel, copper, aluminum using Brinell hardness tester
13. Determination of hardness of OHNS and HCHCr using Brinell hardness tester.
14. Study of Metallurgical microscope and grain structures.
15. Preparation of specimen for study of micro structure of ferrous metals
16. Examine the micro structure of metal samples (i) Ferrous and (ii) Non- Ferrous.
17. Detection of Cracks in casting using Detection methods.
    i. Visual Inspection and ring test
    ii. Die penetrant test
18. Detection of Cracks in casting using Magnetic particle test

**MODEL EXAM – 7 Hrs**

**SCHEME OF EXAMINATION:**

Part -A (1½ Hours) : 45 marks

Part -B (1½ Hours) : 45 marks

Viva-Voce : 10 marks

**Total : 100 marks**

**SCHEME OF VALUATION:**

Observation / Reading - 15 marks

Tabulation / Formula - 15 marks

Calculation & Result - 15 marks

## Details Of The Equipment's (for a batch of 30 students)

| | |
|---|---|
| **NAME OF THE BRANCH / COURSE** | MECHANICAL ENGINEERING (TOOL & DIE) |
| **YEAR** | SECOND |
| **SEMESTER** | IV |
| **NAME OF THE LABORATORY** | 32245 MECHANICAL MATERIAL TESTING PRACTICAL |

| S.NO | LIST OF THE EQUIPMENTS | QUANTITY REQUIRED |
|---|---|---|
| 1 | Universal Testing Machine (UTM) | 1 |
| 2 | Rockwell Hardness Testing machine | 1 |
| 3 | Torsion testing machine | 1 |
| 4 | Defection testing machine | 1 |
| 5 | Impact test machine | 1 |
| 6 | Torsion testing arrangement | 1 |
| 7 | Shear testing machine | 1 |
| 8 | Brinell hardness testing machine | 1 |
| 9 | Metallurgical microscope | 2 |
| 10 | Metallurgical specimens | 1set |
| 11 | Double disk polishing machine | 1 |
| 12 | Electromagnetic crack detector with its accessories | 1 |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR

**N – SCHEME**

**IV SEMESTER**

**2020 – 2021 onwards**

# 4022460 – HYDRAULICS AND PNEUMATICS PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

**Course Name** : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

**Subject Code** : 4022460

**Semester** : IV

**Subject Title** : **HYDRAULICS AND PNEUMATICS PRACTICAL**

## TEACHING AND SCHEME OF EXAMINATION:

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| HYDRAULICS AND PNEUMATICS PRACTICAL | 3 | 48 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Objectives:**

- Study Pneumatic system and its functioning
- Study Hydraulic system and its functioning
- Control operation of cylinders using metering in and metering out control
- Design and operate application oriented pneumatics circuits
- Design and operate application oriented hydraulic circuits
- Use special purpose valves such as shuttle valve and quick exhaust valve
- Compare the functioning of pneumatic and hydraulic systems
- Trouble shoot in pneumatic and hydraulic circuits

**Note:**

The students should be trained in Pneumatics and Hydraulics and all exercises should be completed. The students should maintain a Record Note book and submit the bonafide record for Board Practical Examination. Examination has to be conducted in Pneumatics and Hydraulics lab.

**List of exercises in Pneumatic System: (24 Hrs)**

1. Study of Pneumatic System and its elements.
2. Direct operation of a Single Acting Cylinder.
3. Direct operation of a Double Acting Cylinder.
4. Operation of a Single Acting Cylinder controlled from two different positions using Shuttle Valve.
5. Operation of a Double Acting Cylinder with quick return using quick exhaust valve.
6. Controlling the speed of a Double Acting Cylinder using metering –in and metering –out controls.
7. Automatic operation of a Double Acting Cylinder in single cycle using limit switch and memory valve.
8. Design a pneumatic circuit for operating a jack ,Brake, Clamps, push & move parts**.(one circuit design is to be asked compulsory for end examination with a maximum of 10 marks)**

**List of exercises in Hydraulic System (21 Hrs)**

1. Study of hydraulic System and its elements.
2. Direct operation of a Double Acting Cylinder.
3. Direct operation of a Hydraulic motor.
4. Controlling the speed of a Double Acting Cylinder using metering-in and metering-out type control.
5. Controlling the speed of hydraulic motor using metering-in and metering-out control
6. Sequencing of two cylinders using Sequence Valve.
7. Design a hydraulic circuit for operating a hydraulic press, jack, milling machine table movement**. (one circuit design is to be asked compulsory for end examination with a maximum of 10 marks)**

**MODEL EXAM: 3 Hrs**

**Scheme of Evaluation**

<table>
<tr><td rowspan="4">Pneumatics<br>(45 marks)</td><td rowspan="4">Any one exercise (Ex No 2-7)<br>&<br>Circuit Design (Ex No 8) (Compulsory)</td><td>Procedure</td><td>5 marks</td></tr>
<tr><td>Circuit Diagram</td><td>20 marks</td></tr>
<tr><td>Execution</td><td>10 marks</td></tr>
<tr><td>Circuit Design & Procedure</td><td>10 marks</td></tr>
<tr><td rowspan="4">Hydraulics<br>(45 marks)</td><td rowspan="4">Any one exercise (Ex 2-6)<br>&<br>Circuit Design (Ex No 7) (Compulsory)</td><td>Procedure</td><td>5 marks</td></tr>
<tr><td>Circuit Diagram</td><td>20 marks</td></tr>
<tr><td>Execution</td><td>10 marks</td></tr>
<tr><td>Circuit Design & Procedure</td><td>10 marks</td></tr>
<tr><td colspan="3">Viva voce</td><td>10 marks</td></tr>
<tr><td colspan="3">Total</td><td>100 marks</td></tr>
</table>

## List of Equipment’s (for a batch of 30 students)

1. Pneumatic system with necessary DCV, FCV and Actuators.
2. Hydraulic system with necessary DCV, FCV and Actuators.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

(TOOL& DIE)

II YEAR

N – SCHEME

IV SEMESTER

2020 – 2021 onwards

# 4022470 – TOOL ROOM SPECIAL MACHINES PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL&DIE) |
| Subject Code | : | 4022470 |
| Semester | : | IV |
| Subject Title | : | **TOOL ROOM SPECIAL MACHINES PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Semester | Internal Assessment | Board Examinations | Total | |
| TOOL ROOM SPECIAL MACHINES PRACTICAL | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES:**

- Identify a milling machine and its parts
- Identify a cylindrical grinder, surface grinder and tool and cutter grinder
- Identify Shaping machine and its parts
- Identify the tools and instruments
- Handle the different types of work holding devices
- Machine a component using different machine tools.
- Calculate the indexing for a work

## DETAILED SYLLABUS

Contents: Practical

**Name of the Topics:**

**Syllabus**

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

**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

## BOARD EXAMINATION

**Note to the faculty :-** Last job of the raw material (MS Rod Ǿ32x33mm, MS Rod Ǿ25x98mm and 13x13x75 mm MS square rod) to be retain in student wise or batch wise(not more than 2 students)

This may be verifiable at the time of Board Practical Examination by the external examiner

### DETAILED ALLOCATION OF MARKS

| | |
|---|---|
| Milling / Grinding/Shaping | : 90 marks |
| Viva-voce | : 10 marks |
| **Total** | **: 100 marks** |

Note: Sketches enclosed

Note **:** All dimensions are in mm

## Board Examination-Question Paper Pattern

One Experiment should be carried out given in the question paper(1x90=90)

- Procedure - 10marks
- Calculation -10 marks
- Dimensioning – 40 marks
- Finish - 30 Marks

Viva – Voce - 10 Marks

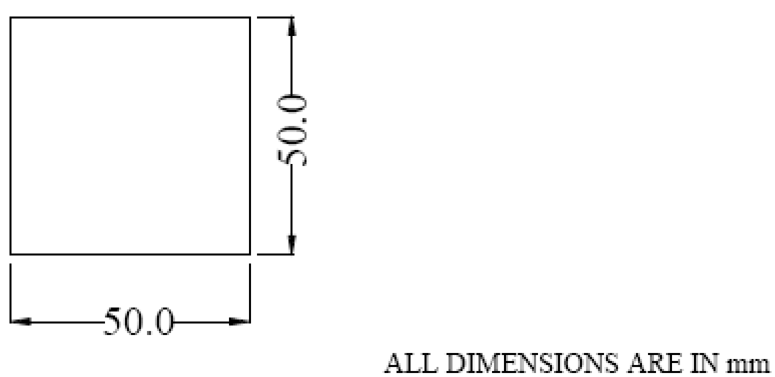
**Total – 100 Marks**

1.To machine the component in a given raw material as per the sketch attached

**Note** : Attach the sketch with the question paper

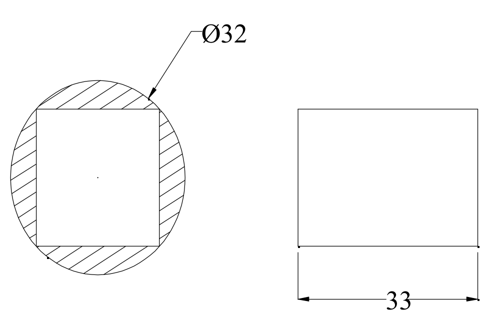
**EXERCISE NO: 1 SHAPING A PLAIN SURFACE**
**MANUFACTURE A SQUARE BLOCK USING SHAPING MACHINE.**

Raw material size: 52 mm CI (or) MS cube




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

RAW MATERIAL SIZE: Ø32X33 mm MS ROUND



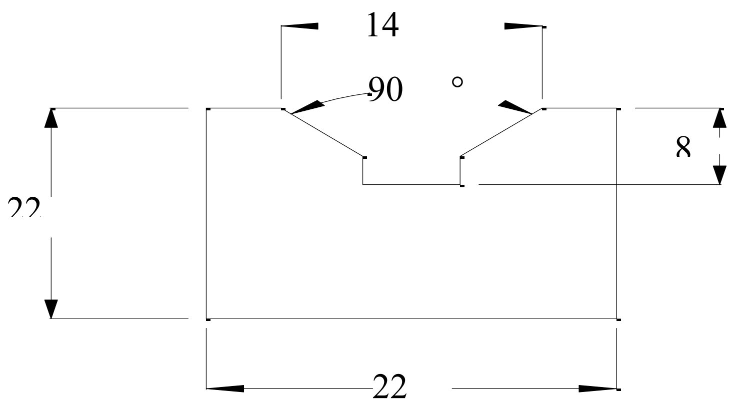
ALL

DIMENSIONS ARE IN mm

**EXERCISE NO : 3**

**MACHINE A V BLOCK BY USING MILLING MACHINE**

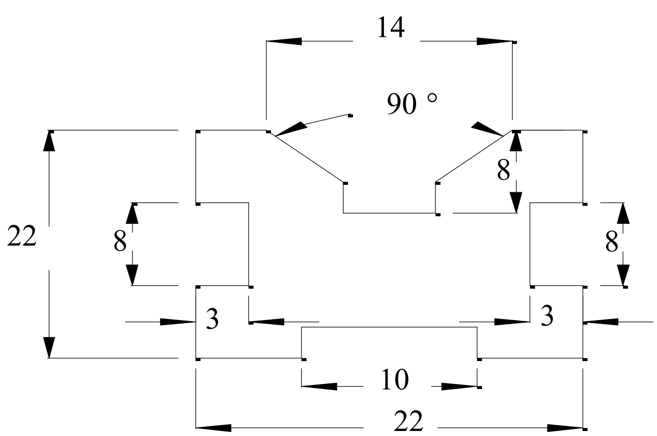
RAW MATERIAL SIZE:22 X33




**EXERCISE NO:4 GROOVE MILLING**

**MACHINE THE REQUIRED GROOVES BY USING VERTICAL MILLING MACHINE**

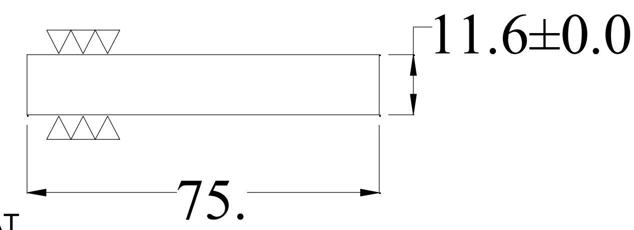
RAW MATERIAL SIZE:22X33



**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

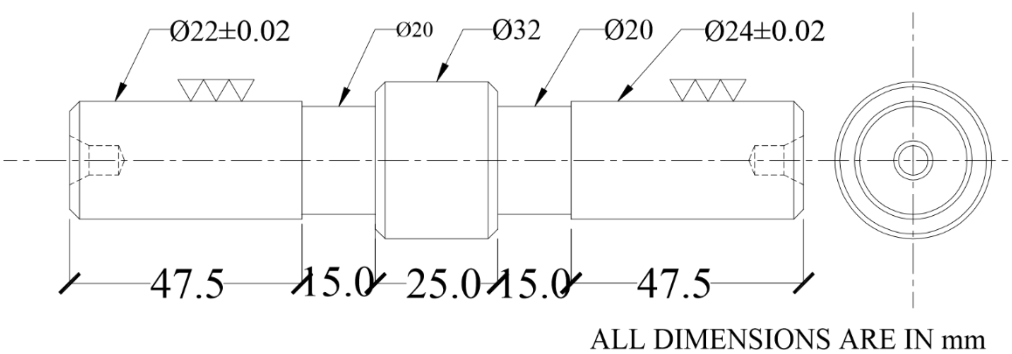



FLAT

**EXERCISENO:6 CYLINDRICAL GRINDING**

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

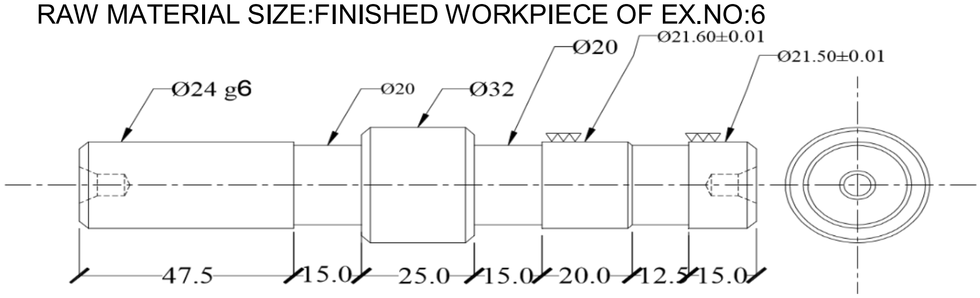
RAW MATERIAL SIZE:Ø32X150 MM MS POLISH ROD




**EXERCISE NO:7 CYLINDRICAL GRINDING**

**MANUFACTURE A PROGRESSIVE TYPE PLUG GAUGE BY USING CYLINDRICAL GRINDING**

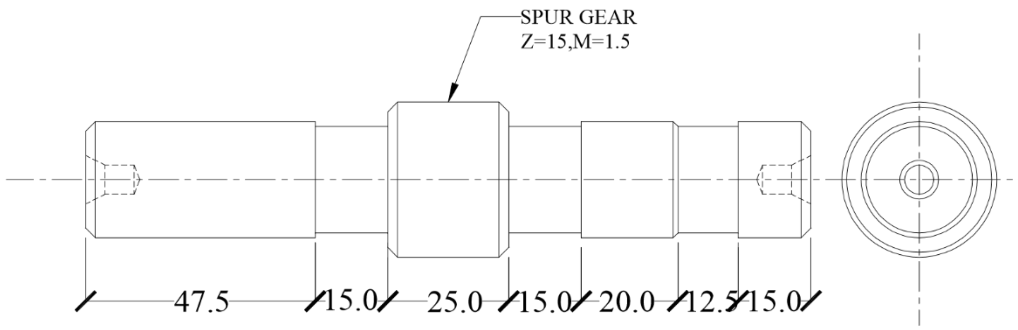
RAW MATERIAL SIZE:FINISHED WORKPIECE OF EX.NO:6



## EXERCISE NO:8 SPUR GEAR MILLING

## MACHINE A SPUR GEAR BY USING MILLING MACHINE

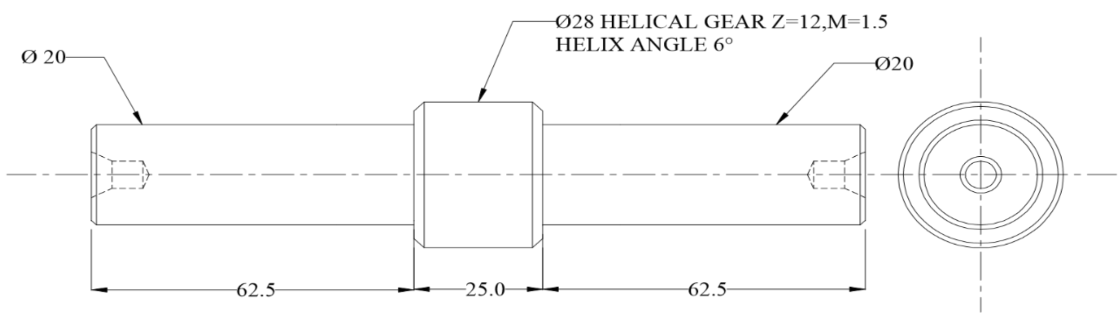
RAW MATERIAL SIZE:FINISHED WORKPIECE OF EX.NO:7




## EXERCISE NO:9 HELICAL GEAR MILLING

## MACHINE A HELICAL GEAR BY USING MILLING MACHINE

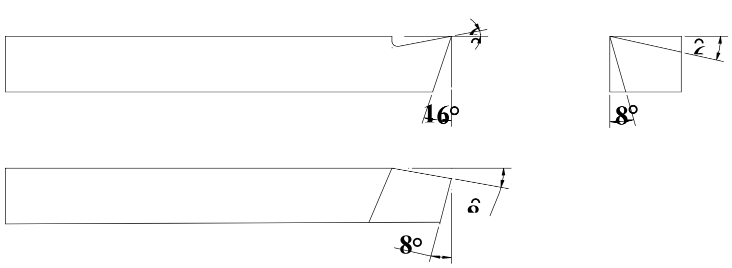
RAW MATERIAL SIZE:FINISHED WORKPIECE OF EX.NO:6




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

## TOOL AND CUTTER GRINDING

RAW MATERIAL:13 x13x 75



## List of Equipment's (for a batch of 30 students)

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

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4022510 – JIGS, FIXTURES AND GAUGES

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

Course Name : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4022510

Semester : V

Subject Title : **JIGS, FIXTURES AND GAUGES**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| JIGS, FIXTURES AND GUAGES | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**TOPICS AND ALLOCATION OF HOURS:**

| Unit No | Topics | Time Hours |
|---|---|---|
| Unit – I | Basics of Work Holding Devices | 14 |
| Unit – II | Clamping and Tool Guiding Elements | 15 |
| Unit – III | Principles of Jig Design | 15 |
| Unit – IV | Principles of Fixture Design | 15 |
| Unit – V | Gauges | 14 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | **Total** | **80** |

**Rationale:-**

In the present competitive environment, elimination of non-productive time in the processes is essential to improve productivity. For improving the productivity in the engineering industries various types of production tools Viz., Jigs, Fixtures, Gauges etc., are employed wherever necessary /possible. Hence thorough knowledge on the principles, construction and working principle of various Work holding devices and gauges is absolutely essential.

**OBJECTIVES**

- Identify the Difference between Jig & Fixtures
- Study the plane of movements
- 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 and Fixtures
- Explain mounting of jig on a machine tool
- Explain mounting of fixtures on the machine tool
- To understand the construction of various types of gauges

# DETAILED SYLLABUS

## 4022510 JIGS, FIXTURES AND GUAGES

Contents: Theory

| Unit No. | Name of the Topic | Hours |
|---|---|---|
| I | **BASICS OF WORKHOLDING DEVICES:**<br>**Work holding Concepts –** Basic Work holders, work holder purpose and function, General Considerations | 2 |
| | **Jigs and Fixtures –** Introduction – Definition – Difference between Jigs and Fixtures – Advantages of Jigs and Fixtures. | 2 |
| | **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. | 5 |
| | **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 | 5 |
| II | **CLAMPING AND TOOL GUIDING ELEMENTS**:<br>**CLAMPING**: Clamping principles – Tool forces, clamping forces, positioning clamps. Rigid Vs Elastic work holders.<br>Types of Clamps – Strap clamp, screw clamp, cam action clamps, Toggle action clamps, wedge action clamps, latch clamps, rack and pinion clamps, specialty clamps.<br>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.<br>VISES – Special jaws, independent jaws.<br>Non-Mechanical Clamping – Magnetic chucks, vacuum chucking, | 8 |

| | | |
|---|---|---|
| | Electrostatic chuck.<br>Power Clamping – Hydraulic and Pneumatic clamping. Multiple part clamping.<br>**TOOL GUIDING ELEMENTS:**<br>**Drill jig bushings and liners –** Selection, Bushing / liner installation, interference fit, chip clearance, accuracy and life.<br>**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. | **7** |
| **III** | **PRINCIPLES OF JIG DESIGN**<br>**Introduction** – General considerations – Machine considerations – Process considerations. Basic requirements of Drill jigs.<br>**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 | **5**<br><br>**10** |
| **IV** | **PRINCIPLES OF FIXTURE DESIGN**<br>**Introduction:** General Considerations, fixture cost, production capabilities, Production process, part considerations.<br>**Types of fixtures** – Milling fixture, Lathe fixture, Grinding fixture, Broaching fixture, Assemble fixture, Inspection fixture, Boring fixture, Indexing fixture, welding fixture and sawing fixture.<br>**Basic Design Characteristics that apply to** – Milling fixture, Lathe fixture, Grinding fixture, Boring fixture, Broaching fixture, welding fixture and sawing fixtures.<br>**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 | **2**<br><br>**3**<br><br>**3**<br><br>**7** |

| | | |
|---|---|---|
| | Example – Plain Milling fixture.<br>Fixture design for numerically controlled machine Tools | |
| **V** | **GAUGES**<br>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.<br>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. | **7**<br><br>**7** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text Books:-**


1. Cyril Donaldson, Tool Design, Special Indian Edition, 2012, Tata Mc Graw Hill
2. P.C.Sharma ,A Text Book of Production Engineering, , 2013, S.Chand & Co
3. P.H.Joshi ,Jigs & Fixtures
4. G.K.Vijayaraghavan, Design of Jigs,Fixtures and Press Tools, Suchitra publications


**References:-**


1. Edward Hoffman ,Jig & Fixture design
2. Roop Lal ,Jig & Fixtures design
3. W boyes,Handbook of Jig & Fixture Design
4. Elanchezhian C ,Design of Jigs, Fixtures & Press tool

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

### III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4022520– PRESS TOOLS

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**
**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022520 |
| Semester | : | V |
| Subject Title | : | **PRESS TOOLS** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| PRESS TOOLS | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Time allocation**

| UNIT | TOPIC | TIME (Hrs) |
|---|---|---|
| I | Press working fundamentals, operations, and machinery | 15 |
| II | Press & Press Tool Accessories And Types Of Die Construction | 15 |
| III | Bending And Forming Dies | 14 |
| IV | Drawing Dies And Dies For Secondary Operations | 14 |
| V | Advanced Press Tool Applications and Trouble shooting | 15 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | Total | 80 |

**Rationale:**

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.

**OBJECTIVES**

**The objective of this course is to make the Student:**

- 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 learn about the different types of Die construction.
- 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 the construction and working principle of various fine blanking dies.
- 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.

## DETAILED SYLLABUS

Contents: Theory

| UNIT NO | Name of the Topic | Hours |
|---|---|---|
| I | **PRESS WORKING FUNDAMENTALS, OPERATIONS, AND MACHINERY**<br>**Press working operations-** Shearing, cutting off, parting, blanking, Punching, piercing, slotting, perforating, Notching, semi notching, lancing, parting, Trimming , slitting, shaving. Safety in press working. | 4 |
| | **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. | 6 |
| | **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, burr. Effects of clearance variation – Secondary shear, large clearance, clearance selection, cutting characteristic – Dish distortion, spacing distortion, typical wear.<br>**Forces for cutting sheet metal –** Cutting with square faces, cutting with shear, shear on punch, slug bending force, shear on die steel, stripping force. | 5 |
| II | **PRESS & PRESS TOOL ACCESSORIES AND TYPES OF DIE CONSTRUCTION**<br>**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. | 7 |

| | | |
|---|---|---|
| | Ejection mechanism – Gravity, air, kicker, lifter, shovel, mechanical hand, ejection by next part. Transfer mechanisms – Conveyors, shuttle, turnover, turnaround, stacker, rails.<br>**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. | **8** |
| III | **BENDING AND FORMING DIES:-**<br>**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.<br>**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 mouldings, riveting, burnishing or sizing, Ironing.<br>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. | **7**<br>**7** |

| | | |
|---|---|---|
| IV | **DRAWING DIES AND DIES FOR SECONDARY OPERATIONS**<br>**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. | **5** |
| | **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. | **6** |
| | **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. | **3** |
| V | **FINE BLANKING TOOL AND SPECIALISED PRESS TOOL APPLICATIONS, PRESS TOOL MAINTANANCE.**<br>**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 | **5** |
| | **Fine Blanking Machines:** Working principle – Ram movement, Drive systems-Mechanical drives, hydraulic drives, Machine force, Ring indenter force, counter force. | **2** |
| | **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 | **2** |

| | | |
|---|---|---|
| | **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.<br>**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.<br>**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. | **2**<br><br>**2**<br><br>**2** |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text Books:**


1. Donald F. Eary., Edward A. Reed, Techniques of Press working sheet metal, Prentice-Hall,Inc., Second Edition
2. Donaldson, Tool Design, Tata McGraw-hill Book Company
3. D.Eugene ostergaard, Advanced die making, McGraw-Hill Book company


**References:-**


1. Dr.John G.Nee, Fundamentals of Tool Design, Society of Manufacturing Engineers, Fourth Edition
2. ASTME National Book Committee, McGraw-hill Book Company
3. J.R.Paquin, Die design fundamentals, Industrial Press Inc
4. D.Eugene ostergaard, Basic die making, McGraw-hill Book Company

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4020531 – COMPUTER INTEGRATED MANUFACTURING

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N - SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING(TOOL & DIE) |
| Subject Code | : | 4020531 |
| Semester | : | V |
| Subject Title | : | **COMPUTER INTEGRATED MANUFACTURING** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| COMPUTER INTEGRATED MANUFACTURING | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

### Topics and Allocation of Hours

| Unit No | Topics | Hours |
|---|---|---|
| I | Computer Aided Design | 15 |
| II | Computer Aided Manufacturing | 14 |
| III | CNC programming | 16 |
| IV | FMS, AGV, AS/RS, Robotics | 14 |
| V | Advanced concepts of CIM | 14 |
| | TEST & MODEL EXAMINATIONS | 7 |
| | **Total** | **80** |

**RATIONALE:**

As per the latest requirements in the Industries this enables to learn the various concepts of Computer Aided Design and Manufacturing. They are able to operate CNC machines and write part program. They are able to understand the advanced concepts adopted in automated industries.

**OBJECTIVES:**

- Acquire knowledge in the field of Computer aided Design
- Explain the various concepts of Computer Aided manufacturing
- Write part program for manufacturing components in CNC machines
- Explain the concepts of automatic material handling and storage systems and robotics
- Explain the advanced concepts of CIM

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **Computer Aided Design** | |
| | Computer Aided Design: Introduction – definition – Shigley's design process – CAD activities – benefits of CAD - CAD software packages – point plotting, drawing of lines, Bresenham's circle algorithm, Transformations: 2D & 3D transformations – translation, scaling, rotation and concatenation. | **6** |
| | Geometric modelling: Techniques - Wire frame modelling – applications – advantages and disadvantages. Surface modelling – types of surfaces – applications – advantages and disadvantages – Solid modelling – entities – advantages and disadvantages – Boolean operations - Boundary representation – Constructive Solid Geometry – Comparison. | **6** |
| | Graphics standard: Definition – Need - GKS –IGES – DXF. Finite Element Analysis: Introduction – Development - Basic steps – Advantages. | **3** |
| II | **Computer Aided Manufacturing** | |
| | CAM – Definition - functions of CAM – benefits of CAM. Introduction of CIM | **3** |

| | | |
|---|---|---|
| | – concept of CIM - evolution of CIM – CIM wheel – Benefits – integrated CAD/CAM.<br>Group technology: Part families - Parts classification and coding - coding structure – Opitz system, MICLASS system and CODE System. Process Planning: Introduction – Computer Assisted Process Planning (CAPP) – Types of CAPP - Variant type, Generative type – advantages of CAPP.<br>Production Planning and Control (PPC): Definition – objectives - Computer Integrated Production management system – Master Production Schedule (MPS) – Capacity Planning – Materials Requirement Planning (MRP) – Manufacturing Resources Planning (MRP-II) – Shop Floor Control system (SFC) - Just In Time manufacturing philosophy (JIT) - Introduction to Enterprise Resources Planning (ERP). | **6**<br><br><br><br>**5** |
| **III** | **CNC Programming**<br>NC in CAM, tooling for CNC – ISO designation for tooling – CNC operating system. Programming for CNC machining –part program - Manual part programming - coordinate system – Datum points: machine zero, work zero, tool zero - reference points - NC dimensioning – G codes and M codes – linear interpolation and circular interpolation - CNC program procedure - sub-program – canned cycles - stock removal – thread cutting – mirroring – drilling cycle – pocketing. Rapid prototyping: Classification – subtractive – additive – advantages and applications – materials – Virtual machining. | **16** |
| **IV** | **FMS, AGV, AS/RS, Robotics**<br>FMS: Introduction – FMS components – FMS layouts – Types of FMS: Flexible Manufacturing Cell (FMC) – Flexible Turning Cell (FTC) – Flexible Transfer Line (FTL) – Flexible Machining System (FMS) – benefits of FMS - introduction to intelligent manufacturing system.<br>Material handling in CIM environment: Types – AGV: Introduction – AGV - working principle – types – benefits. AS/RS – working principle –types – benefits.<br>Robotics: Definition – robot configurations – basic robot motion – robot programming method – robotic sensors – end effectors – mechanical | <br>**5**<br><br><br><br>**3**<br><br><br>**6** |

| | | |
|---|---|---|
| | grippers – vacuum grippers – robot programming concepts - Industrial applications of Robot: Characteristics - material transfer and loading – welding - spray coating - assembly and inspection. | |
| **V** | **Advanced Concepts Of CIM**<br>Concurrent Engineering: Definition – Sequential Vs Concurrent engineering – need of CE – benefits of CE. Quality Function Deployment (QFD): Definition – House of Quality (HOQ) – advantages – disadvantages. Steps in Failure Modes and Effects Analysis (FMEA) – Value Engineering (VE) – types of values – identification of poor value areas – techniques – benefits. Guide lines of Design for Manufacture and Assembly (DFMA). Product Development Cycle: Product Life Cycle - New product development processes. Augmented Reality (AR) – Introduction - concept – Applications. | **14** |

**REFERENCES BOOKS:**

1. R.Radhakrishnan, and S.Subramanian, “CAD/CAM/CIM”, New Age International Pvt. Ltd.
2. Mikell P.Groover, and Emory Zimmers, “CAD/CAM”, Jr.Prentice Hall of India Pvt., Ltd.
3. Dr.P.N.Rao, “CAD/CAM Principles and Applications,”, Tata Mc Graw Hill Publishing Company Ltd.
4. Ibrahim Zeid, “Mastering CAD/CAM”, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
5. Mikell P. Groover, “Automation, Production Systems, and Computer-Integrated Manufacturing”, Pearson Education Asia.
6. Yoram Koren, “Computer control of manufacturing systems,”, McGraw Hill Book.
7. Chris Mcmahon and Jimmie Browne, “CAD/CAM – Principle Practice and Manufacturing Management”, Addision Wesley England, Second Edition,2000.
8. Dr.Sadhu Singh, “Computer Aided Design and Manufacturing,”, Khanna Publishers, NewDelhi, Second Edition,2000.
9. S.Kant Vajpayee, “Principles of Computer Integrated Manufacturing,”, Prentice Hall of India, 1999.
10. David Bed worth, “Computer Integrated Design and Manufacturing,”, TMH, 1998.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## II YEAR / III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4020533 – MECHATRONICS

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N - SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220 DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020533 |
| Semester | : | V |
| Subject Title | : | **MECHATRONICS** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

<table>
<tr><th rowspan="3">Subject</th><th colspan="2">Instructions</th><th colspan="4">Examination</th></tr>
<tr><th rowspan="2">Hours / Week</th><th rowspan="2">Hours / Semester</th><th colspan="3">Marks</th><th rowspan="2">Duration</th></tr>
<tr><th>Internal Assessment</th><th>Board Examinations</th><th>Total</th></tr>
<tr><td>MECHATRONICS</td><td>5</td><td>80</td><td>25</td><td>100*</td><td>100</td><td>3 hrs.</td></tr>
</table>

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

### Topics and Allocation of Hours

| Unit No | Topics | Hours |
|---|---|---|
| I | Introduction, Sensors & Transducers | 15 |
| II | Actuation systems | 14 |
| III | Basic system models, Input / Output systems | 14 |
| IV | Programmable Logic Controller | 14 |
| V | Design examples & advanced applications In Mechatronics | 16 |
| Test And Revision | | 7 |
| **Total** | | **80** |

**RATIONALE:**

As per the latest requirements in the automation industries this enables to learn the various concepts of automation components. They are able to write program, and operate PLCs. They are able to select the electronic components for various industry applications.

**OBJECTIVES:**

- Explain the working of sensors and transducers
- Acquire knowledge about actuation systems
- Explain the system models and I/O systems
- Write program and operate PLCs
- Explain the applications of mechatronics

## DETAILED SYLLABUS

### 4020533 MECHATRONICS

Contents: Theory

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **Introduction, Sensors & Transducers**<br>Introduction – Systems – Measurement Systems – Control Systems – Microprocessor Based Controllers. Examples – Mechatronics approach. Measurement System terminology – Displacement, Position & Proximity Sensors – Velocity and Motion Sensors – Force Sensors – Fluid Pressure Sensors – Flow Sensors – Liquid Level Sensors – Temperature Sensors – Light Sensors – Selection of Sensors – Calibration of sensors. | **15** |
| II | **Actuation Systems**<br>Mechanical Actuation Systems – Types of motion – Freedom and constraints – Loading – Gear Trains – Pawl & Ratchet – Belt & Chain drive – Bearing – Selection – Ball & Roller bearings – Mechanical aspects of motor selection.<br>Electrical Actuation Systems – Switches & Relays – Solenoids – D.C Motors – A.C. Motors – Stepper Motors – Specification and control of stepper motors – Servomotors: D.C Servomotor and A.C Servomotor. | **14** |

| | | |
|---|---|---|
| | Pneumatic & Hydraulic Systems – Power supplies – DCV – PCV – Cylinders – Rotary actuators. | |
| **III** | **Basic System Models, Input/Output Systems**<br>Mathematical Model – Introduction to mathematical model – Mechanical System building blocks – Electrical System building blocks – Fluid System building blocks – Thermal System building blocks. System Model – Engineering Systems – Rotational – Translational Systems – Electro-Mechanical System – Hydro- Mechanical System.<br>Interfacing – Input/Output ports – Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing – Introduction to PIA – Serial communications interface – Example of interfacing of a seven-segment display with a decoder. | **14** |
| **IV** | **Programmable Logic Controller**<br>Definition – Basic block diagram and structure of PLC – Input/Output processing – PLC Programming: Ladder diagram, logic functions, latching and sequencing – PLC mnemonics – Timers, internal relays and counters – Shift registers – Master and jump controls – Data handling – Analog input/output – Selection of PLC – sample ladder programs. | **14** |
| **V** | **Design Examples & Advanced Applications In Mechatronics**<br>Design process stages – Traditional Vs Mechatronics designs – Possible design solutions: Timed switch, Wind- screen wiper motion, Bath room scale – Case studies of mechatronics systems: A pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine. Sensors for condition monitoring systems of production systems – Examples of monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring – Mechatronics control in automated manufacturing: Monitoring of manufacturing processes, On-line quality monitoring, Model-based systems, Hardware-in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of heterogeneous systems. | **16** |

**REFERENCES BOOKS:**


1. W.Bolton, “Mechatronics”, 2nd Edition 2001, Pearson Education, New Delhi.
2. R.K.Rajput, A Text Book of Mechatronics, 1st Edition 2007, S.Chand & Co. Ltd., New Delhi.
3. HMT, “Mechatronics”, 1st Edition 1998, Tata McGraw Hill, New Delhi.
4. Devdas Shetty & Kolk, “Mechatronics System Design”, 1st Reprint, 2001, PWS Publishing Co., Boston.
5. James H.Harter, “Electromechanics”, 1st Edition 2003, Prentice-Hall of India, New Delhi.
6. M.D.Singh & J.G.Joshi, “Mechatronics”, 1st Edition 2006, Prentice-Hall of India, New Delhi.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4020440 – PROCESS PLANNING AND QUALITY CONTROL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : 1020 Diploma in Mechanical Engineering

Subject Code : 4020440

Semester : V

Subject Title : **PROCESS PLANNING AND QUALITY CONTROL**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Semester | Internal Assessment | Board Examinations | Total | |
| PROCESS PLANNING AND QUALITY CONTROL | 5 | 80 | 25 | 100* | 100 | 3 Hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**Topics and Allocation of Hours:**

| Unit No | Topics | Hours |
|---|---|---|
| I | Process Planning and Selection | 15 |
| II | Basic concepts of Total Quality Management | 14 |
| III | TQM Tools | 14 |
| IV | Statistical Fundamentals & Charts | 15 |
| V | Lean Manufacturing Concepts | 15 |
| | Test And Model Examinations | 07 |
| | **Total** | **80** |

**RATIONALE:**

In the product manufacturing the process selection and planning are important. Quality and customer satisfaction in every product and every activity is the order of the day. As there is a shift from quality control to quality management in all activities, the concept Total Quality Management and the pillars of TQM are to be given to Engineers, who are designing products and production systems.

**OBJECTIVES:**

- Understand the process planning.
- Study the process selection.
- Define quality and appreciate its signature.
- Explain the concept of TQM.
- Appreciate the use of principles of TQM to meet customer satisfaction.
- Solve problem using the Quality control tools.
- Apply Brainstorming and quality circle to solve problems.
- Use PDCA cycle for continuous improvement.
- Appreciate the benefits of implementing 5S concepts.
- Collect, classify and present the data.
- Determine the process capability of a manufacturing process.
- Practice on management planning tools.
- Use Bench Mark and JIT concepts.

## DETAILED SYLLABUS

**Contents: Theory**

| Unit | Name of the Topic | Hours |
|---|---|---|
| I | **Process Planning And Selection** | |
| | **Chapter: 1.1:** | 3 |
| | **Production:** Types of Production – Mass production, batch production and job order production | |
| | **Chapter: 1.2:** | 6 |
| | **Process Planning:** Introduction – concept – Information required to do processplanning – factors affecting process planning – process planningprocedure – Make (or) Buy decision using Break Even Analysis – simple problems. Manual process planning – Introduction ofAutomated process planning and generator process planning –Advantage of computer aided process planning – Principle of linebalancing – need for line balancing – Value Engineering –Definition – cost control Vs cost reduction – value analysis when todo – steps information needed – selection of product. | |
| | **Chapter: 1.3:** | 6 |
| | **Process Selection:** Process selection – technological choice – specific componentchoice – Process flow choice – Factors affecting process selection– machine capacity – analysis of machine capacity – process andequipment selection procedure – Determination of man, machineand material requirements – simple problems – selection ofmaterial – jigs – fixtures etc. – Factors influencing choice of machinery – selection of machinery – simple problems –Preparation of operation planning sheet for simple components. | |
| II | **Chapter: 2.1: Basic Concepts Of Total Quality Management** | 14 |
| | Quality-Definitions – Dimensions of quality – Brainstorming and itsobjectives – Introduction to TQM - Characteristics – Basic concepts – Elements - Pillars – Principles – Obstacles to TQMimplementation - Potential benefits of TQM - Quality council – duties – Responsibilities - Quality statements – Vision – Mission – Quality policy statements – | |

| | | |
|---|---|---|
| | Strategic planning – Seven steps tostrategic planning – Deming philosophy – Customer – Input / Output process model – Juran Trilogy - PDCA (Deming Wheel) cycle. | |
| III | **TQM Tools**<br>**Chapter: 3.1:**<br>**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 Qualitycircle and objectives of Quality circle. Zero Defect Concepts.<br>**Chapter: 3.2:**<br>**Management Planning Tools ( M 7 Tools)**<br>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. | 14 |
| IV | **Statistical Fundamentals And Control Charts**<br>**Chapter: 4.1:**<br>Types of Data – Collection of Data – Classification of Data – Tabular presentation of Data - Graphical representation of afrequency distribution – Comparison of Frequency distribution – Mean - Median – Mode – Comparison of measures of centraltendency - Introduction to measures of dispersion – Sample – sampling – Normal curve – Sigma – Concept of six sigma – Principles – Process- Problems.<br>**Chapter: 4.2:**<br>Control chart – Types of control charts – Control chart for variables – Construction of X bar and R charts – control limits Vs specification limits – Process capability – Method of doing process capability Analysis – Measures of process capability – Problems.<br>Attributes – Control charts - P chart – np chart – c chart – u chart – Construction of above diagrams – Problems – Comparison between | <br>7<br><br><br><br><br><br><br>8 |

| | | |
|---|---|---|
| | variable chart and Attribute chart. | |
| V | **Capter 5.1: Lean Manufacturing Concepts**<br>5S Concepts (SEIRI, SEITON, SEISO, SEIKETSU and SHITSUKE) – needs and objectives – effective implementation of 5S concepts in an organisation – Housekeeping – Kaizen – Kanban System.Bench marking - Objectives of bench marking – Types – Benchmarking process – Benefits of Bench marking – Pit falls of Benchmarking-Just In Time(JIT) concepts and its objectives – TotalProductive Maintenance(TPM) – Introduction, Objectives of TPM –steps in implementing TPM. – Overall Equipment Effectiveness( OEE)–Lean Six Sigma – Value Stream Mapping – DMAIC(Define, Measure, Analyse, Improve, Control) – DMADV (Define , Measure, Analyse, Design, Verify) | 15 |

**Reference Books:**


1. Industrial Engineering & Management – O.P Khanna
2. Industrial Engineering & Production Management – Martand Telsang
3. Total Quality Management, Date H.Besterfiled, Pearson Education Asia.
4. Total Quality Management, V.Jayakumar, Lakshmi Publications.(reprint 2005)
5. Training manual on ISO 9001 : 2000 & TQM, Girdhar J.Gyani, Raj PublishingHouse, Second Edition 2001
6. Quality Management, Howard Cuitlow, Tata Mc Graw Hill, 1998
7. Production Engineering – P.C.Sharma.
8. Production and Costing – GBS Narang and V.Kumar
9. Mechanical Estimating and Costing – Banga & Sharma.
10. Total Quality Management, Oakiand.J.S. Butterworth Heinemann Ltd. Oxford1989.
11. Quality Management – Concepts and Tasks- Narayana.V and
12. Sreenivasan.N.S., New Age International 1996.
13. Total Quality Management for engineers, Zeiri. Wood Head Publishers. 1991.
14. Quality Planning and Analysis, Juran J.M and Frank M.Gryna Jr., TMH. India.1982
15. ISO 9001, Brain Rethry, Productivity and Quality Publications.
16. ISO 9001, Brain Rethry, Productivity and Quality Publishing Pvt. Ltd. 1993.
17. Quality Auditing D.Mills, Chapman and Hall, 1993.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

## 4020561 – COMPUTER INTEGRATED MANUFACTURING PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N – SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020561 |
| Semester | : | V |
| Subject Title | : | **COMPUTER INTEGRATED MANUFACTURING PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| COMPUTER INTEGRATED MANUFACTURING PRACTICAL | 4 | 64 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**RATIONALE:**

As per the latest requirements in the Industries this enables to learn the various concepts of Computer Integrated Manufacturing. They are able to write part program and able operate CNC lathe and Milling machines. They are able to understand the advanced concepts adopted in CIM.

**OBJECTIVES:**

- Acquire knowledge in the field of Computer Integrated Manufacturing
- Create 3D Solid models of machine components using modelling software
- Execute and perform machining operations in CNC Lathe and CNC Milling machines.

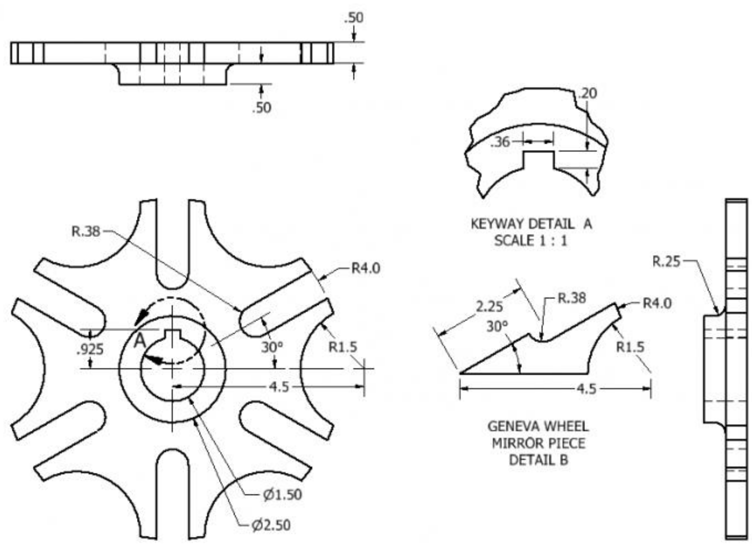
# DETAILED SYLLABUS

Contents: Practical

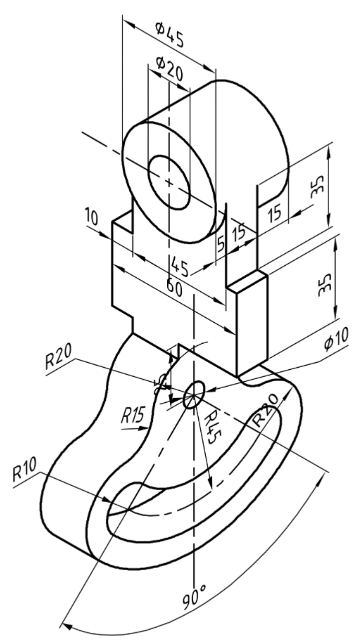
**PART A: SOLID MODELLING**

Introduction to Part modelling - Datum Plane – constraint – sketch – dimensioning – extrude – revolve – sweep – blend – protrusion – extrusion – rib – shell – hole – round – chamfer – copy – mirror – assembly – align – orient – drawing and detailing –creating assembly views

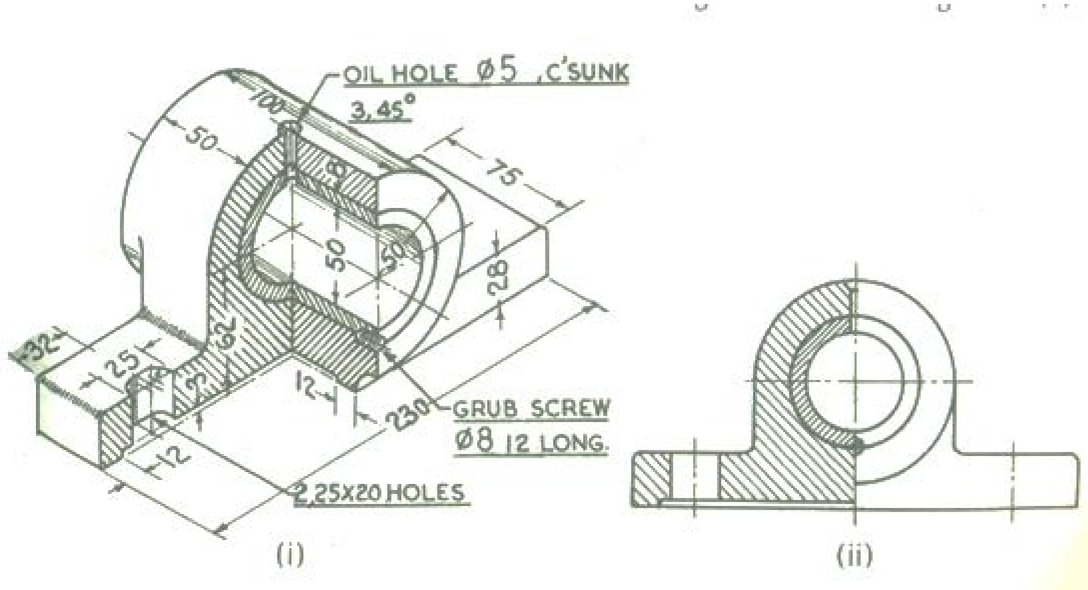
Exercise No. 1. Geneva Wheel



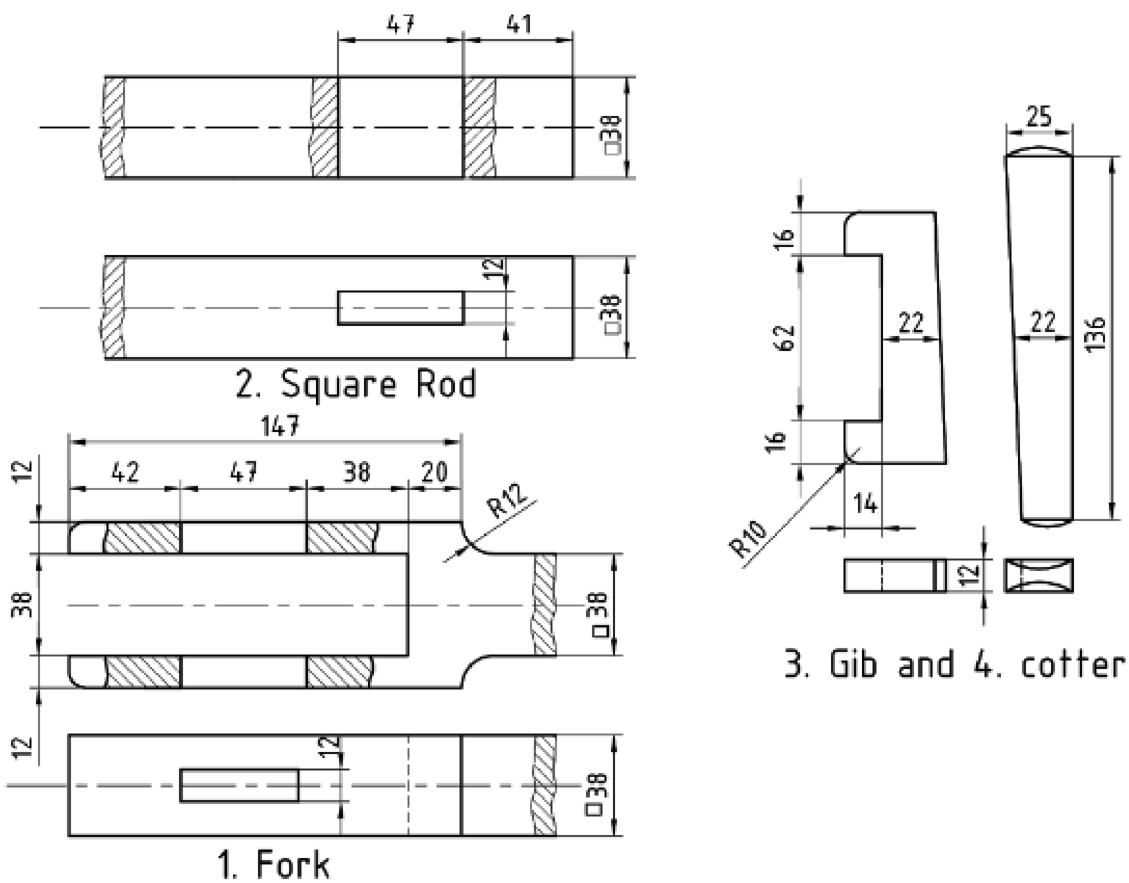

Exercise No. 2. Bearing Block



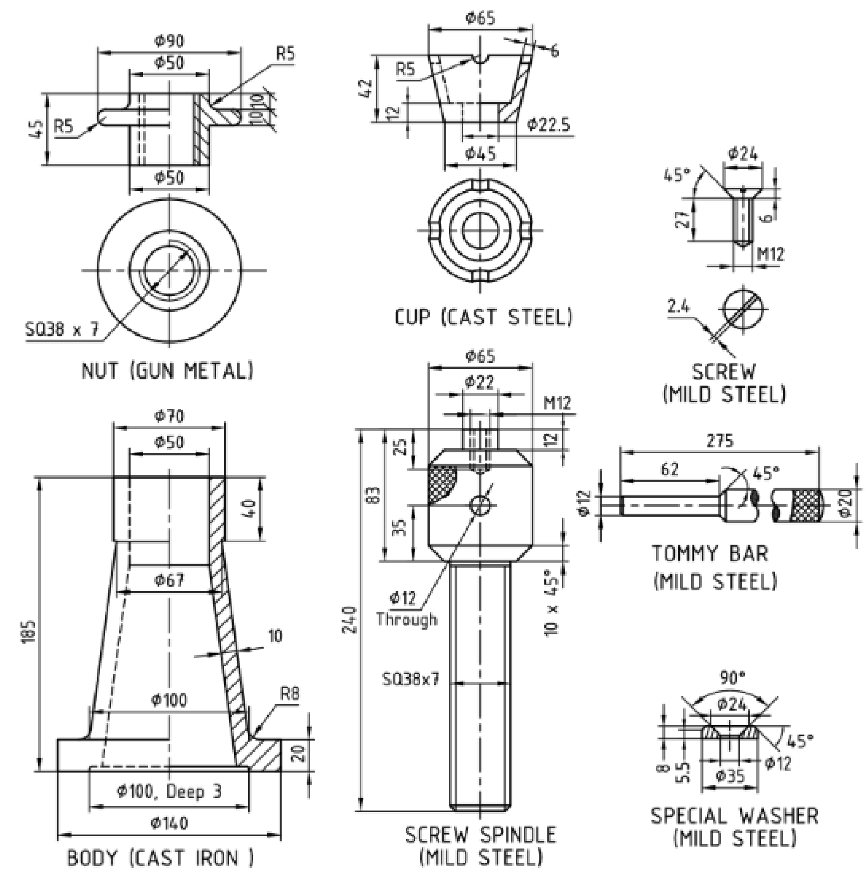
Exercise No. 3. Bushed bearing



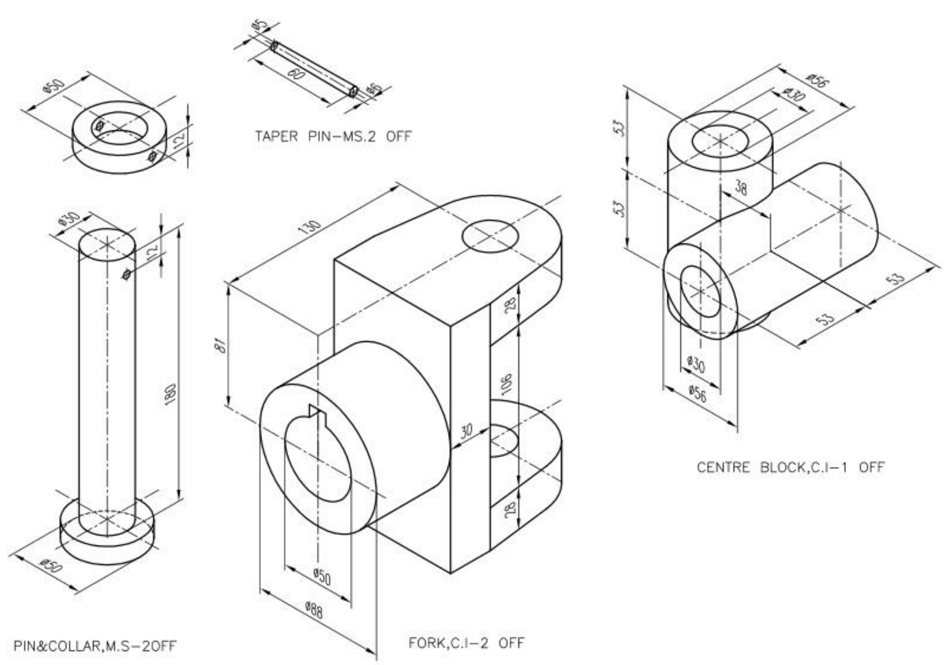

Exercise No. 4. Gib and Cotter joint



Exercise No. 5. Screw Jack




Exercise No. 6. Universal Coupling



Note: Print the orthographic view and sectional view from the above assembled 3D drawing.

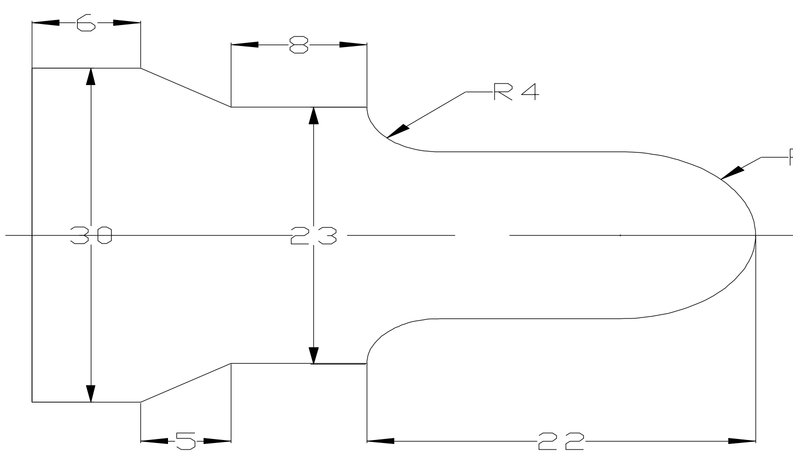
**PART B: CNC Programming and Machining**

Introduction: 1. Study of CNC lathe, milling. 2. Study of international standard codes: G-Codes and M-Codes 3. Format – Dimensioning methods. 4. Program writing – Turning simulator – Milling simulator, IS practice – commands menus. 5. Editing the program in the CNC machines. 6. Execute the program in the CNC machines.

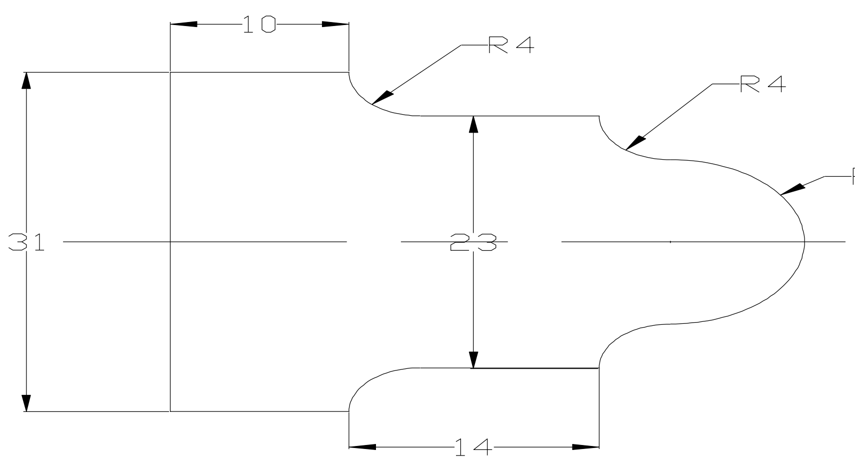
Exercises Note: Print the part program from the simulation software and make the component in the CNC machine.

**CNC Turning Machine** Material: M.S / Aluminium / Acrylic fibre / Plastic

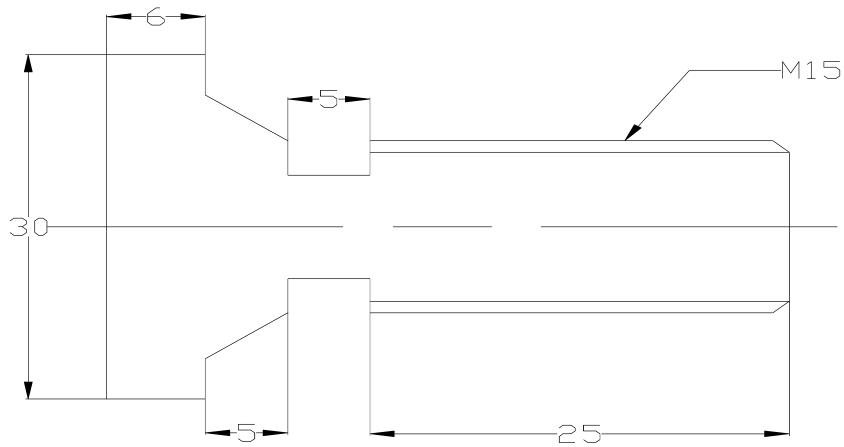
1. Using Linear and Circular interpolation - Create a part program and produce component in the Machine.




2. Using Stock removal cycle – Create a part program for multiple turning operations and produce component in the Machine.



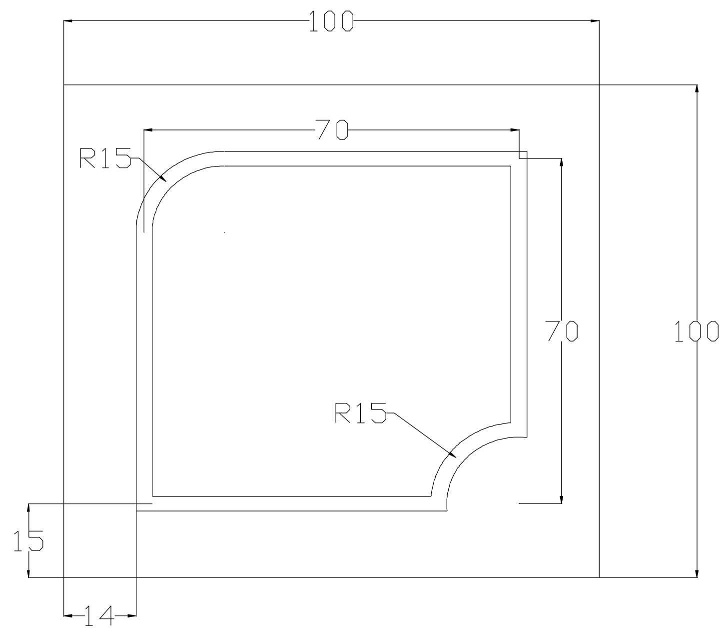
3. Using canned cycle - Create a part program for thread cutting, grooving and produce



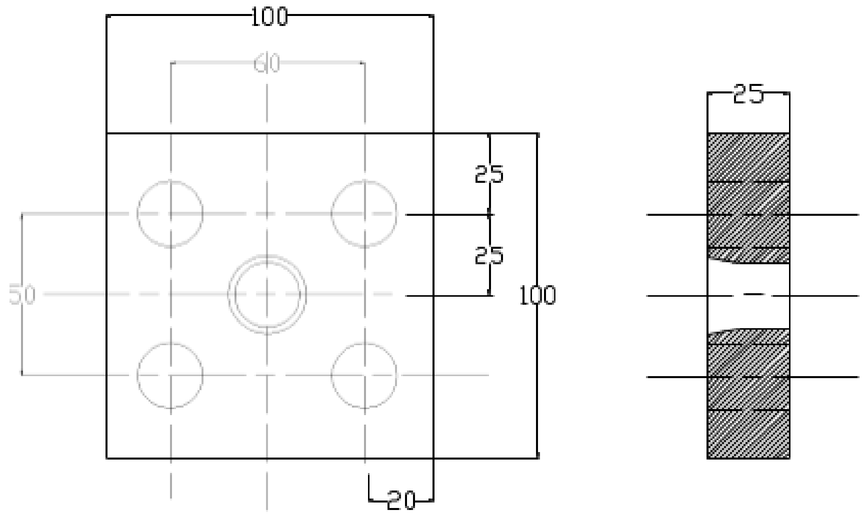

component in the Machine.

**CNC Milling Machine** Material: M.S / Aluminum / acrylic fibre / plastic

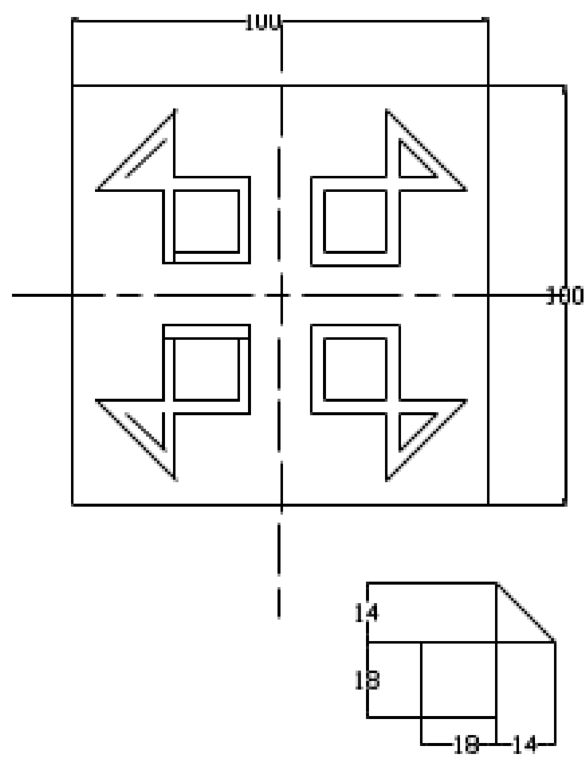
4. Using Linear interpolation and Circular interpolation – Create a part program for grooving and produce component in the Machine.



5. Using canned cycle - Create a part program for drilling, tapping, counter sinking and produce component in the Machine.




6. Using subprogram - Create a part program and produce component in the Machine.



## BOARD EXAMINATION

Note:

- All the exercises in both sections should be completed. Two exercises will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the exercises should be given in the question paper and students are allowed to select by a lot or question paper issued from the DOTE should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

**Note:** Part A – The given component drawing should be created and solid modelling after assembly should be printed and submitted along with the answer paper for evaluation by the external examiner.

Part B – The program for the given component should be written in the answer paper. The program should be entered in the CNC machine and the component should be submitted for evaluation by the external examiner. The machined component should be kept under the custody of examiner.

### Allocation of marks for Board Examination

| | | |
|---|---|---|
| **PART A: Solid Modelling** | | |
| Creation of sketch | : | 15 |
| Modelling | : | 25 |
| Accuracy | : | 5 |
| **PART B: CNC Programming** | | |
| Program writing | : | 15 |
| Editing and Machining | : | 25 |
| Finish | : | 5 |
| Viva voce | : | 10 |

Total Marks : 100

**LIST OF EQUIPMENTS (for a batch of 30 students)**

1. Personal computer - 30 Nos.
2. 3D Solid Modelling and Simulation software - Sufficient to the strength
3. CNC Lathe –2 Nos.
4. CNC Mill –2 Nos.
5. Consumables - Sufficient quantity
6. Laser / Inkjet Printer – 1 No.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

### III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

## 4020563 – MECHATRONICS PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(implemented from the Academic year 2020-2021 onwards)**

Course Name : 1220: Diploma in Mechanical Engineering (TOOL & DIE)

Subject Code : 4020563

Semester : V

Subject Title : **MECHATRONICS PRACTICAL**

## TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| MECHATRONICS PRACTICAL | 4 | 64 | 25 | 100* | 100 | 3Hrs. |

*Examinations will be conducted for 100 marks and it will be reduced for 75 marks for result

**RATIONALE:**

As per the latest requirements in the Industries this enables to learn the various concepts of industrial automation. They are able to write ladder logic program and able operate PLCs. They are able to understand the advanced concepts adopted in industrial automation.

**OBJECTIVES:**

- Acquire knowledge in the field of mechatronics
- Explain the various components of electro pneumatics and electro hydraulics
  Handle PLC, HMI, SCADA and DCS components

# DETAILED SYLLABUS

**ELECTRO PNEUMATICS:** Introduction to Electro Pneumatics -Applications of pneumatics - Pneumatic and electro pneumatic controllers - Components and assemblies in the electrical signal control section: Power supply unit - Push button and control switches - Sensors for measuring displacement and pressure - Relays and contactors. Electrically actuated directional control valves - Construction and mode of operation - Functions - Electrical connection of solenoid coils. Procedure for developing a control system.

**ELECTRO HYDRAULICS:** Basic principles of electro hydraulics - Function and use of electrohydraulic components - Production and interpretation of standard hydraulic and electrical circuit diagrams

**PROCESS CONTROL INSTRUMENTATION:** Process control - Types of processes – Structure of control system – Controllers - Digital controllers – Types of process control – ON/OFF Control – Analog control – Digital control. Data Acquisition System - Objectives of DAS - Types of DAS: Single channel DAS – Multichannel DAS – Computer based DAS. Data Loggers - Block diagram of Data Loggers – Control facilities in Data Logger – Uses of Data Logger - Different stages of Direct Digital Control.

SCADA - Fundamental principles of modern SCADA systems - SCADA hardware - SCADA software - Landlines for SCADA - SCADA and local area networks - Modem used in SCADA systems - Remote terminal units. Human Machine Interface – components of HMI.

Distributed Control System - Parts of DCS – Layered structure of DCS – Communication options in DCS.Variable Frequency Drives - Construction, Working, Operation, Applications and Specifications

**Experiments**

**PART A**

**(ELECTRO PNEUMATICS)**

1. Direct control of a 3/2 NC Single solenoid valve and a 3/2 NO Single solenoid valve
2. Direct control of a 5/2 single solenoid valve and a 5/2 double solenoid valve
3. Simple circuit using OR Logic and AND Logic
4. Limit switch and proximity switch application circuits

**(ELECTRO HYDRAULICS)**

1. Sorting device using double acting cylinder, directly actuated, manually

2. Component selection on conveyor belt using double acting cylinder and directly actuated, manually
3. Lifting station using single acting cylinder and directly actuated, manually
4. Door control using double acting cylinder and interlocking

**PART B**

**PROCESS CONTROL INSTRUMENTATION**

1. Wiring practice of HMI
2. Design of HMI screen
3. HMI Configuration and Interfacing with PLC and PC
4. Configuring Alarms in SCADA
5. Real time project development and interfacing with PLC
6. Monitoring & Control of Pneumatic System using HMI

**BOARD EXAMINATION**

Note:

1. All the experiments in both sections should be completed. Two experiments will be given for examination by selecting one from PART A and one from PART B.
2. All the experiments should be given in the question paper and students are allowed to select by a lot or Question paper issued from the DOTE should be followed.
3. All regular students appearing for first attempt should submit record notebook for the examination.
4. The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
5. The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

**ALLOCATIONOFMARKS**

**PART A:** Electro Pneumatic circuit/Electro Hydraulic circuit (bylot):

| | | |
|---|---|---|
| Circuit diagram | : | 15 |
| Components connections & execution | : | 20 |
| Output | : | 10 |

**PARTB:** Process Control Instrumentation

| | | |
|---|---|---|
| Circuit diagram | : | 15 |

| | | |
|---|---|---|
| Execution &Programming | : | 20 |
| Output | : | 10 |
| Vivavoce | : | 10 |
| Total Marks | : | 100 |

**List of Equipment (for the batch of 30 students)**

**Electro Pneumatics:**

1. Basic Pneumatic Trainer Kit with FRL Unit, Compressor and Accessories – 2 Nos
    - 3/2 NC Single Solenoid Valve - 2Nos
    - 3/2 NO Single Solenoid Valve - 2Nos
    - 5/2 Single Solenoid Valve - 2Nos
    - 5/2 Double Solenoid Valve - 2Nos
    - Limit Switch – 6 Nos
    - Proximity Sensor (Inductive, Capacitive & Optical) – Each 2 Nos
    - Single Acting Pneumatic Cylinder – 4 Nos
    - Double Acting Pneumatic Cylinder – 2 Nos
    - Power Supply Unit, Connecting Leads and Hoses – As per Requirements

**Electro Hydraulics:**

1. Basic Hydraulics Trainer Kit with Hydraulic Pump, Regulator and Hoses Accessories – 2 Nos
    - Double Acting Cylinder – 2 Nos
    - Single Acting Cylinder – 2 No
    - Manual Actuator Switch – 4 Nos
    - Material Sorting assembly set up – 1 No
    - Conveyor Assembly set up – 1 No
    - Lifting Station Assembly Set up – 1 No
    - Limit Switch - 4 Nos

**Process Control Instrumentation:**

- Programmable Logic Controller (PLC) with Software – 3 Nos
- Human Machine Interface (HMI) with Software - 3 Nos
- SCADA Software – 1 No or Integrated Software for PLC, HMI and SCADA)
- Personnel Computer – 3 Nos
- Water Tank Assembly set up with Level Sensor and Flow Controller (Actuator) to interface with PLC and HMI – 1 No

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4020540 – PROCESS AUTOMATION PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N – SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020540 |
| Semester | : | V |
| Subject Title | : | **PROCESS AUTOMATION PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| STRENGTH OF MATERIALS | 4 | 64 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**OBJECTIVES:**

- Design and operate pneumatic circuits.
- Design and operate fluid power circuits
- Use PLC system and its elements for process control
- Familiarize the working of function blocks in PLC
- Use ON-Delay timer to control a motor
- Use OFF-Delay timer to control a motor
- Use counter function block (Up counter and Down counter)
- Control the automatic operation of pneumatic cylinder using PLC
- Record of work to be prepared.

**Exercises**

**PART A**

**Pneumatics Lab.**

1. Direct operation of single and double acting cylinder.
2. Operation of double acting cylinder with quick exhaust valve.
3. Speed control of double acting cylinder using metering-in and metering-out circuits.
4. Automatic operation of double acting cylinder in single cycle - using limit switch.

**Hydraulics Lab.**

5. Direct operation of double acting cylinder.
6. Direct operation of hydraulic motor.
7. Speed control of double acting cylinder metering-in and metering-out control.

**PART B**

**PLC Lab.**

1. Direct operation of a motor using latching circuit.
2. Operation of a motor using ‘AND’ logic control.
3. Operation of a motor using ‘OR’ ‘control.
4. On-Delay control of a motor and Off –Delay control of a motor.
5. Automatic operation of a Double acting cylinder-single cycle - forward, time delay, return.
6. Automatic operation of Double acting cylinder-Multi cycle.
7. Sequential operation of double acting cylinder and a motor.

## BOARD EXAMINATION

Note:

- All the experiments in both sections should be completed. Two experiments will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the experiments should be given in the question paper and students are allowed to select by a lot or Question paper issued from the DOTE should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

**Detailled Allocation of Marks**

| | | |
|---|---|---|
| **Part A:** | | **45** |
| Procedure / Circuit diagram | 10 | |
| Identification of Components | 15 | |
| Connection and execution | 20 | |
| **Part B:** | | **45** |
| Procedure / Circuit diagram | 10 | |
| Ladder diagram / Programming | 25 | |
| Execution | 10 | |
| **Viva Voce** | | **10** |
| **Total** | | **100** |

**LIST OF EQUIPMENTS (for a batch of 30 students)**

1. Pneumatic Trainer Kit – 3Nos
   (All Cylinders, Control Valves, Limit switches and other accessories)
2. Hydraulics Trainer Kit – 2No.
   (All Cylinders, Control Valves, Limit switches and other accessories)
3. PLC kit – 3 Nos.
4. Computer with software – 10 Nos.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4022550 – JIGS AND FIXTURES PRACTICAL

# CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

Course Name : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4022550

Semester : V

Subject Title : **JIGS AND FIXTURES PRACTICAL**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| JIGS AND FIXTURES PRACTICAL | 5 | 80 | 25 | 100* | 100 | 16 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES:**

- Manufacture of template type drill jig
- Manufacture of Channel drill jig and indexing drill jig
- Manufacture of milling fixture
- Manufacture of inspection fixture
- Manufacture of welding fixture
- Use different machine tool in Manufacture of jigs and fixtures.

**A. Manufacture of following Jigs**

1. Template drill jig
2. Channel drill jig
3. Indexing drill jig

**B. Manufacture of following Fixtures**

4. Milling Fixture
5. Inspection Fixture
6. Welding Fixture

## DETAILED SYLLABUS

| Ex. No. | Name of the exercise | Time in Hours |
|---|---|---|
| 1. | Manufacture of Template drill jig | 14 |
| 2. | Manufacture of Channel drill jig | 13 |
| 3. | Manufacture of Indexing drill jig | 13 |
| 4. | Manufacture of Milling Fixture | 14 |
| 5. | Manufacture of Inspection Fixture | 13 |
| 6. | Manufacture of Welding Fixture | 13 |
| **TOTAL** | | 80 |

**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 Jig/Fixture on the machine tool, to make necessary adjustments, trial production using the tool fabricated by them and rectification of tool defects if any.
5. For Board examination any one of the above tool (sl no 1 to 6) is to be manufactured, fitted in the machine tool and trial production should be taken. The evaluation of the performance should be based on the component dimensions and finish obtained from the Jig / Fixture manufactured by the student during the 16 hours examination.

**SCHEME OF EXAMINATION:**

| | | |
|---|---|---|
| Manufacture of Jig / Fixture | - | 50marks |
| Tool finish | - | 20 marks |
| Component finish / accuracy | - | 10 marks |
| Tool setting & trial production | - | 10 Marks |
| Viva Voce | - | 10 Marks |
| **Total** | **-** | **100 Marks** |

## Details of The Equipment's (for a batch of 30 students)

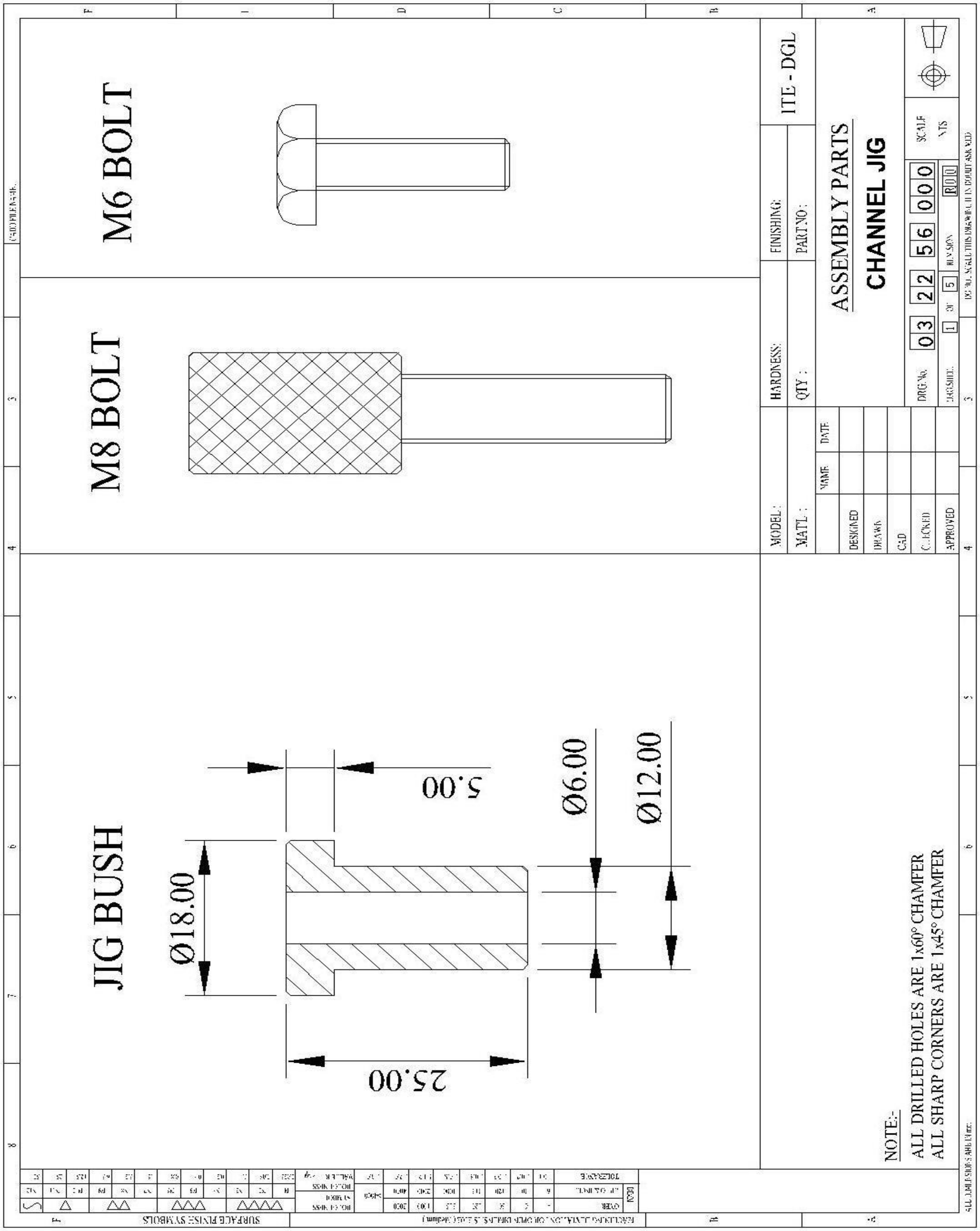
| | |
|---|---|
| **NAME OF THE BRANCH / COURSE** | MECHANICAL ENGINEERING (TOOL & DIE) |
| **YEAR** | THIRD |
| **SEMESTER** | V |
| **NAME OF THE LABORATORY** | 4022550 JIGS AND FIXTURES PRACTICAL |

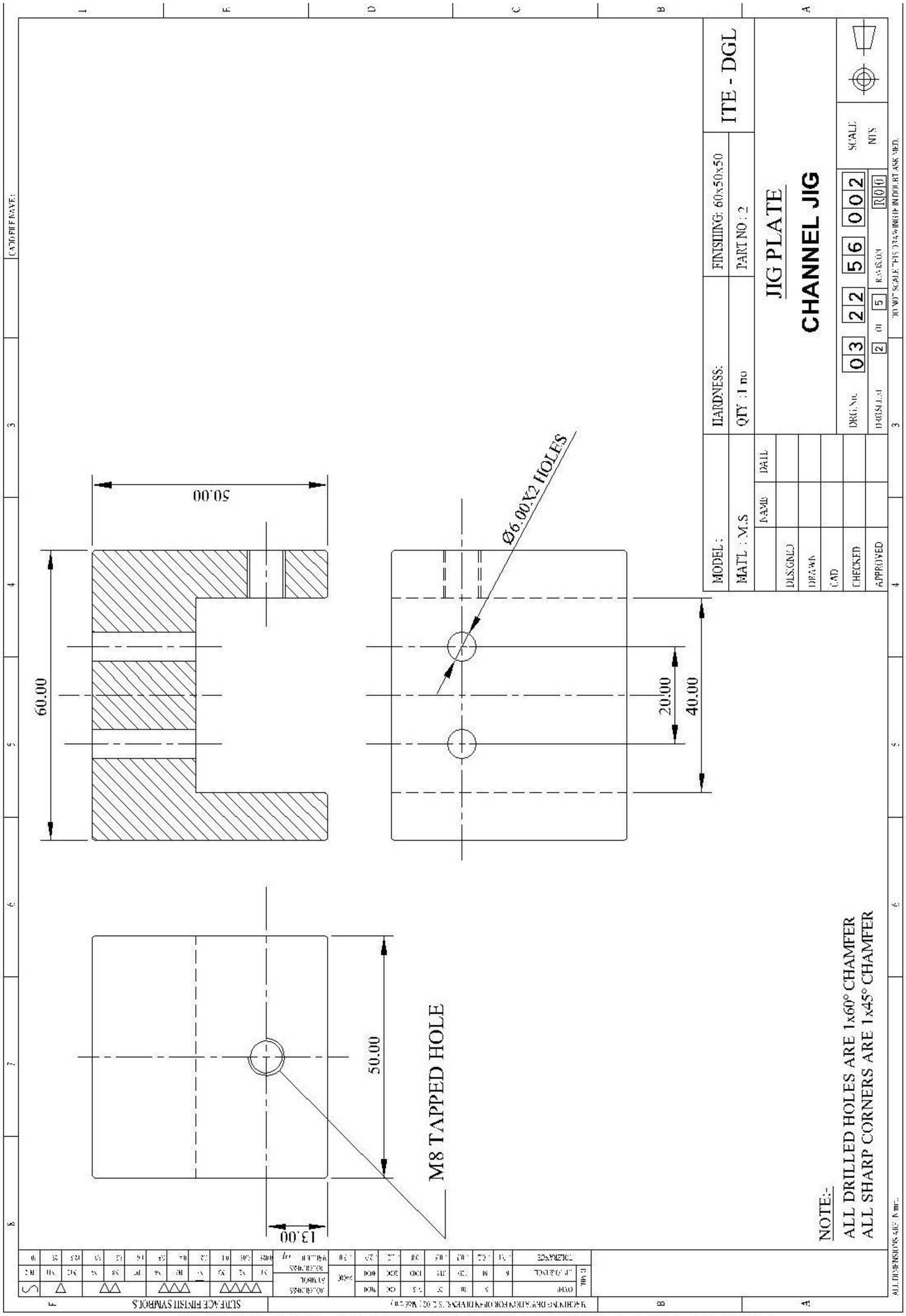
| **S.N** | **LIST OF THE EQUIPMENTS WITH SPECIFICATIONS REMARKS, IF ANY** | **QUANTITY REQUIRED** |
|---|---|---|
| 1 | Centre Lathe, 4 ½' bed length | 5 |
| 2 | Drilling machine | 2 |
| 3 | Shaping machine, stroke length 300mm | 2 |
| 4 | Vertical milling machine | 2 |
| 5 | Surface grinding machine | 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. | Tool maker's straight edge – 150 mm | 1 |
| 14. | Digital Micrometer – 0.-25mm range, 0.001mm least count | 3 |

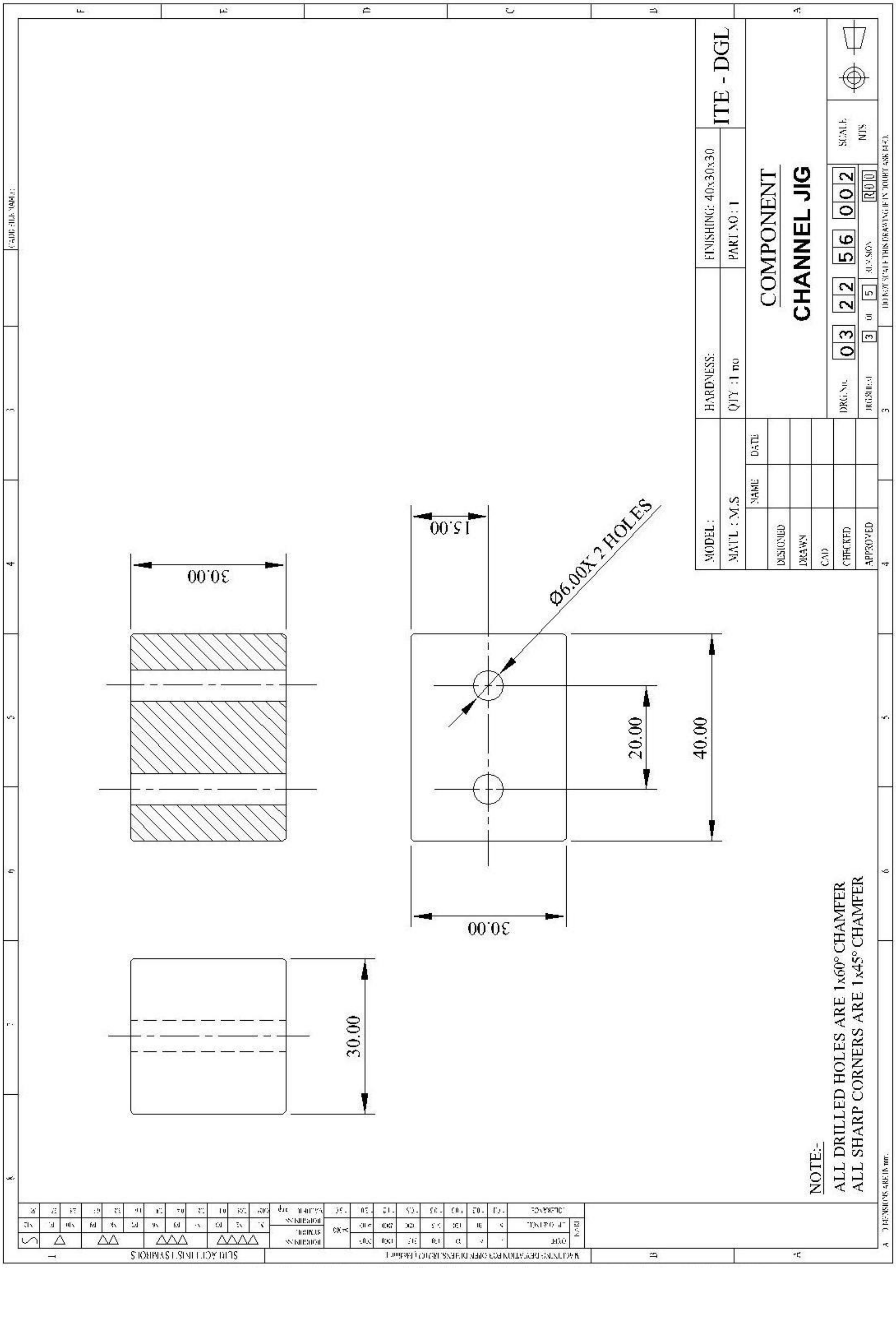
**Exercise – I Template Jig**

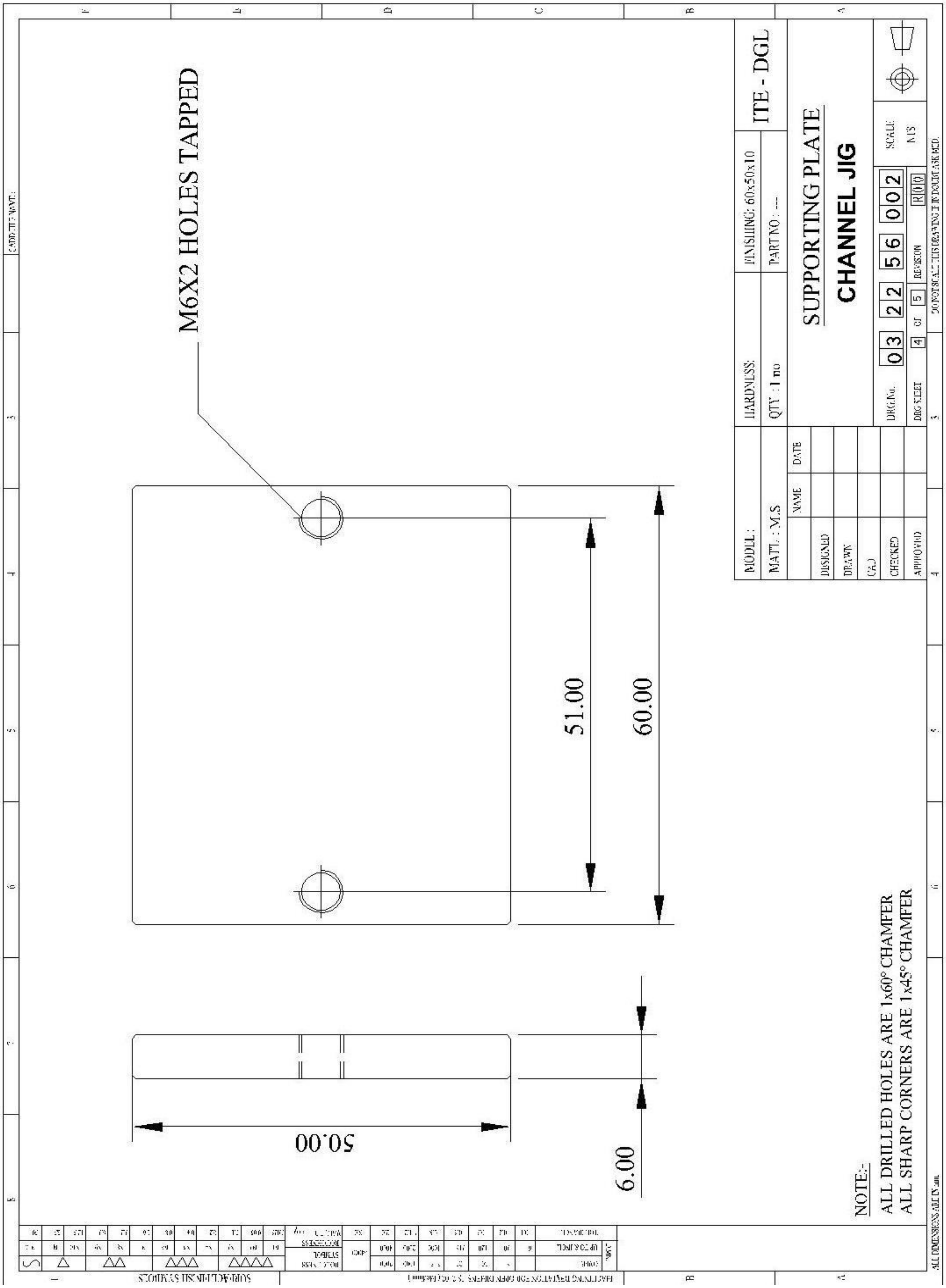
- Pl refer the sketches available in subject code:4022340 – Computer Aided Machine & Tool Drawing Exercise no.7

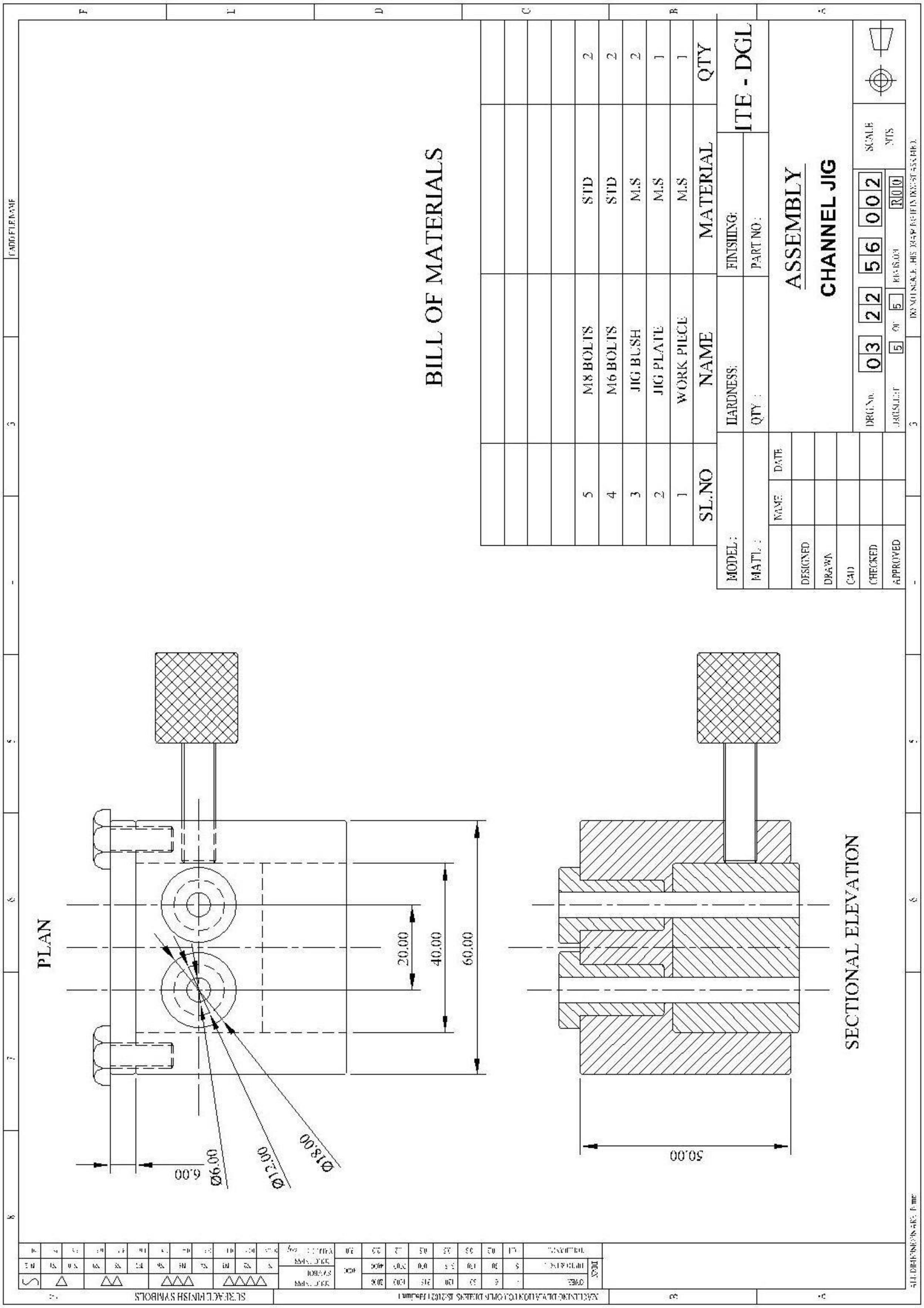
## Exercise – II Channel Jig



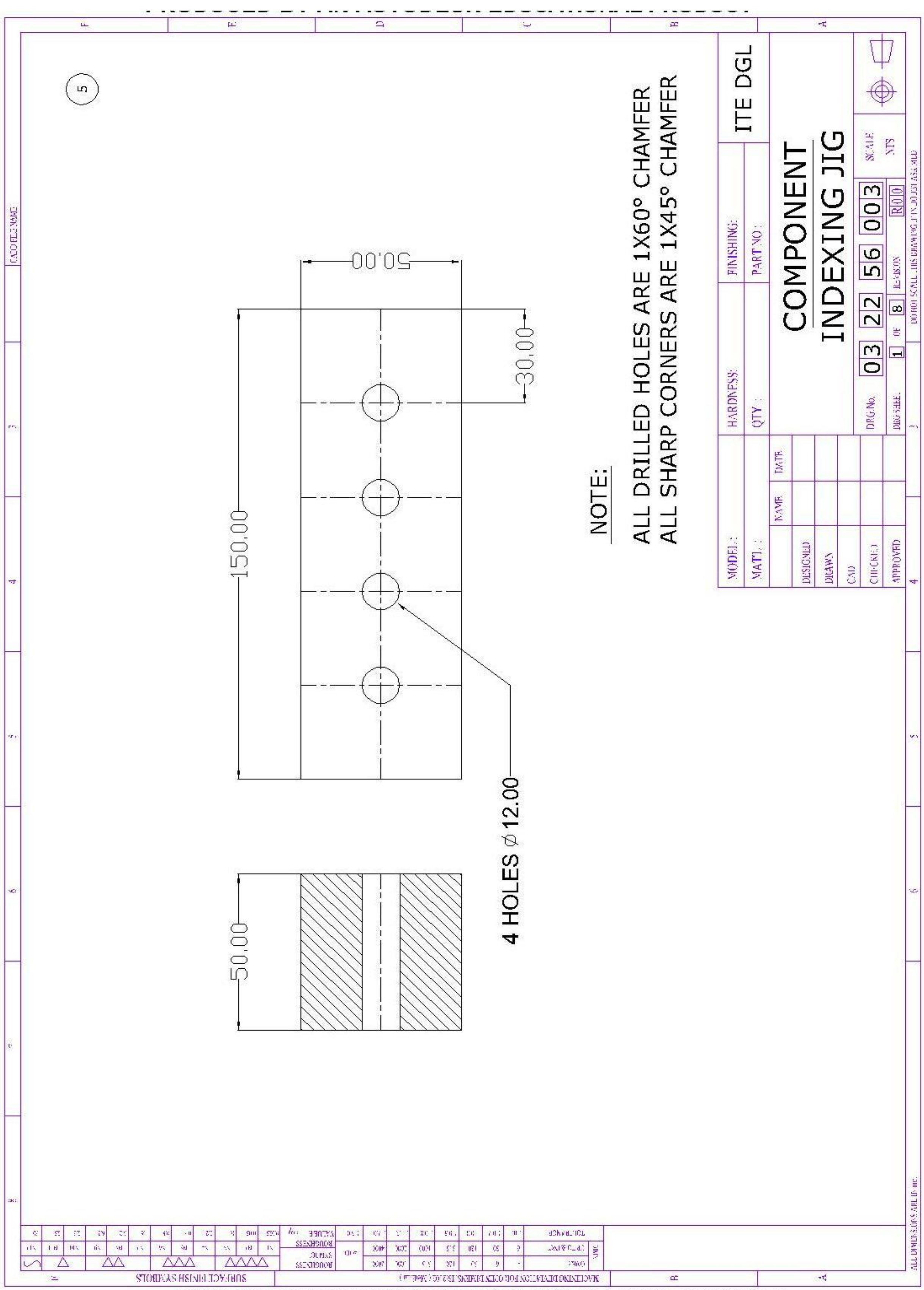

ITE - DGL
FINSHING: 60x50x50
PART NO : 2
JIG PLATE
CHANNEL JIG
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG No.
03 22 56 002
SCALE
NTS
50.00
60.00
Ø6.00X2 HOLES
20.00
40.00
50.00
M8 TAPPED HOLE
13.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS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

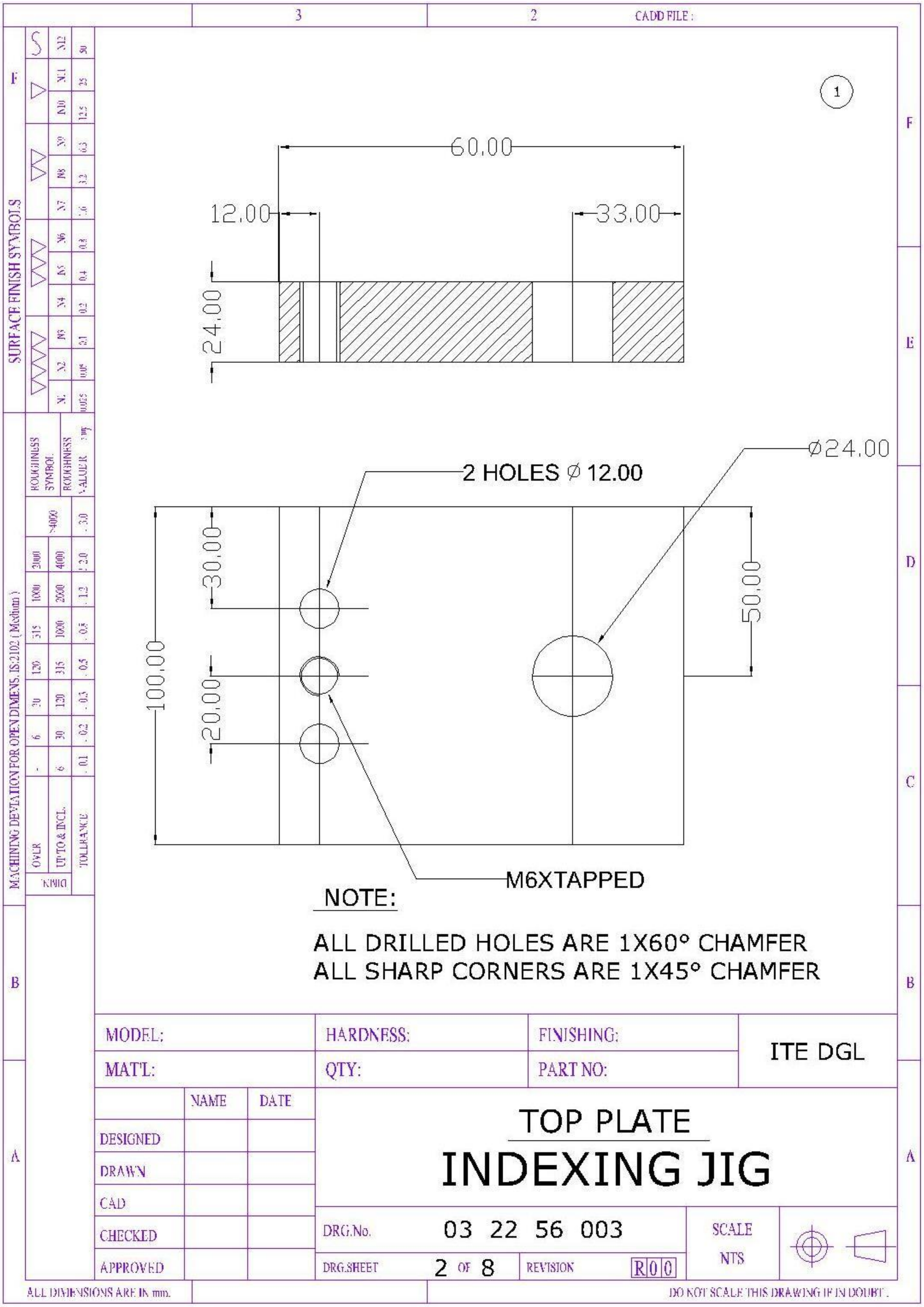

ITE - DGL
FINISHING: 40x30x30
PART NO : 1
COMPONENT
CHANNEL JIG
HARDNESS:
QTY : 1 no
MODEL :
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
03 22 56 002
SCALE
NTS
Ø6.00X 2 HOLES
15.00
30.00
20.00
40.00
30.00
30.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER


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
CHECKED
APPROVED
NAME
DATE
DRG.No. 03 22 56 002
SCALE
NTS


PLAN
SECTIONAL ELEVATION
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
6.00
Ø6.00
Ø12.00
Ø18.00
20.00
40.00
60.00
50.00
MODEL :
MATL :
HARDNESS:
QTY :
FINSIHING:
PART NO :
ITE - DGL
ASSEMBLY
CHANNEL JIG
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG No.
03 22 56 002
R00
SCALE
NTS
SURFACE FINISH SYMBOLS

## Exercise – III Indexing Jig

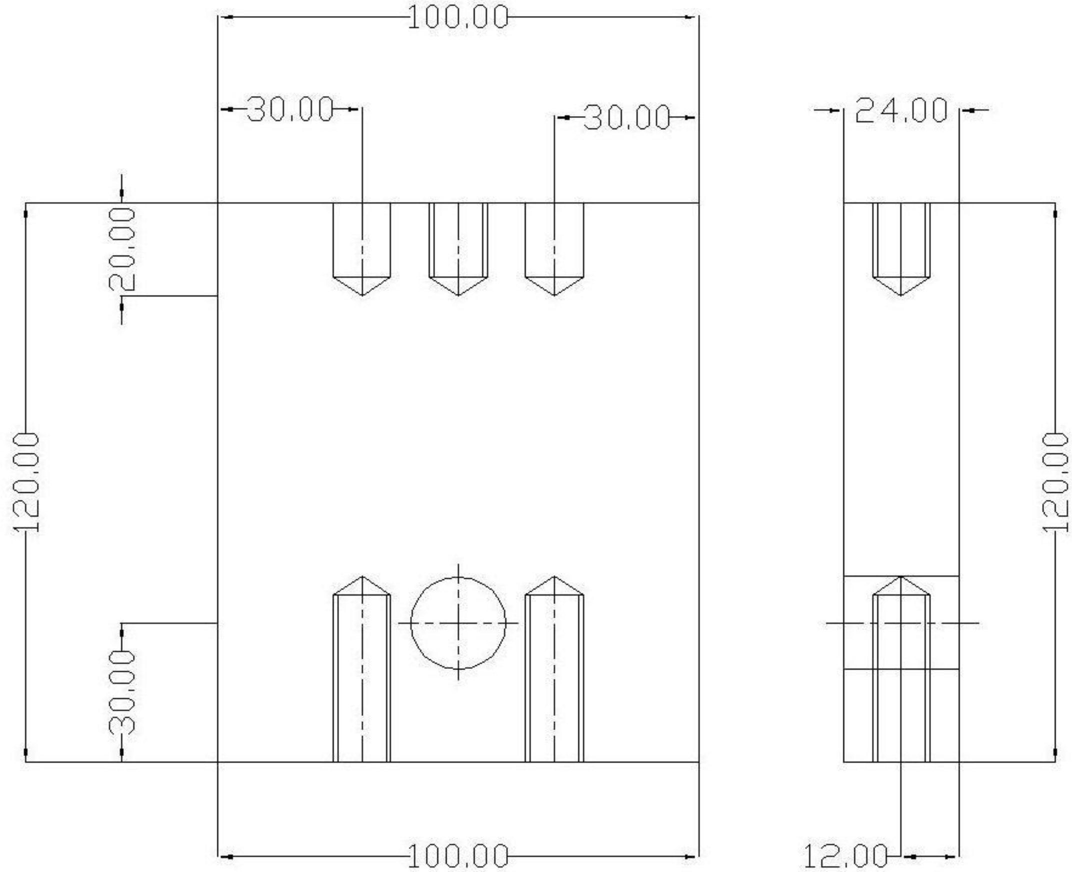



CADD FILE :
1
60.00
12.00
33.00
24.00
2 HOLES Ø 12.00
Ø24.00
30.00
50.00
100.00
20.00
M6XTAPPED
NOTE:
ALL DRILLED HOLES ARE 1X60° CHAMFER
ALL SHARP CORNERS ARE 1X45° CHAMFER
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
MODEL:
HARDNESS:
FINISHING:
ITE DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
TOP PLATE
INDEXING JIG
DRG.No.
03 22 56 003
SCALE
NTS
DRG.SHEET
2 OF 8
REVISION
R00
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 )




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 | | |

# SIDE PLATE
# INDEXING JIG

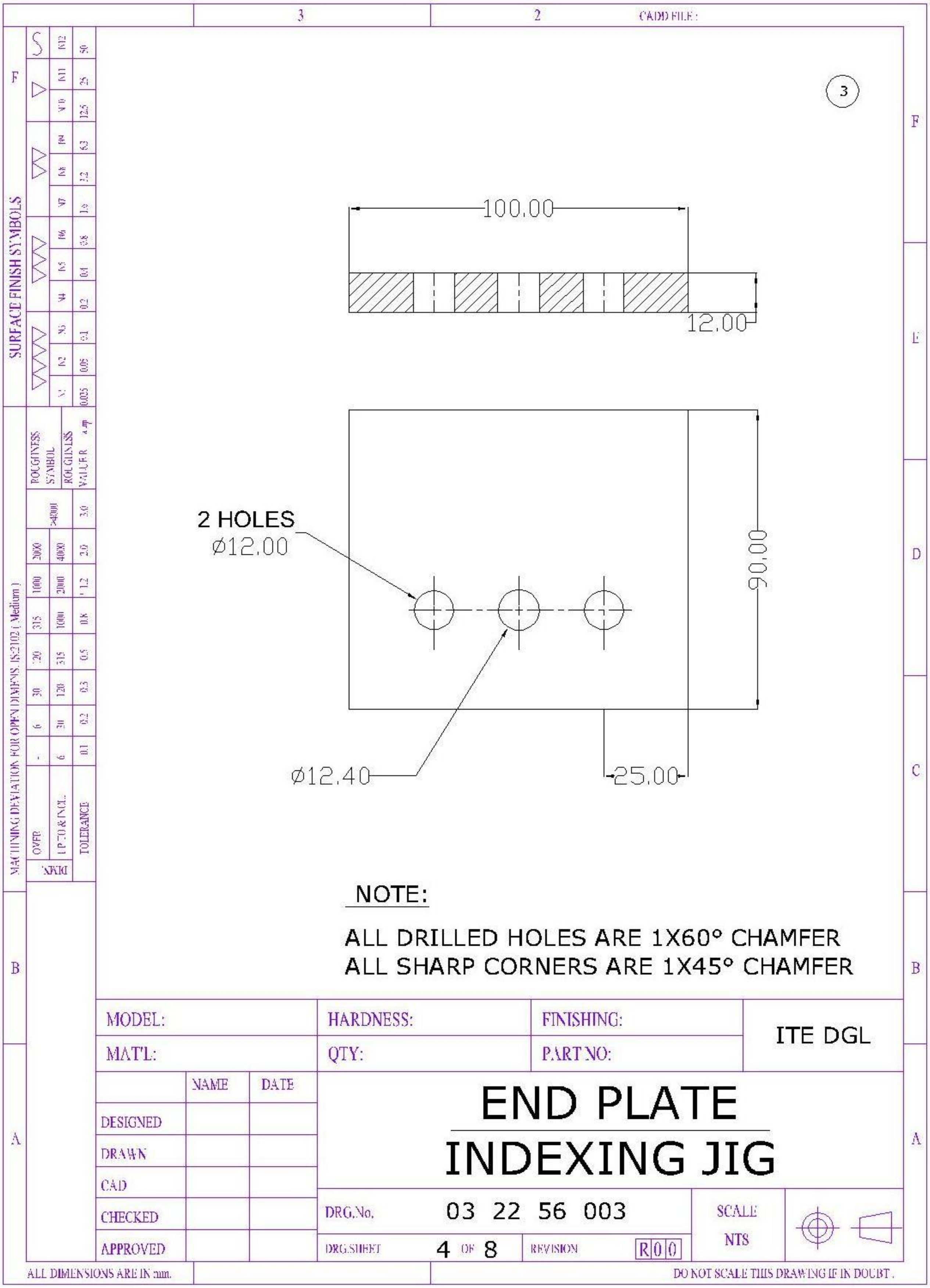
DRG.No. 03 22 56 003

DRG.SHEET 3 OF 8 REVISION R00

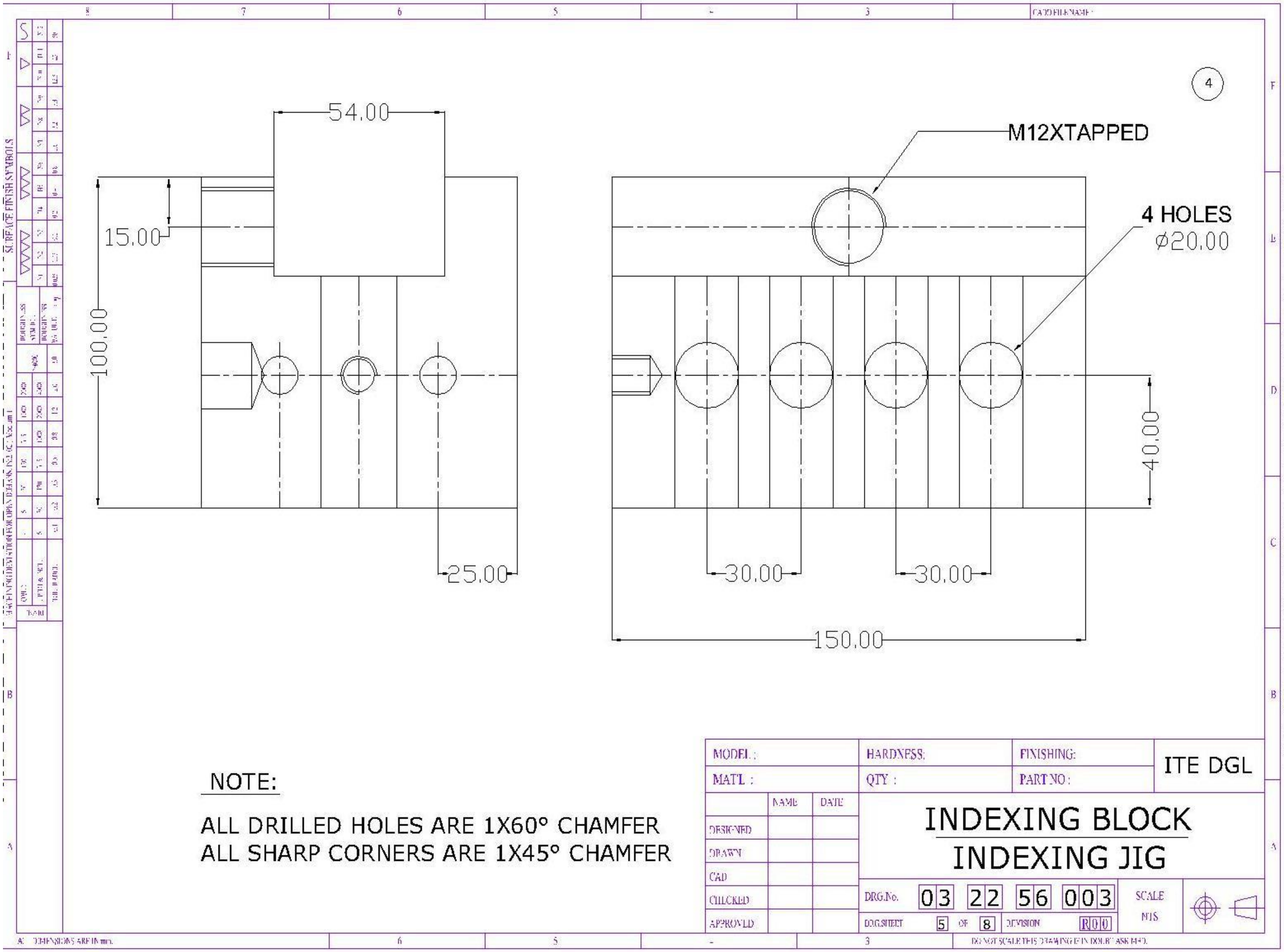
SCALE NTS

ALL DIMENSIONS ARE IN mm.

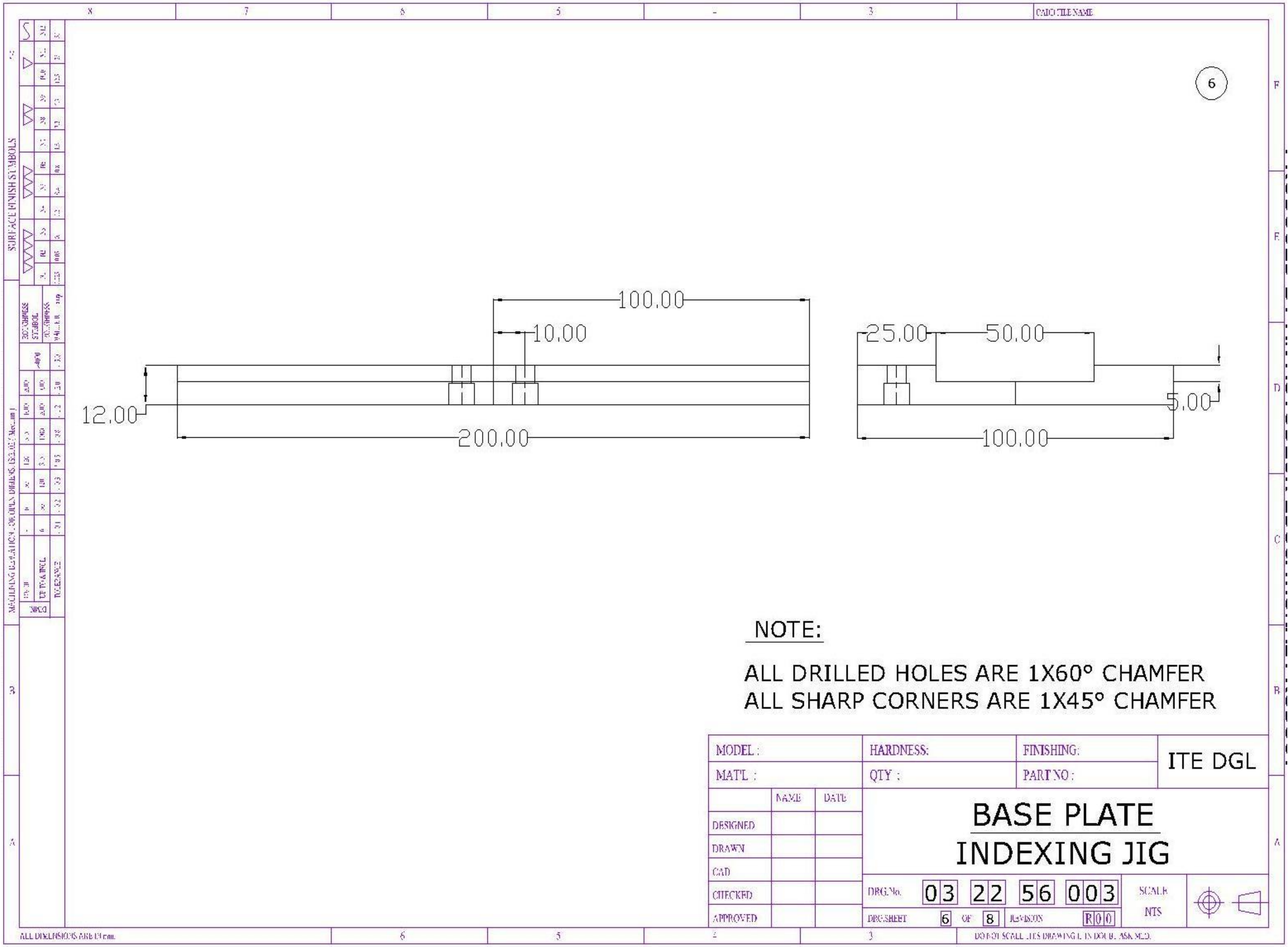
DO NOT SCALE THIS DRAWING IF IN DOUBT .



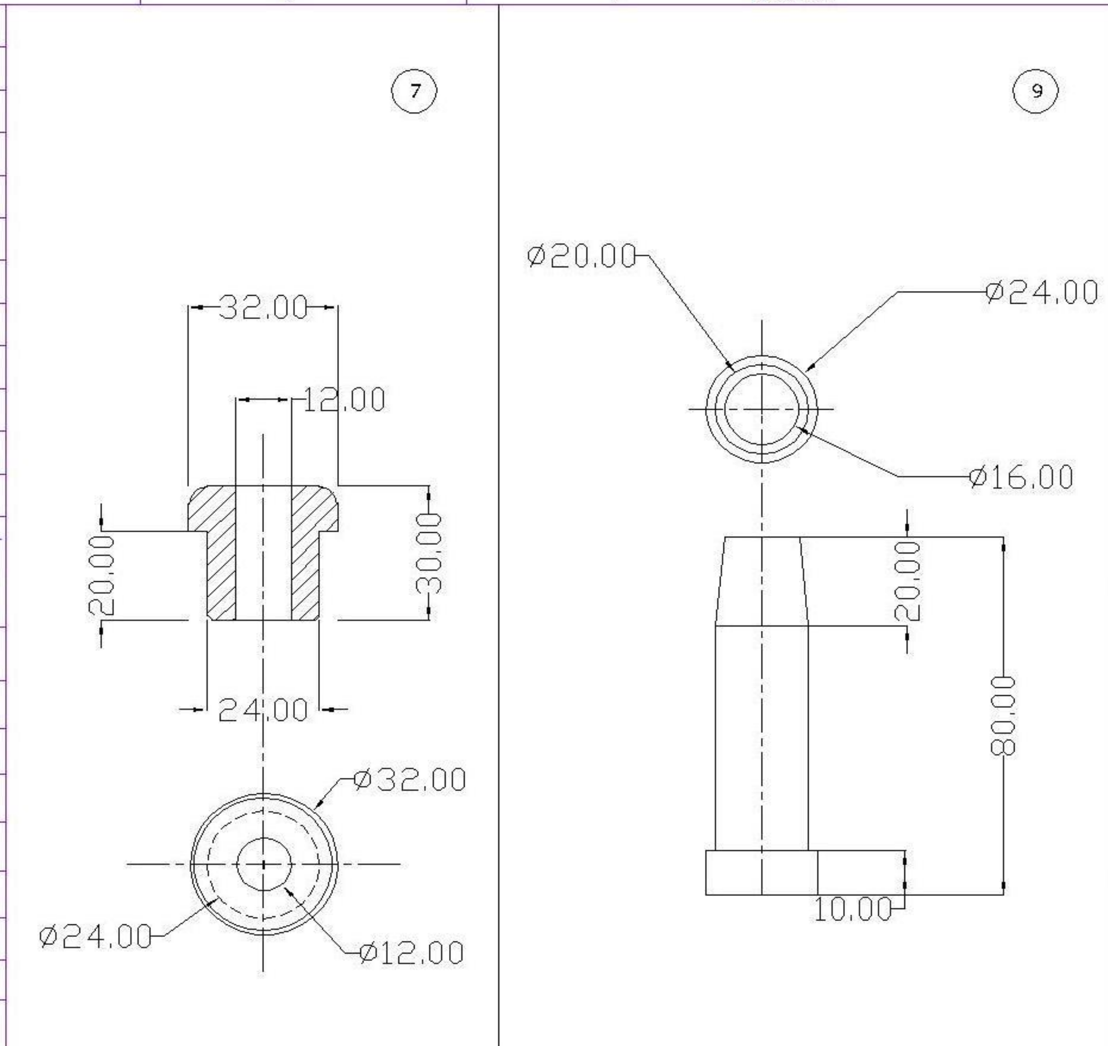
3
100.00
12.00
2 HOLES
Ø12.00
90.00
Ø12.40
25.00
NOTE:
ALL DRILLED HOLES ARE 1X60° CHAMFER
ALL SHARP CORNERS ARE 1X45° CHAMFER
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
MODEL:
HARDNESS:
FINISHING:
ITE DGL
MAT'L:
QTY:
PART NO:
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
END PLATE
INDEXING JIG
DRG.No. 03 22 56 003
SCALE NTS
DRG.SHEET 4 OF 8
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.



4
M12XTAPPED
4 HOLES
⌀20.00
54.00
15.00
100.00
25.00
30.00
30.00
40.00
150.00
NOTE:
ALL DRILLED HOLES ARE 1X60° CHAMFER
ALL SHARP CORNERS ARE 1X45° CHAMFER
MODEL :
MAT'L :
HARDNESS:
QTY :
FINISHING:
PART NO :
ITE DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
INDEXING BLOCK
INDEXING JIG
DRG.No. 03 22 56 003
DRG.SHEET 5 OF 8
REVISION R00
SCALE
NTS
SURFACE FINISH SYMBOLS
ALL DIMENSIONS ARE IN mm.


6
100.00
10.00
12.00
200.00
25.00
50.00
5.00
100.00
NOTE:
ALL DRILLED HOLES ARE 1X60° CHAMFER
ALL SHARP CORNERS ARE 1X45° CHAMFER
MODEL :
MAT'L :
HARDNESS:
QTY :
FINISHING:
PART NO :
ITE DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
BASE PLATE
INDEXING JIG
DRG.No. 03 22 56 003
DRG.SHEET 6 OF 8
REVISION R00
SCALE
NTS
SURFACE FINISH SYMBOLS
ALL DIMENSIONS ARE IN mm.

3 | 2 | CADD FILE :




**NOTE:**

ALL DRILLED HOLES ARE 1X60° CHAMFER
ALL SHARP CORNERS ARE 1X45° CHAMFER

**SURFACE FINISH SYMBOLS**

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

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

| DIMN. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| OVER | - | 6 | 30 | 120 | 315 | 1000 | 2000 | >4000 |
| UP TO & INC. | 6 | 30 | 120 | 315 | 1000 | 2000 | 4000 | |
| TOLLRANCE | 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 | | |

## DRILL BUSH & INDEXING PIN

# INDEXING JIG

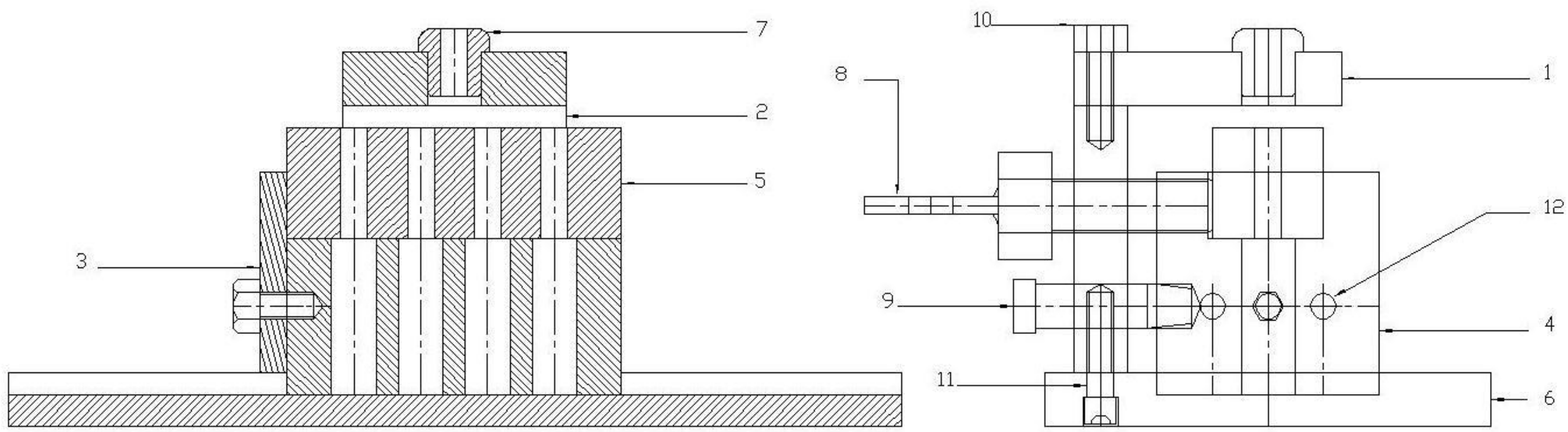
DRG.No. 03 22 56 003

DRG.SHEET 7 OF 8 REVISION R00

SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT .




| | | | |
|---|---|---|---|
| 12 | Ø6 DOWEL | STD | 4 |
| 11 | M6 ALLEN SECREW | STD | 2 |
| 10 | HEXOGONAL BOLT | STD | 2 |
| 9 | INDEXING PIN | MS | 1 |
| 8 | EYE BOLT | STD | 1 |
| 7 | DRILL BUSH | MS | 1 |
| 6 | BASE PLATE | MS | 1 |
| 5 | COMPONENT | MS | 1 |
| 4 | INDEXING BLOCK | MS | 1 |
| 3 | END PLATE | MS | 1 |
| 2 | SIDE PLATE | MS | 1 |
| 1 | TOP PLATE | MS | 1 |
| SL.NO | PART NAME | MATERIAL | QUANTITY |

BILL OF MATERIALS

| | | | | |
|---|---|---|---|---|
| MODEL : | | HARDNESS: | FINISHING: | ITE DGL |
| MATL : | | QTY : | PART NO : | |
| | NAME | DATE | | |
| DESIGNED | | | | |
| DRAWN | | | | |
| CAD | | | | |
| CHECKED | | | | |
| APPROVED | | | | |

ASSEMBLY VIEW

INDEXING JIG

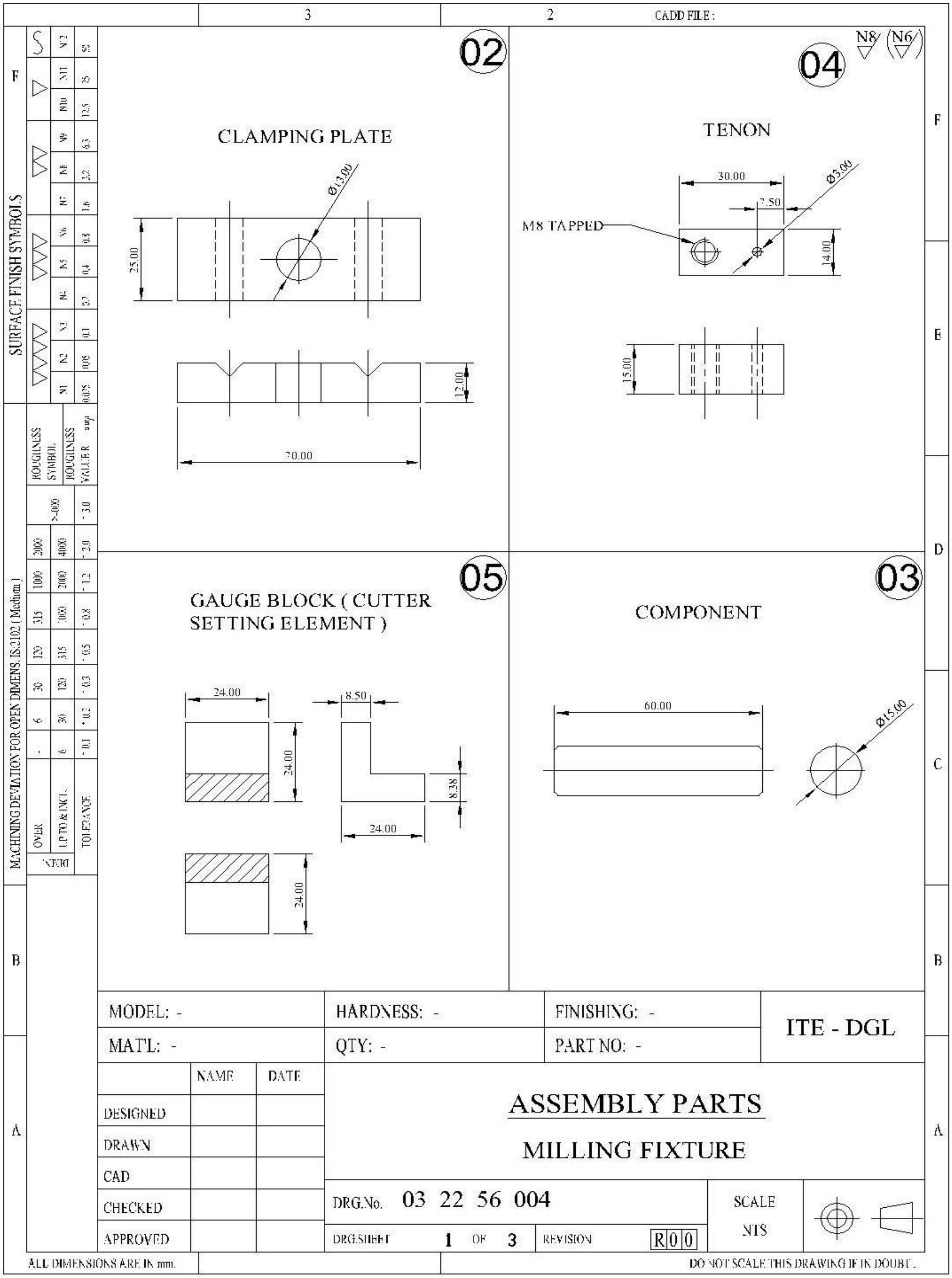
DRG.No. 03 22 56 003 SCALE NTS

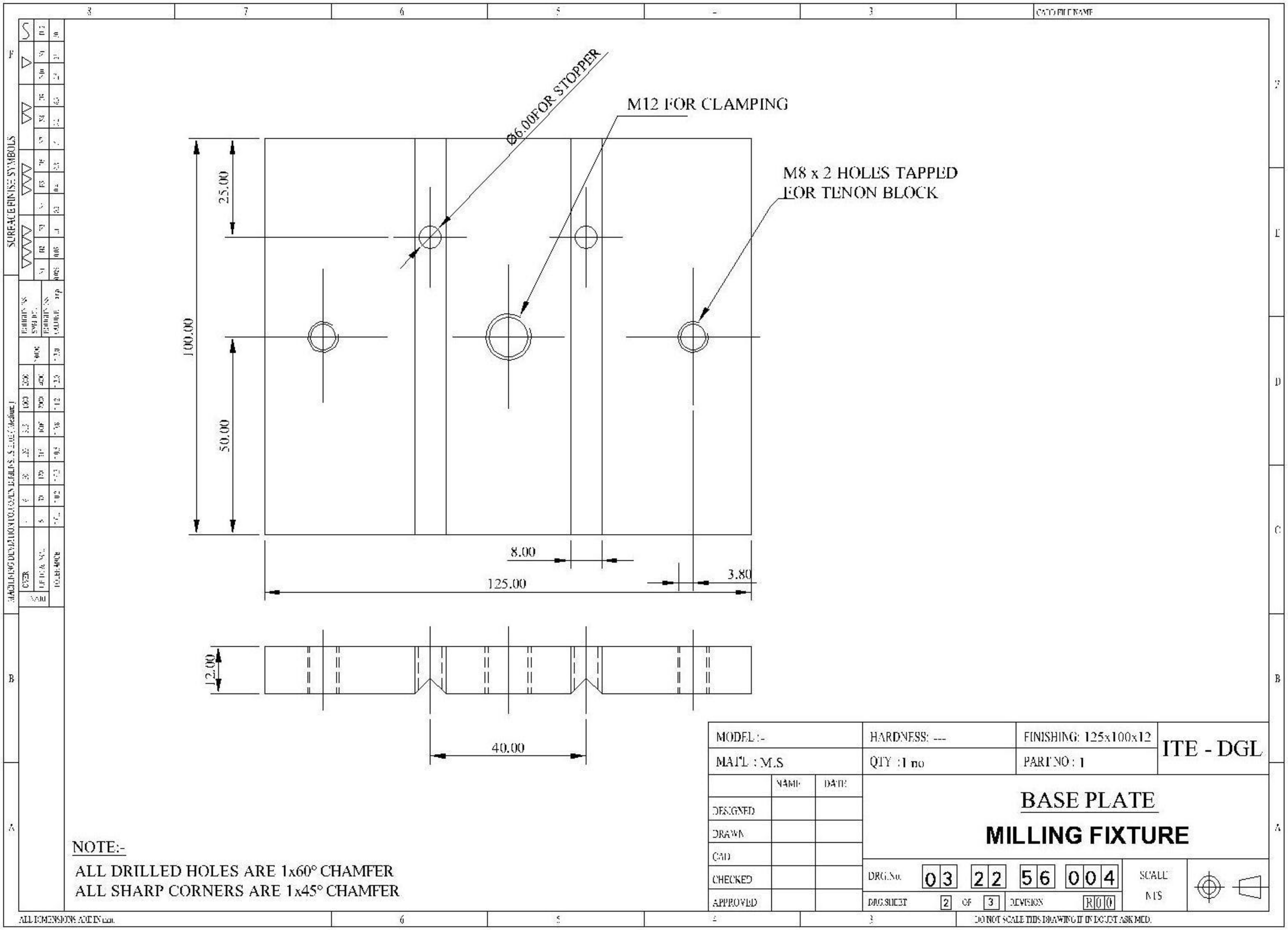
DRG SHEET 8 OF 8 REVISION R00

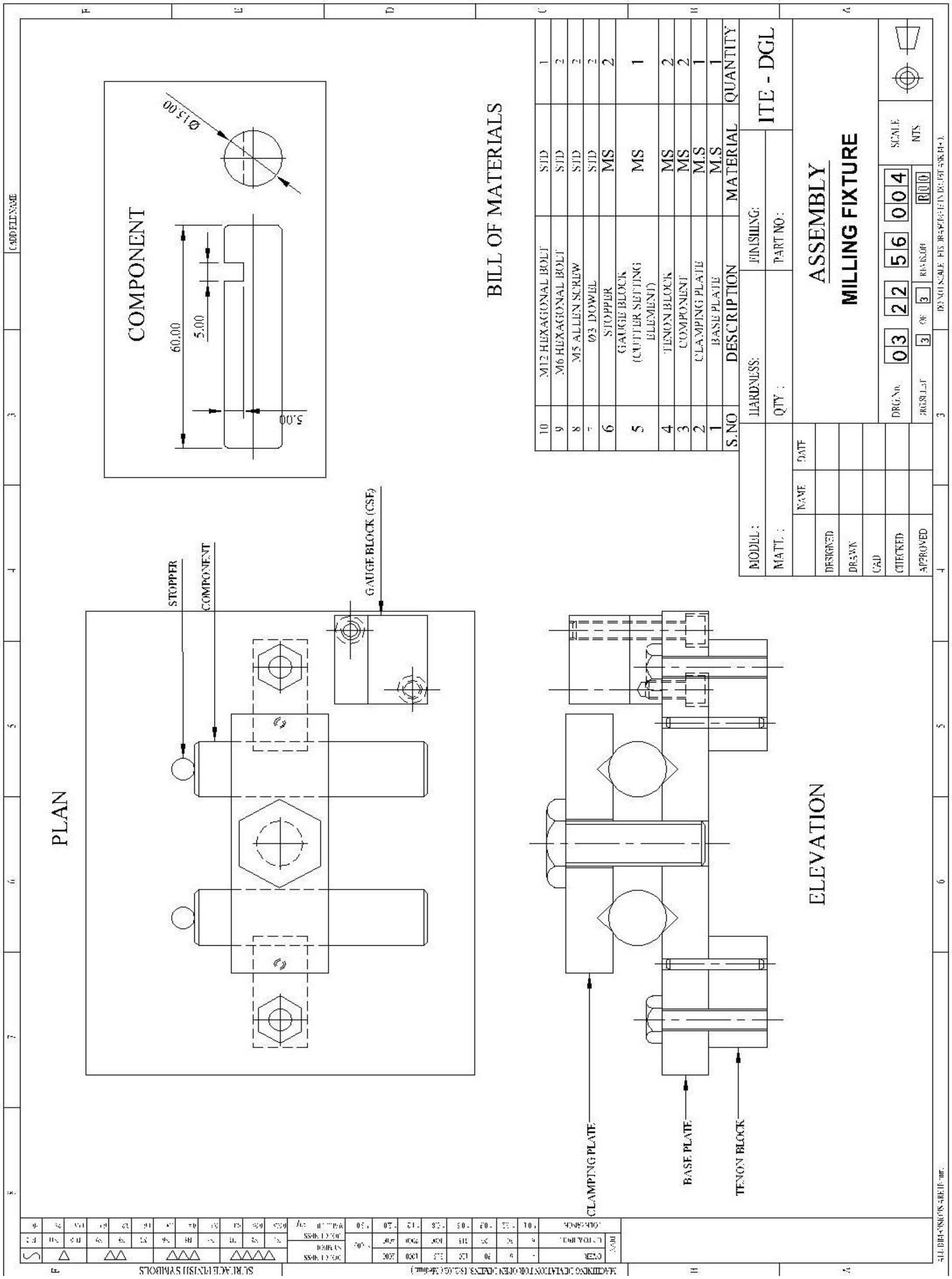
ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MFD

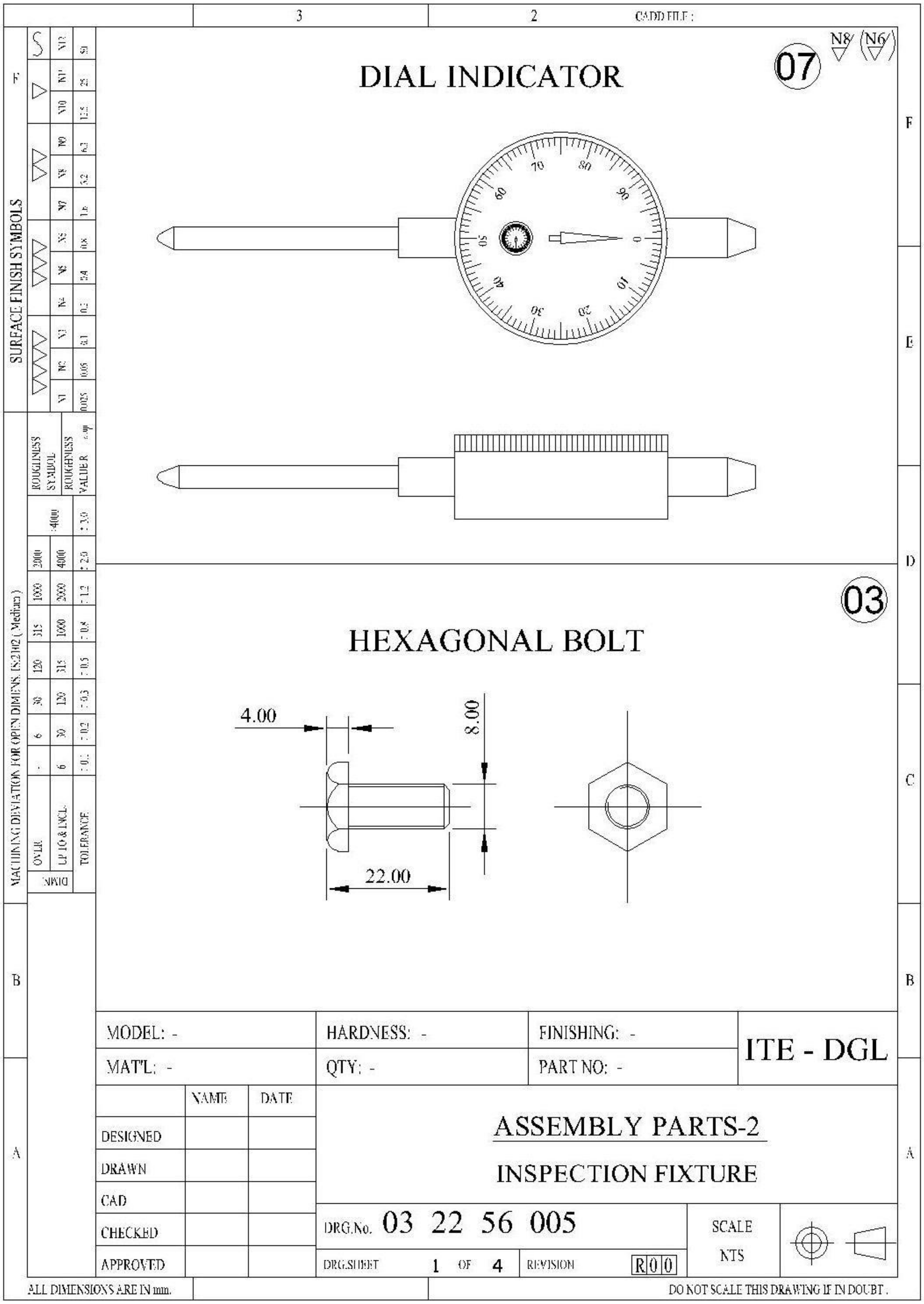
## Exercise – IV Milling Fixture

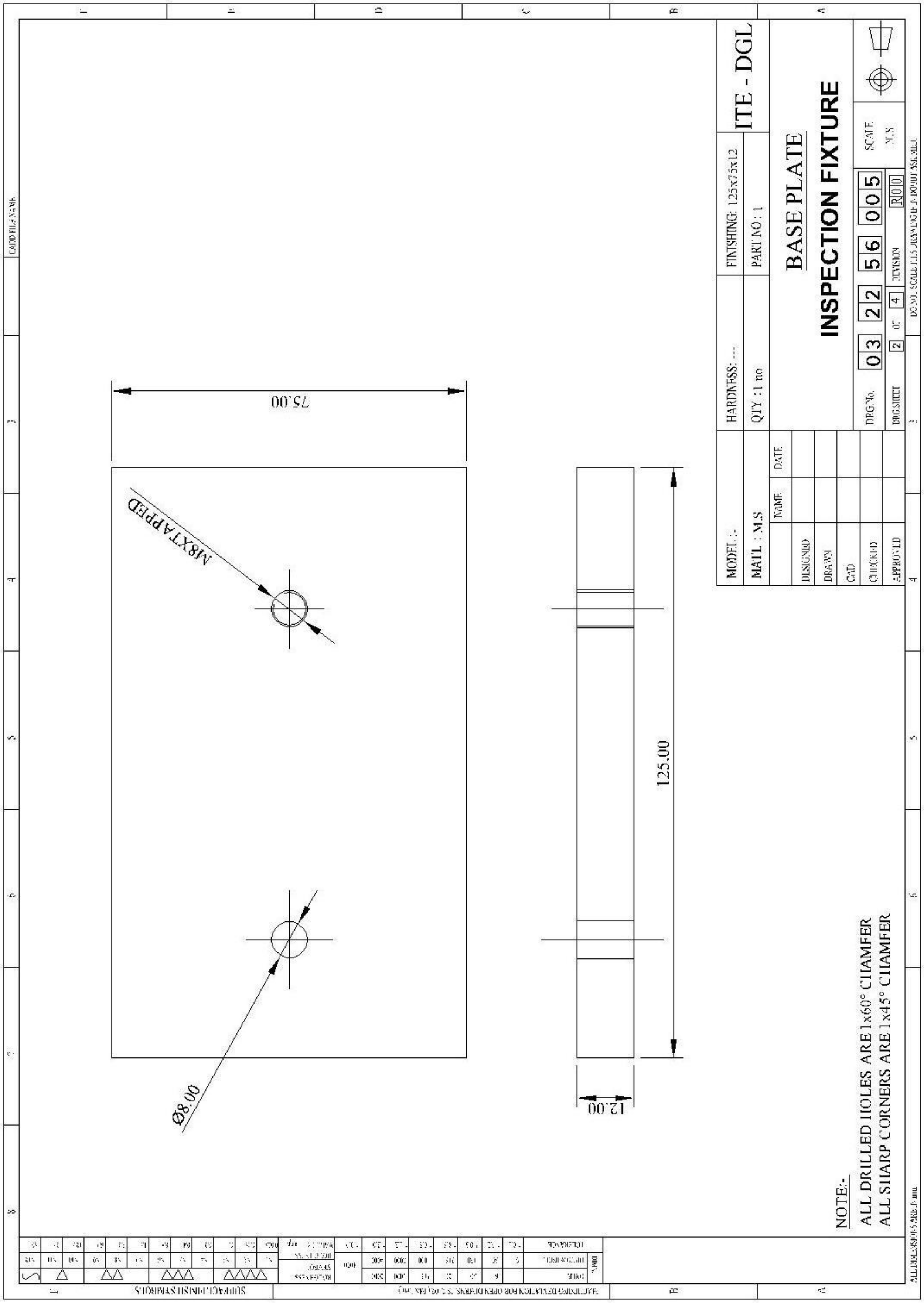


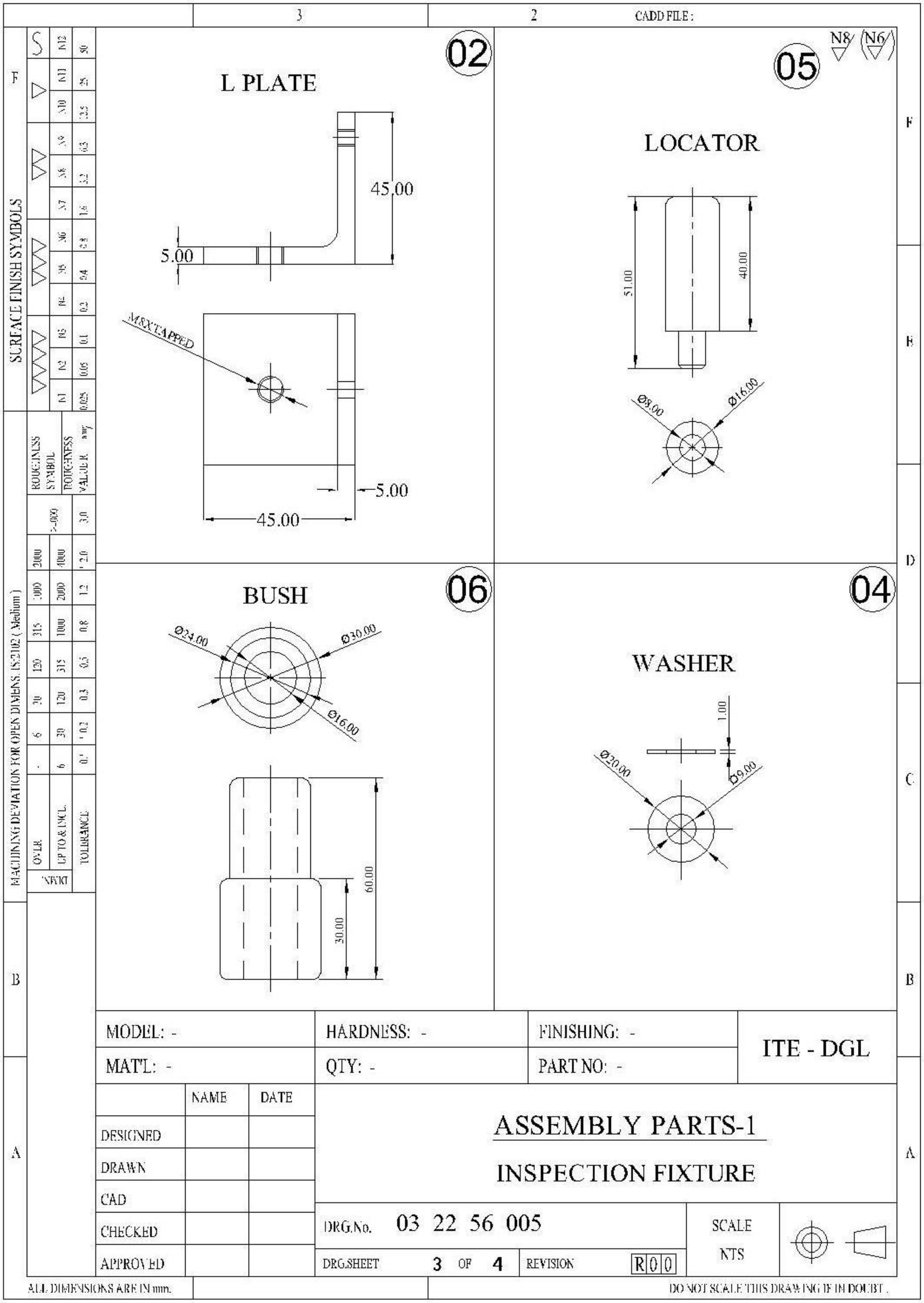

Ø6.00FOR STOPPER
M12 FOR CLAMPING
M8 x 2 HOLES TAPPED
FOR TENON BLOCK
25.00
50.00
100.00
8.00
3.80
125.00
12.00
40.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL :-
MAT'L : M.S
HARDNESS: ---
QTY :1 no
FINISHING: 125x100x12
PART NO : 1
ITE - DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
BASE PLATE
MILLING FIXTURE
DRG.No. 03 22 56 004
DRG.SHEET 2 OF 3
REVISION R00
SCALE
NTS
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MED.
ALL DIMENSIONS ARE IN mm.
SURFACE FINISH SYMBOLS

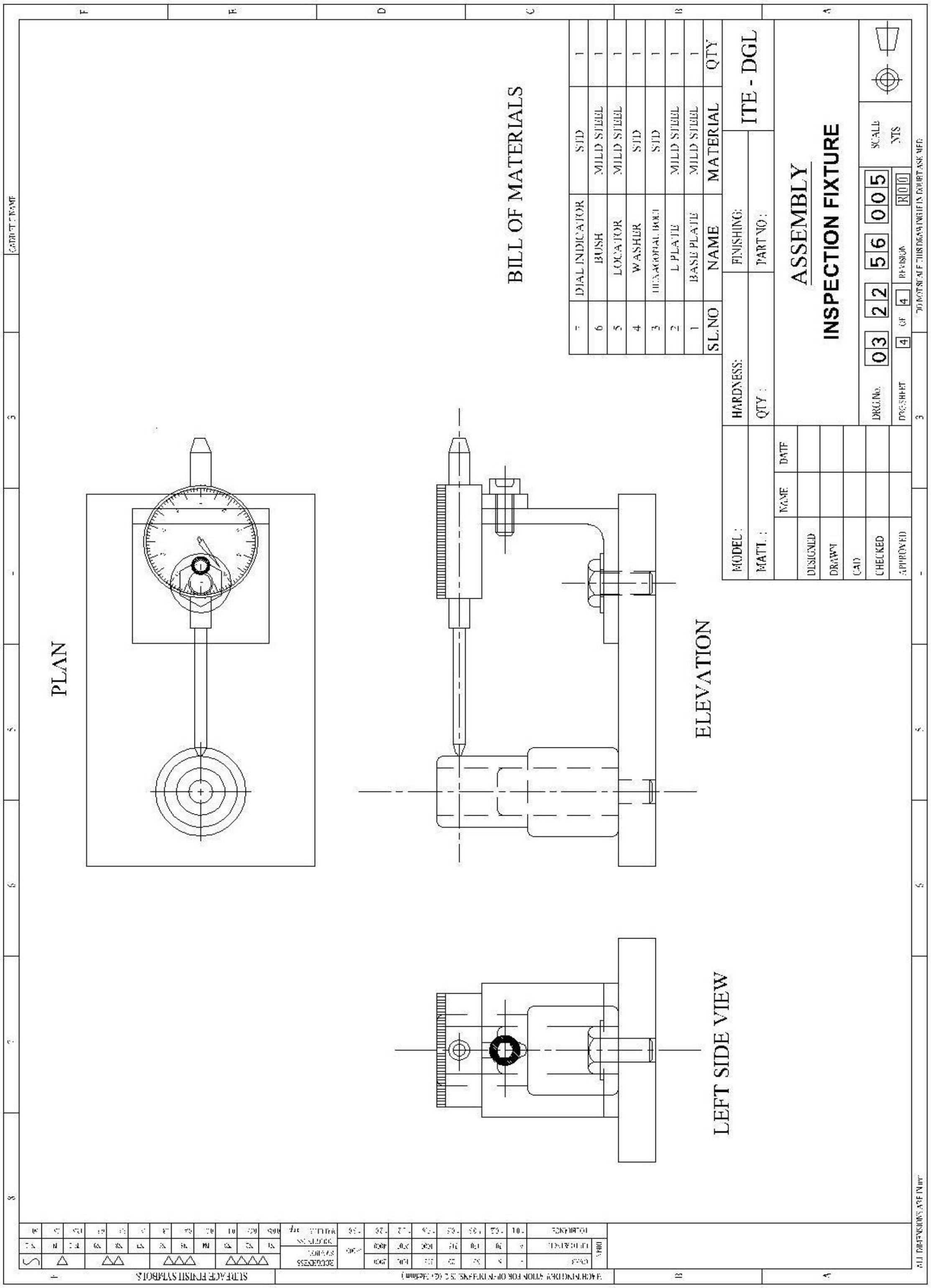

COMPONENT
60.00
5.00
5.00
Ø15.00
BILL OF MATERIALS
S.NO | DESCRIPTION | MATERIAL | QUANTITY
10 | M12 HEXAGONAL BOLT | STD | 1
9 | M6 HEXAGONAL BOLT | STD | 2
8 | M5 ALLEN SCREW | STD | 2
7 | Ø3 DOWEL | STD | 2
6 | STOPPER | MS | 2
5 | GAUGE BLOCK (CUTTER SETTING ELEMENT) | MS | 1
4 | TENON BLOCK | MS | 2
3 | COMPONENT | MS | 2
2 | CLAMPING PLATE | M.S | 1
1 | BASE PLATE | M.S | 1
HARDNESS:
FINISHING:
QTY :
PART NO :
ITE - DGL
MODEL :
MATL :
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY
MILLING FIXTURE
DRG.No.
03 22 56 004
R00
SCALE
NTS
PLAN
STOPPER
COMPONENT
GAUGE BLOCK (CSE)
ELEVATION
CLAMPING PLATE
BASE PLATE
TENON BLOCK
SURFACE FINISH SYMBOLS

## Exercise – V Inspection Fixture




ITE - DGL
FINISHING: 125x75x12
HARDNESS: ---
MODEL :-
MAT'L : M.S
QTY :1 no
PART NO: 1
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
BASE PLATE
INSPECTION FIXTURE
DRG No. 03 22 56 005
DRG.SHEET 2 OF 4
REVISION R00
SCALE N.S
75.00
125.00
12.00
Ø8.00
M8XTAPPED
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 )
02
L PLATE
45.00
5.00
M8X TAPPED
5.00
45.00
05
N8 (N6)
LOCATOR
51.00
40.00
Ø8.00
Ø16.00
06
BUSH
Ø24.00
Ø30.00
Ø16.00
60.00
30.00
04
WASHER
1.00
Ø20.00
Ø9.00
MODEL: -
HARDNESS: -
FINISHING: -
ITE - DGL
MAT'L: -
QTY: -
PART NO: -
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
ASSEMBLY PARTS-1
INSPECTION FIXTURE
DRG.No. 03 22 56 005
SCALE
NTS
DRG.SHEET 3 OF 4
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .




## Exercise – VI Welding Fixture

- Pl refer the sketches available in subject code:4022340 – Computer Aided Machine & Tool Drawing Exercise no.8

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### V SEMESTER

### 2020 – 2021 onwards

# 4022560 – PRESS TOOLS PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMIL NADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

Course Name : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4022560

Semester : V

Subject Title : **PRESS TOOLS PRACTICAL**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| SUBJECT | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| PRESS TOOLS PRACTICAL | 5 | 80 | 25 | 100* | 100 | 16 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**OBJECTIVES:**

At the end of the practice, the students will be able to

- 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.

## DETAILED SYLLABUS

| Ex. No. | Name of the exercise | Time in Hours |
|---|---|---|
| 1 | Manufacture of Blanking Tool – Drop through type | 16 |
| 2 | Manufacture of Progressive Tool – Drop through type | 16 |
| 3 | Manufacture or Compound Tool | 16 |
| 4 | Manufacture of V Bending tool | 16 |
| 5 | Manufacture of drawing tool ( single stage) | 16 |
| | **TOTAL** | 80 |

Note:-

1. Batch size should not be more than 5 students for Practical classes.
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 Press Setting, Tool setting, shut height Adjustment, trial production using the tool fabricated by them and rectification of tool defects if any.
5. For Board examination any one of the above tool ( sl no 1 to 4) is to be fabricated by each student, fitted in the press and trial production should be taken. The evaluation of the performance should be based on the component dimensions and finish obtained from the tool fabricated by the student during the 16 hours examination.
6. For all the four exercises, the sketches are given and should be followed.

**SCHEME OF EXAMINATION:**

| | | |
|---|---|---|
| Manufacture of Tool | - | 50 marks |
| Tool finish | - | 20 marks |
| Component finish / accuracy | - | 10 marks |
| Tool setting & trial production | - | 10 Marks |
| Viva Voce | - | 10 Marks |
| **Total** | **-** | **100 Marks** |

## Details of The Equipment's (for a batch of 30 students)

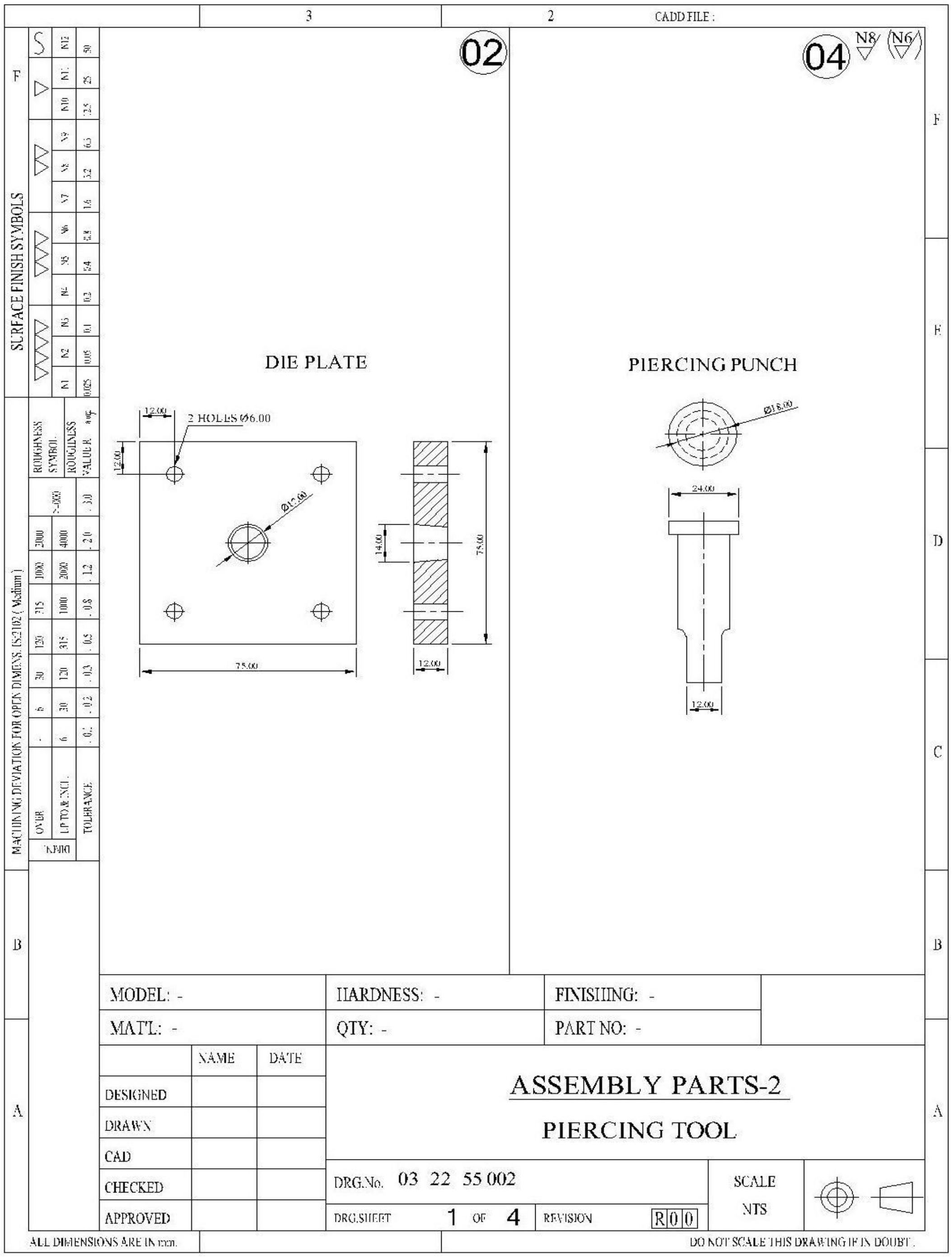
| NAME OF THE BRANCH / COURSE | MECHANICAL ENGINEERING (TOOL & DIE) |
|---|---|
| YEAR | THIRD |
| SEMESTER | V |
| NAME OF THE LABORATORY | 4022560 PRESS TOOLS PRACTICAL |

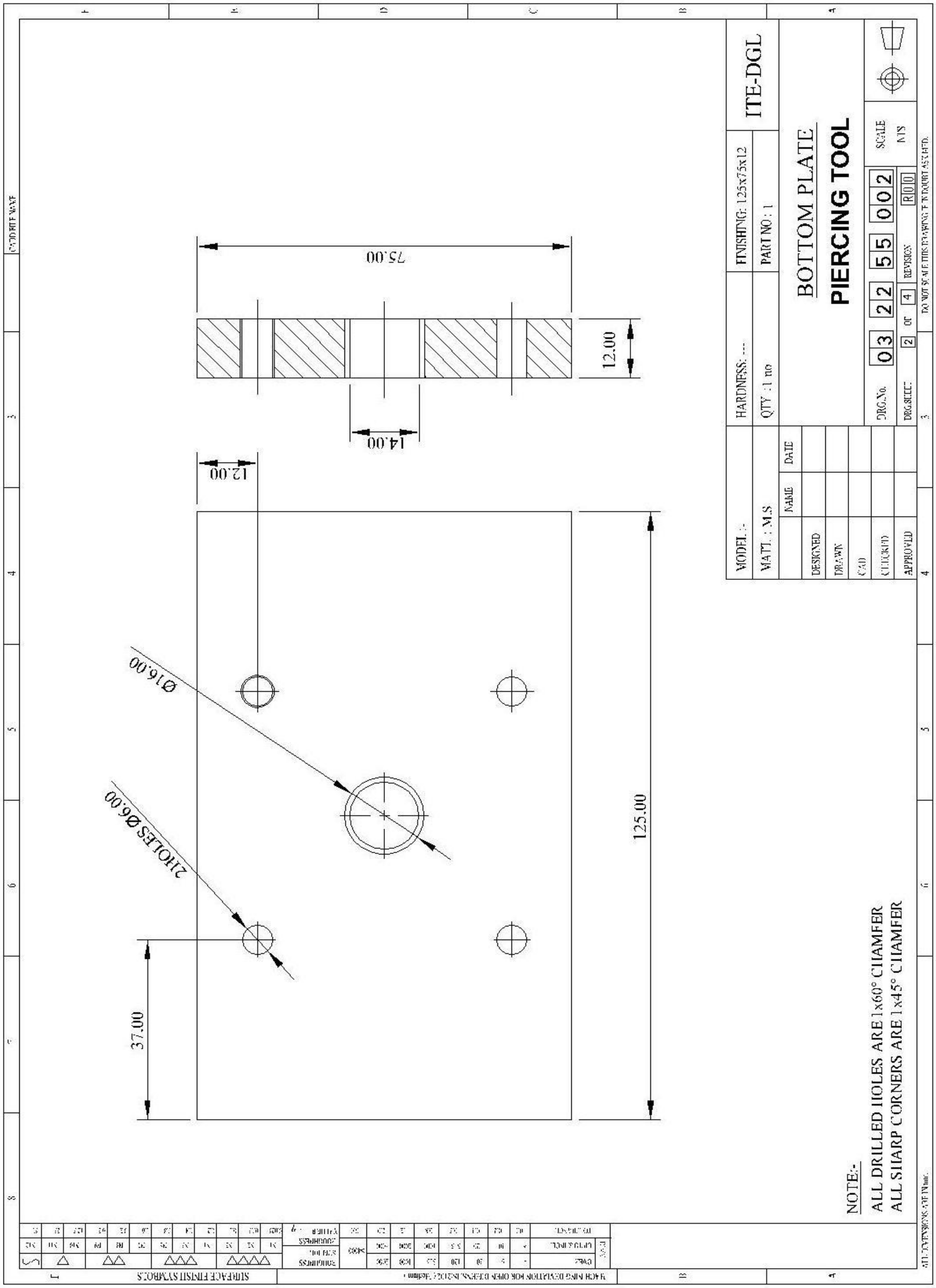
| S.NO | LIST OF THE EQUIPMENT'S WITH SPECIFICATIONS REMARKS IF ANY | QUANTITY REQUIRED |
|---|---|---|
| 1 | Centre Lathe, 4 ½' bed length | 5 |
| 2 | Drilling machine | 2 |
| 3 | Shaping machine, stroke length 300mm | 2 |
| 4 | Vertical milling machine | 2 |
| 5 | Surface grinding machine | 2 |
| 6 | 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 |

**Exercise-I Blanking Tool – Drop through type**

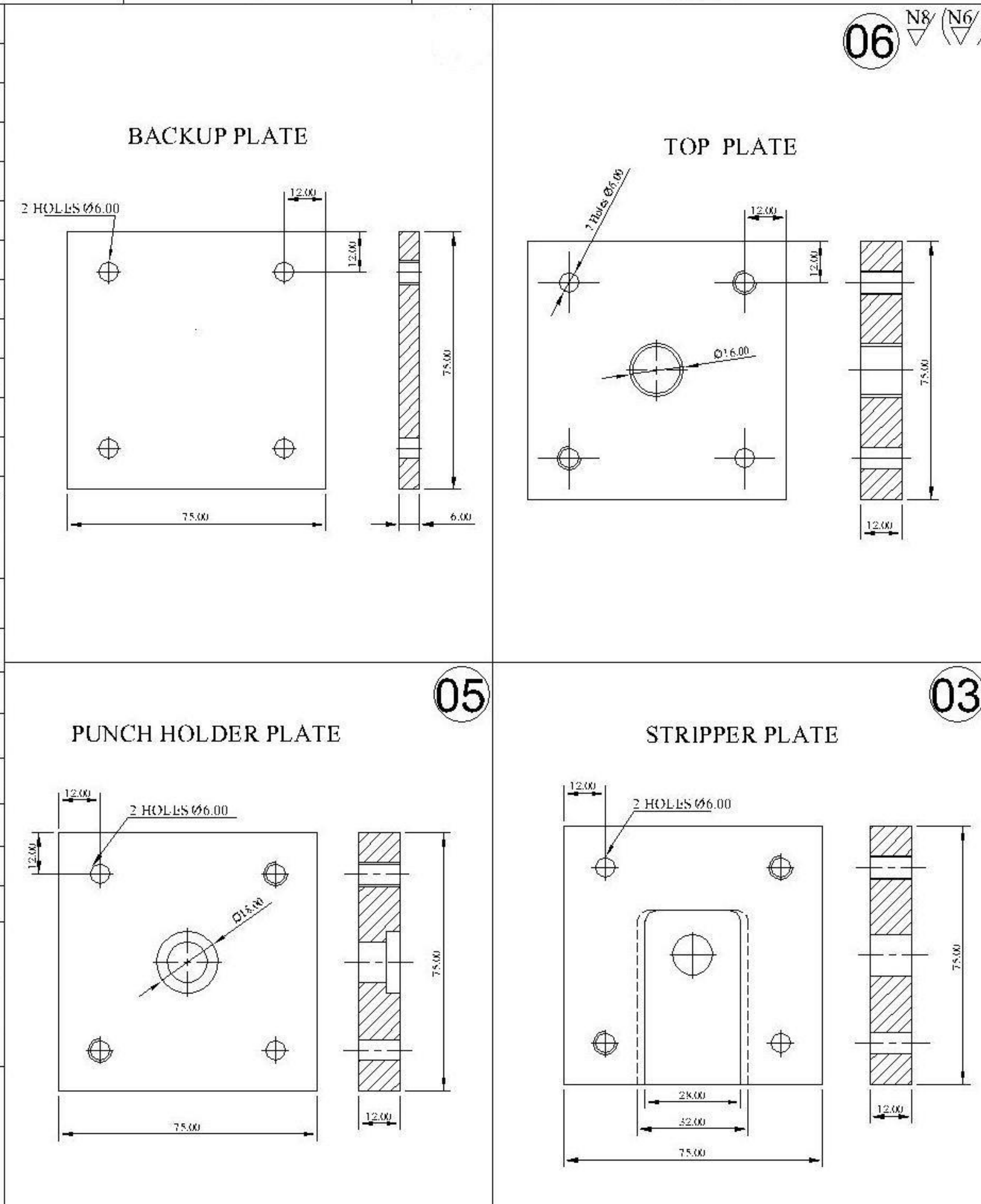
- Pl refer the sketches available in the subject 4022340 Computer Aided Machine & Tool Drawing Exercise no.9

**Exercise-II Piercing Tool**





ITE-DGL
FINISHING: 125x75x12
PART NO : 1
HARDNESS: ---
QTY : 1 no
MODEL :-
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
BOTTOM PLATE
PIERCING TOOL
DRG.No. 03 22 55 002
DRG.SHEET 2 OF 4
REVISION R00
SCALE
NTS
75.00
12.00
14.00
12.00
Ø16.00
2HOLES Ø6.00
125.00
37.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS




CADD FILE :

SURFACE FINISH SYMBOLS

| ROUGHNESS SYMBOL | N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N9 | N10 | N11 | N12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROUGHNESS VALUE R | 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 | 4000 |
|---|---|---|---|---|---|---|---|---|
| UP TO & INCL. | 6 | 30 | 120 | 315 | 1000 | 2000 | 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 | | |

# ASSEMBLY PARTS-1

## PIERCING TOOL

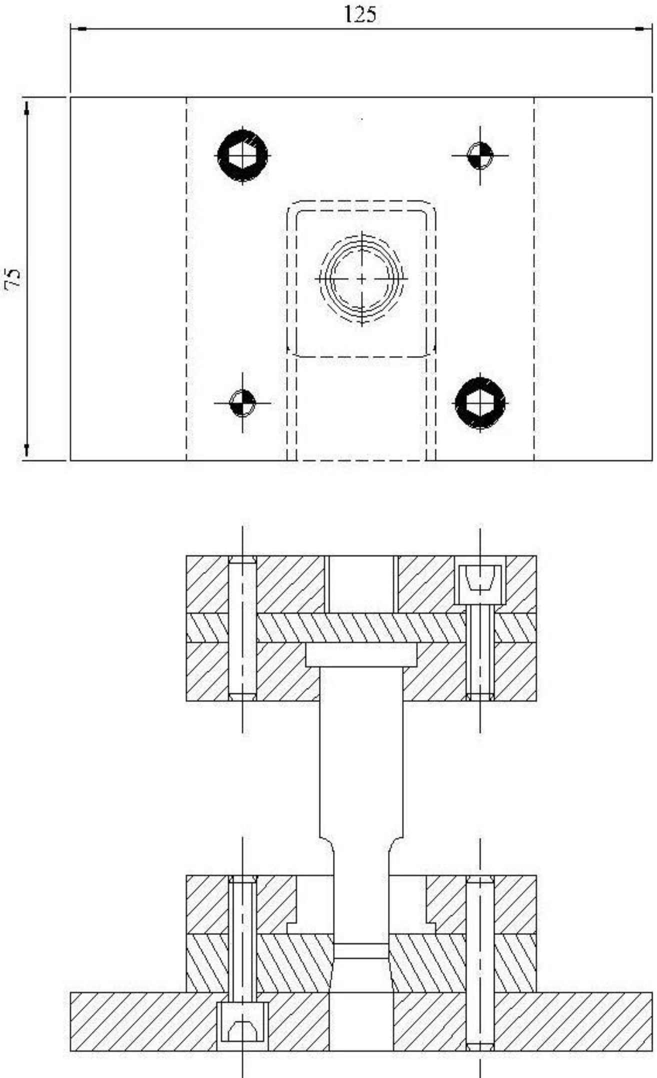
DRG.No. 03 22 55 002

DRG.SHEET 3 OF 4 REVISION R00

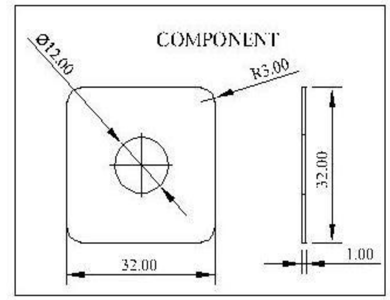
SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT .




NOTE:
1. ALL DIMENSIONS ARE IN mm.
2. THE PUNCH SHALL BE HARDENED AND TEMPERED TO 60-62 HRC.
3. THE DIE SHALL BE HARDENED AND TEMPERED TO 60-62 HRC.
4. PROVIDE PUNCH AND DIE CLEARANCE PER SIDE 0.01 mm
5. AVOID SHARP CORNERS
6. FOR DIMENSIONS WITHOUT TOLERANCE, TOLERANCE SHALL BE GIVEN AS PER ISO-2678




## BILL OF MATERIALS

| SL.NO | NAME | MATERIAL | QTY |
|---|---|---|---|
| 9 | O6 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 | PIERCING PUNCH | M.S (CASE HAEDENED) | 1 |
| 3 | STRIPPER PLATE | M.S | 1 |
| 2 | DIE BLOCK | M.S (CASE HARDENED) | 1 |
| 1 | BOTTOM PLATE | M.S | 1 |

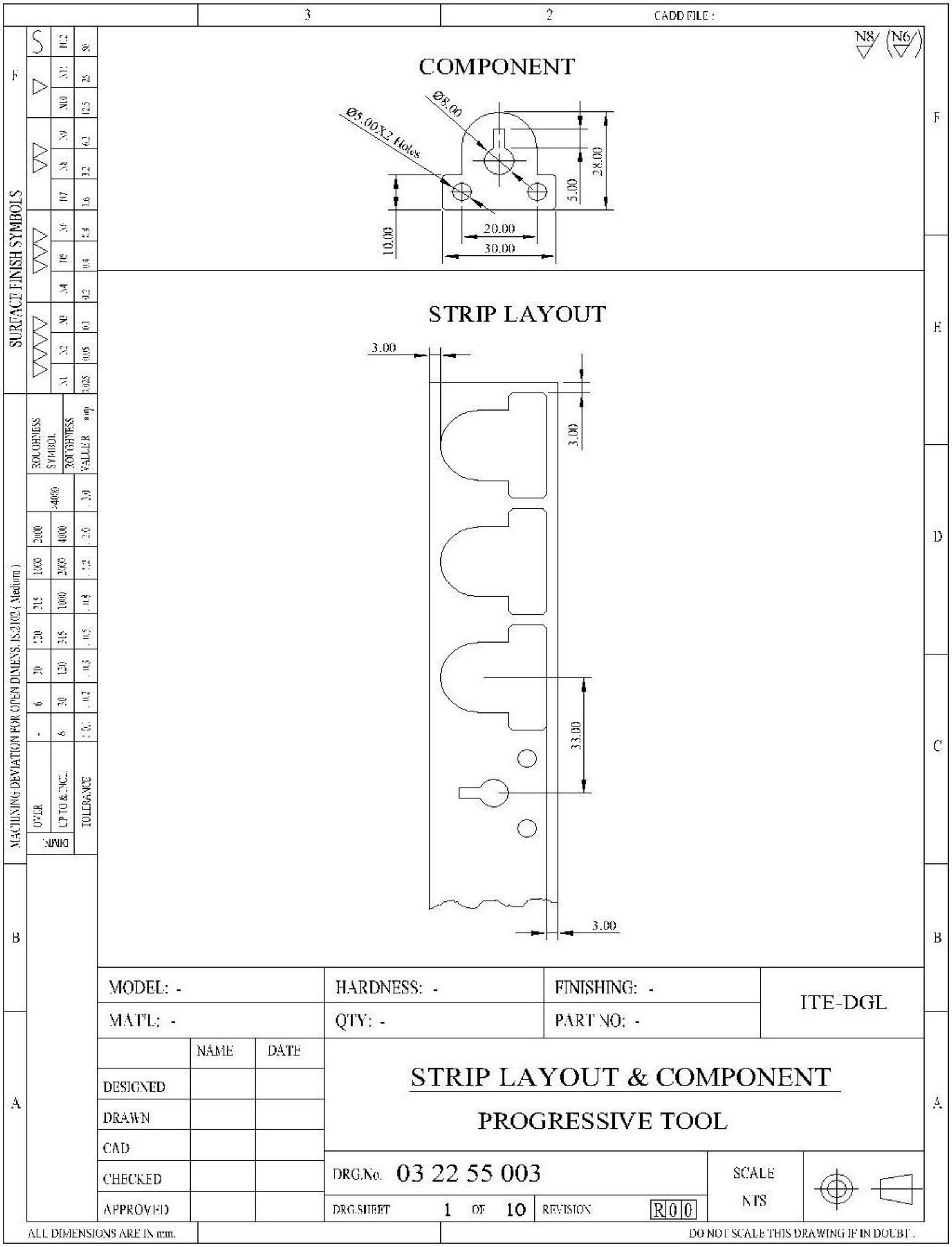
| | | | |
|---|---|---|---|
| MODEL : | HARDNESS: | FINISHING: | ITE-DGL |
| MATL : | QTY : | PART NO : | |

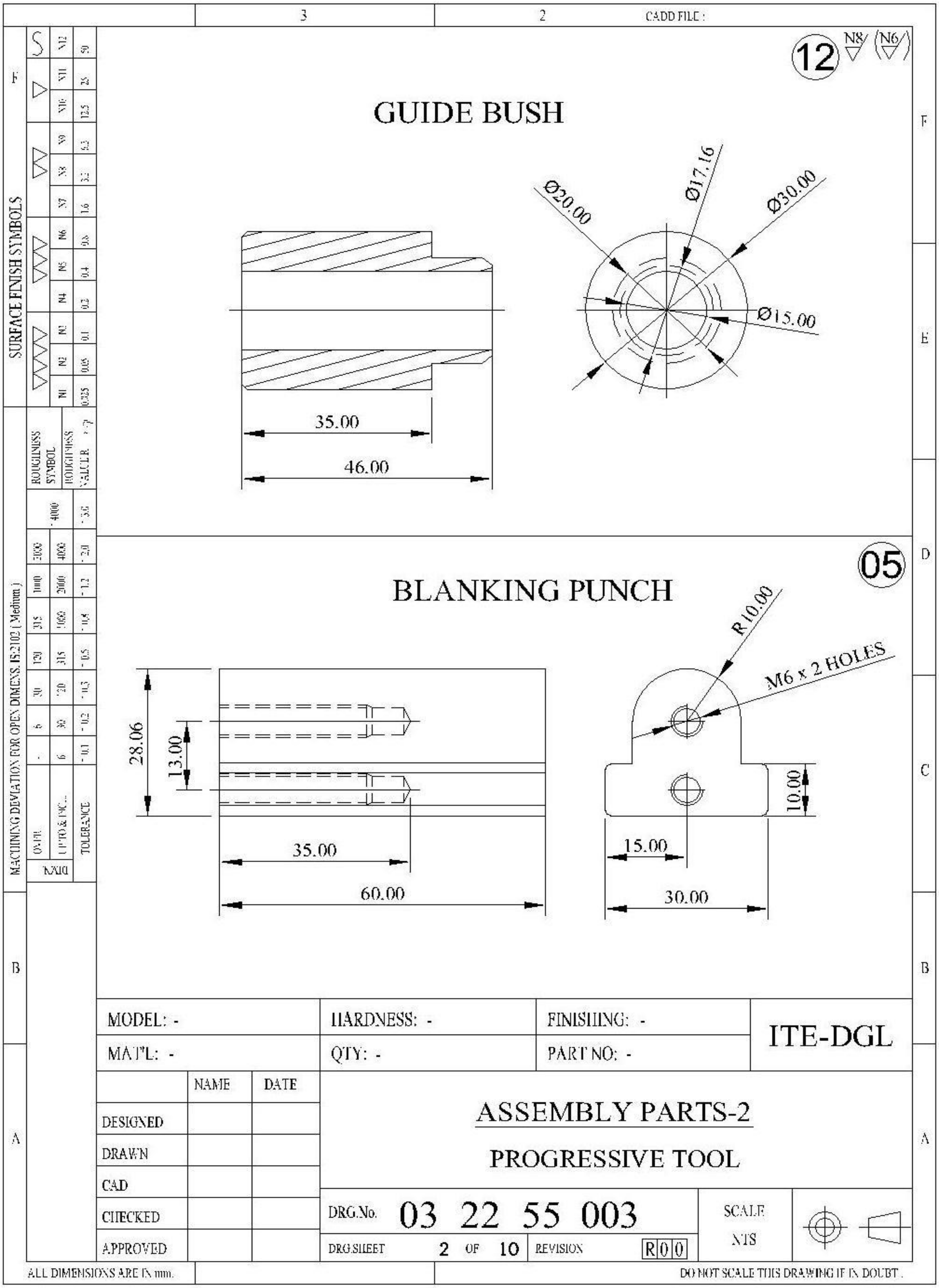
| | NAME | DATE |
|---|---|---|
| DESIGNED | | |
| DRAWN | | |
| CAD | | |
| CHECKED | | |
| APPROVED | | |

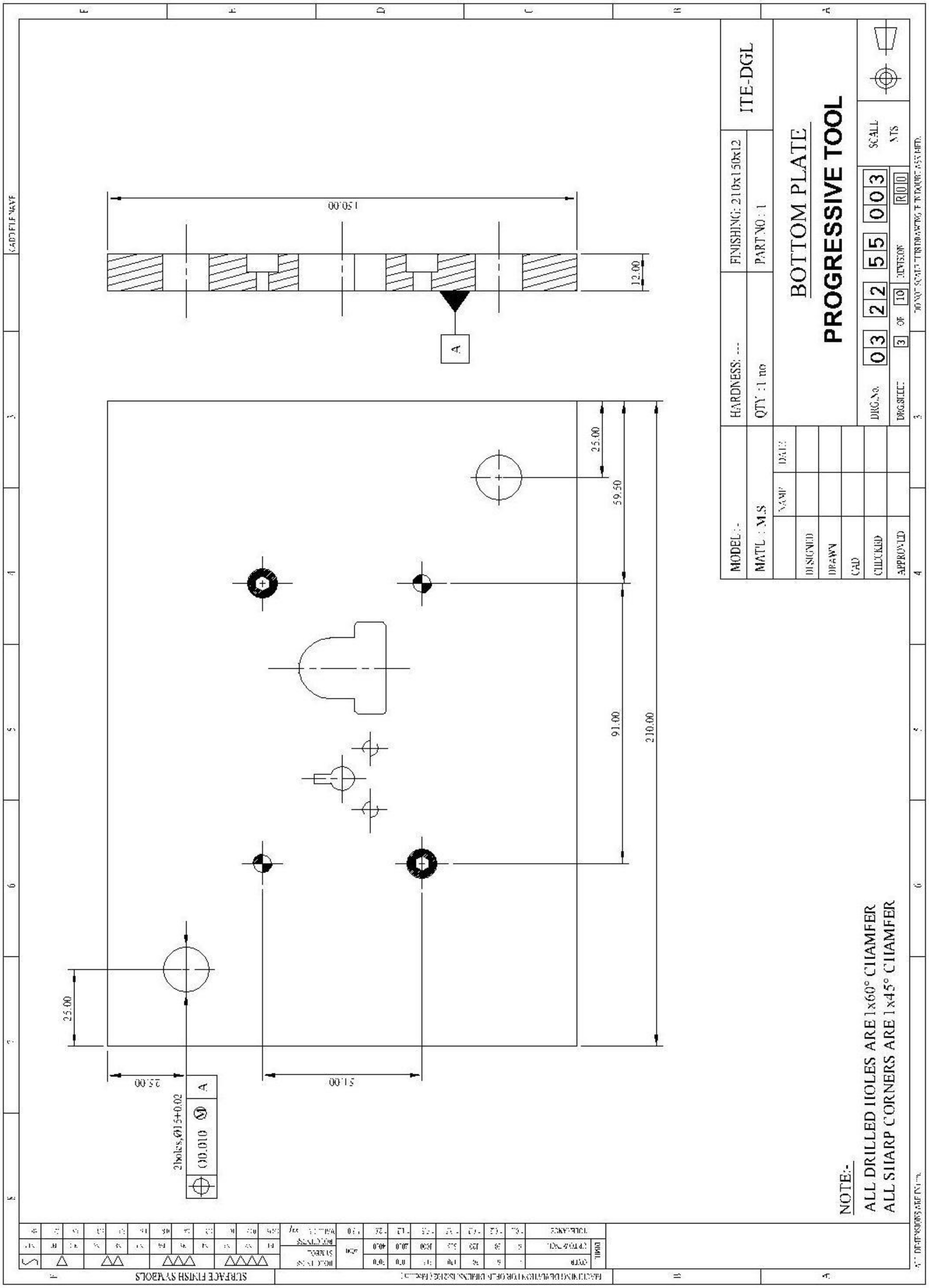
# ASSEMBLY
## PIERCING TOOL

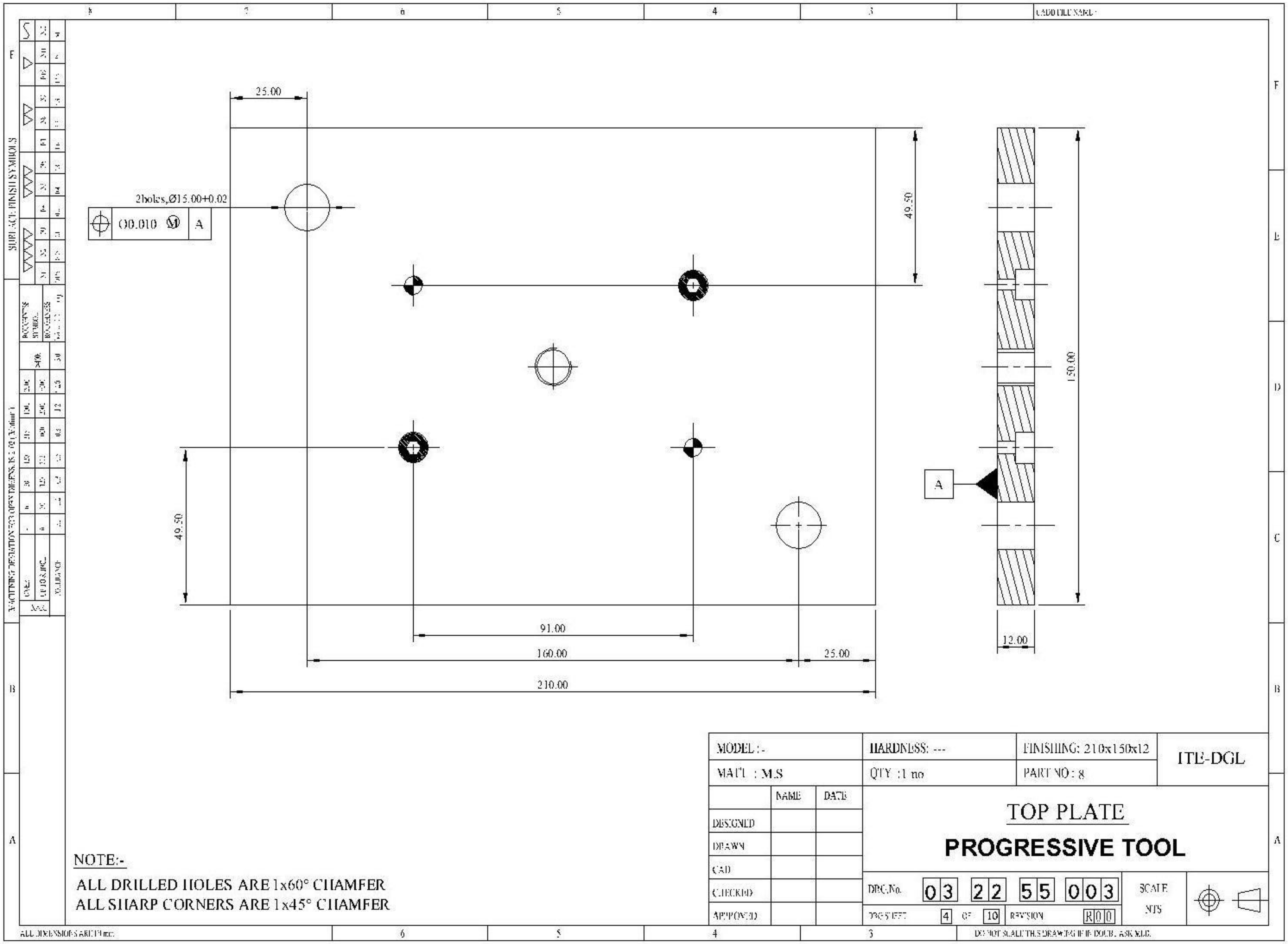
DRG.No. 03 22 55 002
DRG.SHEET 4 OF 4 REVISION R00
SCALE NTS

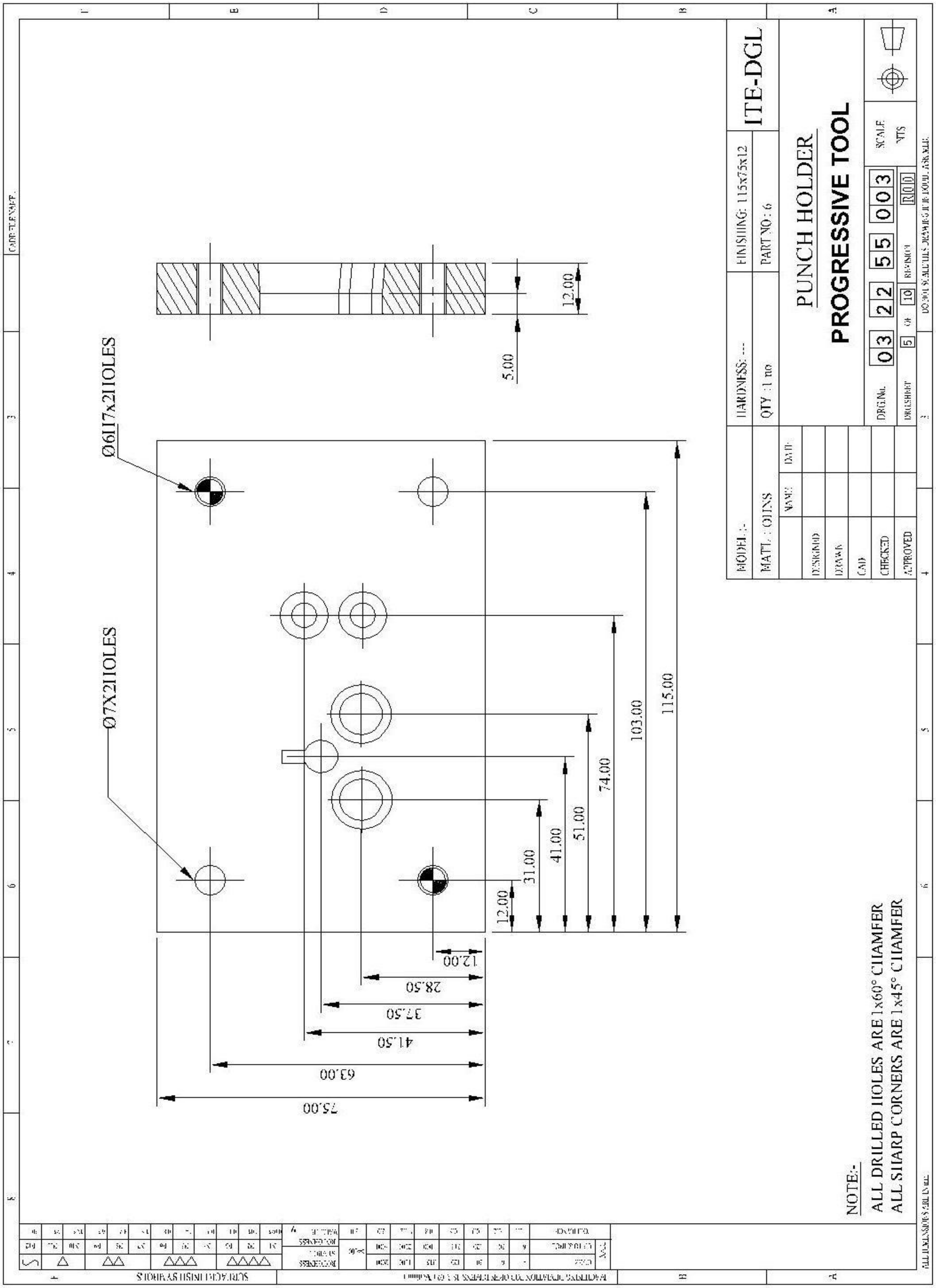
## Exercise – III Progressive Tool

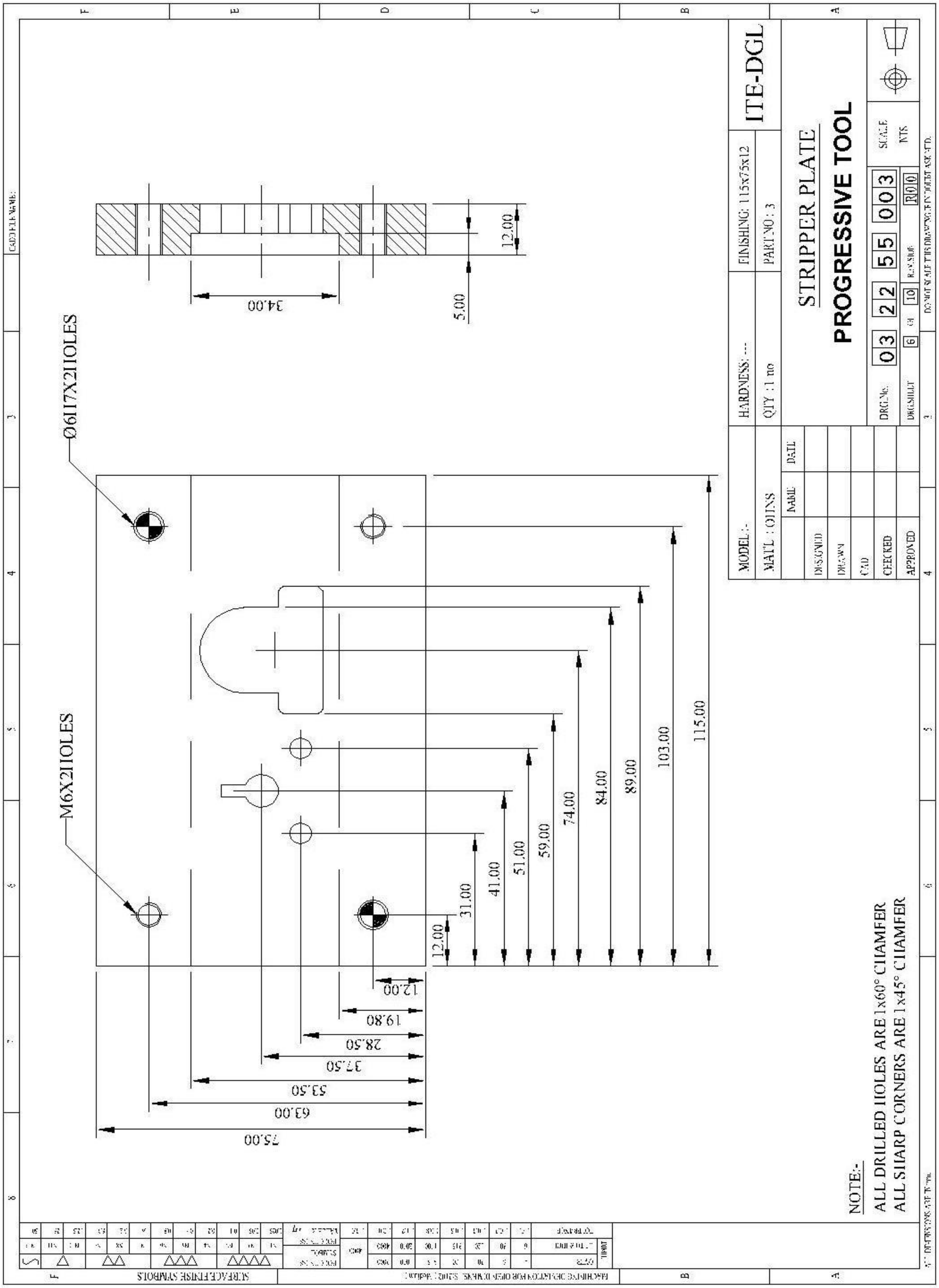


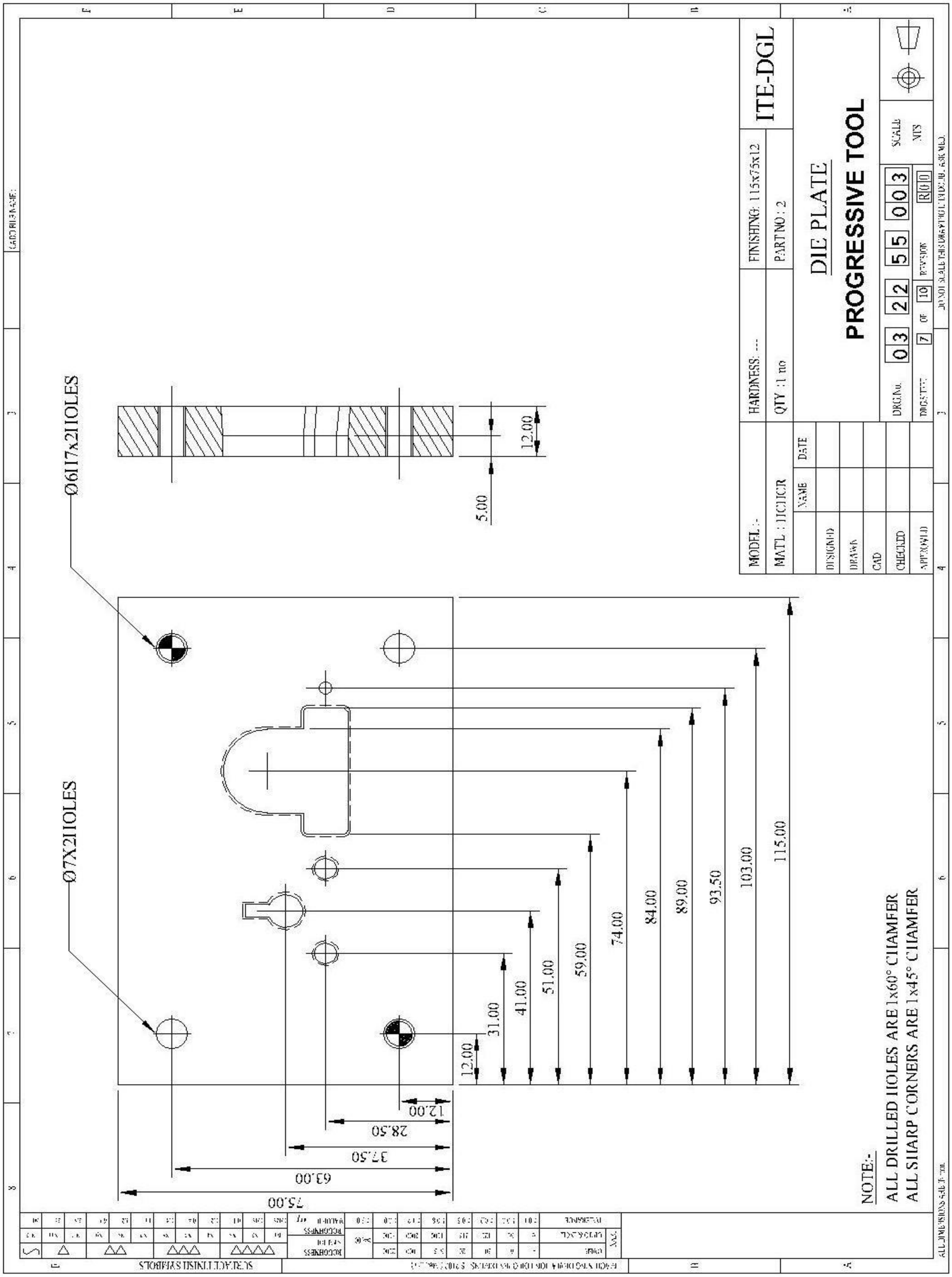

CADD FILE :
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
ROUGHNESS SYMBOL
ROUGHNESS VALUE
TOLERANCE
12
N8
N6
GUIDE BUSH
Ø20.00
Ø17.16
Ø30.00
Ø15.00
35.00
46.00
05
BLANKING PUNCH
R10.00
M6 x 2 HOLES
28.06
13.00
35.00
60.00
10.00
15.00
30.00
MODEL: -
HARDNESS: -
FINISHING: -
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
SCALE
NTS
DRG.SHEET 2 OF 10
REVISION R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .


ITE-DGL
FINISHING: 210x150x12
PART NO: 1
HARDNESS: ---
QTY: 1 no
MODEL: -
MATL: M.S
BOTTOM PLATE
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
SCALE NTS
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
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 Ⓜ A
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

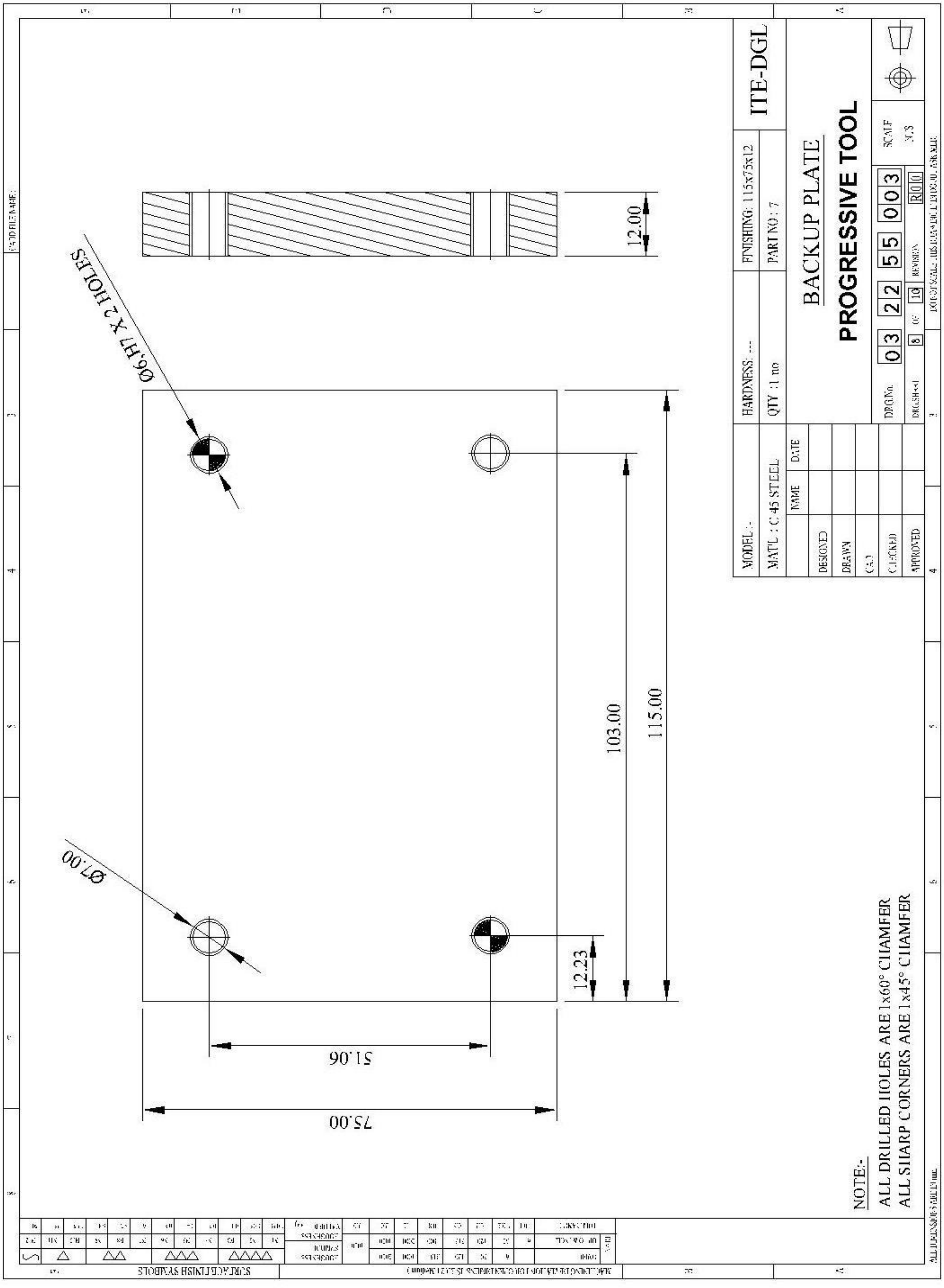

2holes,Ø15.00+0.02
0.010 M A
25.00
49.50
91.00
160.00
210.00
150.00
12.00
A
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL :-
MAT'L : M.S
HARDNESS: ---
QTY :1 no
FINISHING: 210x150x12
PART NO : 8
ITE-DGL
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
TOP PLATE
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
SCALE
NTS
4 OF 10
REVISION R00
SURFACE FINISH SYMBOLS

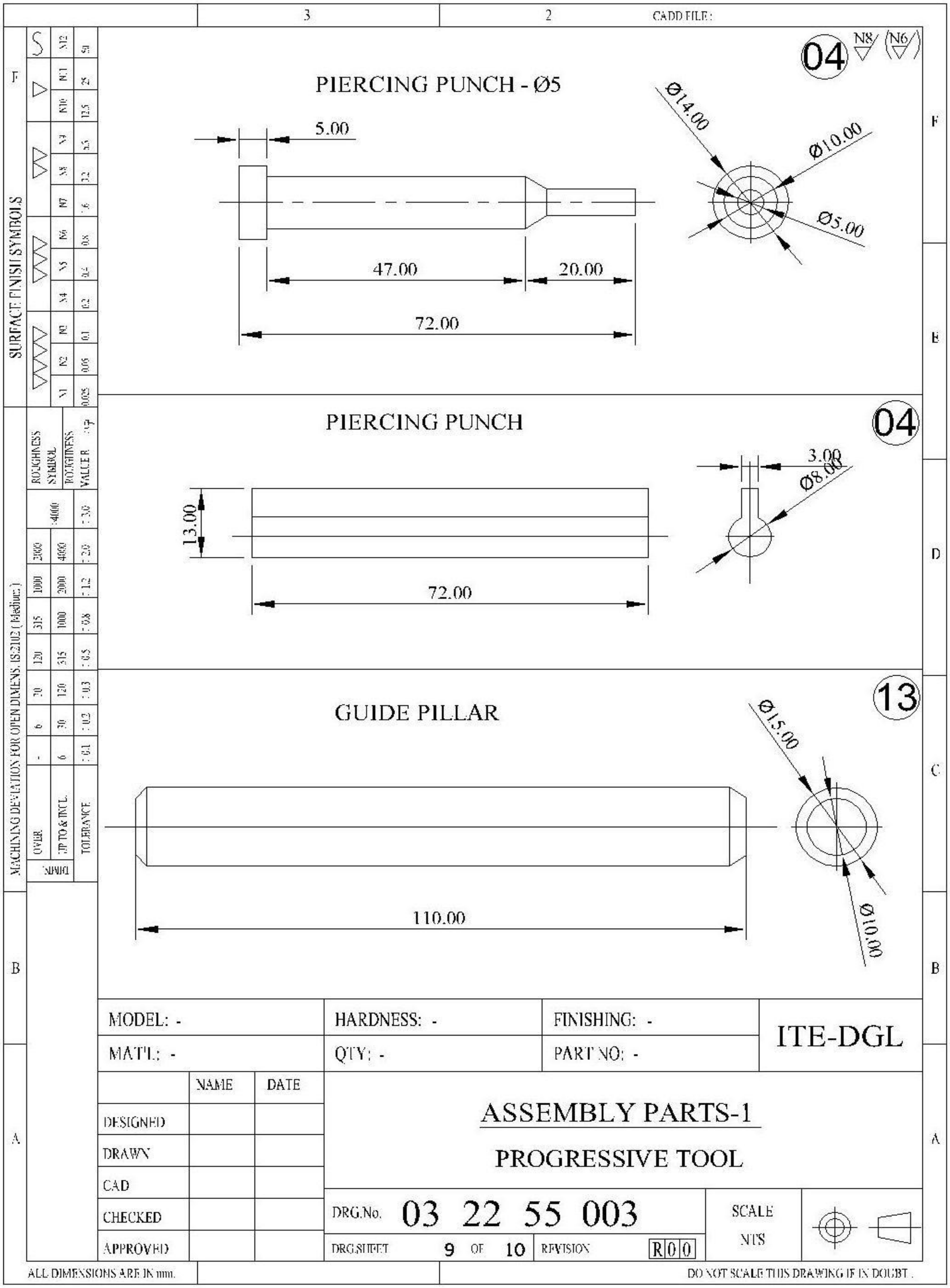

ITE-DGL
FINISHING: 115x75x12
PART NO: 6
HARDNESS: ---
QTY :1 no
MODEL :-
MAT'L : OHNS
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
PUNCH HOLDER
PROGRESSIVE TOOL
DRG.No.
03 22 55 003
SCALE
NTS
REVISION
R00
Ø6H7x2HOLES
Ø7X2HOLES
12.00
5.00
115.00
103.00
74.00
51.00
41.00
31.00
12.00
12.00
28.50
37.50
41.50
63.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

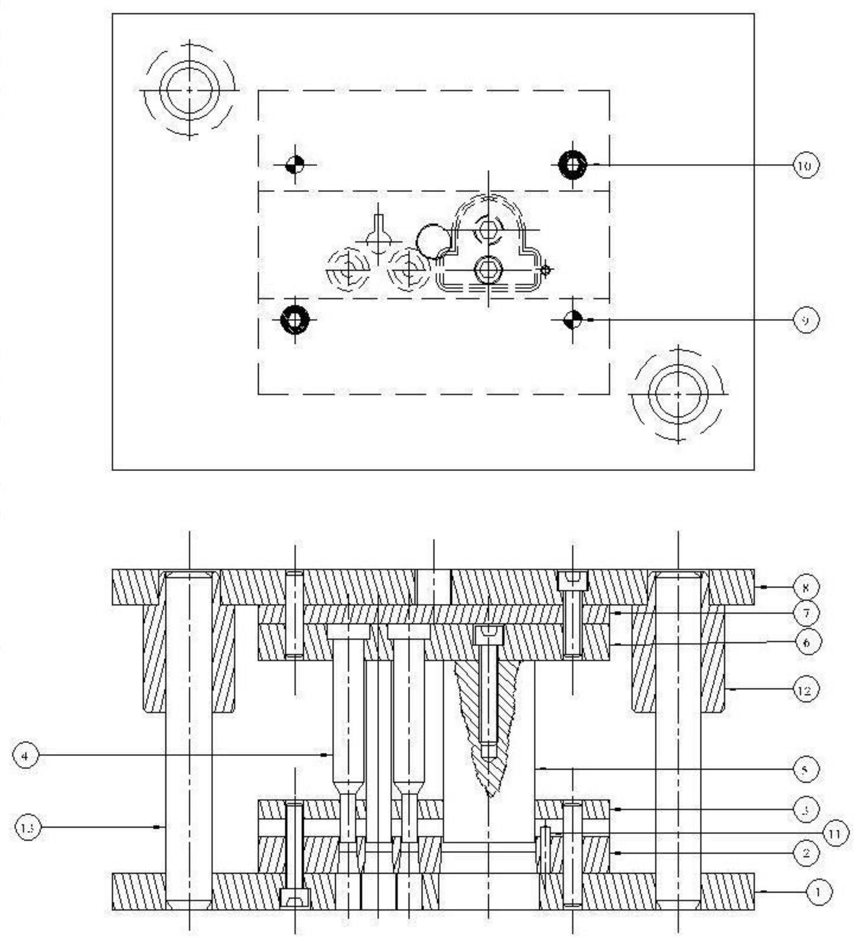

ITE-DGL
STRIPPER PLATE
PROGRESSIVE TOOL
MODEL:-
MAT'L : OHNS
HARDNESS: ---
QTY : 1 no
FINISHING: 115x75x12
PART NO : 3
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 55 003
SCALE
NTS
REVISION R00
Ø6H7X2HOLES
M6X2HOLES
34.00
12.00
5.00
12.00
31.00
41.00
51.00
59.00
74.00
84.00
89.00
103.00
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
SURFACE FINISH SYMBOLS



ITE-DGL
FINISHING: 115x75x12
PART NO : 2
HARDNESS: ---
QTY :1 no
MODEL :-
MATL : HCHCR
DIE PLATE
PROGRESSIVE TOOL
DRG.No. 03 22 55 003
SCALE NTS
Ø6H7x2HOLES
Ø7X2HOLES
12.00
5.00
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


ITE-DGL
FINISHING: 115x75x12
PART NO: 7
HARDNESS: ---
QTY :1 no
MODEL:-
MAT'L : C 45 STEEL
NAME
DATE
DESIGNED
DRAWN
CHECKED
APPROVED
BACKUP PLATE
PROGRESSIVE TOOL
DRG.No.
03 22 55 003
R00
REVISION
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


3
2
CADD FILE :
PIERCING PUNCH - Ø5
04
N8
N6
5.00
Ø14.00
Ø10.00
Ø5.00
47.00
20.00
72.00
PIERCING PUNCH
04
3.00
Ø8.00
13.00
72.00
GUIDE PILLAR
13
Ø15.00
Ø10.00
110.00
SURFACE FINISH SYMBOLS
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)
OVER
UP TO & INCL.
TOLERANCE
ROUGHNESS SYMBOL
ROUGHNESS VALUE
MODEL: -
HARDNESS: -
FINISHING: -
ITE-DGL
MAT'L: -
QTY: -
PART NO: -
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
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 | Hefer | 1 |
| 1 | BOTTOM PLATE | MILD STEEL | 1 |

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

| | NAME | DATE |
|---|---|---|
| DESIGNED | | |
| DRAWN | | |
| CAD | | |
| CHECKED | | |
| APPROVED | | |

# ASSEMBLY

## PROGRESSIVE TOOL

DRG.No. 03 22 55 003 SCALE NTS

DRG.SHEET 10 OF 10 REVISION R00

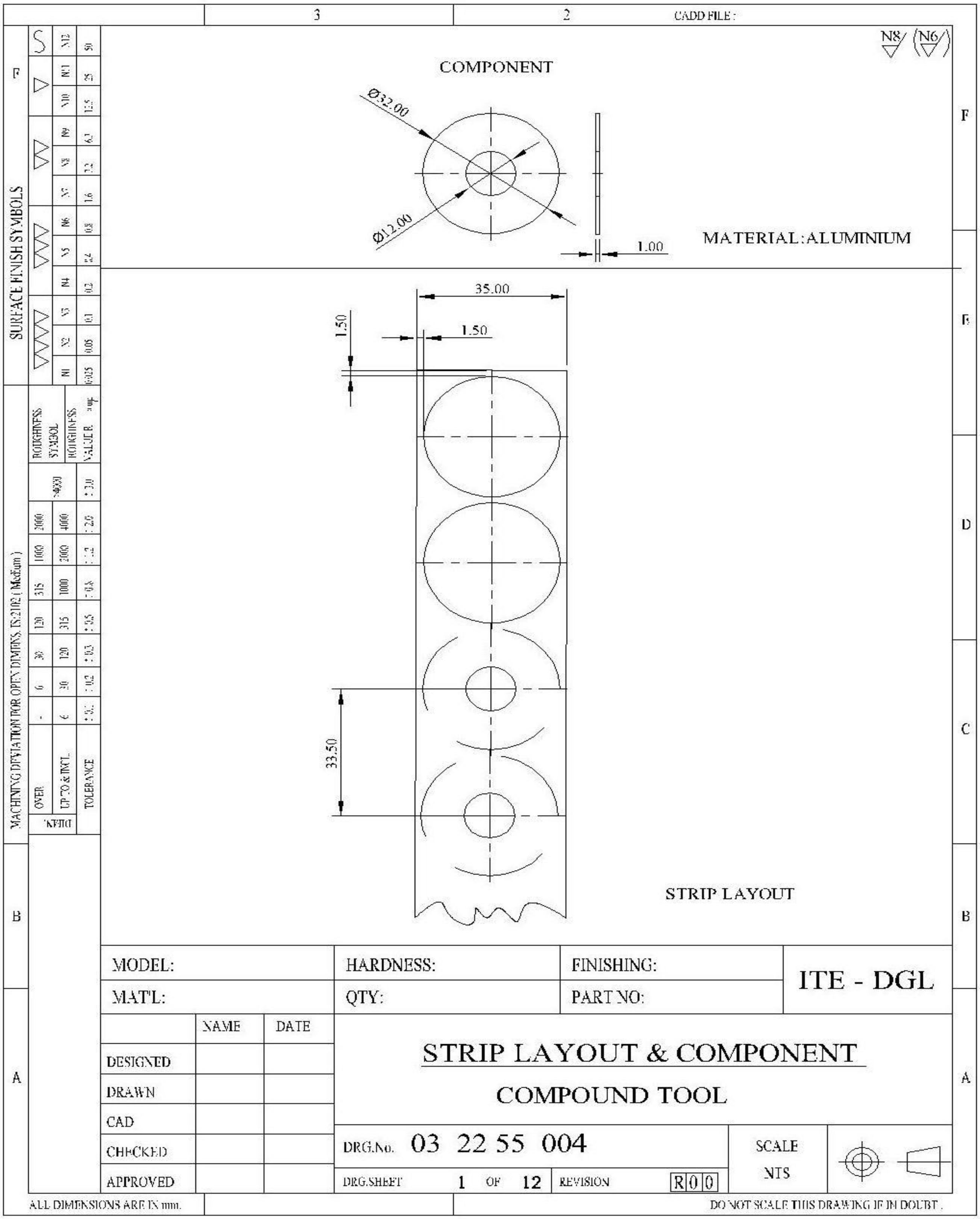
DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MFD.

CAD FILE NAME:

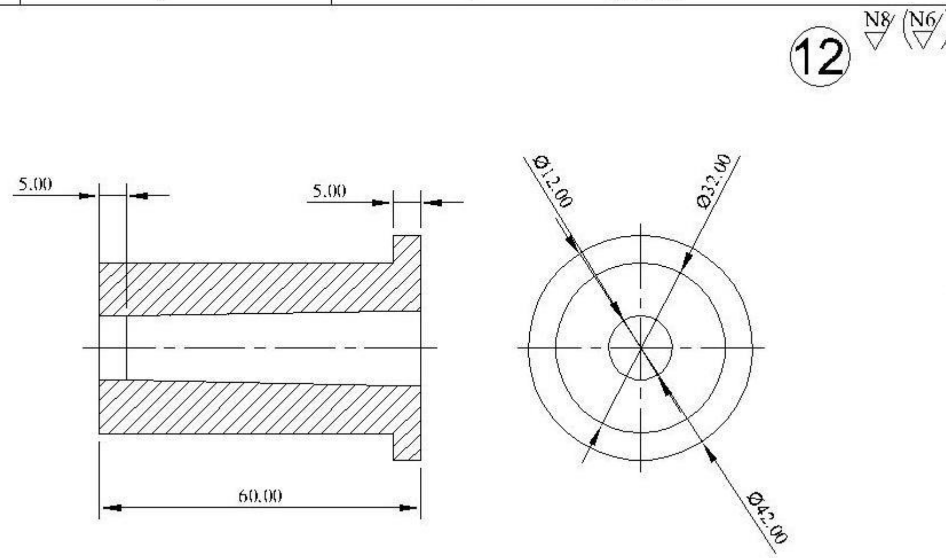
ALL DIMENSIONS ARE IN mm.

SURFACE FINISH SYMBOLS

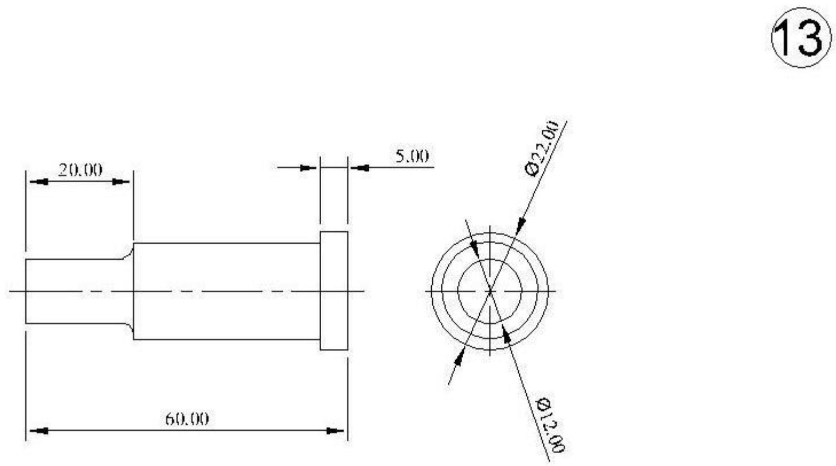
## Exercise – IV Compound Tool



| | 3 | 2 | CADD FILE : |
|---|---|---|---|




BLANKING PUNCH




PIERCING PUNCH

SURFACE FINISH SYMBOLS

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

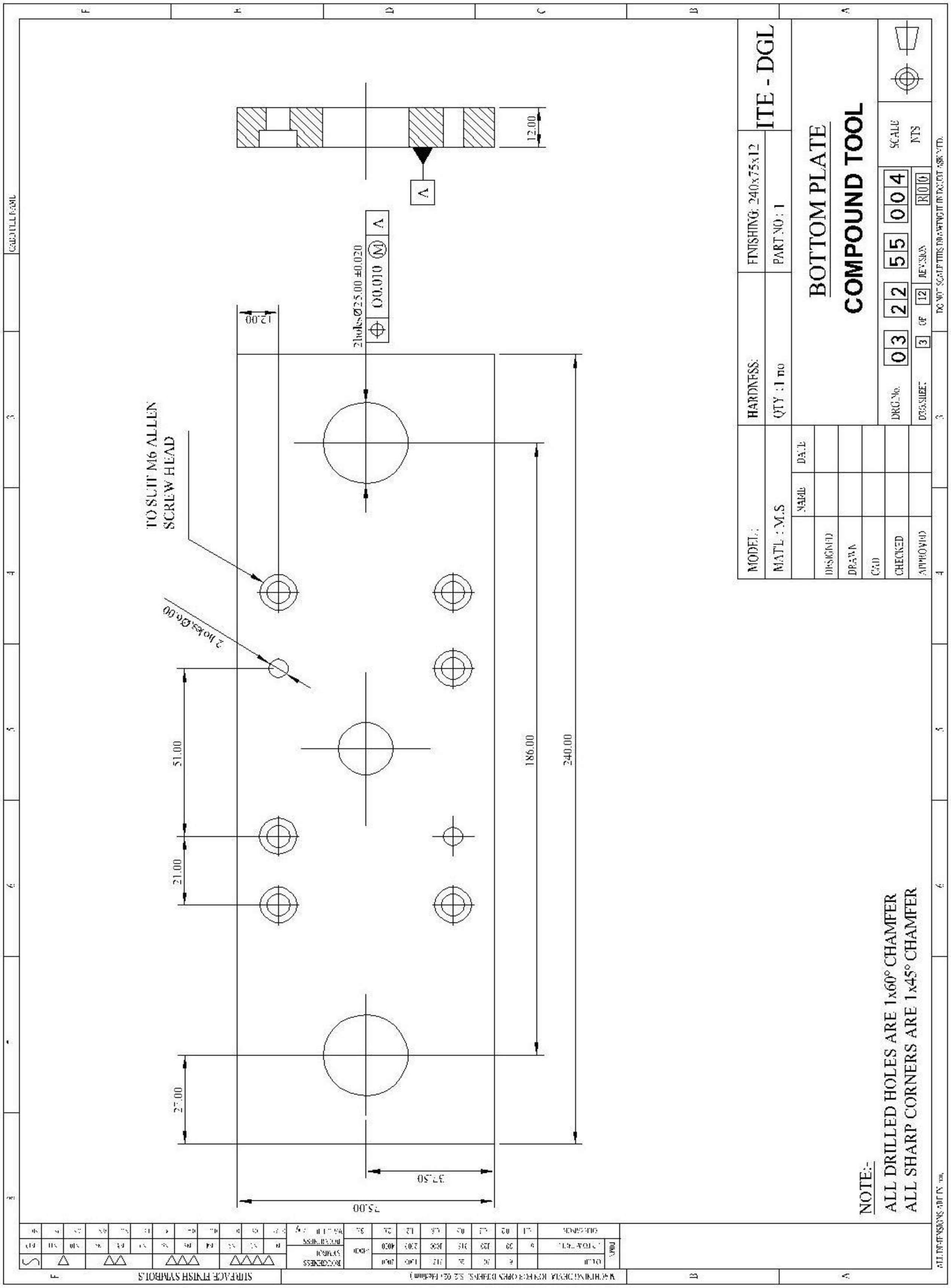
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 (Medium)

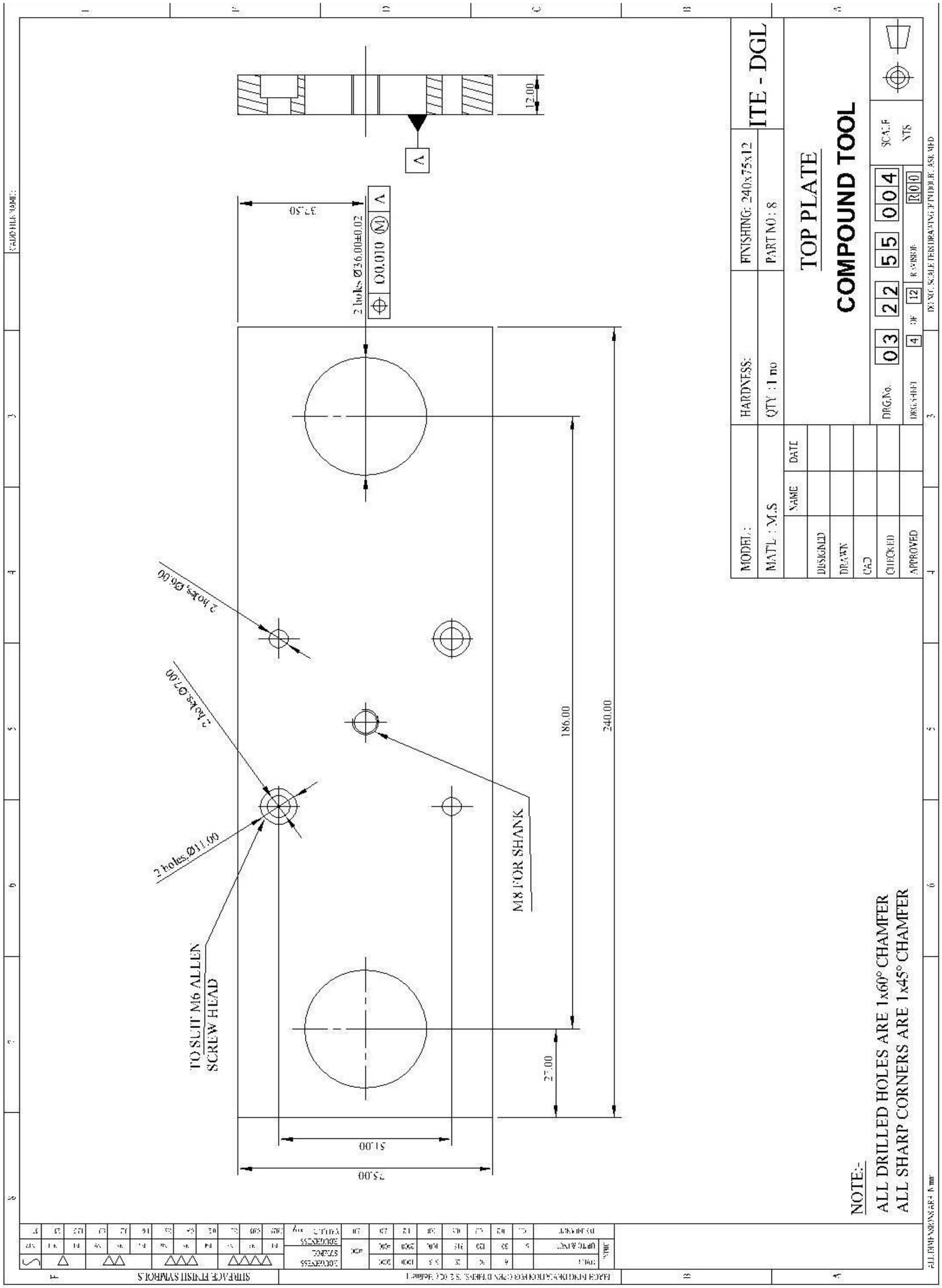
| OVER | UP TO & INCL. | TOLERANCE |
|---|---|---|
| - | 6 | ±0.1 |
| 6 | 30 | ±0.2 |
| 30 | 120 | ±0.3 |
| 120 | 315 | ±0.5 |
| 315 | 1000 | ±0.8 |
| 1000 | 2000 | ±1.2 |
| 2000 | 4000 | ±2.0 |
| >4000 | | ±3.0 |

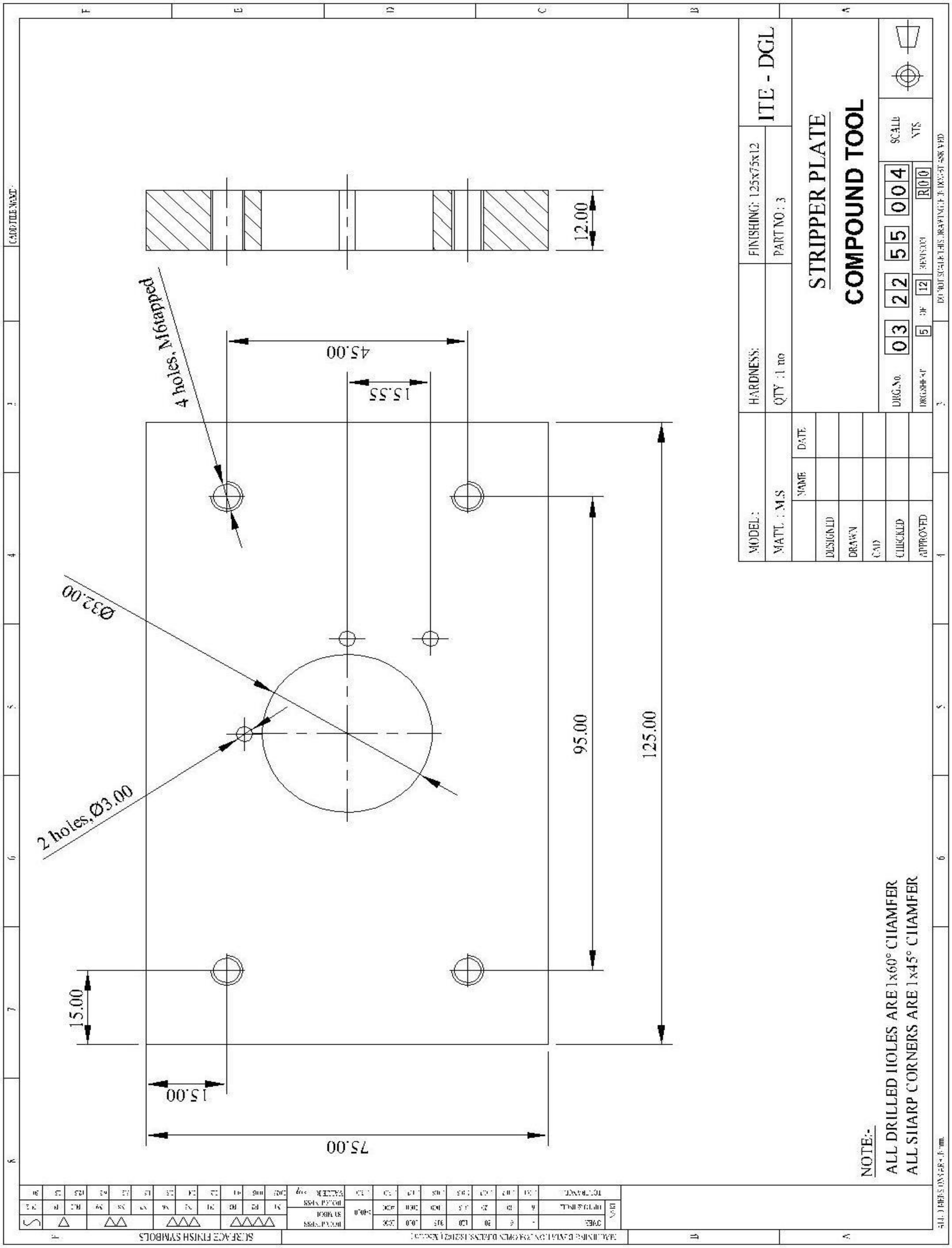
| MODEL: | HARDNESS: | FINISHING: | ITE - DGL |
|---|---|---|---|
| MAT'L: | QTY: | PART NO: | |

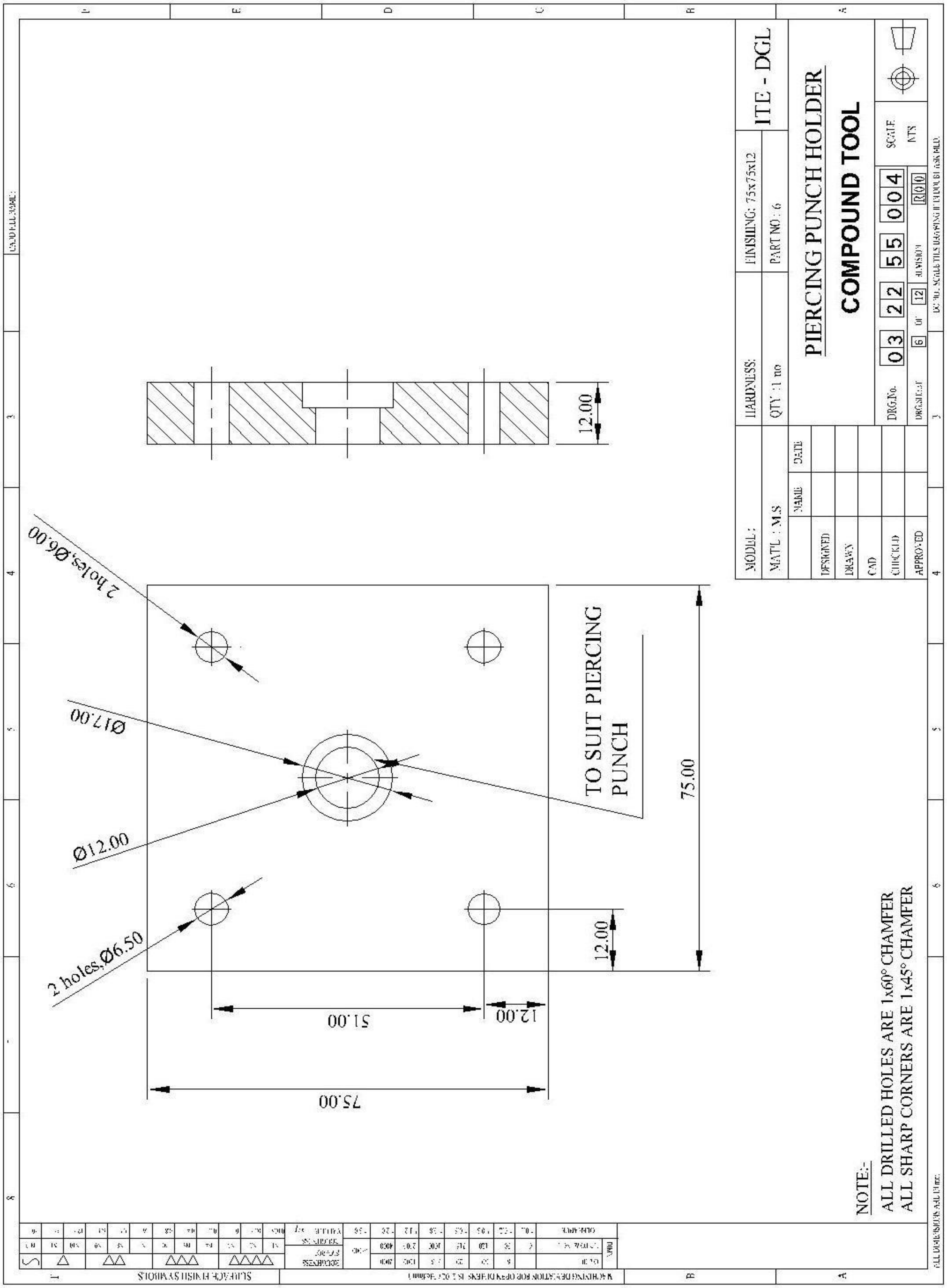
| | NAME | DATE | ASSEMBLY PARTS-2<br>COMPOUND TOOL |
|---|---|---|---|
| DESIGNED | | | |
| DRAWN | | | |
| CAD | | | DRG.No. 03 22 55 004 — SCALE NTS |
| CHECKED | | | |
| APPROVED | | | DRG.SHEET 2 OF 12 — REVISION R00 |

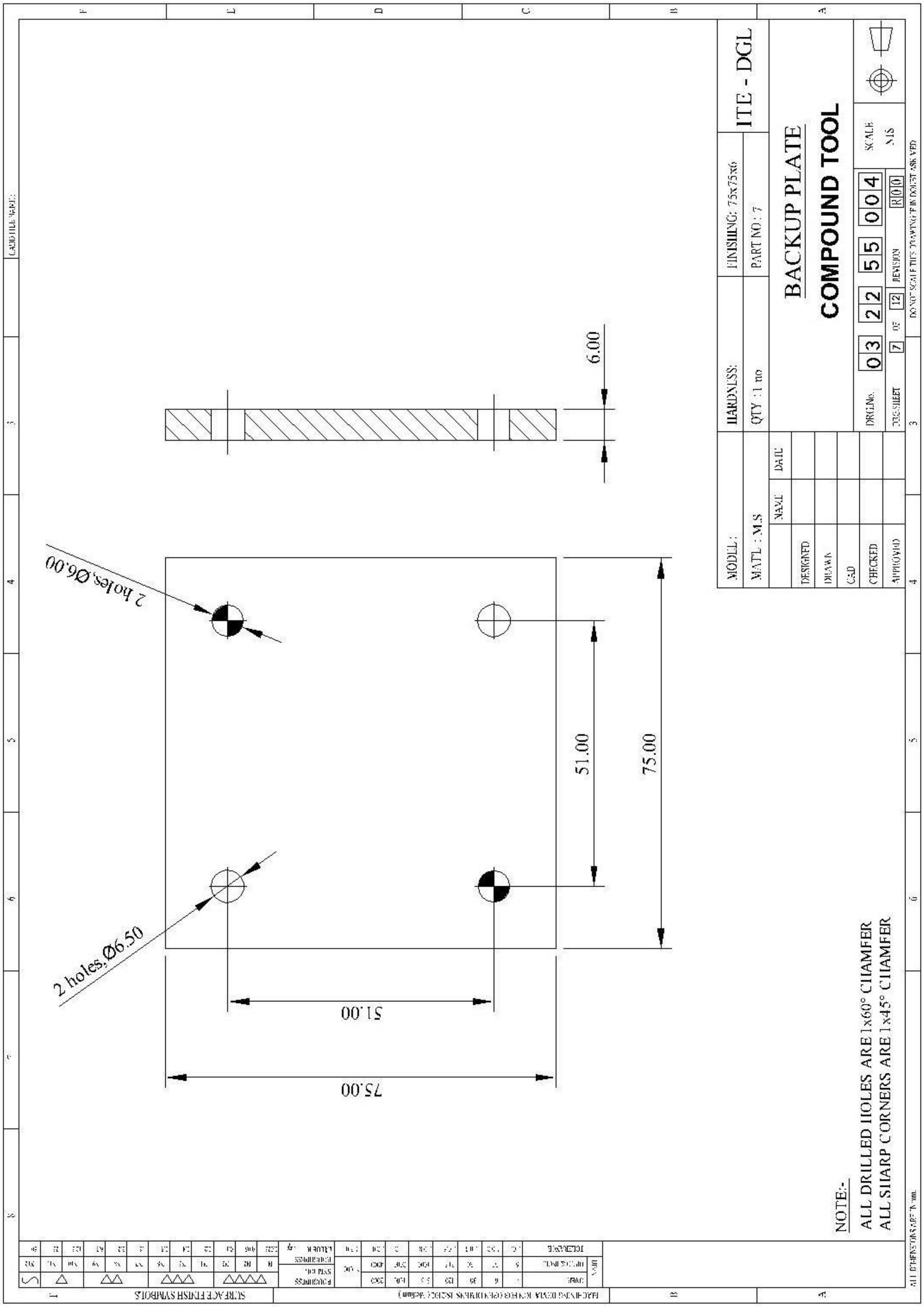
ALL DIMENSIONS ARE IN mm. — DO NOT SCALE THIS DRAWING IF IN DOUBT.

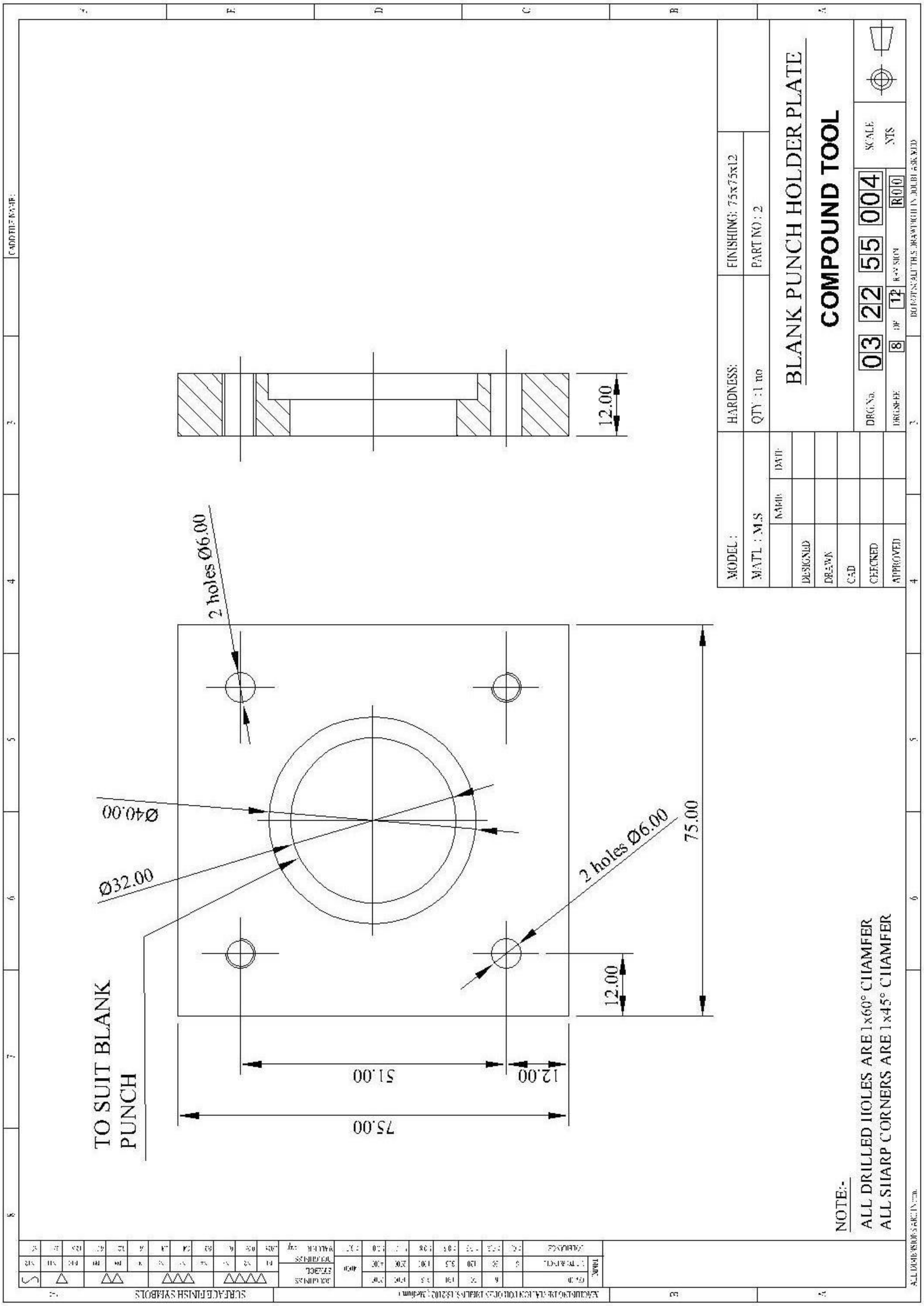

ITE - DGL
FINISHING: 240x75x12
PART NO: 1
HARDNESS:
QTY: 1 no
MODEL:
MAT'L: M.S
BOTTOM PLATE
COMPOUND TOOL
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No. 03 22 55 004
SCALE
NTS
TO SUIT M6 ALLEN SCREW HEAD
2 holes Ø6.00
2holes Ø25.00 ±0.020
Ø0.010 Ⓜ A
A
12.00
12.00
51.00
21.00
27.00
186.00
240.00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


ITE - DGL
TOP PLATE
COMPOUND TOOL
FINISHING: 240x75x12
PART NO : 8
HARDNESS:
QTY : 1 no
MODEL :
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
03 22 55 004
SCALE
NTS
R00
2 holes Ø36.00±0.02
Ø0.010 M A
37.50
12.00
A
2 holes, Ø6.00
2 holes, Ø7.00
2 holes, Ø11.00
M8 FOR SHANK
TO SUIT M6 ALLEN SCREW HEAD
186.00
240.00
27.00
51.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

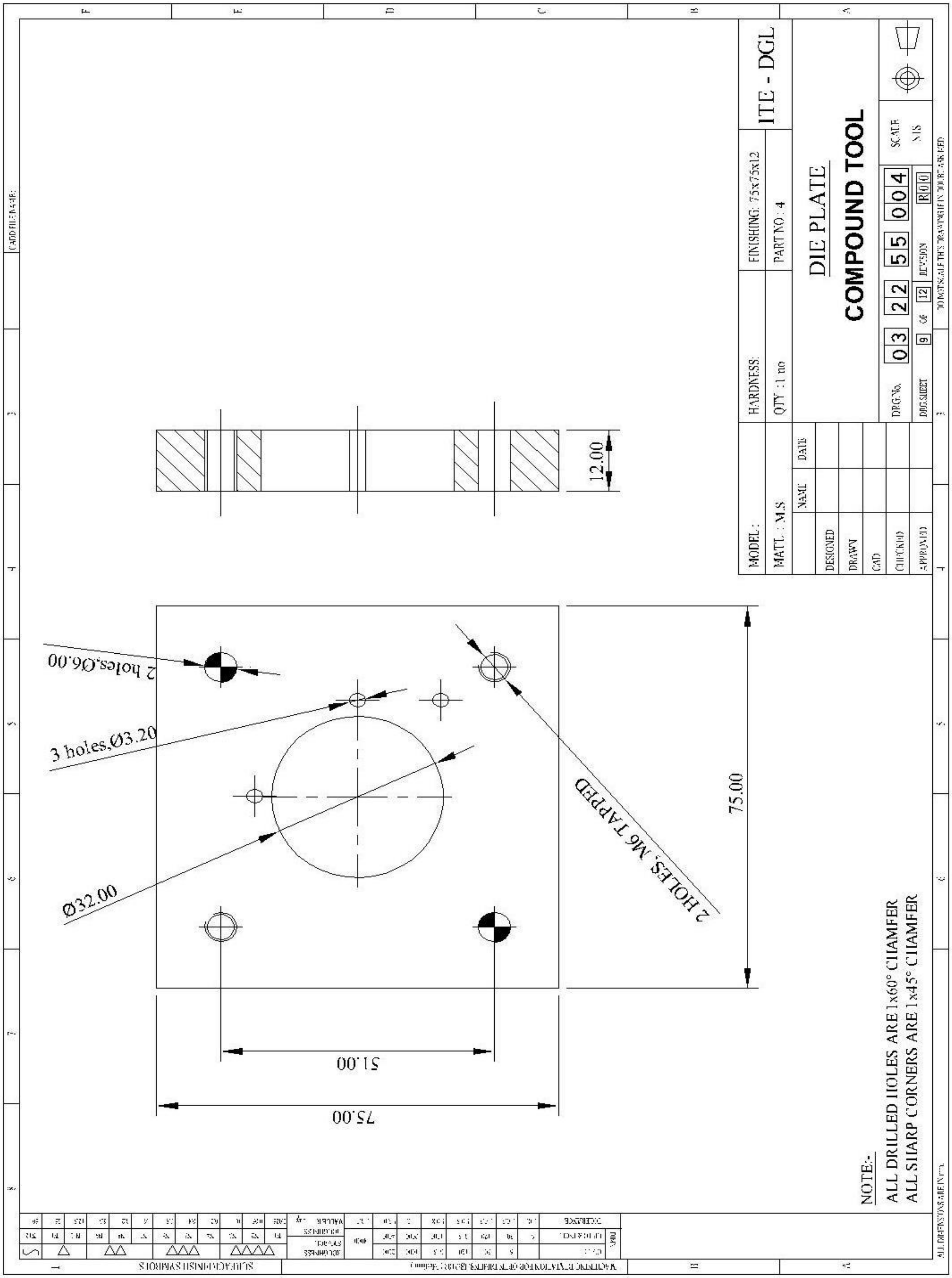

ITE - DGL
FINISHING: 125x75x12
PART NO : 3
HARDNESS:
QTY : 1 no
STRIPPER PLATE
COMPOUND TOOL
MODEL:
MAT'L : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 55 004
SCALE
NTS
4 holes, M6tapped
45.00
15.55
12.00
Ø32.00
2 holes, Ø3.00
95.00
125.00
15.00
15.00
75.00
NOTE:-
ALL DRILLED HOLES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

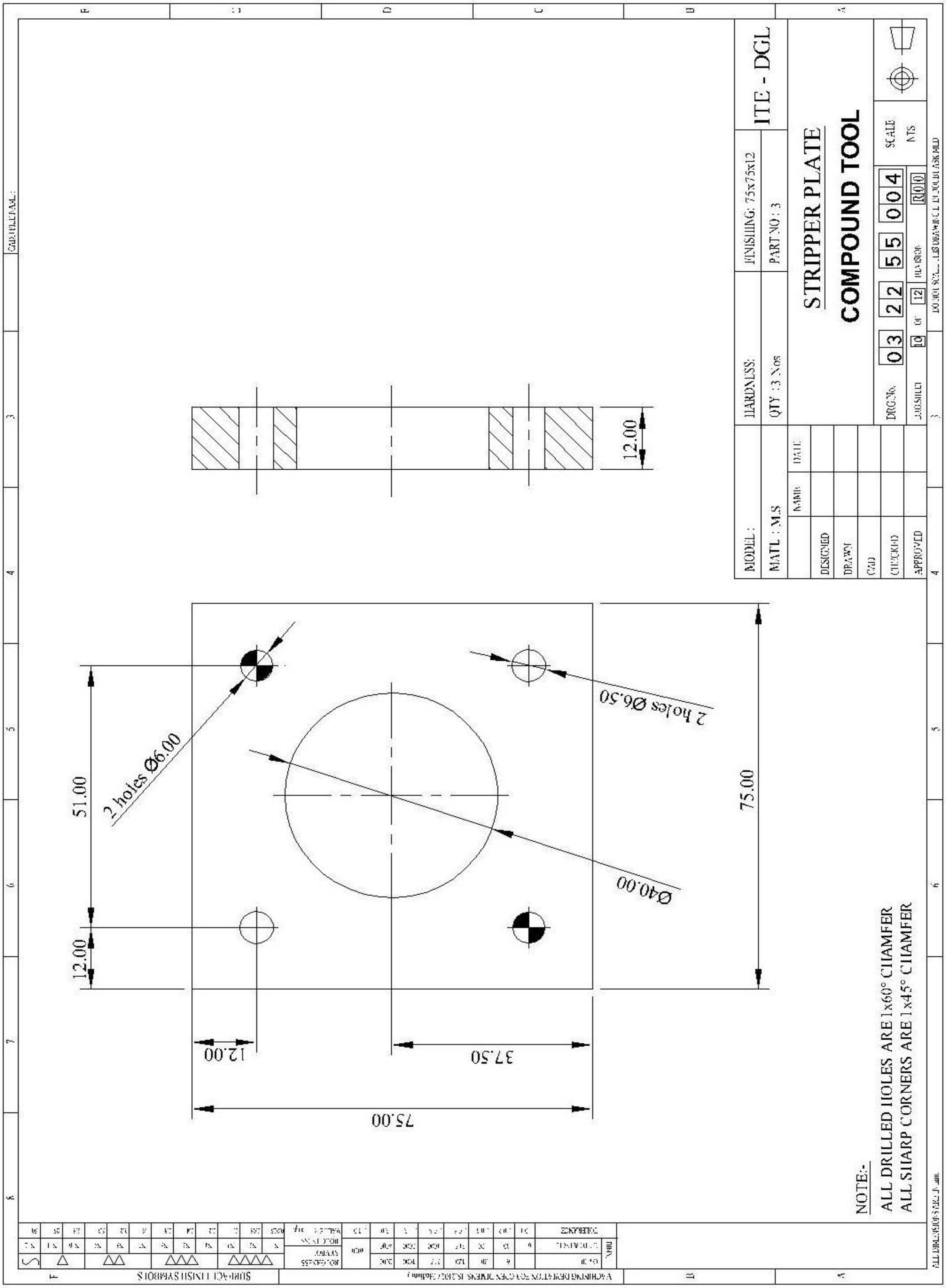

ITE - DGL
PIERCING PUNCH HOLDER
COMPOUND TOOL
HARDNESS:
FINISHING: 75x75x12
QTY: 1 no
PART NO: 6
MODEL:
MAT'L: M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No.
03 22 55 004
SCALE
NTS
12.00
2 holes,Ø6.00
Ø17.00
Ø12.00
TO SUIT PIERCING PUNCH
75.00
2 holes,Ø6.50
12.00
51.00
12.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS


ITE - DGL
BACKUP PLATE
COMPOUND TOOL
FINISHING: 75x75x6
PART NO: 7
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG.No. 03 22 55 004
7 OF 12
REVISION R00
SCALE N.T.S
2 holes,Ø6.00
2 holes,Ø6.50
6.00
51.00
75.00
51.00
75.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS

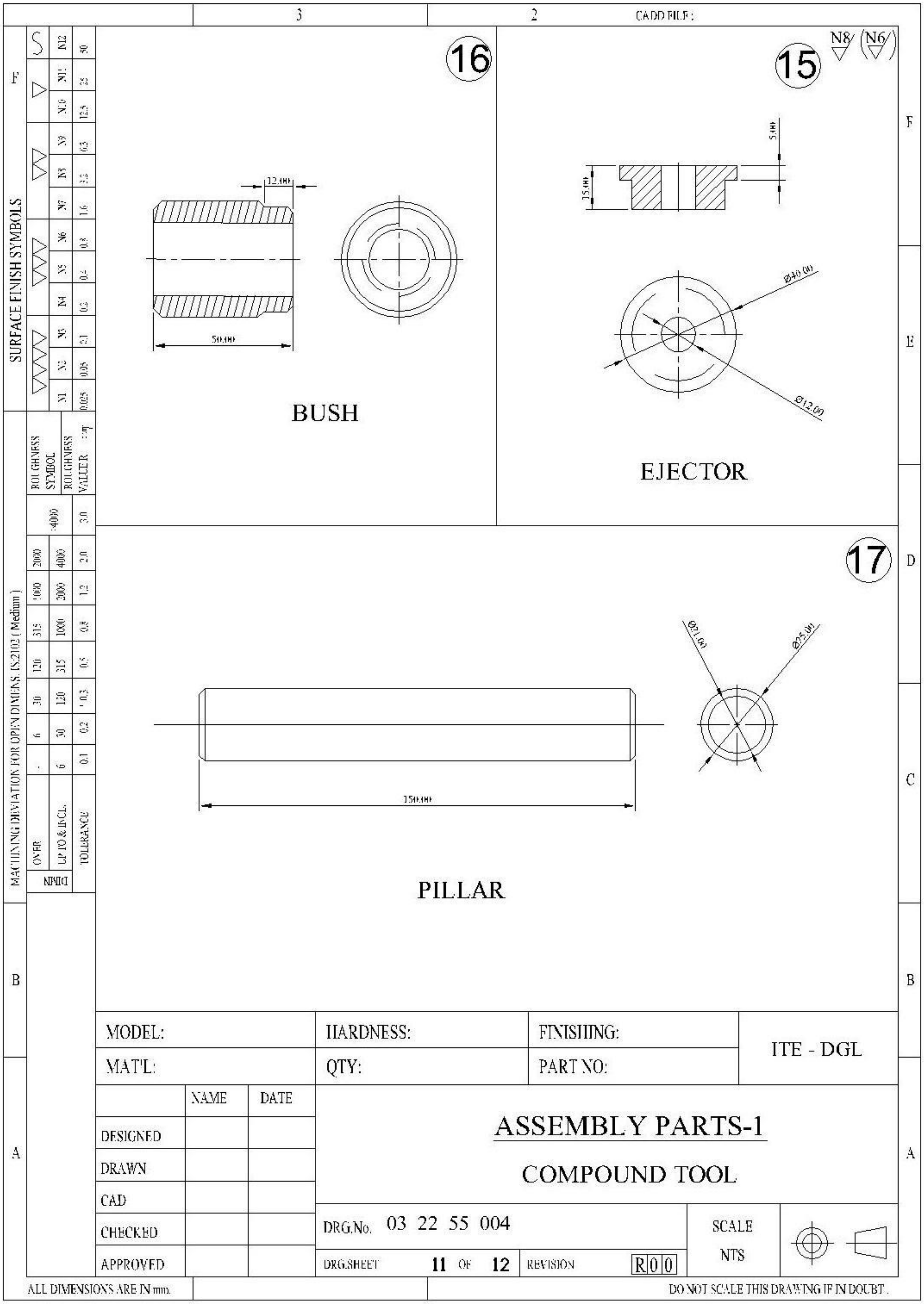


TO SUIT BLANK PUNCH
Ø40.00
Ø32.00
2 holes Ø6.00
2 holes Ø6.00
75.00
51.00
12.00
75.00
12.00
12.00
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
MODEL :
MATL : M.S
HARDNESS:
QTY : 1 no
FINISHING: 75x75x12
PART NO : 2
BLANK PUNCH HOLDER PLATE
COMPOUND TOOL
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No. 03 22 55 004
8 OF 12
R0|0
SCALE
NTS
SURFACE FINISH SYMBOLS

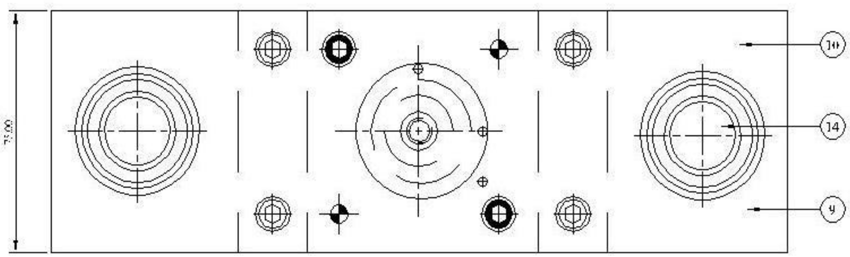

ITE - DGL
FINISHING: 75x75x12
PART NO : 4
HARDNESS:
QTY : 1 no
MODEL :
MATL : M.S
DIE PLATE
COMPOUND TOOL
DRG No. 03 22 55 004
DRG SHEET 9 OF 12
REVISION R00
SCALE N/S
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
12.00
2 holes,Ø6.00
3 holes,Ø3.20
Ø32.00
2 HOLES, M6 TAPPED
75.00
51.00
75.00
NOTE:-
ALL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



ITE - DGL
STRIPPER PLATE
COMPOUND TOOL
MODEL :
MATL : M.S
HARDNESS:
QTY :3 Nos
FINISHING: 75x75x12
PART NO : 3
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
0 3 2 2 5 5 0 0 4
SCALE
NTS
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
SURFACE FINISH SYMBOLS


16
BUSH
12.00
50.00
15
N8 (N6)
EJECTOR
5.00
25.00
Ø40.00
Ø12.00
17
PILLAR
Ø21.00
Ø25.00
150.00
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE
MACHINING DEVIATION FOR OPEN DIMENS. IS:2102 ( Medium )
DIMEN
OVER
UP TO & INCL.
TOLERANCE
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
DRG.SHEET 11 OF 12
REVISION R00
SCALE
NTS
CADD FILE :
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT .

PLAN




NOTE

1. ALL DIMENSIONS ARE IN mm

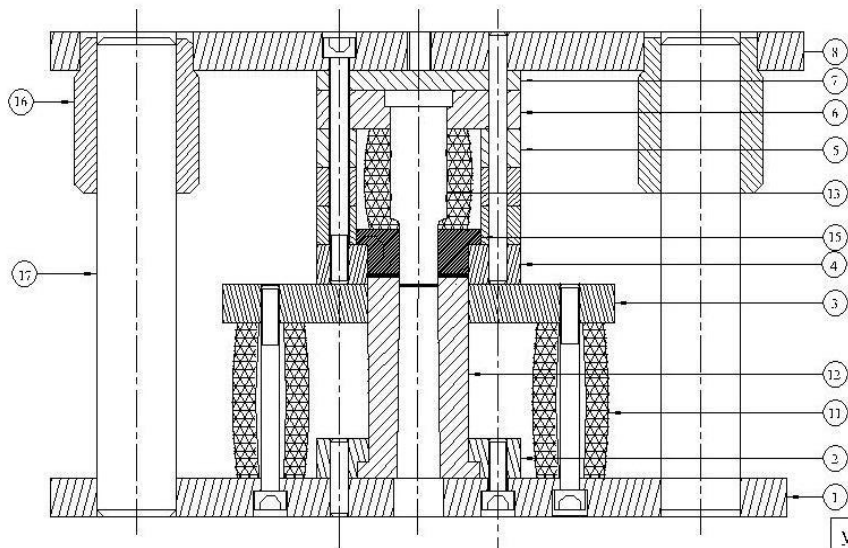
2. PROVIDE PUNCH DIE CLEARENCE PERSIDE AS 0.001

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




SECTIONAL ELEVATION

BILL OF MATERIALS

| SL.NO | NAME | MATERIAL | QUANTITY |
|---|---|---|---|
| 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 |

| | | | | | |
|---|---|---|---|---|---|
| MODEL : | | | HARDNESS: | FINISHING: | ITE - DGL |
| MATL : | | | QTY : | PART NO : | |
| | NAME | DATE | ASSEMBLY | | |
| DESIGNED | | | COMPOUND TOOL | | |
| DRAWN | | | | | |
| CAD | | | | | |
| CHECKED | | | DRG.No. 03 22 55 004 | SCALE NTS | |
| APPROVED | | | DRG.SHEET 12 OF 12 REVISION R00 | | |

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT ASK HED

## Details of The Equipment's (for a batch of 30 students)

| | |
|---|---|
| **NAME OF THE BRANCH / COURSE** | MECHANICAL ENGINEERING (TOOL & DIE) |
| **YEAR** | THIRD |
| **SEMESTER** | V |
| **NAME OF THE LABORATORY** | 4022560 PRESS TOOLS PRACTICAL |

| **S.N** | **LIST OF THE EQUIPMENTS 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 |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

**N – SCHEME**

**V SEMESTER**

**2020 – 2021 onwards**

# 4020570–ENTREPRENEURSHIP AND START UP

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N-SCHEME**

**(Implemented from the Academic year 2020-2021 onwards)**

Course Name : 1220: Diploma in Mechanical Engineering (TOOL & DIE)

Subject Code : 4020570

Semester : V

Subject Title : **ENTREPRENEURSHIP & STARTUP**

## TEACHING AND SCHEME OF EXAMINATION

No. of Weeks per Semester: 16 Weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| ENTREPRENEURSHIP & STARTUP | 4 | 64 | 25 | 100* | 100 | 3 Hrs. |

*Examinations will be conducted for 100 marks and it will be reduced for 75 marks for result

**<u>Topics and Allocation of Hours</u>**

| UNIT | Topic | Hours |
|---|---|---|
| 1 | Entrepreneurship – Introduction and Process | 10 |
| 2 | Business Idea and Banking | 10 |
| 3 | Start ups, E-cell and Success Stories | 10 |
| 4 | Pricing and Cost Analysis | 10 |
| 5 | Business Plan Preparation | 10 |
| Revision, Field visit and Preparation of case study report | | 14 |
| Total | | 64 |

**RATIONALE:**

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspiration 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 promoting concern for excellence. In this context the course on entrepreneurship and start ups 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 ensure good means of living for every individual, provides jobs and develop Indian economy.

**OBJECTIVES:**

At the end of the study of 5th semester the students will be able to

- To excite the students about entrepreneurship
- Acquiring Entrepreneurial spirit and resourcefulness
- Understanding the concept and process of entrepreneurship
- Acquiring entrepreneurial quality, competency and motivation
- Learning the process and skills of creation and management of entrepreneurial venture
- Familiarization with various uses of human resource for earning dignified means of living
- Know its contribution in and role in the growth and development of individual and the nation
- Understand the formation of E-cell
- Survey and analyze the market to understand customer needs
- Understand the importance of generation of ideas and product selection
- Learn the preparation of project feasibility report
- Understand the importance of sales and turnover
- Familiarization of various financial and non financial schemes
- Aware the concept of incubation and starts ups

## DETAILED SYLLABUS

| Unit | Name of the Topics | Hours |
|---|---|---|
| 1 | **ENTREPRENEURSHIP – INTRODUCTION AND PROCESS**<br>• Concept, Functions and Importance<br>• Myths about Entrepreneurship<br>• Pros and Cons of Entrepreneurship<br>• Process of Entrepreneurship<br>• Benefits of Entrepreneur<br>• Competencies and Characteristics<br>• Ethical Entrepreneurship<br>• Entrepreneurial Values and Attitudes<br>• Motivation<br>• Creativity<br>• Innovation<br>• Entrepreneurs - as problem solvers<br>• Mindset of an employee and an entrepreneur<br>• Business Failure – causes and remedies<br>• Role of Networking in entrepreneurship | **10** |
| 2 | **BUSINESS IDEA AND BANKING**<br>• Types of Business: Manufacturing, Trading and Services<br>• Stakeholders: Sellers, Vendors and Consumers<br>• E- Commerce Business Models<br>• Types of Resources - Human, Capital and Entrepreneurial tools<br>• Goals of Business and Goal Setting<br>• Patent, copyright and Intellectual Property Rights<br>• Negotiations - Importance and methods<br>• Customer Relations and Vendor Management<br>• Size and Capital based classification of business enterprises<br>• Role of Financial Institutions | **10** |

| | | |
|---|---|---|
| | • Role of Government policy<br>• Entrepreneurial support systems<br>• Incentive schemes for State Government<br>• Incentive schemes for Central Government | |
| **3** | **STARTUPS, E-CELL AND SUCCESS STORIES**<br><br>• Concept of Incubation centre's<br>• Activities of DIC, financial institutions and other relevance institutions<br>• Success stories of Indian and global business legends<br>• Field Visit to MSME's<br>• Various sources of Information<br>• Learn to earn<br>• Startup and its stages<br>• Role of Technology – E-commerce and Social Media<br>• Role of E-Cell<br>• E-Cell to Entrepreneurship | **10** |
| **4** | **PRICING AND COST ANALYSIS**<br><br>• Calculation of Unit of Sale, Unit Price and Unit Cost<br>• Types of Costs - Variable and Fixed, Operational Costs<br>• Break Even Analysis<br>• Understand the meaning and concept of the term Cash Inflow and Cash Outflow<br>• Prepare a Cash Flow Projection<br>• Pricing and Factors affecting pricing<br>• Understand the importance and preparation of Income Statement<br>• Launch Strategies after pricing and proof of concept<br>• Branding - Business name, logo, tag line<br>• Promotion strategy | **10** |

| | | |
|---|---|---|
| **5** | **BUSINESS PLAN PREPARATION**<br><br>• Generation of Ideas,<br>• Business Ideas vs. Business Opportunities<br>• Selecting the Right Opportunity<br>• Product selection<br>• New product development and analysis<br>• Feasibility Study Report – Technical analysis, financial analysis and commercial analysis<br>• Market Research - Concept, Importance and Process<br>• Marketing and Sales strategy<br>• Digital marketing<br>• Social Entrepreneurship<br>• Risk Taking-Concept<br>• Types of business risks | **10** |

**REFERNCE BOOKS:**


1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications, Agra - 282002
2. Dr. G.K. Varshney, Business Regulatory Framework , Sahitya Bhawan Publications, Agra - 282002
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship , McGraw Hill (India) Private Limited, Noida - 201301
4. M.Scarborough, R.Cornwell, Essentials of Entrepreneurship and small business management, Pearson Education India, Noida - 201301
5. Charantimath Poornima M. Entrepreneurship Development and Small Business Enterprises, Pearson Education, Noida - 201301
6. Trott, Innovation Management and New Product Development, Pearson Education, Noida - 201301
7. M N Arora, A Textbook of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd., New Delhi-110044
8. Prasanna Chandra, Financial Management, Tata McGraw Hill education private

limited, New Delhi

9. I. V. Trivedi, Renu Jatana, Indian Banking System, RBSA Publishers, Rajasthan
10. Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai - 600018
11. Ramani Sarada, The Business Plan Write-Up Simplified - A practitioners guide to writing the Business Plan, Notion Press Media Pvt. Ltd., Chennai 600095.

**Board Examination – Evaluation Pattern**

**Internal Mark Allocation**

| | | |
|---|---|---|
| Assignment (Theory portion)* | - | 10 |
| Seminar Presentation | - | 10 |
| Attendance | - | 5 |
| **Total** | **-** | **25** |

**Note: * Two assignments should be submitted. The same must be evaluated and converted to 10 marks.**

**Guidelines for assignment:**

First assignment – Unit I

Second assignment – Unit II

Guidelines for Seminar Presentation - Unit III

Each assignment should have five three marks questions and two five marks questions.

## BOARD EXAMINATION

**Note**

1. The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations.
2. The students should maintain theory assignment and seminar presentation. The assignment and seminar presentation should be submitted during the Board Practical Examinations.
3. The question paper consists of theory and practical portions. All students

should write the answers for theory questions (45 Marks) and practical portions (55 Marks) should be completed for board examinations.

4. All exercises should be given in the question paper and students are allowed to select by lot. If required the dimensions of the exercises may be varied for every batch. No fixed time allotted for each portion and students have liberty to do the examination for 3Hrs.
5. For Written Examination: theory question and answer: 45 Marks
   Ten questions will be asked for 3 marks each. Five questions from each unit 1 & 2. (10 X 3 = 30).
   Three questions will be asked for 5 marks each. One question from each unit 1, 2 & 3. (3 X 5 = 15)
6. For Practical Examination: The business plan/Feasibility report or Report on Unit 4 & 5 should be submitted during the board practical examinations. The same have to be evaluated for the report submission (40 marks).

## DETAILED ALLOCATION OF MARKS

| Sl. No | Description | Marks |
|---|---|---|
| Part A | Written Examination - Theory Question and answer<br>10 questions x 3 marks = 30 marks<br>3 questions x 5 marks = 15 marks | 45 |
| Part B | Practical Examination – Submission on Business Plan/Feasibility Report or Report on Unit 4 & 5 | 40 |
| Part C | Viva voce | 15 |
| | Total | 100 |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### VI SEMESTER

### 2020 – 2021 onwards

# 4022610 – TOOL DESIGN AND DRAWING

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

Course Name : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4022610

Semester : VI

Subject Title : **TOOL DESIGN AND DRAWING**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester**:** 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| TOOL DESIGN AND DRAWING | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Time allocation**

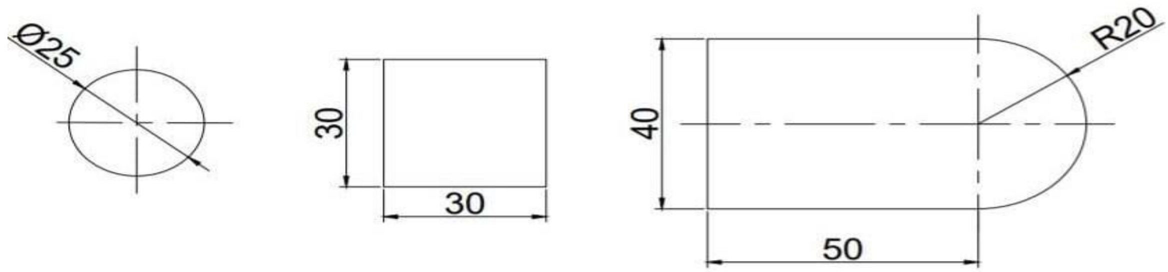
| TOPIC | TIME (Hrs) |
|---|---|
| I. Design of Press Tools | 40 |
| II. Design of Jigs and Fixtures | 20 |
| III. Design of Gauges | 13 |
| TEST & MODEL EXAMINATIONS | 10 |
| **TOTAL** | 80 |

# DETAILED SYLLABUS

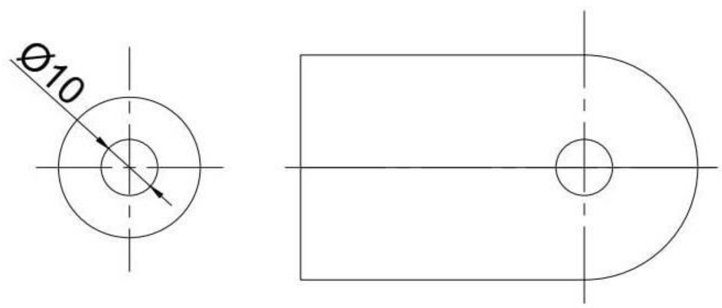
**Contents: Theory**

| Name of the Topic | Hours |
|---|---|
| **I. DESIGN OF PRESS TOOLS:**<br>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** |
| **II. DESIGN OF JIGS AND FIXTURES:**<br>Design of Plate jig (turn over type) - Indexing jig - Milling fixture - Grinding fixture. | **20** |
| **III. GAUGE DESIGN**<br>1. Design of Plain plug gauge as per IS 3455, IS 6137, IS 6244, IS 6246 and IS 7018 : Part 2<br>2. Design of snap gauge as per IS 3477<br>3. Design of plain ring gauges as per IS 3485 | **13** |
| **TEST & MODEL EXAMINATIONS** | **07** |
| **Total** | **80** |

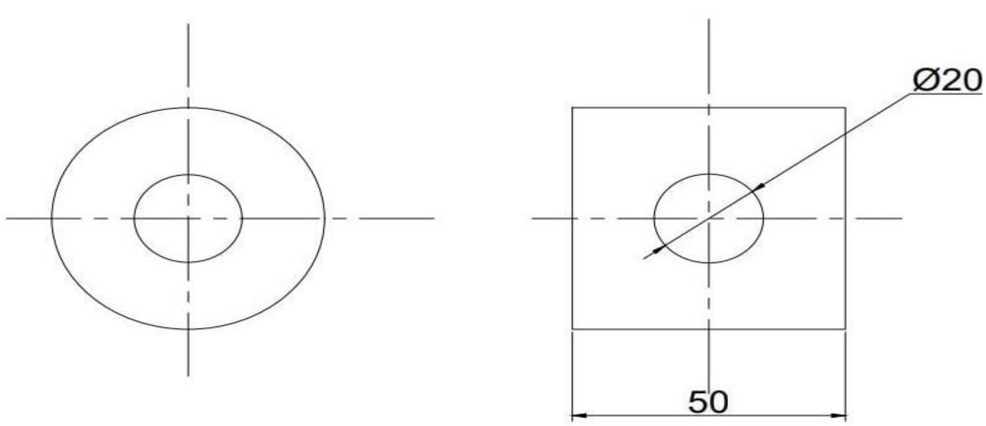
**Design of Blanking Tool:**



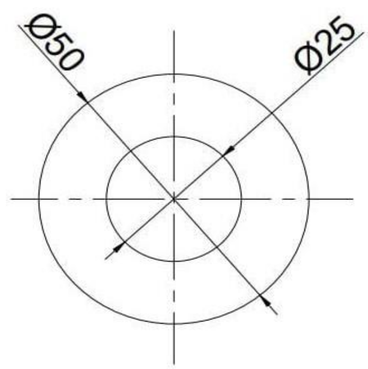

**Design of piercing Tool**



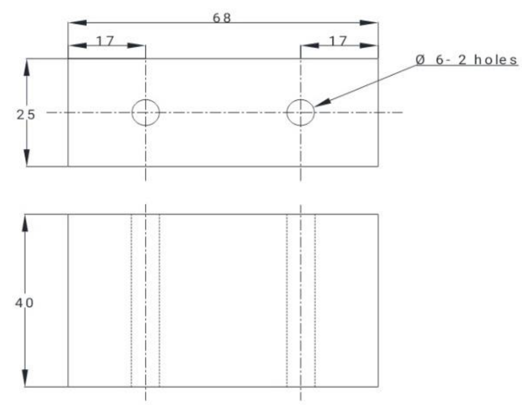

**Design of Progressive Tool**



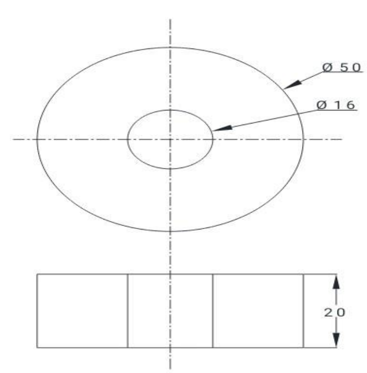
## Design of Compound Tool



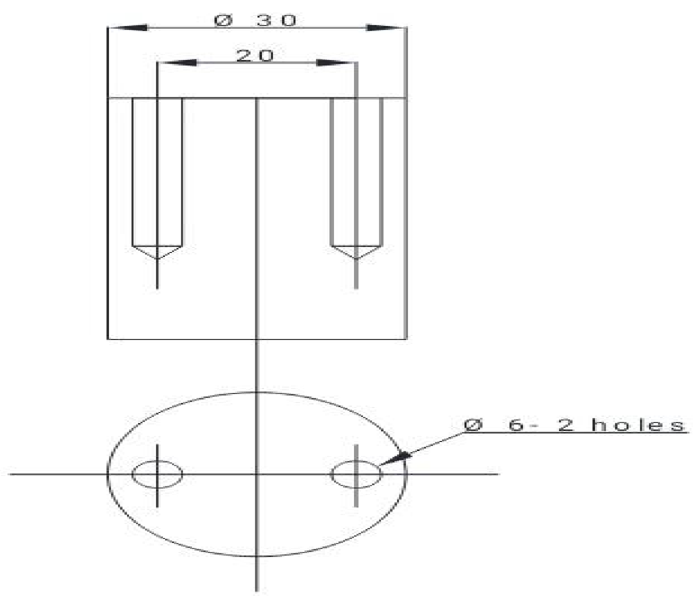

## Channel Drill Jig



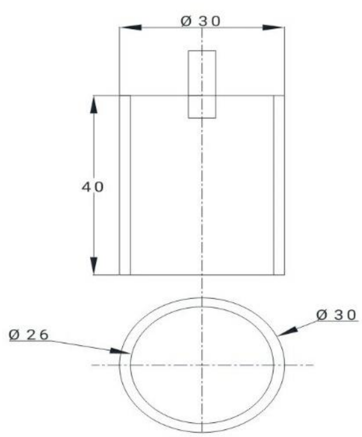

## Inspection Fixture



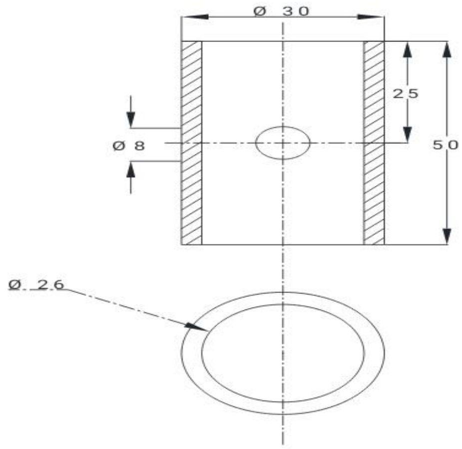
## Template Drill Jig



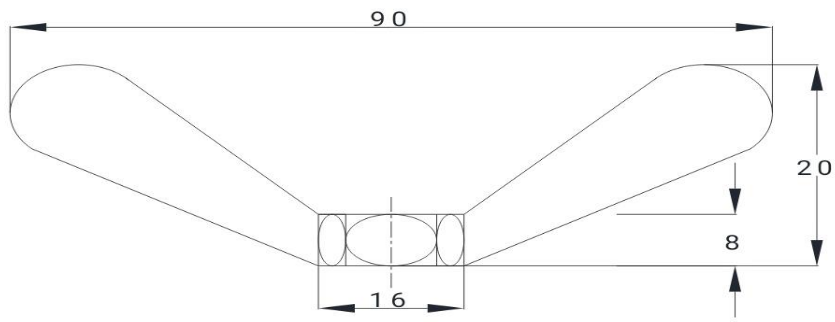

## Milling Fixture



**Indexing Drill Jig**




**Welding Fixture**




**References:-**

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.**

**INSTRUCTIONS FOR QUESTION PAPER SETTING:**

1. **Part A** is Tool Design and drawing Question for 50 marks. Either or Type question is to be asked. **One question from UNIT I and one question from Unit II**. The question asked should be such that it could be answered in **135 minutes** time. Please avoid components of very complicated profiles which consumes more time.
2. **Part B** is gauge design and drawing question from **UNIT III** for 25 marks . Please ensure that the tolerance grade for gauge design dimensions are given in question paper which is an essential data for gauge design using standards.
3. For mark and time allocation please refer the model question paper enclosed herewith

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

**N – SCHEME**

**V SEMESTER**

**2020 – 2021 onwards**

# 4022620 PLASTIC MOLDING TECHNOLOGY

**CURRICULUM DEVELOPMENT CENTRE**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022620 |
| Semester | : | VI |
| Subject Title | : | **PLASTIC MOULDING TECHNOLOGY** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| PLASTIC MOULDING TECHNOLOGY | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**Topics and Time allocation**

| UNIT | TOPIC | TIME (Hrs) |
|---|---|---|
| I | Plastic Materials and Processing techniques | 14 |
| II | Injection Moulding Machine, Injection Mould and its functional system | 15 |
| III | Injection Mould Design | 15 |
| IV | Compression, Blow and Transfer moulding machine and Mould Design | 14 |
| V | Plastic Product Design , Decoration of Plastic Products & Maintenance and repairs of injection moulds | 15 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | Total | 80 |

**RATIONALE: -**

Plastic plays an important role in the present day industrial products and for the manufacture of plastic components lot of moulds are used. Hence Considering the immense potential in the fields of Plastic processing, mould design, making and maintenance, it is essential to understand the basics of plastic materials, processing and moulding technology adopted to convert the raw plastic material into desired products.

**OBJECTIVES**

- Familiarise different plastics materials and their properties
- Familiarise of the conventional injection-moulding machine types, their specification, Operation terminology and their parts.
- Compare different moulding processes used in industries, their application
- Explain the design procedure for injection moulding.
- Explain the design procedure for compression moulding
- Explain the concepts in the design of blow moulds.
- Appreciate the decoration techniques, plating techniques used for plastic components.
- Explain the working of injection moulding machine
- Understand the intermediate injection moulding design concepts

# DETAILED SYLLABUS

## 4022620 - PLASTIC MOULDING TECHNOLOGY

Contents: Theory

| Unit No. | Name of the Topics | Hours |
|---|---|---|
| I | **Plastic Materials and Processing techniques**<br>**1.0 Plastics:** Introduction – type of Plastics - Thermo Plastic Materials – Thermo setting Materials – Commodity Plastics – Engineering materials – Density - Melting Temperature – Shrinkage – Bulk Factor – Moulding Properties – Applications – Additives - Master Batches – Pigments.<br>**Injection Moulding:** Hot Runner Injection Moulding Process, Multi colour and multi component Injection Moulding Process, Reaction Injection Moulding Process**.**<br>**1.2 Blow Moulding**: concept and working principle only<br>**1.3 Compression & Transfer Moulding** – Compression Moulding Procedure- Difference between Injection and Compression moulding.- Transfer Moulding -Advantages and Disadvantages.<br>**1.4 Other processes:** Rotational Moulding, Thermoforming, Extrusion- Pipe extrusion, Blown film, Cast film extrusion, Rod Extrusion– Co extrusion, | 7<br>2<br>3<br>2 |
| II | **Injection Moulding machine, injection mould and its functional systems**<br>**2.1 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).<br>**2.2 Injection Mould: - Terms** used in connection with injection moulds, classification of moulds, Functions of the injection moulds**.**<br>**2.3 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.<br>**Core and Cavity-** Shrinkage calculation - Core and cavity dimension. | 3<br>3<br>3 |

| | | |
|---|---|---|
| | **Parting surface:** Flat Parting surface – Non flat parting surface - Venting – Mould clamping - direct, indirect.<br>**2.4 Cooling System** – Cooling Integer type cavity plates – Cooling integer type core plate - Cooling bolster – Cooling cavity inserts – Cooling core inserts – Water connection and seals. (Concept & Description of design only)<br>**2.5 Ejection system**: Ejector grid - Ejector plates assembly – Ejector rod, Ejector plate and ejector retaining plate - Methods of Ejection – Ejection from fixed half- Sprue puller. | **3**<br><br>**3** |
| **III** | <u>**Injection Mould Design & Intermediate Moulds**</u><br>**3.1 –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.<br>**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 & automatic unscrewing methods hand mould for rotating & lose core methods - Multi day light mould – Under feed mould – Triple day 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).<br>**3.3 Alignment of Moulds**: Functions of alignment, alignment with the axis of the plasticizing unit, internal alignment and interlocking, alignment of large moulds. Changing of moulds – system for a quick change of moulds for thermoplastics, mould exchanger for elastomer moulds. | **4**<br><br>**6**<br><br>**5** |

| | | |
|---|---|---|
| IV | <u>**Compression, Blow and Transfer Moulding machines and Mould Design**</u><br>**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<br>**4.2 Compression mould Design:** Economic determination of no. of cavities, flash thickness allowances, design of mould cavity, design of loading chamber, bulk factor, loading chamber depth & heat requirement for heating the mould related to - curing time, breathing time. Materials for Compression mould.<br>**4.3 Blow moulding Machines** - Extrusion Blow Moulding Machine (EBM) – Stretch Blow Moulding Machine (SBM) – Injection Blow Moulding Machine (IBM) – Machine Parts – Machine Specifications.<br>**4.4 Blow Mould Design:** Mould layout, pinch off, venting, Head die design, parison diameter calculation, shrinkage calculation, design of mould clamping accessories. | **4**<br>**4**<br>**3**<br>**3** |
| V | <u>**Plastic Product Design, Decoration of Plastic Products and Maintenance & Repair of Injection Moulds:**</u><br>**5.1 Plastic Product Design:** Wall thickness - Ribs and profiled structures – Gussets or support ribs - Bosses - Holes - Radii & Corners - Tolerances - Coring - Undercuts – Draft angle.<br>**5.2 Decoration of Plastic Parts:** Painting and coating (Dipping, Spraying and Depositing) – Metalizing (Vacuum metallization, Vacuum evaporation, sputtering) – Plating (Electroless plating, Electrolytic plating) - Flame and arc spraying - hot foil stamping – hot transfer – In mold decorating - Water transfer – Printing– Laser Marking, Vapor polishing, Decals - Understanding Recycling Codes.<br>**5.3 Maintenance of Injection Moulds:** Advantages of Preventive maintenance, maintenance of - cooling lines, mould surfaces, heating & control systems. Action taken after examination and cleaning. Repair and | **4**<br>**7**<br>**4** |

| | | |
|---|---|---|
| | alterations of injection moulds. | |
| | **TEST & MODEL EXAMINATIONS** | **07** |

**Text Books:**

1. Pye.R.G.W., "Injection Mould Design", Affiliated East – west press pvt Ltd, 2000
2. Athalye.A.S., 'Injection Moulding", 2nd Edn., Multi Tech Publishing Co., 1998
3. George menges and Paul mohren, "How to make Injection moulds", Hawer publishers, 1991

**Reference Books:**

1. Briston and Gosselin, "Introduction to Plastics", Newnes-Butterworths, London, 1970
2. Mills.N.J., "Plastics", ELBS, 1986
3. Dominick V.Rosato and Donald V.Rosato., "Injection Moulding Hand Book", CBS Publishers & Distributors, Delhi, 1987
4. Athalye.A.S., "Plastics Materials Handbook", Multi Tech Publishing Co., 1995

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

**N – SCHEME**

**VI SEMESTER**

**2020 – 2021 onwards**

# 4020610 – INDUSTRIAL ENGINEERING & MANAGEMENT

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N - SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020610 |
| Semester | : | VI |
| Subject Title | : | **INDUSTRIAL ENGINEERING AND MANAGEMENT** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| INDUSTRIAL ENGINEERING MANAGEMENT | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**Topics and Allocation of Hours:**

| Unit No | Topics | Hours |
|---|---|---|
| I | Plant Engineering and Plant Safety | 14 |
| II | Work Study, Method Study and Work Measurement | 15 |
| III | Principles, Personnel Management and Organizatioal Behavior: | 16 |
| IV | Financial and Material Management | 14 |
| V | Engineering Ethics and Human Values | 14 |
| | TEST & MODEL EXAMINATIONS | 07 |
| | **Total** | **80** |

**RATIONALE:**

In the Indian Economy, Industries and Enterprises always find prominent place. After globalization, the students should be trained not only in manufacturing process but also in managing activities of industries. The knowledge about plant, safety, work study techniques, personnel management, financial management and engineering ethics and human values will definitely help the students as managers to suit the industries.

**OBJECTIVES:**

- 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 engineering ethics and human values.
- To study the staff selection procedure and training of them.
- To study capital and resources of capital.
- To study inventory control system.
- To study about organization and it's behavior.

## DETAILED SYLLABUS

### 4020610 INDUSTRIAL ENGINEERING AND MANAGEMENT

**Contents: Theory**

| Unit | Name of the Topics | Time |
|---|---|---|
| I | **Plant Engineering and Plant Safety** | |
| | **Chapter: 1.1: Plant Engineering :** Plant – Selection of site of industry – Plant layout – Principles of a good layout – types – process, product and fixed position – techniques to improve layout – Principles of material handling equipment – Plantmaintenance – importance – Break down maintenance, preventive maintenance and scheduled maintenance. | **7** |
| | **Chapter: 1.2: Plant Safety:** Importance – accident - causes and cost of an accident-accident proneness - prevention of accidents - Industrial disputes - settlement of Industrial disputes-Collective bargaining, conciliation, Mediation, arbitration - Indian Factories Act 1948 and its provisions related to health, welfare and safety. | **7** |

| | | |
|---|---|---|
| II | **Work Study, Method Study and Work Measurement**<br>**Chapter: 2.1: Work Study:** Productivity – Standard of living – method of improving productivity – Objectives – Importance of good working conditions.<br>**Chapter: 2.2: Method Study:** Definition – Objectives – Selection of a job for method study –Basic procedure for conduct of method study – Tools used – Operation process chart, Flow process chart, two handed process chart, Man Machine chart, String diagram and flow diagram.<br>**Chapter: 2.3: Work Measurement:** Definition – Basic procedure in making a time study – Employees rating factor – Application of time allowances – Rest, Personal, Process, Special and Policy allowances – Calculation of standard time – Problems – Basic concept of production study – Techniques of work measurement-Ratio delay study, Synthesis from standard data, analytical estimating and Pre determined Motion Time System (PMTS). | **3**<br>**5**<br>**7** |
| III | **Principles, Personnel Management and Organizational Behavior:**<br>**Chapter: 3.1: Principles of Management:** Definition of management – Administration - Organization – F.W. Taylor's and Henry Fayol's Principles of Management – Functions of Manager – Directing – Leadership –Types of Leadership – Qualities of a good leader – Motivation – Positive and negative motivation --Modern management techniques- Management Information Systems – Strategic management – SWOT Analysis - Business Process Re-engineering (BPR) – Enterprises Resource Planning (ERP) –Activity Based Management (ABM) – Global Perspective – Principles and brief description.<br>**Chapter: 3.2: Personnel Management:** Responsibility of human resource management – Selection procedure – Training of workers – Apprentice training – On the job training and vestibule school training – Job evaluation and merit rating – objectives and importance – wages and salary administration – Components of wages – Wage fixation – Type of wage payment – Halsey's 50% plan, Rowan's plan and Emerson's efficiency plan – Problems. | **6**<br>**6** |

| | | |
|---|---|---|
| | **<u>Chapter: 3.3:</u> Organizational behavior:** Definition – organization-- Types of Organization – Line, Staff, Taylor's Pure functional types – Line and staff and committee type –Organizational Approaches, individual behavior - causes - Environmental effect - Behavior and Performance, Perception - organizational implications. | **4** |
| **IV** | **Financial and Material Management**<br>**<u>Chapter: 4.1:</u> Financial Management:**Fixed and working capital – Resources of capital – shares preference and equity shares – debentures – Type of debentures – Public deposits, 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 – Problems.<br>**<u>Chapter: 4.2:</u> 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 management - Introduction – Purchasing procedure – Store keeping – Bin card. | **7**<br><br><br><br><br><br>**7** |
| **V** | **Engineering Ethics and Human Values**<br>**<u>Chapter: 5.1:</u> Engineering Ethics**: Definition-engineering ethics-personal and business ethics- duties and rights-engineering as a profession - core qualities of professional practitioners-environment and their impact-code of ethics- procedure for solving ethical conflicts - ethical judgement-Kohiberg's stages of moral development - value based ethics- engineers as managers, consultants and leaders- environmental ethics- computer ethics- Intellectual Property Rights (IPRs).<br>**<u>Chapter: 5.2:</u> Human values :** morals – values – integrity- service learning-civic virtue - respect for others- living peacefully- caring – sharing – honesty- courage - valuing time cooperation - commitments – empathy-selfconfidence – character- stress management. | **8**<br><br><br><br><br><br><br><br>**6** |

**Reference Books :**


1. Industrial Engineering and Management, O.P. Khanna, Revised Edition Publications(P)Ltd – 2004, 67/4 Madras House, Daryaganj, NewDelhi– 110002.
2. Engineering Economics and Management, T.R. Banga& S.C. Sharma, McGraw Hill Editiion. 2 – 2001, NewDelhi.
3. HeraldKoontz and Heinz Weihrich,' Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition.Latest
4. Govindarajan .M, Natarajan. S, Senthilkumar V.V, Engineering ethics , prentice hall of India New Delhi, 2004.
5. Management, Aglobal perspective, Heinz Weihrich, Harold Koontz, 10th Edition, McGraw Hill International Edition.Latest.
6. Essentials of Management,4th Edition, Joseph L.Massie,Prentice- Hall of India, NewDelhi 2004.
7. S.Chandran, Organizational Behaviours,Vikas Publishing House Pvt. Ltd. Latest
8. M.Govindarajan and S.Natarajan ,Principles of Management ,Prentce Hall of India Pvt.Ltd. NewDelhi.Latest.
9. Charles B. Fledderman, Engineering ethics, pearson prentice hall, New Jersey, 2004.

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### VI SEMESTER

### 2020 – 2021 onwards

# 4020631 – INDUSTRIAL ROBOTICS AND 3D PRINTING

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**
**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N – SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : 1220 DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4020631

Semester : VI

Subject Title : **INDUSTRIAL ROBOTICS AND 3D PRINTING**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| INDUSTRIAL ROBOTICS AND 3D PRINTING | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**Topics and Allocation of Hours:**

| Unit No | Topics | Hours |
|---|---|---|
| I | Fundamentals of Robot Technology | 12 |
| II | Drive Systems, End Effecters, Sensors and Machine Vision System | 12 |
| III | Robot Programming, Robot Applications in Maufacturing | 12 |
| IV | Introduction and Design for Additive Manufacturing | 18 |
| V | Additive Manufacturing Processes | 19 |
| TEST AND MODEL EXAMINATION | | 07 |
| **Total** | | **80** |

**RATIONALE:**

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 major role. Hence study of robotic technology is very essential.

3Dprinting is often utilized when manufacturers need to create a product accurately, quickly and at a low quantity. This has lead to 3D printers being brought in to prototype industrial robots, helping to aid the development of better, more efficient robots in the industrial sector.

**OBJECTIVES:**

- Understand fundamentals of robotics
- Acquire knowledge structure and elements of robot
- Gain knowledge on controller and various drives used in robotics
- Develop knowledge on role of sensors and vision system
- Acquire skill to program and control robot
- Understand to adopt robot to various industrial applications.
- To acquire the knowledge on 3D Printing and design principles for additive manufacturing
- To understand the principles of latest manufacturing processes in Additive manufacturing

## DETAILED SYLLABUS

Contents: Theory

| Unit | Name Of The Topic | Hours |
|---|---|---|
| **I** | **Fundamentals of Robot Technology**<br>Introduction – History of robot– Definitions– Basic configuration of Robotics – Robot Components – Manipulator, End effecter, Driving system, Controller and Sensors – Degrees of freedom – Links and joints – Types of joints – Joint notation scheme – Pitch, Yaw, Roll – Classification of robots – Work envelope and Work Volume – Effect of structure on Control ,Work envelop and Work | 12 |

| | | |
|---|---|---|
| | volume- Introduction to PUMA robot- 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. | |
| **II** | **Drive Systems, End Effecters, Sensors and Machine Vision System**<br>Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – Stepper motors, DC Servo motors and AC Servo motors– Applications and Comparisons of Drives. End effecters – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers- Selection and design considerations in robot gripper- Requirements of Sensors – Position sensors: LVDT, Resolvers, Optical encoders- Proximity sensors: Inductive, Capacitive, Ultrasonic and Optical proximity sensors- Touch Sensors – Range Sensors- Machine Vision System: Sensing & Digitizing Image Data – Image Processing and Analysis - Application | 12 |
| **III** | **Robot Programming, Robot Applications In Manufacturing**<br>Forward kinematics, Inverse kinematics and differences – Forward kinematics and Reverse kinematics of manipulators with Two and Three degrees of freedom – Derivations. Robot programming –Lead through programming, Textual programming – Teach Pendant for Robot system– Robot programming languages – Motion commands, Sensor commands, End effecter commands. Robot applications – Material handling-Spot welding – Arc welding – Spray painting – Assembling – Finishing-AGV-RGV. | 12 |
| **IV** | **Introduction and Design for Additive Manufacturing**<br>**Introduction to Additive Manufacturing**<br>Additive Manufacturing – 3D Printing – Rapid prototyping – Overview – Need – Additive manufacturing Vs CNC Machining - Development of Additive Manufacturing Technology – Principle of AM Process – Generalised Additive Manufacturing Process Chain | 9 |

| | | |
|---|---|---|
| | - Classification - Benefits – Direct and Indirect process, Prototyping, Manufacturing and Tooling<br>**Design for Additive Manufacturing**<br>Design tools: Data processing - CAD model preparation – STL file - Part orientation and support structure generation - Model slicing - Tool path generation. Design for Additive Manufacturing: Concepts and objectives - AM unique capabilities - DFAM for part quality improvement – strategies – Design Rules – Quality aspects – Software for AM – MIMICS, etc. | <br><br>9 |
| **V** | **Additive Manufacturing Processes**<br>**Photo polymerization and Powder Bed Fusion Processes**<br>Photo polymerization: SLA - Photo curable materials - Process - reaction rates – scan patterns - Advantages and Applications. Powder Bed Fusion: SLS - Process description - powder fusion mechanism – material feed system - Process Parameters - Materials and Applications. Electron Beam Melting<br>**Extrusion Based And Sheet Lamination Processes**<br>Extrusion Based System: FDM – Introduction - Basic Principle – plotting and path control - Materials - Applications and Limitations - Bio-extrusion. Sheet Lamination Process: LOM – Materials - Gluing or Adhesive bonding - Thermal bonding – Ultrasonic AM.<br>**Printing Processes And Beam Deposition Processes**<br>Droplet formation technologies - Continuous mode - Drop on Demand mode - Three Dimensional Printing – Advantages – Bio-plotter - Beam Deposition Process: LENS- Process description - Material delivery - Process parameters – Materials – Benefits. Applications of AM technologies in Automotive, Manufacturing, Architectural, Healthcare, and Consumer products. | <br>7<br><br>5<br><br>7 |

**Reference Books:**


1. Industrial Robotics – Technology, Programming and Applications, P.Groover, MCGraw Hill, 2001

2. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third edition, World Scientific Publishers, 2010.
3. Ian Gibson, David W. Rosen, Brent Stucker "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing" Springer, 2010.
4. Robotics Control, Sensing, Vision and Intelligence, Fu.K.S.Gonzalz.R.C., and Lee C.S.G, McGraw-Hill Book Co., 1987
5. Robotics for Engineers, Yoram Koren, McGraw-Hill Book Co., 1992
6. Robotics and Image Processing, Janakiraman.P.A, Tata McGraw-Hill, 1995
7. Andreas Gebhardt "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing" Hanser Gardner Publication 2011.
8. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.
9. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
10. Tom Page, "Design for Additive Manufacturing" LAP Lambert Academic Publishing, 2012.
11. Amit Bandyopadhyay, and Susmita Bose, "Additive Manufacturing", CRC Press.
12. John O Milewski., "Additive Manufacturing of Metals: From Fundamental Technology to Rocket Nozzles, Medical Implants, and Custom Jewellery", Springer Series in Materials Science
13. Sabrie Soloman. "Additive Manufacturing: Advanced Manufacturing Technology in 3d Print Deposit"
14. David Ian Wimpenny and Pulak M Pandey, "Advances in 3D Printing and Additive Manufacturing Technologies"
15. Andreas Gebhardt, Hanser, "Understanding Additive Manufacturing"

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

**N – SCHEME**

**VI SEMESTER**

**2020 – 2021 onwards**

# 4020620 – E VEHICLE TECHNOLOGY & POLICY

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N - SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020620 |
| Semester | : | V |
| Subject Title | : | **E VEHICLE TECHNOLOGY & POLICY** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Semester | Internal Assessment | Board Examinations | Total | |
| E VEHICLE TECHNOLOGY & POLICY | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

### Topics and Allocation of Hours

| Unit No | Topics | Hours |
|---|---|---|
| I | Environmental impact and history, Types of Electric vehicles | 15 |
| II | Electric vehicle, Electrical Propulsion System | 15 |
| III | Energy Storages, Charging System, Effects and Impacts | 14 |
| IV | Electric Mobility Policy Frame Work | 14 |
| V | Tamilnadu E-Vehicle Policy 2019 | 15 |
| | TEST & MODEL EXAMINATIONS | 7 |
| | **Total** | **80** |

**RATIONALE:**

The world is transitioning to cleaner mobility options with the aim at improving air quality and reducing dependency on fossil fuels. Electric Vehicles (EVs) have emerged a popular clean mobility choice to reduce emissions. EVs are powered fully or partially by batteries, they can help to reduce dependence on fossil fuels also air quality. Tamil Nadu is one of the most advanced states in India. Tamil Nadu has a highly developed industrial eco-system and is very strong in sectors like automobiles and auto-components. Many globally renowned companies have setup their manufacturing facilities in Tamil Nadu. Due the rapid depletion of fossil fuel and increase in fuel cost, environmental pollution, the shift to clean transport is necessary. This subject introduced by keeping all the above factors.

**OBJECTIVES:**

- To learn the environmental impact and history of Electric Vehicles.
- To understand the concept of Electric Vehicle and its types.
- To study the configurations of Electric Vehicles
- To acquire knowledge about Energy Storages, Charging System, Effects and Impacts
- To appreciate the Electric Mobility Policy Frame work India and EV Policy Tamil Nadu 2019.

# DETAILED SYLLABUS

## 4020620 E Vehicle Technology & Policy

**Contents: Theory**

| Unit | Name of the Topics | Hours |
|---|---|---|
| I | **Environmental impact and history:**<br>Environmental impact of conventional vehicle **-** Air pollution – Petroleum resources – History of Electric vehicles & Hybrid Electric Vehicles - Conventional drive train system – Rear Wheel, Front Wheel and All wheel - Parts of Drive train system<br>**Types of Electric Vehicles:**<br>Introduction to Battery Electric Vehicle (BEV) – Definition BEV – Necessity BEV – Different between BEV and Conventional Vehicle - Advantages of BEV - Block diagram of BEV – Hybrid electric Vehicle (HEV) - Plug-in Hybrid Electric Vehicle (PHEV) – Fuel Cell Electric Vehicle (FCEV) – Description. | **8**<br><br><br><br><br>**7** |
| II | **Electric Vehicles:**<br>Configurations of Electric Vehicle – Performance of Electric Vehicles – Tractive Effort in Normal Driving – energy consumption.<br>Hybrid Electric Vehicles: Concept of Hybrid electric drive trains – Architecture of Hybrid Electric Drive trains – Series, Parallel and Series & Parallel<br>**Electric Propulsion Systems:**<br>Types of EV motors - DC motor drives– Permanent Magnetic Brush Less DC Motor Drives (BLDC) – Principles, Construction and Working – Hub motor Drive system – Merits and Demerits of DC motor drive, BLDC motor drive | **7**<br><br><br><br><br>**8** |
| III | **Energy Storages:**<br>Electrochemical Batteries – Battery Technologies – Construction and working of Lead Acid Batteries, Nickel Based Batteries and Lithium Based Batteries - Role of Battery Management System (BMS)– Battery pack development Technology– Cell Series and Parallel connection to | **6** |

| | | |
|---|---|---|
| | develop battery pack.<br>**Charging:**<br>Battery Charging techniques - Constant current and Constant voltage, Trickle charging – Battery Swapping Techniques – DC charging – Wireless charging **–** Maintenance of Battery pack – Latest development in battery chemistry.<br>**Effects and Impacts:**<br>Effects of EV – Impacts on Power grid – Impacts on Environment – Impacts on Economy. | **6**<br><br><br><br><br><br><br>**2** |
| IV | **Electric Mobility Policy Frame Work**<br>Government of India Electric Mobility Policy Frame work – Global Scenario of EV adoption – Electric mobility in India – National Electric Mobility Mission Plan 2020 – Action led by Original Equipment Manufacturers – Need of EV Policy – Advantage of EV Eco system – Scope and Applicability of EV Policy – ARAI Standards for Electric Vehicle – AIS 038, AIS 039 &AIS 123 - Key Performance Indicator - Global impact – Trends and Future Developments | **14** |
| V | **Tamil Nadu E-Vehicle Policy 2019**<br>Tamil Nadu E-vehicle Policy 2019: Vehicle Population in Tamil Nadu – Objectives of EV Policy – Policy Measures – Demand side incentives – Supply side incentives to promote EV manufacturing – Revision of Transport Regulation of EV – City building codes – Capacity Building and Skilling – Charging structure – implementing agencies – Reasearch &Development and Business Incubation – Recycling Ecosystem – Battery and EVs | **15** |

**Reference Books**


1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles, Mehrdad Ehsani, Yimin Gao, Sebastien E.Gay, Ali Emadi, CR Press, London, New York.
2. Comparison of Electric and Conventional Vehicles in Indian Market: Total Cost of Ownership, Consumer Preference and Best Segment for Electric Vehicle (IJSR), Akshat Bansal, Akriti Agarwal
3. A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development (MDPI), Fuad Un-Noor, Sanjeevikumar Padmanaban, Lucian Mihet-Popa, Mohammad Nurunnabi Mollah and Eklas Hossain.
4. Electric Vehicles: A future Projection CII October 2020 report.
5. Design and analysis of aluminum/air battery system for electric vehicles, Shaohua Yang, Harold Knickle, Elsevier.
6. Propelling Electric Vehicles in India, Technical study of Electric Vehicles and Charging Infrastructure
7. ZERO EMISSION VEHICLES (ZEVs): TOWARDS A POLICY FRAMEWORK – NTI Aayog.
8. FASTER ADOPTION OF ELECTRIC VEHICLES IN INDIA: PERSPECTIVE OF CONSUMERS AND INDUSTRY, The Energy and Resources Institute, New Delhi.
9. India EV Story: Emerging Opportunities by Innovation Norway.
10. Automotive Industry Standards – AIS 038, AIS 039 & AIS 123 – Manual

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### VI SEMESTER

### 2020 – 2021 onwards

# 4020640 – SOLID MODELLING PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N - SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220 DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020640 |
| Semester | : | VI |
| Subject Title | : | **SOLID MODELLING PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours / Week | Hours / Semester | Internal Assessment | Board Examinations | Total | |
| SOLID MODELLING PRACTICAL | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**RATIONALE:**

A Mechanical Engineering Diploma Engineer is expected to possess a thorough understanding of drawing, which includes clear visualization and proficiency in reading and interpreting a wide variety of production drawing. The market driven economy demands frequent changes in product design to suit the customer requirements. The introduction of this subject is to provide hands on experience in sketching and modeling of the industrial components using any one of the Computer Aided Design and Modelling packages. The aim of this subject is to help the student to attain the industry identified competency through practice in CAD software.

**OBJECTIVES:**

- Prepare 2D Drawing using sketcher or part modelling of any parametric CAD software.
- Generate 3D Solid models from 2D sketch or part modelling of any parametric CAD software.
- Prepare assembly of part models using assembly of any parametric CAD software.
- Generate orthographic views of 3D solid models/assemblies using drafting of any parametric software.
- Plot a drawing for given part model/assembly.

## DETAILED SYLLABUS

Contents: Practical

**Introduction**

Parametric CAD software – sketch – elements – entities: line – circle – arc – ellipse – polygon – text – dimensions – sketch tools – fillet – chamfer – offset – trim – extend – mirror – rotate – block. Partmodelling– reference planes – reference point – reference axes – co-ordinate system – extrude – revolve – swept – helix and spiral – lofts – dome – shell – draft – rib – wrap – intersect – holes – patterns. Assembly – approaches – mate – coincident – sub assembly –rebuild – isolate. Drawing views – Save – Plot – model view – exploded view – projected view – section view – import – export – Appearance – rendering.

**Exercises**

PART A: Draw the given 3D drawing using 3D modelling commands.

1. Model 1
2. Model 2
3. Model 3
4. Model 4
5. Model 5
6. Model 6

PART B: Draw the part models and assemble the components using 3D modelling.

1. Revolving Centre
2. Tail stock
3. Machine Vice

4. Crane hook
5. Petrol Engine Connecting Rod
6. Pipe Vice

**Board Examination**

Note: All the exercises should be completed All the exercises should be given for examination, the students are permitted to select by lot or the question paper from DOTE should be followed. Record note book should be submitted during examination.

Two exercises will be given for examination by selecting one exercise in each PART. The printout of exercises of the student work should be submitted with answer paper and the same have to be evaluated as per the allocation.

**DETAILLED ALLOCATION OF MARKS**

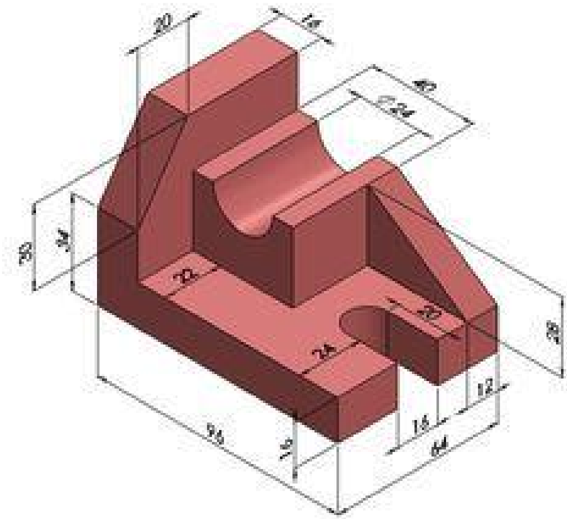
| Sl. No. | Performance Indicator | Marks |
|---|---|---|
| Part A – 3D Component Modelling | | |
| 1 | Sketching | 15 |
| 2 | 3D Modelling | 15 |
| Part B – Assemble Drawing Modelling | | |
| 3 | Sketching / Part modelling | 20 |
| 4 | Assembly | 30 |
| 5 | Solid Model / Views | 10 |
| 6 | Vivavoce | 10 |
| | Total | 100 |

**LIST OF EQUIPMENTS (for the batch of 30 students)**

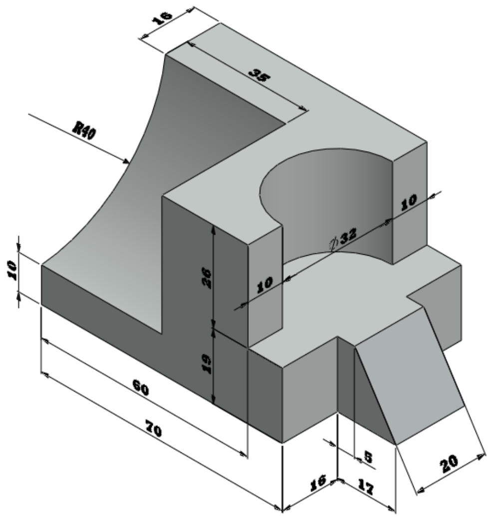
- Personal computer : 30 Nos.
- Laser Printer : 1 No.
- Software : GUI System Software
  : Modelling package – Sufficient to the strength.

**Exercises**

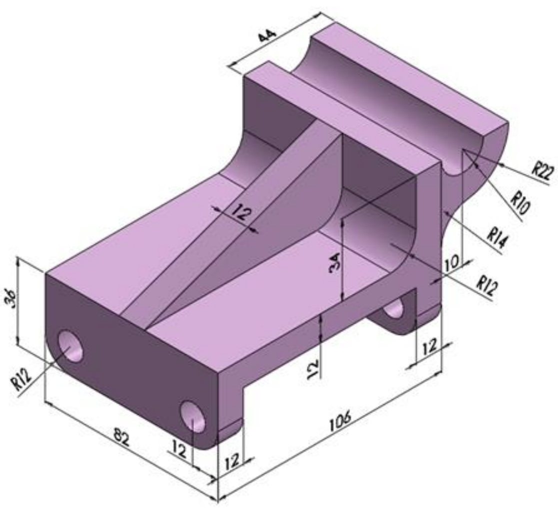
PART A: Draw the given 3D drawing using 3D modelling commands.



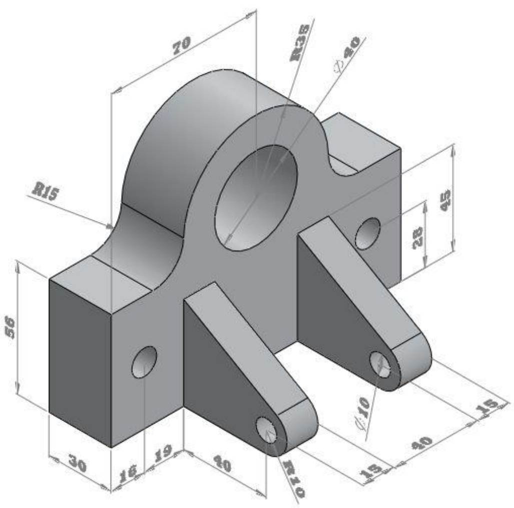
Model 1



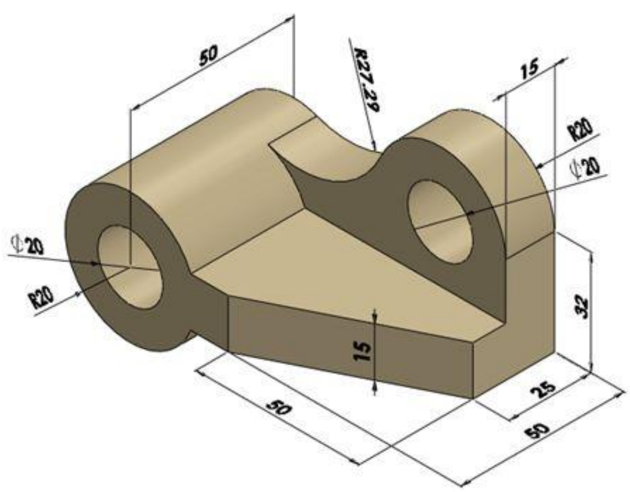
Model 2



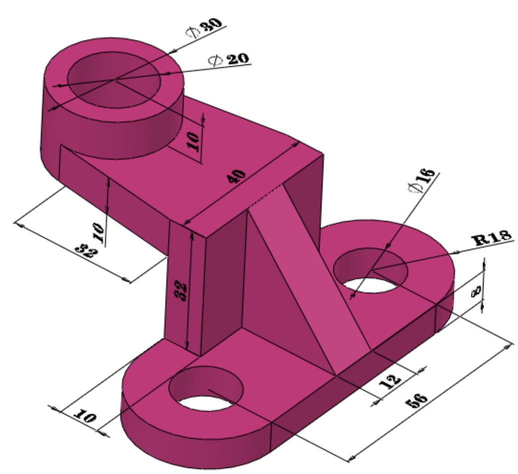
Model 3



Model 4



Model 5



Model 6

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### VI SEMESTER

### 2020 – 2021 onwards

# 4020651 – INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N – SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4020651 |
| Semester | : | VI |
| Subject Title | : | **INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | |
| | Hours / Week | Hours / Semester | Internal Assessment | Board Examinations | Total | Duration |
| INDUSTRIAL ROBOTICS AND 3D PRINTING PRACTICAL | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**Objectives**

- Study of Robot / Study of robot simulation software
- To study the components required.
- To study the techniques of programming for various industrial manufacturing applications.
- Prepare a record of work done.
- Acquire knowledge in the field of Additive Manufacturing
- Explain the various concepts of Solid Modelling
- Create STL files to manufacture components using 3D Printer

# DETAILED SYLLABUS

Contents:

3D Printing : Getting to know the User Interface of the Modelling software – Home Screen – Navigating the main Screen – Options Bar – Application Menu & Quick Access Toolbar – Describe the function of a sketch - Describe the various types of sketches. Create sketches of 3D models. Basic Modelling Considerations – Describe part creation within the design process. Add placed features to existing parts. Create complex shapes by sweeping or lofting profiles. Assemblies - Managing the assemblies - Assemble a mechanical piece of equipment using constraints. STL files – introduction – conversion of parts from other file formats to STL file – Additive Manufacturing – types of 3D Printers – orientation and positioning of parts - producing 3D working models using 3D Printers.

**Exercises:**

**PART A- Robot Programming**

1. Position recording using Cartesian co-ordinate system - (No. of positions - 9)
2. Position recording using Polar co-ordinate system - (No. of positions - 9)
3. Pick and place the objects - No. of objects - 6)
4. Pick and stack the objects - (No. of objects - 6)
5. Spray painting practice - (Area - 300mm x 300mm)
6. Spot welding practice - (No. of spots - 9)
7. Arc welding practice – (Length of weld 50 mm)
8. Assembling practice - (Minimum 3 Components)
9. Profile cutting practice - (Complicated profile – combination of lines and arcs)
10. Machine loading and unloading practice with time delay - (No. of times - 9)

**PART B - 3D Printing**

1. Create the model and produce the Gear Train in 3D printing.
2. Create the model and produce the Sun-planetary gear mechanism.
3. Create the model and produce the Geneva Gear & Ratchet mechanism.

4. Create the model and produce the Slide-crank mechanism.

***Note:*** Every student is asked to design and produce only one component of an assembly. After the completion of the product, individual parts are checked for its precision and matting in the assembly. Hence group exercises can be given. The models can be scaled according to the print area of the 3D Printer.

**Board Examination**

**Note**:

- All the exercises should be completed. Two exercises will be given for examination by selecting one exercise in each PART.
- All the exercises should be given for examination, the students are permitted to select by lot or the question paper from DOTE should be followed.
- Record note book should be submitted during examination.

**DETAILLED ALLOCATION OF MARKS**

| Sl. No. | Performance Indicator | Marks |
|---|---|---|
| Part A – Robot Programming | | |
| 1 | Robot Program | 20 |
| 2 | Simulate / Execution | 30 |
| 3 | Result | 10 |
| Part B – 3D Prinitng | | |
| 4 | CAD - Modelling | 15 |
| 5 | 3D Printing | 15 |
| 6 | Vivavoce | 10 |
| Total | | 100 |

**LIST OF EQUIPMENTS (for the batch of 30 students)**

| | | |
|---|---|---|
| Personal computer | : | 15 Nos. |
| 6 Axis Robot | : | 1 No. |
| 3D Printer | : | 1 No. |
| Software | : | GUI System Software |
| | : | Modelling package / 3D Printer–Sufficient to the strength. |

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### VI SEMESTER

### 2020 – 2021 onwards

# 4020550 – THERMAL ENGINEERING PRACTICAL

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION &TRAINING, TAMILNADU**

**DIPLOMA IN ENGINEERING / TECHNOLOGY SYLLABUS**

**N - SCHEME**

**(Implemented from the Academic year 2020 - 2021 onwards)**

Course Name : 1020 DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)

Subject Code : 4020550

Semester : VI

Subject Title : **THERMAL ENGINEERING PRACTICAL**

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours / Week | Hours / Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examinations | Total | |
| STRENGTH OF MATERIALS | 5 | 80 | 25 | 100* | 100 | 3 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks for result.

**OBJECTIVES:**

- Determine the flash and fire point and viscosity of oil.
- Draw the valve timing diagram of petrol and diesel engines.
- Draw the port timing diagram of petrol and diesel engines.
- Conduct performance test on petrol and diesel engines.
- Prepare heat balance sheet for an IC engine.
- Conduct of C.O.P of Refrigerators.
- Determine the volumetric efficiency of the Air Compressor.

**Experiments:**

**PART-A**

1. Determine flash and fire point of the given oil using open cup and closed cup apparatus.
2. Determine the absolute viscosity of the given lubricating oil using Redwood viscometer.
3. Determine the absolute viscosity of the given lubricating oil using Say bolt viscometer.
4. Port timing diagram of two stroke petrol Engine
5. Valve time diagram for four stroke petrol Engine.
6. Valve time diagram for four stroke diesel engines.

**PART-B**

1. Load test (Performance test) on Four Stroke Petrol Engine.
2. Load test (Performance test) on Four Stroke diesel Engine.
3. Morse test on Multi-cylinder petrol engine.
4. Heat balance test on Four Stroke Diesel / Petrol Engine.
5. Volumetric efficiency of Air Compressor.
6. Determination of COP of Refrigeration System.

## BOARD EXAMINATION

Note:

- All the experiments in both sections should be completed. Two experiments will be given for examination by selecting one exercise from PART A and one exercise from PART B.
- All the experiments should be given in the question paper and students are allowed to select by a lot or Question paper issued from the DOTE should be followed.
- All regular students appearing for first attempt should submit record notebook for the examination.
- The external examiner should verify the availability of the facility for the batch strength before commencement of practical examination.
- The external examiner should verify the working condition of machinery's / equipment before commencement of practical examination.

## Detailled Allocation of Marks

| | | |
|---|---|---|
| **Part A:** | | **35** |
| Observation and Tabular Column | 5 | |
| Calculations | 20 | |
| Result / Graph | 10 | |
| **Part B:** | | **55** |
| Observation and Tabular Column | 10 | |
| Formulae, Calculations | 30 | |
| Result / Graph | 15 | |
| **Viva Voce** | | **10** |
| **Total** | | **100** |

**LIST OF EQUIPMENTS (for the batch of 30 students)**

1. Open cup apparatus - 2 Nos.
2. Close cup apparatus - 2 Nos.
3. Redwood viscometer - 2 Nos.
4. Say bolt viscometer - 2 Nos.
5. Four stroke petrol engine Model - 2 Nos.
6. Four stroke diesel engine Model - 2 Nos.
7. Two stroke petrol engine Model - 2 Nos.
8. Four stroke Petrol Engine Test rig - 1 No.
9. Four stroke Diesel engine Test rig - 1 No.
10. Multi -cylinder petrol engine test rig - 1 No.
11. Air compressor test rig – 1 No.
12. Refrigeration Test rig – 1 No.
13. Guarded Plate Apparatus – 1 No.
14. Measuring instruments - Required quantity
15. Consumables - Required quantity

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

(TOOL& DIE)

III YEAR

N – SCHEME

VI SEMESTER

2020 – 2021 onwards

# 4022650 - PLASTIC MOULDS PRACTICAL

CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | | |
|---|---|---|
| Course Name | : | 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : | 4022650 |
| Semester | : | VI |
| Subject Title | : | **PLASTIC MOULDS PRACTICAL** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | | | Marks | | | Duration |
| | Hours/ Week | Hours/ Semester | Internal Assessment | Board Examination | Total | |
| PLASTIC MOULDS PRACTICAL | 6 | 96 | 25 | 100* | 100 | 16 hrs. |

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

**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

# DETAILED SYLLABUS

**i) Design of Plastic Moulds:** **(16 Hrs)**

**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.**

**ii) Mould Design and Manufacture Exercises:** **(48 Hrs )**

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.

**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.

**Examination:**

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

**SCHEME OF EXAMINATION:**

| | |
|---|---|
| Design of Mould | -50 marks |
| Mould making | -20 marks |
| Mould setting & trial production | -10 Marks |
| Component quality | -10 marks |
| Viva Voce | -10 Marks |
| **Total** | **-100 Marks** |

## Details of The Equipment's (for a batch of 30 students)

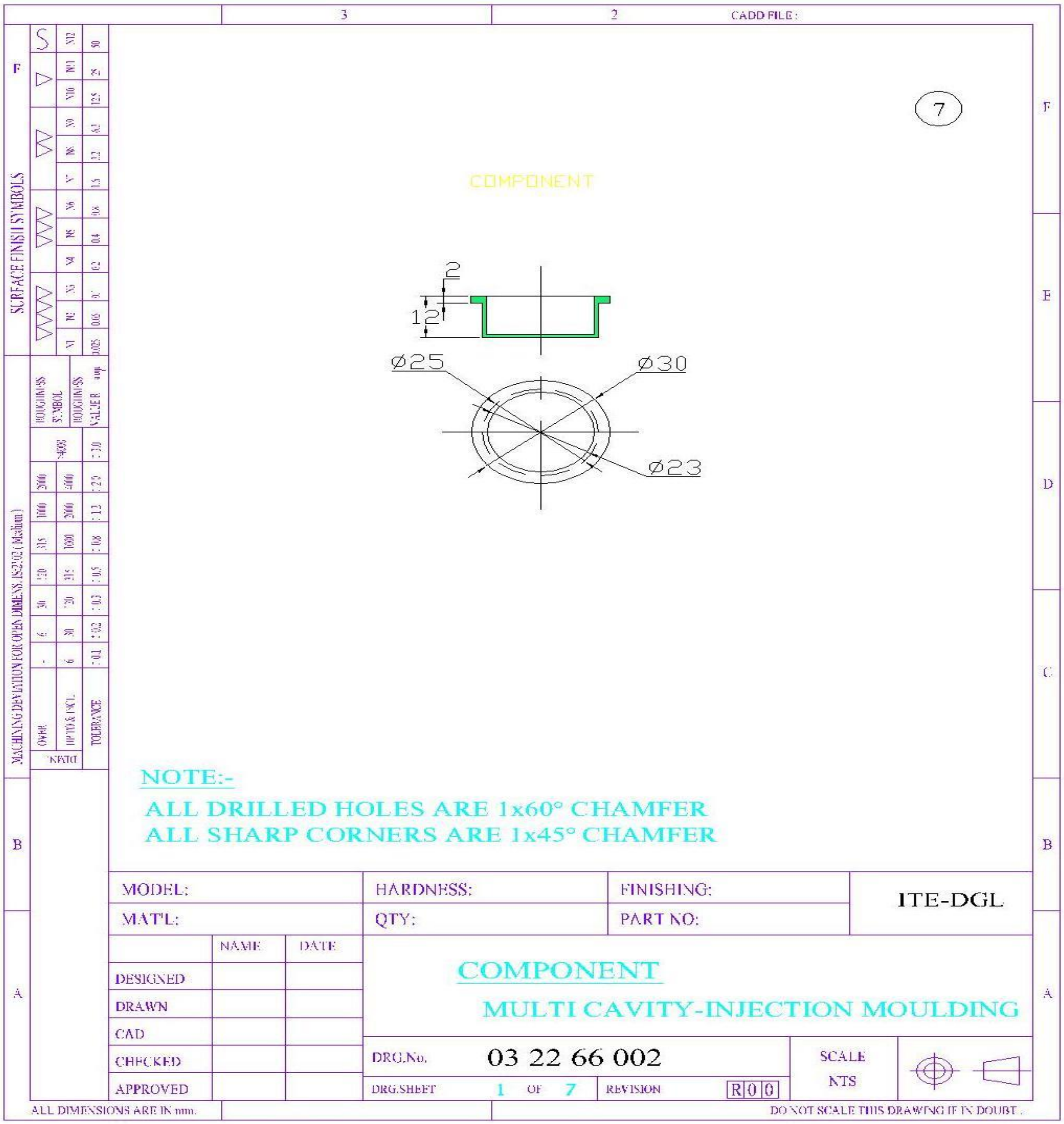
| | |
|---|---|
| **NAME OF THE BRANCH / COURSE** | MECHANICAL ENGINEERING (TOOL & DIE) |
| **YEAR** | THIRD |
| **SEMESTER** | VI |
| **NAME OF THE LABORATORY** | 4022650 PLASTIC MOULDS PRACTICAL |

| **S.N** | **LIST OF THE EQUIPMENTS 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 | 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**

- For exercise I, refer the subject 4022340 and the Drawings are available in the subject 4022340 – Computer Aided Machine & Tool Drawing in Exercise no.10

**Exercise – II Multi Cavity Injection Mould**



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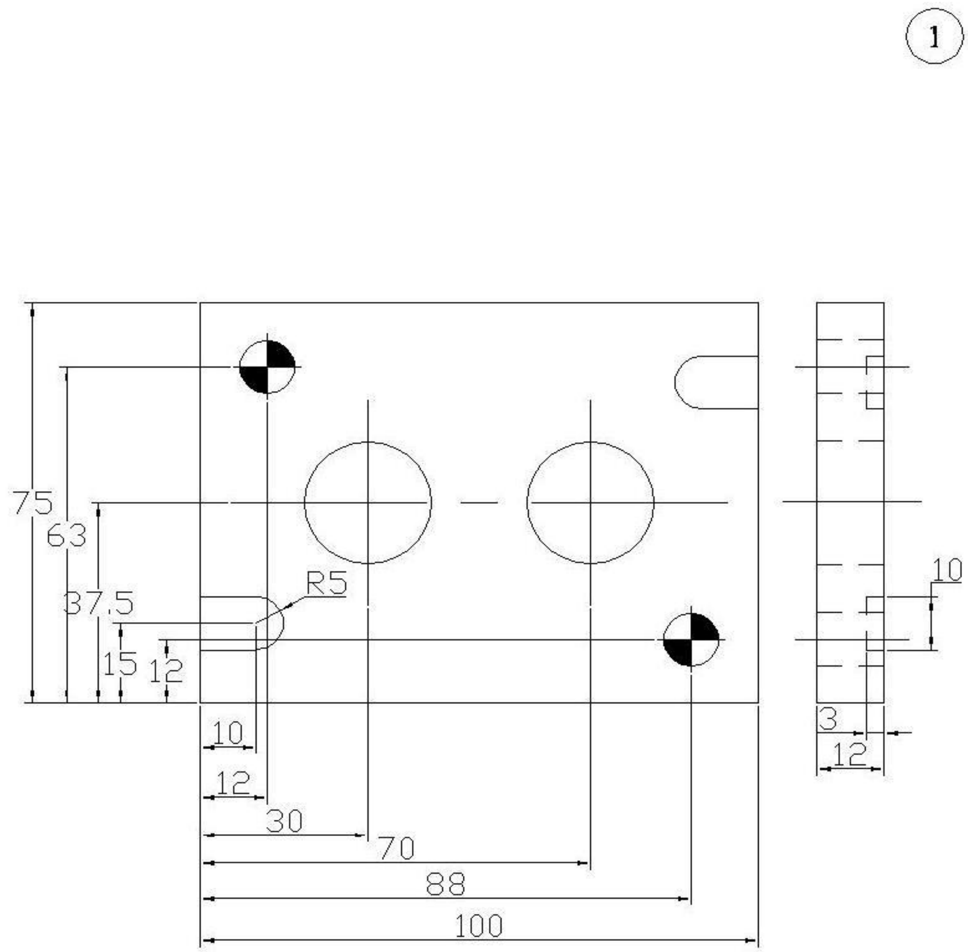
## SURFACE FINISH SYMBOLS

| ROUGHNESS SYMBOL | N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N9 | N10 | N11 | N12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROUGHNESS VALUE R z 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 | >4000 |
| UP TO & INCL. | 6 | 30 | 120 | 315 | 1000 | 2000 | 4000 | |
| TOLERANCE | ±0.1 | ±0.2 | ±0.3 | ±0.5 | ±0.8 | ±1.2 | ±2.0 | ±3.0 |




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 .

| | 3 | 2 | CADD FILE : |
|---|---|---|---|

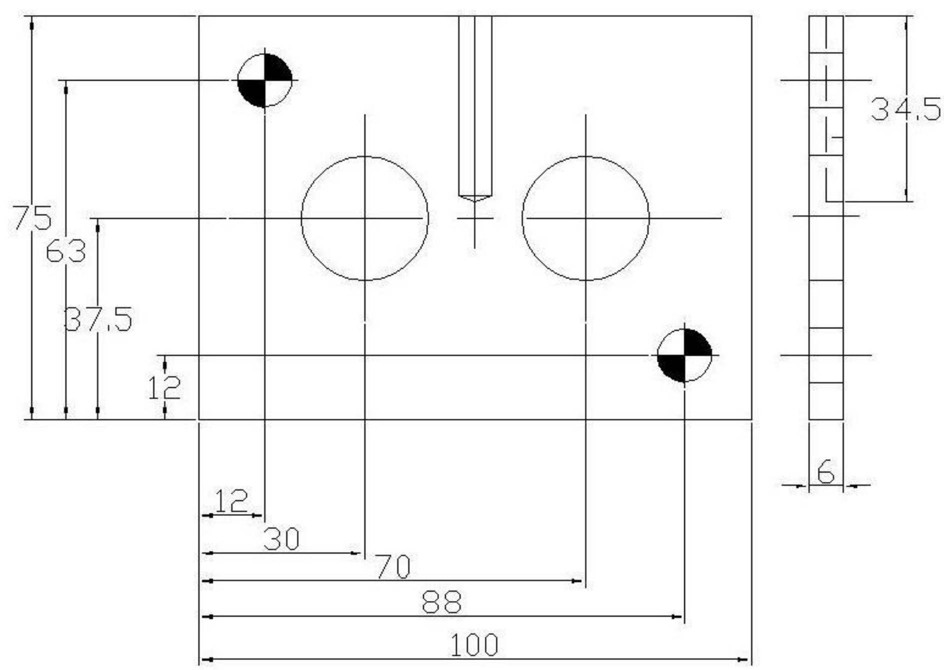
**SURFACE FINISH SYMBOLS**

| 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 )**

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

2




**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 | | | **STRIPPER PLATE** |
| DRAWN | | | |
| CAD | | | |
| CHECKED | | | DRG.No. 03 22 66 002 — SCALE |
| APPROVED | | | DRG.SHEET 3 OF 7 — REVISION R0/0 — NTS |

MULTI CAVITY INJECTION MOULDING

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

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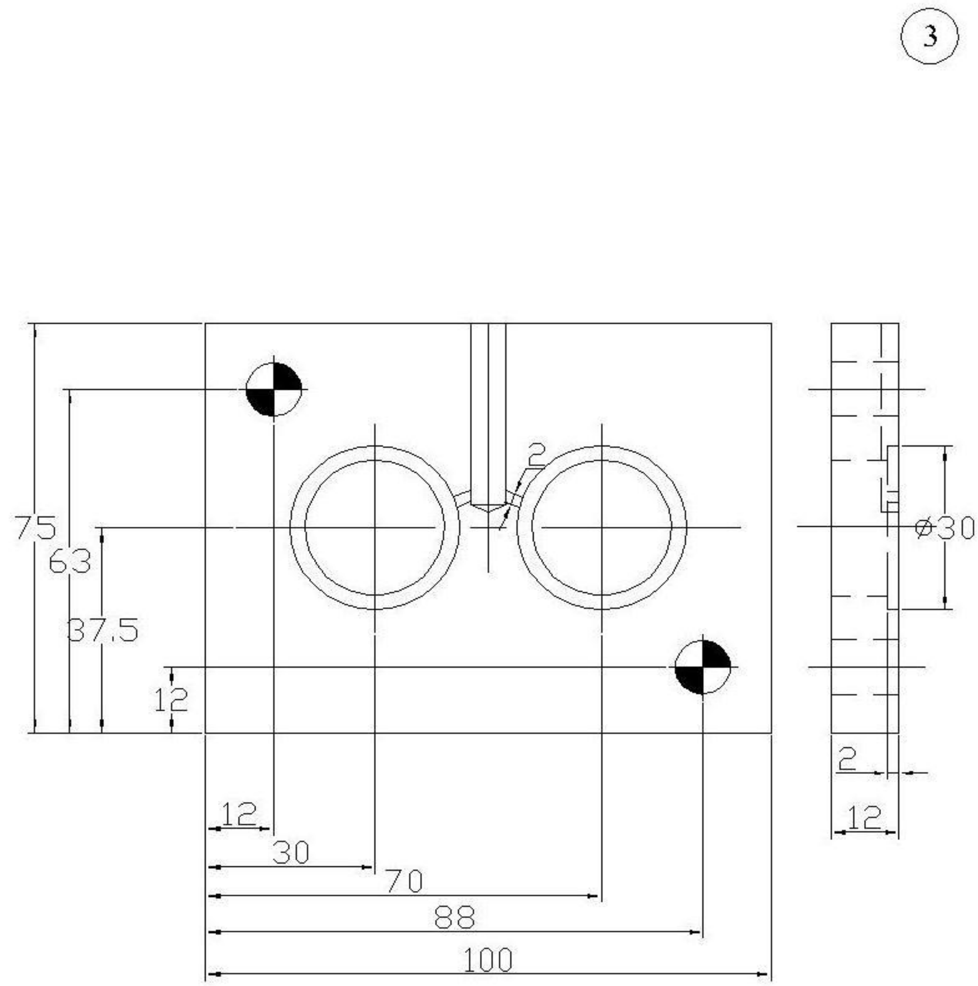



**NOTE:-**

ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER

| | | | |
|---|---|---|---|
| MODEL: | HARDNESS: | FINISHING: | ITE-DGL |
| MATL: | QTY: | PART NO: | |

| | NAME | DATE | |
|---|---|---|---|
| DESIGNED | | | CAVITY PLATE<br>MULTI CAVITY-INJECTION MOULDING |
| DRAWN | | | |
| CAD | | | |
| CHECKED | | | DRG.No. 03 22 66 002 — SCALE NTS |
| APPROVED | | | DRG.SHEET 4 OF 7 — REVISION R00 |

SURFACE FINISH SYMBOLS

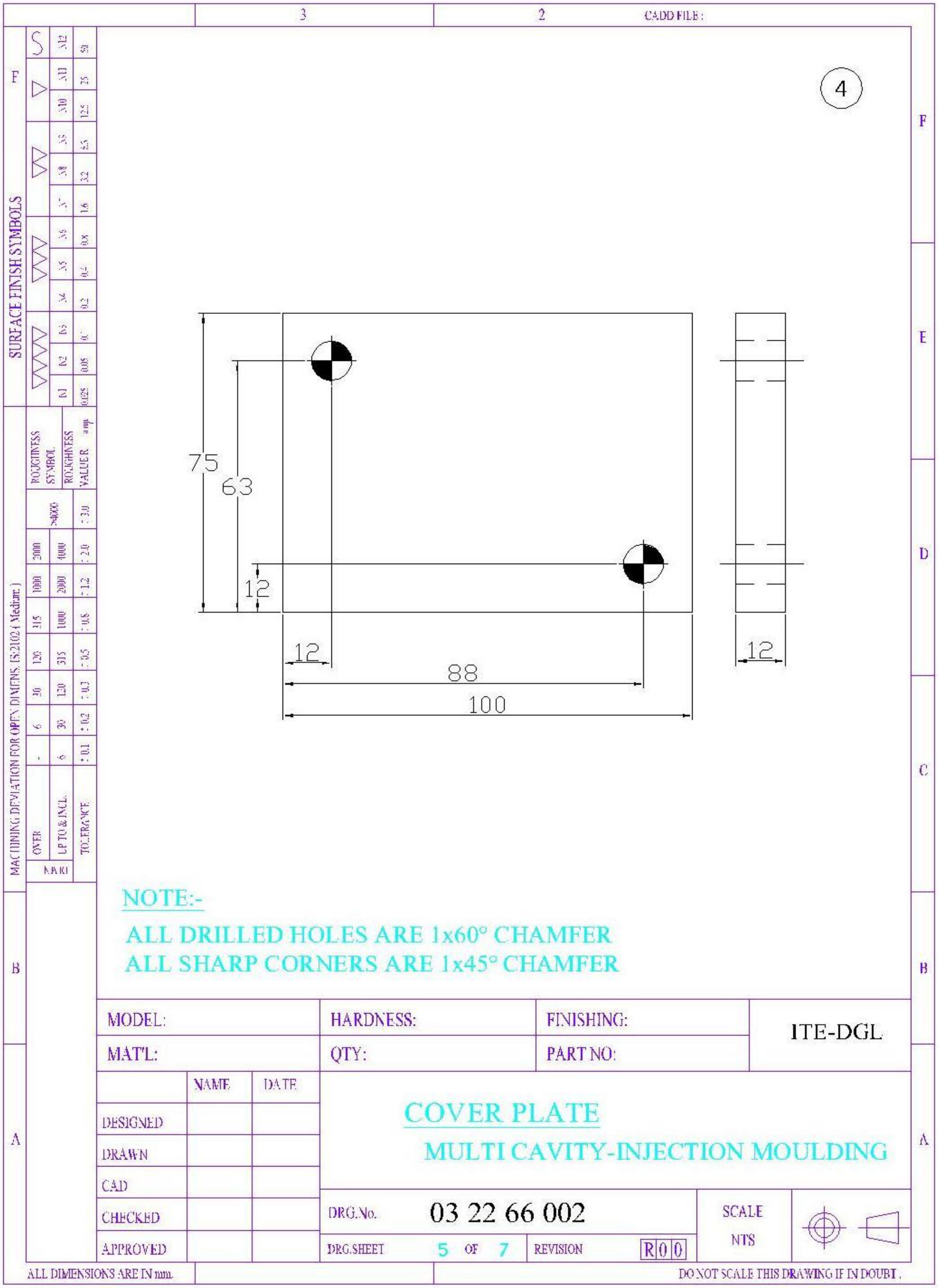
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N9 | N10 | N11 | N12 |
| 0.025 | 0.05 | 0.1 | 0.2 | 0.4 | 0.8 | 1.6 | 3.2 | 6.3 | 12.5 | 25 | 50 |

MACHINING DEVIATION FOR OPEN DIMENS. IS2102 (Medium)

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

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT.


CADD FILE :
4
75
63
12
12
88
100
12
NOTE:-
ALL DRILLED HOLES ARE 1x60° CHAMFER
ALL SHARP CORNERS ARE 1x45° CHAMFER
SURFACE FINISH SYMBOLS
ROUGHNESS SYMBOL
ROUGHNESS VALUE R
MACHINING DEVIATION FOR OPEN DIMENSIONS, IS:2102 (Medium)
OVER
UP TO & INCL.
TOLERANCE
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
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NTS
DRG.SHEET
5 OF 7
REVISION
R00
ALL DIMENSIONS ARE IN mm.
DO NOT SCALE THIS DRAWING IF IN DOUBT.

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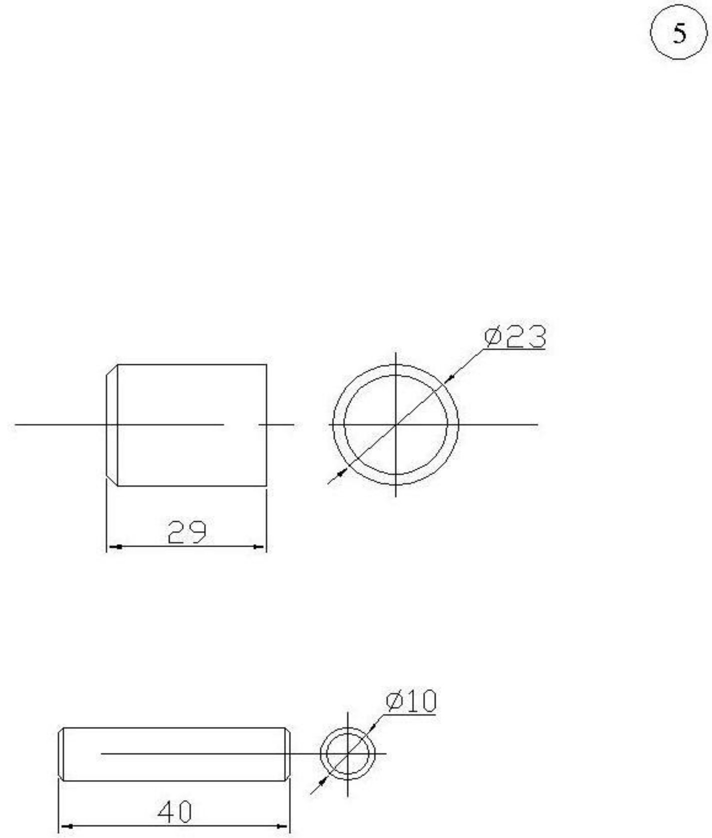



NOTE:-

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

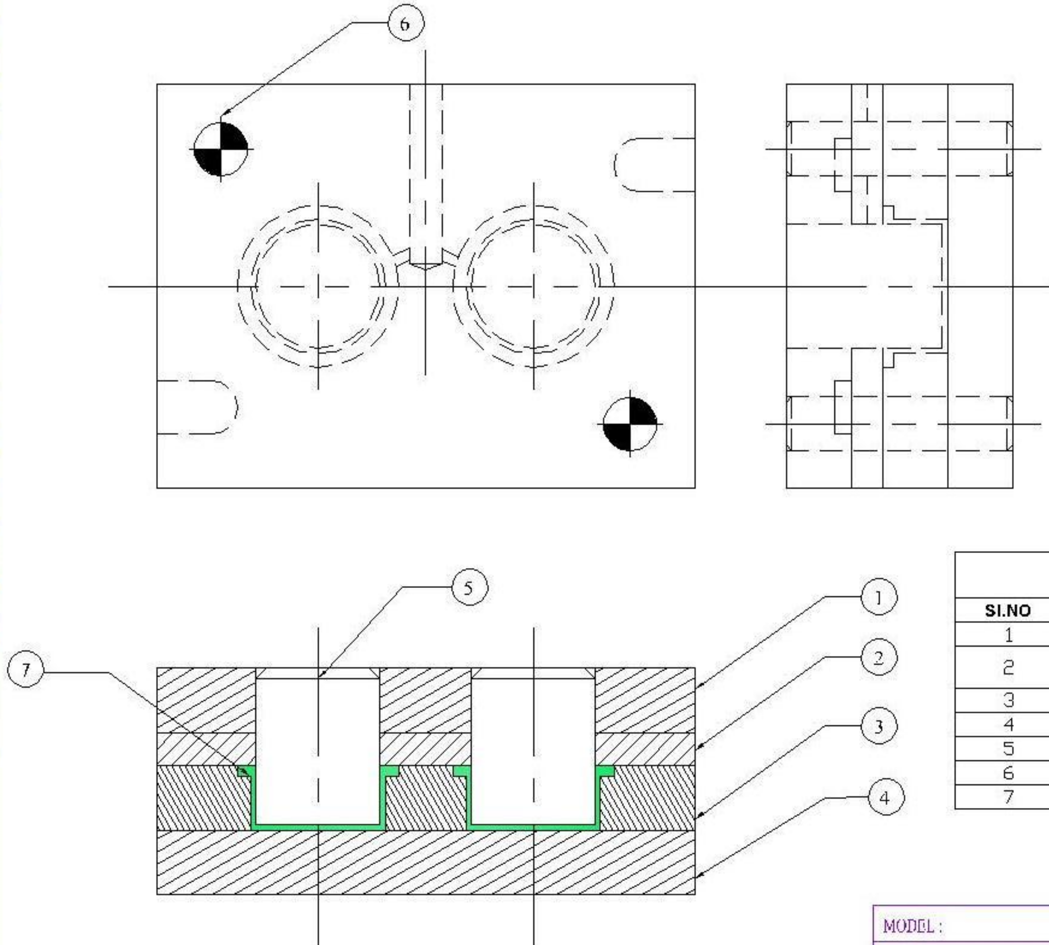
DRG.No. 03 22 66 002

DRG.SHEET 6 OF 7 REVISION R00

SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT.




**BILL OF MATERIALS**

| SI.NO | PART NAME | MATERIAL | QUANTITY |
|---|---|---|---|
| 1 | CORE PLATE | MS | 1 |
| 2 | STRIPPER PLATE | MS | 1 |
| 3 | CAVITY PLATE | MS | 1 |
| 4 | COVER PLATE | MS | 2 |
| 5 | CORE PIN | MS | 2 |
| 6 | GUIDE PIN | STD | 2 |
| 7 | COMPONENT | HDPE | 2 |

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 | | |

ASSEMBLE VIEW

MULTI CAVITY-INJECTION MOULDING

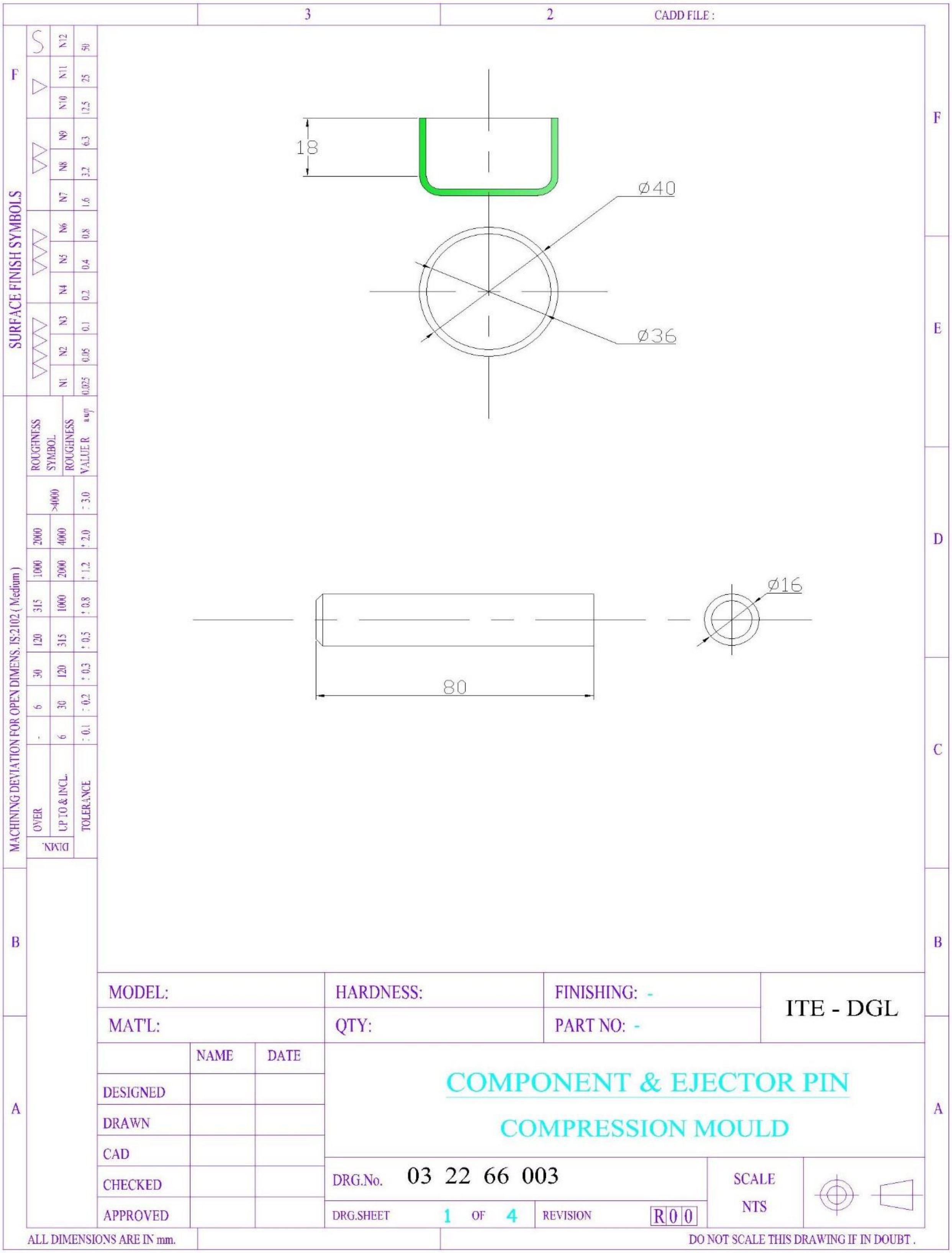
DRG.No. 03 22 66 002

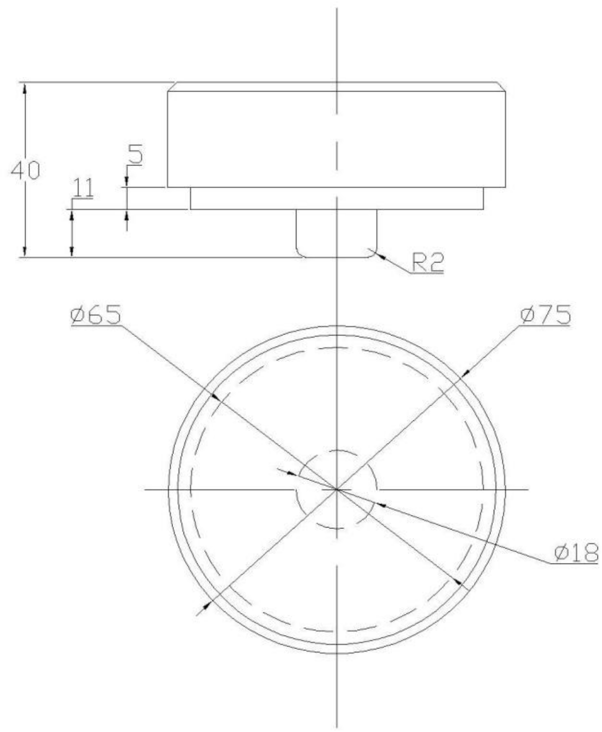
DSG SHEET 7 OF 7 REVISION R00

SCALE NTS

DO NOT SCALE THIS DRAWING IF IN DOUBT ASK MFD.

## Exercise – III Compression Mould






| | | | |
|---|---|---|---|
| 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

DRG.SHEET 2 OF 4 REVISION R00

SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT .

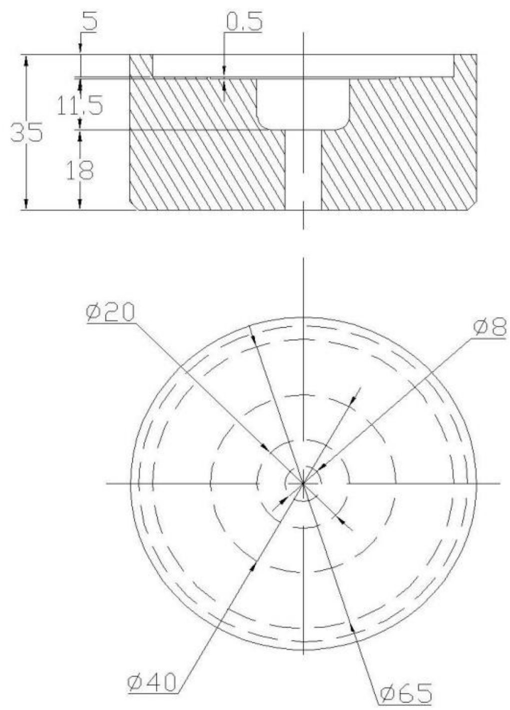
3 | 2 | CADD FILE :

## SURFACE FINISH SYMBOLS

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

## 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 | | |

**BOTTOM HALF**

**COMPRESSION MOULD**

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 .

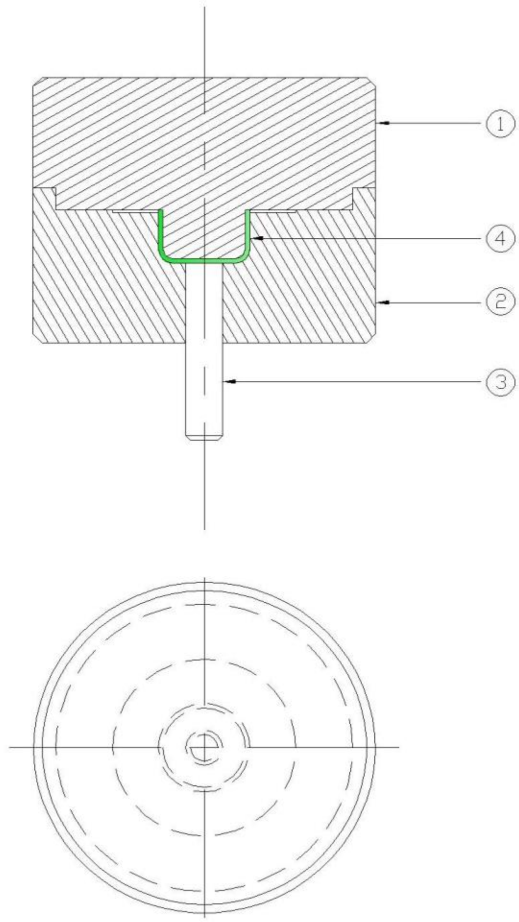
3 | 2 | CADD FILE :

## 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 | >4000 |
| UP TO & INCL. | 6 | 30 | 120 | 315 | 1000 | 2000 | 4000 | |
| TOLERANCE | ± 0.1 | ± 0.2 | ± 0.3 | ± 0.5 | ± 0.8 | ± 1.2 | ± 2.0 | ± 3.0 |




## 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

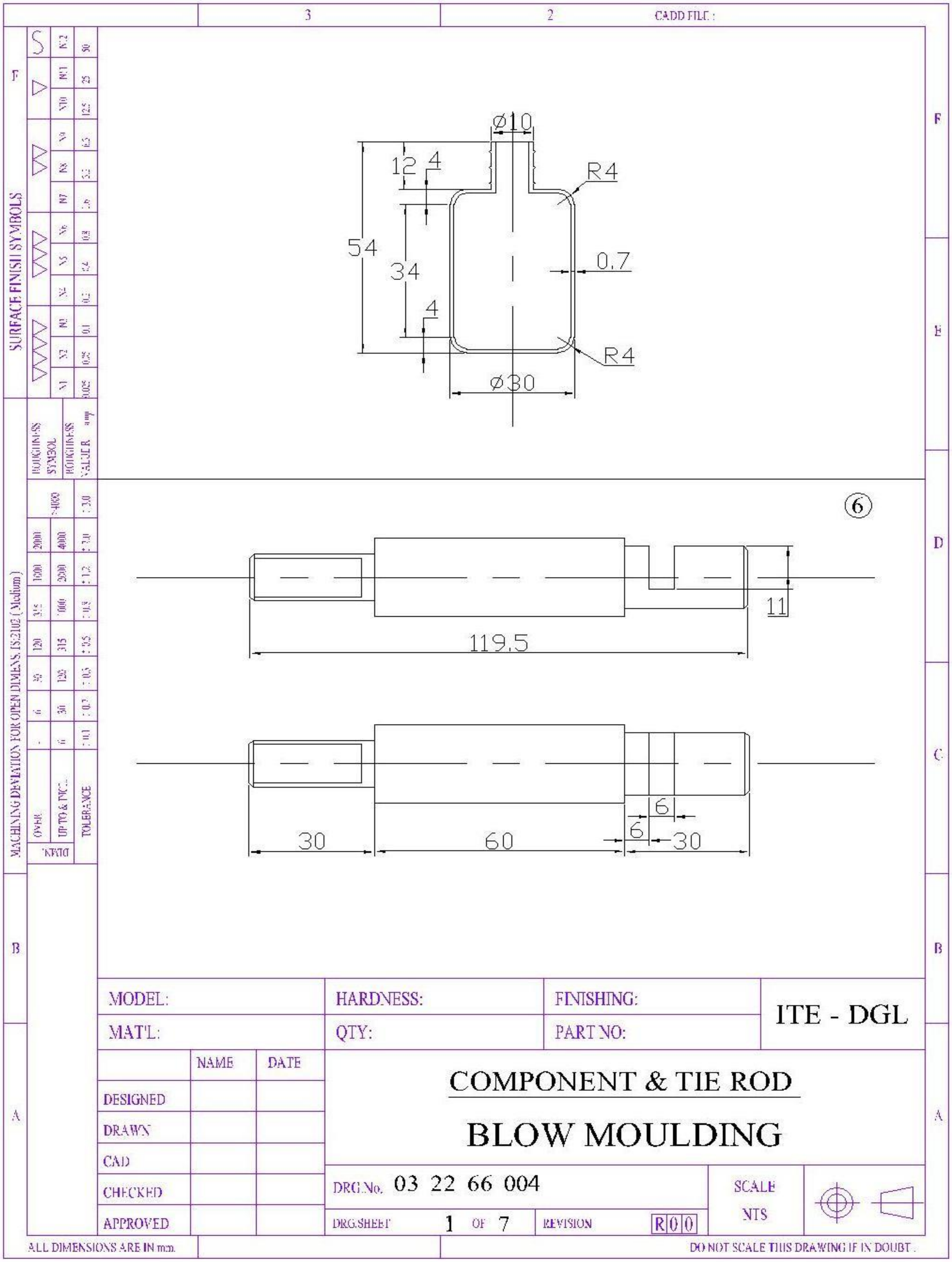
DRG.SHEET 4 OF 4 REVISION R00

SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT .

## Exercise – IV Blow Mould



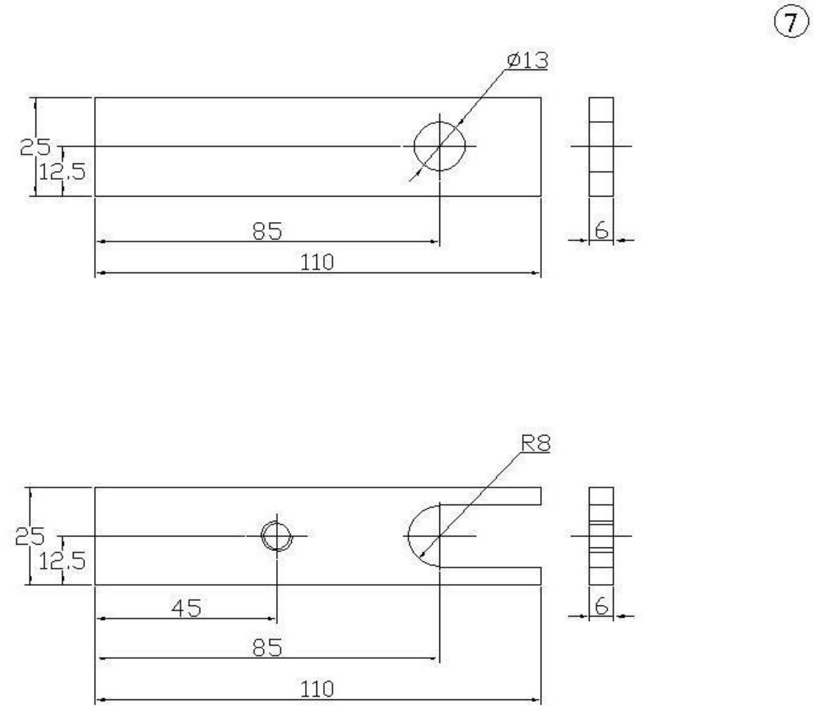
3 | 2 | CADD FILE :

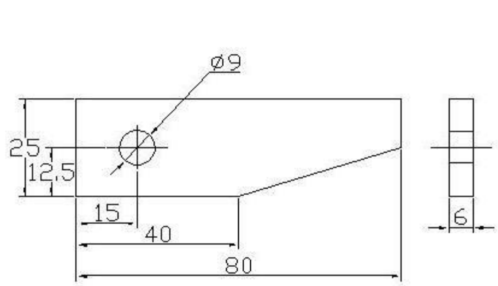
## SURFACE FINISH SYMBOLS

| ROUGHNESS SYMBOL | N1 | N2 | N3 | N4 | N5 | N6 | N7 | N8 | N9 | N10 | N11 | N12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ROUGHNESS VALUE R 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 )

| DIMEN. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| OVER | - | 6 | 30 | 120 | 315 | 1000 | 2000 | >4000 |
| UP TO & INCL. | 6 | 30 | 120 | 315 | 1000 | 2000 | 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 | | |

CLAMPING PLATE (LEFT & RIGHT) & LATCH PLATE

**BLOW MOULDING**

DRG.No. 03 22 66 004

DRG.SHEET 2 OF 7 | REVISION R00 | SCALE NTS

ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT .

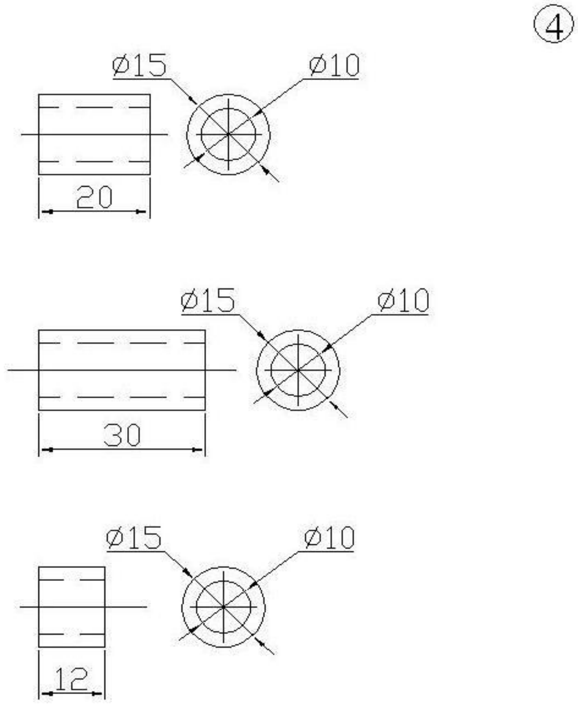
3 | 2 | CADD FILE :

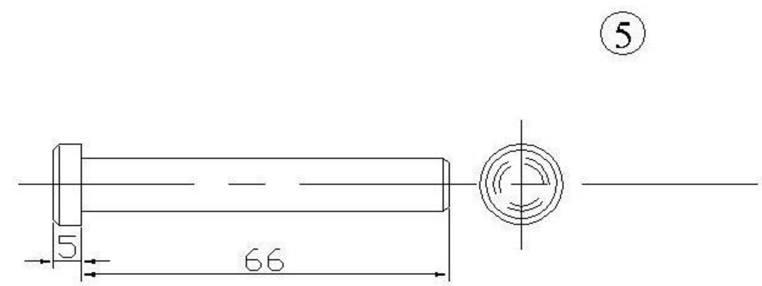
SURFACE FINISH SYMBOLS

| 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 | |
| UPTO & INCL. | 6 | 30 | 120 | 315 | 1000 | 3000 | 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 | | |

## HINGE COLLAR & HINGE PIN

## BLOW MOULDING

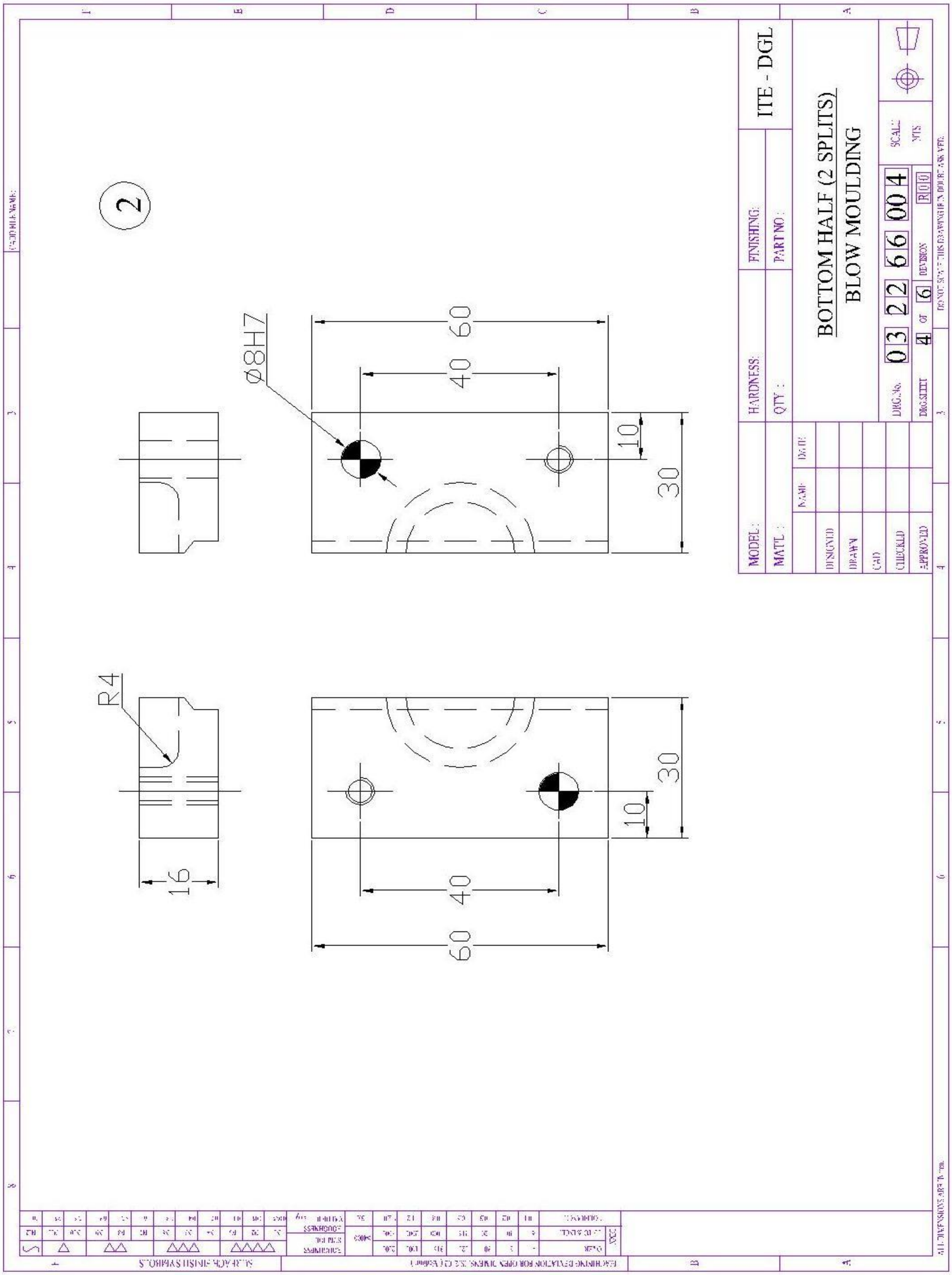
DRG.No. 03 22 66 004

DRG.SHEET 3 OF 7 REVISION R00

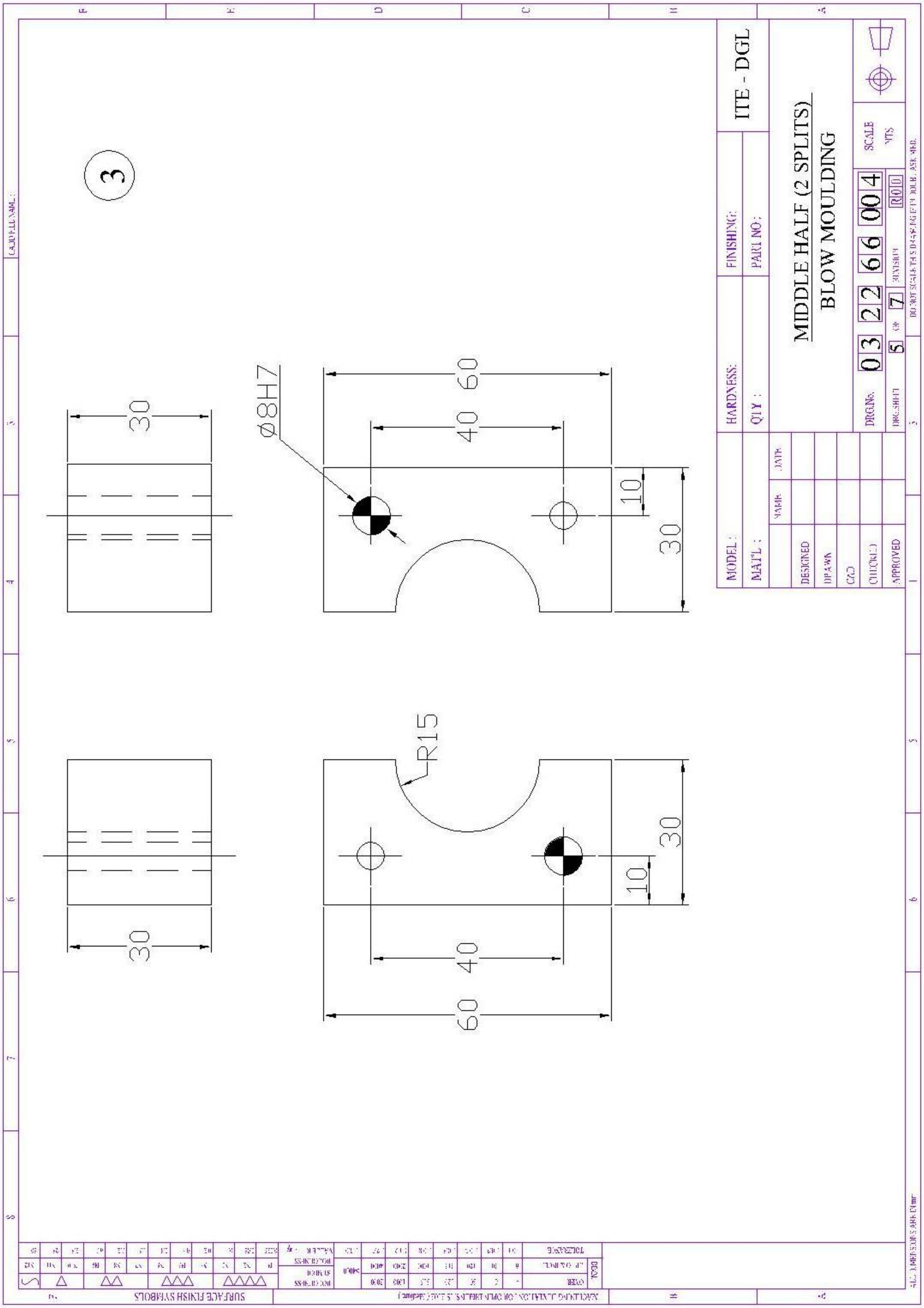
SCALE NTS

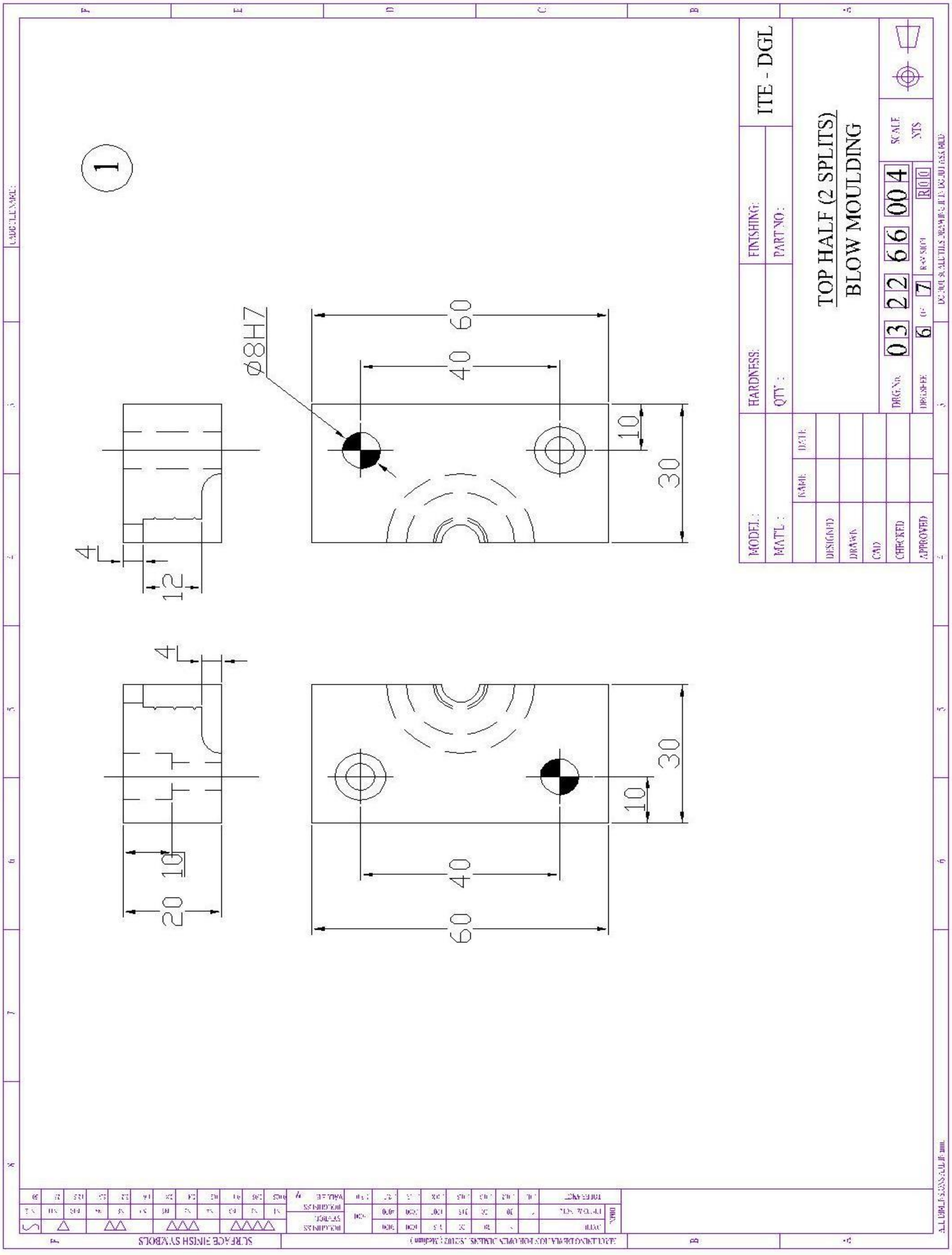
ALL DIMENSIONS ARE IN mm.

DO NOT SCALE THIS DRAWING IF IN DOUBT.



ITE - DGL
BOTTOM HALF (2 SPLITS)
BLOW MOULDING
MODEL :
MAT'L :
HARDNESS :
QTY :
FINISHING :
PART NO :
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No.
0 3 2 2 6 6 0 0 4
DRG.SHEET
4 OF 6
REVISION
R 0 0
SCALE
NTS
2
Ø8H7
R4
60
40
10
30
16


3
Ø8H7
60
40
30
10
R15
ITE - DGL
HARDNESS:
FINISHING:
QTY :
PART NO :
MODEL :
MAT'L :
MIDDLE HALF (2 SPLITS)
BLOW MOULDING
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
NAME
DATE
DRG.No. 03 22 66 004
5 OF 7
R00
SCALE
NTS
SURFACE FINISH SYMBOLS


ITE - DGL
TOP HALF (2 SPLITS)
BLOW MOULDING
HARDNESS:
FINISHING:
MODEL :
MAT'L :
QTY :
PART NO :
NAME
DATE
DESIGNED
DRAWN
CAD
CHECKED
APPROVED
DRG. No.
03 22 66 004
SCALE
NTS
Ø8H7
60
40
30
10
20
12
4
1
SURFACE FINISH SYMBOLS

NOTE

1. ALL DIMENSIONS ARE IN mm

2. PROVIDE PUNCH/DIE CLEARENCE PERSIDE AS 0.001

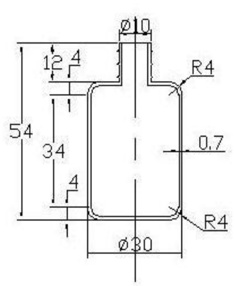
3. THE DIE PLATE SHALL BE HARDENED AND TEMPERED TO 60-62 HRC

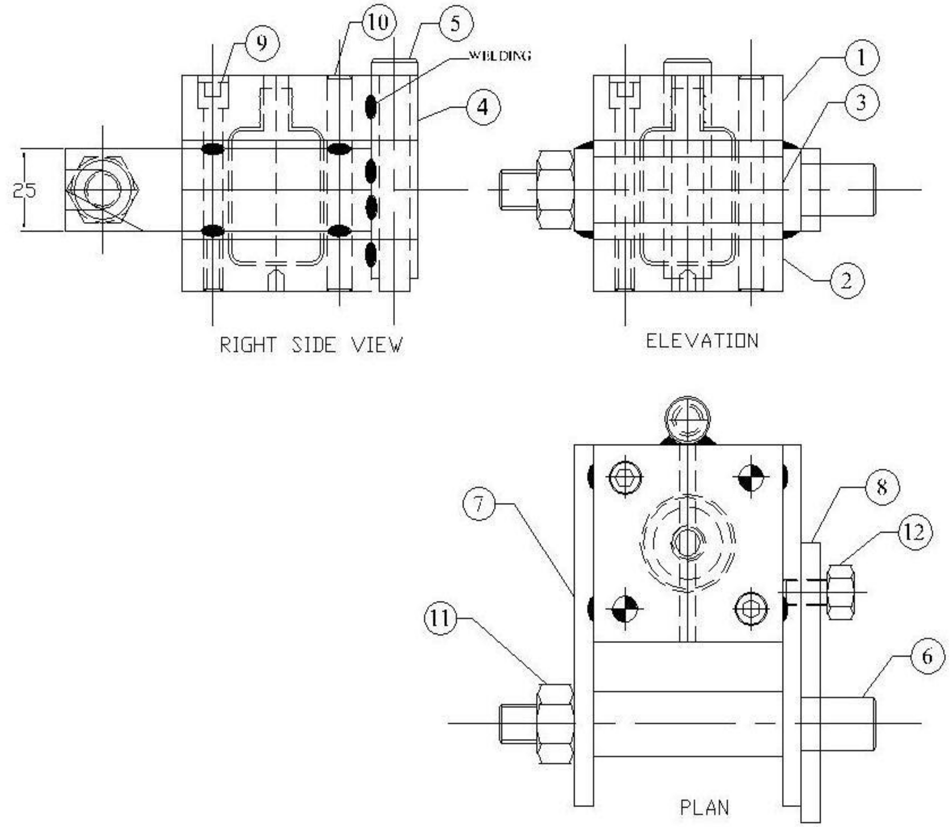
4. THE PUNCH SHALL BE HARDENED TO 60-62 HRC

5. AVOID SHARP CORNERS

6. FOR DIMENSIONS WITHOUT TOLERANCE SHALL BE PROVIDED AS ISO 2768-1

COMPONENT




**BILL OF MATERIALS**

| SI.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 |

| | | | | | |
|---|---|---|---|---|---|
| MODEL : | | | HARDNESS: | FINISHING: | ITE - DGL |
| MATL : | | | QTY : | PART NO : | |
| | NAME | DATE | ASSEMBLY DRAWING BLOW MOULDING | | |
| DESIGNED | | | | | |
| DRAWN | | | | | |
| CAD | | | | | |
| CHECKED | | | DRG.No. 03 22 66 004 | SCALE NTS | |
| APPROVED | | | DRG.SHEET 7 OF 7 REVISION R00 | | |

DO NOT SCALE THIS DRAWING IF IN DOUBT ASK HED

ALL DIMENSIONS ARE IN mm

# DIRECTORATE OF TECHNICAL EDUCATION

## DIPLOMA IN MECHANICAL ENGINEERING

## (TOOL& DIE)

## III YEAR

### N – SCHEME

### VI SEMESTER

### 2020 – 2021 onwards

# 4022660- PROJECT WORK AND INTERNSHIP

## CURRICULUM DEVELOPMENT CENTRE

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU**

**DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE)**

**N-SCHEME**

**(Implemented from the academic year 2020-2021 onwards)**

| | |
|---|---|
| Course Name | : 1220: DIPLOMA IN MECHANICAL ENGINEERING (TOOL & DIE) |
| Subject Code | : 4022660 |
| Semester | : VI |
| Subject Title | : **PROJECT WORK & INTERNSHIP** |

## TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

| Subject | Instructions | | Examination | | | |
|---|---|---|---|---|---|---|
| | Hours/ Week | Hours/ Semester | Marks | | | Duration |
| | | | Internal Assessment | Board Examination | Total | |
| PROJECT WORK & INTERNSHIP | 6 | 96 | 25 | 100* | 100 | 3hrs |

* Minimum marks for pass is 50 out of which minimum 50 marks should be obtained out of 100 marks in the board Examination alone.

**RATIONALE:**

This subject 'Project work & Internship' is the continuation of the previous semester subjects. The students are to implement the detailed project plan, which they have prepared. This project is generally an integration of the various types of skills acquired during their course of study. Hence it is essential that students are given opportunity to develop and integrate the highly essential industry-oriented competencies and skills. The subject build up greater confidence to face in the world of work.

**OBJECTIVES:**

- Implement the theoretical & practical knowledge gained through the curriculum in to an application suitable for a real practical &working environment preferably in an industrial environment.
- Implement the planned activity as a team.

- Take appropriate decisions on collected information.
- Carry out cooperative learning through synchronous guided discussions with in the class in key dates, a synchronous document sharing and discussions, as well as to prepare collaborative edition of final project report.

**PROJECT WORK & INTERNSHIP:**

The students of all Diploma Courses have to do a Project Work as a part of curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamilnadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for best three projects i.e. Institution wise, region wise & state wise. **The project work must be reviewed twice in the same semester. The project work is approved during the V$^{th}$ semester by the properly constituted committee with guidelines.**

**a) Internal Assessment Mark for Project Work & Internship:**

| Detail of Assessment | Period of Assessment | Max Marks |
|---|---|---|
| Project review I | 6$^{th}$ week | **10 marks** |
| Project review II | 12$^{th}$ week | **10 marks** |
| Attendance | Entire semester | **05 marks** (Award of marks same as theory subject pattern) |
| **Total** | | **25 marks** |

Proper record should be maintained for the two projects review and preserved for one semester after the publication of board exam results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

**b) Allocation of marks for Project Work and Internship in Board Examination:**

| Details Of Marks Allocation | Max Marks |
|---|---|
| Demonstration/Presentation | **25 marks** |
| Report | **25 marks** |
| Viva Voce | **30 marks** |
| Internship Report | **20 marks** |
| **Total** | **100* marks** |

*Examination will be conducted for 100 marks and will be converted to 75 marks.

**c) Internship Report:**

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV/V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year" Project Work and Internship" for 20 marks. The internship shall be taken in any Industry/Government are Private Certified Agencies which are in social sector/Govt.skill centers/Institution/Schemes.

**A neatly prepared PROJECT REPORT as per the format has to be submitted by individual student during the Project Work and Internship Board Examination.**