**Certificate Course in Tool & Die Making Course Details**

* Course Id : **MSME/CTDM**
* Candidate Eligibility : **Inter / ITI passed or its equivalent.**
* No. Of NOS (If QP) : **4**
* NSQF Level : **4**
* Cost Category : **2**
* Course Duration
  + Theory duration : **234**
  + Practical duration : **246**
  + OJT duration : **120**

**Trainer Qualification Work Experience**

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| **Trainer Qualification** | **Work Experience** |
| * Minimum - Diploma/Degree in Mechanical Engineering * Certified for Job Role: “Diploma in Tool & Die Making” with Minimum acceptance score of 65 % * Recommended that the Trainer is certified for the Job Role: “Diploma in Tool & Die Making” with Minimum accepted score of 65%. * Alternatively, must have successfully undergone a CGSC organized TOT workshop on “How to Trainer”. | * Minimum 3 to 4 years of industry experience in relevant job role and a Minimum of 3 to 4 years and Training experience in relevant job role. |

**CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE**

**Name and address of submitting body:**

**Tool Room & Training Centre, Patna**

**(An Extension Centre of Indo-Danish Tool Room, Jamshedpur)**

**Ministry of MSME, Govt. of India**

**Patliputra Industrial Estate**

**Patna-800013**

**(0612) 2270744**

**Name and contact details of individual dealing with the submission**

**Name : Shri. Ashutosh Kumar**

**Position in the organisation : General Manager (I/c)**

**Tel number(s) : (0612) 2270744**

**Mobile : 7260801191**

**E-mail address : trtcpatna14@gmail.com**

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| **Qualification Title** | **Certificate Course in Tool & Die Making** |
| **Qualification Code** | **MSME/CTDM** |
| **Nature and purpose of the qualification** | **Nature: Certificate Course**  **Purpose:** Learners who attain this qualification are competent in  Programming and operation of CNC Machines and get a job in the CNC machine shop.  Qualified learners who attain the above skill can also become an entrepreneur. |
| **Body/bodies which will award the qualification** | **Tool Room & Training Centre, Patna**  **(Certificate Awarded by TRTC, Patna)** |
| **Body which will accredit providers to offer courses leading to the qualification** | **Tool Room & Training Centre, Patna**  **(Certificate Awarded by TRTC, Patna)** |
| **Body/bodies which will carry out assessment of learners** | **Examination Cell of Tool Room & Training Centre, Patna** |
| **Occupation(s) to which the qualification gives access** | **Tool Maker & Machine Operator** |
| **Licensing requirements** | **Not Applicable** |
| **Level of the qualification in the NSQF** | **Level 4** |
| **Anticipated volume of training/learning required to complete the qualification** | **600** |
| **Entry requirements and / or recommendations** | **Inter / ITI passed or its equivalent.**  **Age 15 years to 35 years** |
| **Progression from the qualification** | **Job Progression: After completion of course and after 3 years of field experience the trainee can work as a toolmaker and production machinist and after 5 years of experience, the person can work as a supervisor in Tool & Die Maker and machine shop.** |
| **Planned arrangements for the Recognition of Prior learning (RPL)** | **Yes** |
| **International comparability where known** | **Ontario College** [**Tool Design**](http://www.senecacollege.ca/fulltime/MATD.html) **program Level -3**  **CNC** |
| **Date of planned review of the qualification.** | **January 2020** |

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| **Formal structure of the qualification** | | | | | |
| **Title of component and identification code** | **Mandatory/ Optional** | **Estimated size (learning hours)** | **Theory hours** | **Practical hours** | **Level** |
| 1. English Communication | M | 48 | 36 | 12 | 4 |
| 2. Workshop Calculation | M | 48 | 48 | - | 4 |
| 3. Workshop Technology | M | 48 | 24 | 24 | 4 |
| 4. Engineering Metrology | M | 48 | 24 | 24 | 4 |
| 5. Engineering Drawing | M | 72 | 24 | 48 | 4 |
| 6. Material Science | M | 24 | 24 | - | 4 |
| 7. Workshop Practice Bench Work & CNC Machine | M | 112 | 34 | 78 | 4 |
| 8. AutoCAD | M | 40 | - | 40 | 4 |
| 9. Press Tool Theory & Design | M | 40 | 20 | 20 | 4 |
| 10. On Job Training | M | 120 | - | 120 | 4 |
| **Total** | | **600** | **234** | **366** |  |

**ASSESSMENT**

**Body/Bodies which will carry out assessment:**

Examination cell - *Tool Room & Training Centre, Patna*

**How will RPL assessment be managed and who will carry it out?**

*YES. Learners who have met the requirements of any Unit Standard that forms part of this qualification may apply for recognition of prior learning to the relevant Education body. The applicant must be assessed against the specific outcomes and with the assessment criteria for the relevant Unit Standards.*

**Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF.**

**1. ASSESSMENT GUIDELINE:**

- Criteria for assessment based on each learning outcomes, will be assigned marks proportional to its importance.

- The assessment for the theory & practical part is based on knowledge bank of questions created by trainers and approved by Examination cell (TRTC, Patna)

- For each Individual batch, Examination cell will create unique question papers for theory part as well as practical for each candidate at each examination.

- To pass the Qualification, every trainee should score a minimum of 40% in each Theory and 50% in each Practical subject.

- Assessment comprises the following components:

>Job carried out in labs/workshop

>Record book/ daily diary

>Answer sheet of assessment

>Viva –voce

>Progress chart

>Attendance and punctuality

**2. ASSESSORS:**

TRTC Patna faculty teaching the Tool & Die Making course, also assesses the students as per guidelines set by Examination cell of TRTC. Faculties are trained from time to time to upgrade their skills on various aspects such as conduction of assessments, teaching methodology etc.

**3. ELIGIBILITY TO APPEAR IN THE EXAM:**

Minimum 70% attendance is compulsory for the students to appear for the assessments.

**4. MARKING SCHEME:**

**Semester-I**

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| --- | --- | --- | --- |
| **Sr. No.** | **Method of Assessments** | **Weightage** | **Evaluator** |
| **1** | Practical test | 25 | **Trainer + Moderator (Head of Dept)+ Examiner nominated by Examination cell (TRTC)** |
| **2** | Written test (Trade Theory) | 15 |
| **3** | Communication/Employability skills | 10 |
| **4** | Workshop calculation & Metrology | 10 |
| **5** | Engineering Drawing | 15 |
| **6** | Internal assessment | 25 |
| **Total** | | **100** |  |

**5. PASSING MARKS:**

Passing criteria is based on marks obtain in attendance record, term works , assignments, practical’s performance, viva or oral exam, module test, class test, practical exam and final exam

Minimum Marks to pass practical exam – 60%

Minimum Marks to pass theory exam – 40%

Grade Equivalents:-

>85% Ex

>65% & <85% A

>50% & <65% B

>35% & <50% C

<35% D

**6. RESULTS AND CERTIFICATION:**

The assessment results are backed by evidences collected by assessors. Successful trainees are awarded the certificates by TRTC, Patna.

**ASSESSMENT EVIDENCE**

ASSESSMENT EVIDENCE

Assessment evidence comprises the following components document in the form of records:

Job carried out in labs/workshop

Record book/ daily diary

Answer sheet of assessment

Viva –voce

Progress chart

Attendance and punctuality

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| --- | --- | --- |
| **Title of Component** | | **Certificate Course in Tool & Die Making** |
| **Sr.no** | **Outcomes to be assessed** | **Assessment criteria for the outcome** |
|  | Perform task with due consideration to safety rules in coordination with team and following government regulations | * Check for all the personal protection equipments before entering into the workplace * Conduct appropriate discussions within the team * Be aware of the working environment and promptly act during emergencies. * Present facts and situations and use appropriate tools for work and safety. * Helping the co-workers at the time of need at workplace * Maintaining good working relationship |
|  | Follow work ethics and identify necessary materials and tools | * Competent to understand the requirement and physically fit to carry out the work * Ensuring appropriate tools are in working condition and available * Prohibiting consumption of alcohol and tobacco in any form, at workplace * Behave respectfully with co-workers and use appropriate language for inter-personal communication. * Use public conveniences (toilets) only. |
|  | Apply professional knowledge & technical knowledge while performing the task | * Understand the importance of Tool & Die Making. * Displaying skills of Conventional & Non-Conventional Machining and assembly of Tools & Dies. * Cutting Tools, Tooling materials etc. * Taking decisions at the workplace with due recognition and understanding of government set norms. * Showcasing sensitivity towards the precision machines and conventional machines and their maintenance. |
|  | Should be able to work effectively in team to deliver desired results at workplace | * Gather a team * Divide work amongst the team members |
|  | Maintain regularity at the workplace. | * Maintaining regularity at the workplace * Maintaining decorum of the workplace * Open to learning and engaged in discussions * Execute the assigned task with in time frame |
|  | Safety and Health practices at the workplace | * Safe handling of tools, equipment & CNC Machines * & Personal safety tool as per company product requirement. Machining types of CNC Machines advantages & Limitation of CNC computer numerical control applications. * Future of CNC technology (Advance Knowledge), update technology or latest CNC Systems :- CNC interpolation, open loop & close loop control systems with feedback devices co-ordinate systems & points mode knowledge. * CNC Machines-Turning Type Axes nomenclature Review assignment/practical/test * use protective clothing/equipment for specific tasks and work conditions * state the name and location of people responsible for health and safety in the workplace * state the names and location of documents that refer to health and safety in the workplace * identify job-site hazardous work and state possible causes of risk or accident in the workplace * carry out safe working practices while dealing with hazards to ensure the safety of self and others * state methods of accident prevention in the work environment of the job role * state location of general health and safety equipment in the workplace * inspect for faults, set up and safely use steps and ladders in general use * work safely in and around trenches, elevated places and confined areas * lift heavy objects safely using correct procedures * apply good housekeeping practices at all times * use the various appropriate fire extinguishers on different types of fires correctly * participate in emergency procedures |
|  | CNC PROGRAMMING AND CNC MACHINING - On job training | * Study of CNC machine, keyboard & specifications, Machine starting & operating in reference point, jog & incremental modes, coordinate system points, assignments absolute & incremental co-ordinate. * Identification of machines over travel limits & emergency stop, machine parts, mode practice (Jog, MDI, Edit, R.P. Auto, Single Block, MPG) Work & Tool setting CNC m/c part program preparation. * Linear interpolation, assignments & simulations on software on old program. Circular interpolation, assignment & simulation on old program. * Work offset & tool offset measurement & entry in CNC control. * Part program preparation by absolute & incremental programming. * CNC m/c turning with radius/Chamfer with TNRC editing practice & simulation. * Chuck removing & its assembly. * Cutting tool setting * Work setting * Program editing & simulation * Cycle 95-Stock removal cycle OD/ID * Drilling/boring cycles in CNC turning * Grooving/Threading on OD/ID in CNC turning * Offset correction practice * Size control on CNC machine * Sub program with repetition * Threading cycle OD * Sub program with repetition, sub-program with macro * Call eccentric turning etc * CNC turning: Mutlistart threading Programming with variables * final test & evaluations. |
|  | **Means of assessment**  Skill performance is assessed by conducting  i) Assignment for each semester  ii) Written test for each semester  iii) Final exam after completion of both the semesters  iv) Practical exam for each semester  v) Final practical exam after completion of both the semesters  vi) Viva / Oral Exam | |
|  | **Pass/Fail**  Passing criteria is based on marks obtain in attendance record, term works , assignments, practical’s performance, viva or oral exam, module test, practical exam and final exam  i) Minimum Marks to pass practical exam – 60%  ii)Minimum Marks to pass theory exam – 40% | |

**Fig. 1. Career Progression of Certificate course in Tool & Die Maker**



**Course Curriculum**

**Syllabus content with time structure**

**For the course of Certificate Course in Tool & Die Making**

**Duration: 600 hrs.**

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| **Session Name: English communication** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (36 hours)** | **Activity (12 hours)** |  | **Practical** | **Theory** |
| **Phonetics** |  | **The science of speech –** sounds.  Definition – Branches of Phonetics Auditory, Articulatory and Acousit phonetics. | 12 | 36 |
| **Speech** |  | **Mechanism –** How do we speak?  Vocal organs – Their role in production of speech sounds.  Speech sounds in English language consonant sounds and vowel sounds – Monophony and diphthong. |  |  |
| **Units of pronunciation** |  | **Syllable Accented and unaccented.**  Vocal quality – Tone pitch and volume. Innovation, modulation of voice – Falling and rising tone.  Rhythm speaking English.  Received pronunciation of English – difference between Indian pronunciation and R.P.  Kinds of sentences in English language and their pronunciation.  Common errors of as Indian in English. |  |  |
| **Enriching Vocabulary** |  | **Payronymixs,** Synonyms, Antonyms and Homonyms – Acronyms.  Phrases and Idioms, Proverbs and some popular idiomatic expressions.  Formation of words in English language – Nouns, Verbs, Adjective Adverbs etc.  Technical terms and words often confused.  Prefixes and suffixes in English their role in formationof words. |  |  |
| **Writing- Skills** |  | **Application –** writing, letter writing types of letters – personal, official and D.O. letters. Business letters.  Advertisement, Tender – Notices, Memorandum, Notice , Notification, circulars. Press communiqué etc.  Letters to the editor, letter of inquiry. Reply to such letters.  Writing inter office notes, note – sheet, orders, joining letters, show cause memo etc. |  |  |
| **Communication- Skills** |  | **Communication** – Definition, kinds of communication – verbal and Non- verbal.  Aids to verbal communication visual and auditory – electronics media.  Some visual aids – Placards Transparencies, charts, tables, Graphs, Pictorials etc.  Conversation in English. |  |  |
|  | **Public speaking** | How to control the fear and nervousness in public speaking. |  |  |
|  | **Preparation** | selection of a suitable out- fit delivery . |  |  |
|  | **Eye – contact** | Its role in communication . |  |  |
|  | **Body – Language** | Its reusing its contribution in communication. |  |  |
|  | **Presentation skills** |  |  |  |
|  | **Group- discussion** |  |  |  |
|  | **Mock – interview** |  |  |  |

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| **Session Name: Workshop Calculation** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (48 hours)** | **Activity (0 hours)** |  | **Practical** | **Theory** |
| **Trigonometry units and measurement of angles** |  | **To define right angle in** different systems and a radian.  Relation between Radians and Degrees – Problems.  To derive Arc length = r x 0 and Area of a sector A = ½ r20 and to show radian is a constant angle – Related Problems. | **0** | **48** |
| **Trigonometric ratios** |  | **Definition of Trigonometric** functions as sides of a right angled triangle.  To derive Identities – Problems: To find Trigonometric Ratios of Standard angles like 00, 300, etc., |  |  |
| **Allied angles** |  | **Rule of signs:** Meaning of Allied angles and Derivations of -0, 90, -0, 90 + 0.  Formulae of 180 ± 0, 270 ± 0, 360 ± 0, etc. using the formulae of 90±0 |  |  |
| **Mensuration** |  | **Problems based on Allied** angle  Problems on Areas and Volumes & other measurements. |  |  |
| **Heights and distances** |  | **Definition of angle of** elevation and depression  Illustration to find heights and distances of objects  Problems  To write Sin(A-B), Cost(AA\_B) and tan(A-B) by replacing B by –B.  To derive ratios of multiple angles like 2A and 3A – Problems  To writer half angle formulae from ratios of 2A formulae Problems. |  |  |

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| **Session Name: Workshop Technology** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (48 hours)** | **Activity (48 hours)** |  | **Practical** | **Theory** |
|  | **Hand Tools** | **Vices,** Construction parts specification uses of, Bench vice, Leg vice, Pipe vice, Hand vice, Pin vice,  Tool makers vice, Care of vices, Vice clamps, Hammers, Ball peen , Cross peen, Straight peen, Soft hammers, Files, Parts, size, cut of teeth, shapes, filing, methods of filing, care, special purpose file and needle files. Centre punches, Dot punch, Prick punch, Scrapers, Shapes, Scraping, Frosting or flowering, Hacksaws, Definition, types of frames, Parts of a blades, Kinds of blade, Types of blade  Teeth arrangements, Sawing - Power hacksaw, parts, function of type of blade, band saw, parts function, types of blade. Pliers, Spanners, Screw drivers,. | **24** | **24** |
|  | **Marking Tools** | **Scribers,** Try squares, parts of uses, Jenny calipers, parts uses calipers O/S I/S, dividers. Surface plates, material, constructions, specification and uses. Parallel blocks, ‘V’ blocks, Scribers, Features, uses, Surface gauges, types, ordinary universal, parts and uses. Angle plate, features, functions, types of uses. |  |  |
| **Turning tools and Tool Geometry** |  | **HSS, Carbide, Diamond**, Ceramic, Tool angles and their functions, Roughing tools, Finishing tools  Plain turning (1) L.H. tool, (2) R.H. tool, Facing tool, Threading tool, Boring tool, Profile tool, Parting of or end cutting tool. Tool holders, Holders for tool bit, Tool post, Clamping plate, Four way tool post, Single roller knurling tool holder, Joint type knurling tool holder, Revolving head knurling tool. |  |  |
| **Milling Machines** |  | **Principle of Milling**  Classification  Column & knee type  Fixed bed type  Planer type  Special type  Different types  Plain / horizontal milling machine  Vertical milling machine  Universal milling machine  Main parts – column, knee, gear box, spindle, saddle, over arm and brace  Controls  Functions  Specifications |  |  |
| **Milling cutters** |  | **Solid cutters**  Plain Milling cutter of slab milling cutter (solid, inserted)  Light duty plain milling cutter  Heavy duty plain milling cutter  Helical plain milling cutters  Brazed on tip cutters  Side and face milling cutters  Plain S/F  Staggered teeth S/F, Milling  Inter locking S/F  End milling cutters  Slot drills  Gear cutters  Shell end mills  Slot drills  Carbide milling cutters  Angular milling cutters  Single angle  Equal angle  Double unequal angle  Slitting saw  Form Milling cutters  Convex and concave  Corner rounding milling cutter  T-Slot cutter  Wood ruff key cutters  Thread Milling cutter  Sprocket cutters  Spline cutters  Tap & reamer cutter  Fly cutters  Bolted cutters |  |  |
|  | **Holding devises for cutters** | **Long arbor** & stub arbor  Collects  Tapered shanks  “Clarkson” system  Adopter |  |  |
| **Work holding devises** |  | Machine vice  Direct clamping  3-jaw chuck  4-jaw chuck  milling fixtures  Angle plates |  |  |

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| **Session Name: Engineering Metrology** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (24 hours)** | **Activity (24 hours)** |  | **Practical** | **Theory** |
| **Metrology** |  | **Introduction**  Definition of measurement  Aims of measurement  Standards of measurements – primary and electric standards.  Methods of measurement – direct and indirect comparison.  Precision and accuracy  Sensitivity and repeatability  Errors in measurements  Systematic error  Calibration procedure in measuring instruments. | 24 | 24 |
|  | **Measuring Instruments, Principle, Construction Least Count + Uses** | **Precision instruments**  Linear measurements  Non precision, steel rule, calipers dividers, telescopic gauges, Depth gauge.  Micrometers, vernier calipers  Height gauges  Slip gauges  Comparators |  |  |
|  | **Angular Measurements**  **Non Precision** | **Protractors**  Adjustable bevel  Engineers square  Combination set |  |  |
|  | **Precision Angle Measurement** | **Bevel protection,** dividing head sine bar, angle gauges, spirit level clinometers, Auto collimators. |  |  |
|  | **Limits, Tolerances And Fits** | **Definition – Inter** changeability  Basic size – Actual size  Limits of size  Maximum limit of size  Minimum limit of size  Hole  Shaft  Deviation  Upper deviation  Lower deviation  Actual deviation  Tolerance  Zero line  Fundamental deviation  Fundamental tolerance  Toleranced size |  |  |
|  | **Fits And Their Classification** | **Definition of a fit expression** 30H7/g6  Clearance  Clearance fit  Maximum clearance  Minimum clearance  Interference fit  Maximum interference  Minimum interference  Transition fit  Hole basis system  Shaft basis system |  |  |
|  | **Gauges** | **Types of gauges**  Plain gauges  Plug gauges  Snap gauges  Ring gauge  Adjustable type  Gap gauge  Combined limit gauges  Position gauge  Taylor’s principle of gauge design |  |  |
|  | **Comparators** | **Introduction**  Purpose of comparators  Types of comparators  Read type mechanical comparators – Dial indicators, advantages and disadvantages.  Working principle of pneumatic comparator and solex air gauge.  Optical comparators |  |  |

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| **Session Name: Engineering Drawing** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (24 hours)** | **Activity (48 hours)** |  | **Practical** | **Theory** |
| **Engineering drawing as a graphical language used by engineers, users and technicians** |  | **State the importance** and objectives of engineering drawing.  State the standards used for drawing. | 24 | 48 |
| **Drawing equipments** |  | **Explain the use of**  Drawing board  T - square  Set square  Mini drafter  Instrument box  Protractors  French curves  Identify the different grades of pencils HB, H, 2H, 3H.  Classify the different sizes of drawing sheets according to B.I.S.  Describe the layout of Drawing sheets and their contents.  Give idea about Letters and numerals  Explain the use of scales – Enlarging, Reducing, full scale and representative fraction. |  |  |
| **Dimensioning Techniques** |  | **State the types of lines** and their uses.  Identify different dimensioning methods.  Use Chain, parallel and combined dimensioning.  Use aligned and unidirectional system of dimensioning in given situation.  Use co-ordinate dimensioning, methods of dimensioning Diameter, Radii, Chords, angles. |  |  |
| **Recognize the points in various quadrants** |  | Explain all four quadrants  Identify Horizontal plane, Vertical plane and Profile plane.  Explain the projection of points – front view, top view and side view (both left and right). |  |  |
|  | **Orthographic projection of machine parts** | **State Meaning** of orthographic projection  Draw elevation, plan and side elevation of the machine parts like stepped block, fork lever, bearing block, etc. |  |  |
|  | **Isometric projection and views of solids and machine parts** | **Describe the use of Isometric** scale  Distinguish between Isometric view and Isometric projections  To draw the Isometric view of different geometrical objects and machine parts  Convert orthographic views into isometric view |  |  |
|  | **Preparation of assembly drawing** | hinge  C-clamp  Drill base and table  Tool makers clamp  Drill jig  Plumber block, etc. |  |  |
| **Surface finish symbols** |  | **Indication**  Special surface  Direction of lay  Machining allowance  Position of symbol  Symbols with inscriptions  Additional indications |  |  |
|  | **Fits and**  **Tolerance** | Indications in assembly drawings |  |  |

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| **Session Name: Material Science** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (24 hours)** | **Activity (0 hours)** |  | **Practical** | **Theory** |
| **Mechanical Properties Of Metals** |  | **Introduction**  Various Properties:  1) Physical properties  Ex.: Shape, size, colour, luster, sp.gr.  2) Mechanical properties  Ex.: Elasticity, plasticity  3) Technological properties  Ex.: Machinability, Malleability  4) Thermal properties  Ex.: Spl. Heat thermal conductivity  5) Electrical properties  Ex.: Conductivity, resistivity  6) Chemical properties  Ex.: Atomic wt., Equivalent wt. | 0 | 24 |
| **Types Of Mechanical Properties** |  | **Definition and Explanation and examples**  Elasticity, Plasticity, Ductility,  Brittleness, Malleability, Welalebility, Castability,  Hardness, Toughness,  Stiffness, Resilience,  Creep, Edurance,  Strength, Factors affecting, machinability |  |  |
| **Work Hardening** |  | **Definition Explanation**  Due to cold working  Due to hot working  Comparison between cold working and hot working as applied to work hardening  Meaning of Recovery  Recrystallization  Grain growth |  |  |
| **Fracture Of Metals** |  | **Introduction**  Causes of Fracture |  |  |
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| **Session Name: Workshop Practice Bench Work & CNC Machine** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (34 hours)** | **Activity (78 hours)** |  | **Practical** | **Theory** |
|  | **Bench work** | 1. Clamping the job in the Bench Vise 2. Positioning of feet & body for filing 3. Setting the Vice to suitable height 4. Holding of large files 5. Straight filing 6. Filing write angle 7. Checking with tri square 8. Measuring the part with steel rule 9. Marking with reference plane 10. Scribing the lines 11. Dot Punching 12. Number punching 13. Marking lines parallel using jenny caliber 14. Checking flatness & Squareness using a tri square 15. Diagonal filing 16. Longitudinal filing 17. Transfers filing 18. Draw circles with dividers 19. Filing Champers 20. Hecksawing 21. Fixing of blade in Hecksaw frame 22. Holding Hecksaw frame 23. Straight Hecksawing 24. Angular Hecksawing 25. Marking with varnier height gauge 26. Measuring angles with verniar bevel protractor 27. Counter Sinking of holes 28. Counter boring of holes 29. Drilling through holes 30. Drilling large diameter holes 31. Filing radius 32. Checking radius 33. Sharpening of drills 34. Drilling blind holes 35. Measuring depth with venrier calipers 36. Measuring with micrometers 37. Checking dimensions with venrier caliper 38. Checking dimensions with depth caliper/micro meter 39. Drilling tub size hole 40. Internal threading of through holes using hand taps 41. External threading using dies 42. Reaming drilled holes using hand reamers 43. Parting off by chain drilling 44. Checking center to center distance between holes 45. Measuring holes and slots using telescopic gauges 46. Wringing of slip gauges 47. Checking tapers using sign bar/slip gauges and dial indicator 48. Sawing thin metal along a carved line 49. Using profile gauges (Template gauges) 50. Marking parallel line on cylindrical surfaces 51. Rectifying zero error in measuring instruments 52. Spot finishing on flat metallic surfaces 53. Sharpening a center punch 54. Sharpening a scriber 55. Originating flat scraped surfaces by 3 plate method 56. Sharpening flat scraper 57. Scraping carved surfaces 58. Sharpening half round scrapers 59. Sharpening triangular scrapers 60. Assembly of parts | **78** | **34** |
|  | **FITTING** | **Countersinking,** Counterboring & Reaming |  |  |
|  | **Turning** | 1. Identifying parts of a lathe 2. Fixing job in between centers 3. Grinding right hand rough turning of tool 4. Selection of speed and feed 5. Plain turning 6. Mounting & Dismounting of chucks 7. Truing work in a four jaw chuck with the help of a surface gauge 8. Setting the tool in the tool post 9. Facing the work 10. Centre drilling 11. Rectifying damaged center – drilled hole using spotting tool 12. Rectifying damaged center – holes using co8untersinking tool 13. Rough turning work, held in chuck 14. Turning square shoulder 15. Turning beveled shoulder 16. Turning filleted shoulder 17. Turning an undercut shoulder 18. Knurling on lathe 19. Chamfer turning 20. Turning irregular job on a four-jaw chuck 21. Cutting external thread using die and die stock 22. Grinding the parting on tool 23. Grinding the form on tool 24. Turning concave and convex profiles 25. Excentric turning 26. Form turning 27. Drilling on lathe 28. Boring on lathe 29. Step boring on lathe 30. Counter sinking 31. Counter boring 32. Turning taper by compound slide 33. Taper turning by tail stock set over 34. Taper turning using taper turning attachment 35. Tapping on lathe 36. Cutting different forms of threads on lathe 37. Measuring turned jobs using vernier caliper 38. Measuring turned jobs using external micrometer 39. Measuring turned jobs using internal micrometer 40. Measuring turned jobs using depth vernier / Dept. micrometer 41. Checking tapers jobs using a vernier bevel protractor 42. Checking tapers jobs using sine bar, slip gauges and dial indicators 43. Checking bores using bore gauges 44. Checking thread cut jobs using thread gauges |  |  |
|  | **Milling**  **Project:”V” Block** | **At the end of this Project student shall be able to**   1. Operate the different controls of a plain milling machine/vertical milling machine 2. Select and mount a long arbor/stub-arbor into the spindle 3. Mount and align the machine vice on the table with reference to the column face using a try square 4. Set the job in the machine vice for machining 5. Mount slab milling cutter/face milling cutter on the arbor 6. Set the spindle to the required speed 7. Lay out the job as per drawing using a vernier height gauge 8. Mill the surface of the job to an accuracy of ± 0.1 mm 9. Check the dimension of the job using a vernier caliper 10. Check the level and Squareness of the job using a try square 11. Remove the cutter and the arbor from the machine spindle 12. Material – Fe310-O |  |  |
| **CNC Turning (Fanuc)** |  | 1. Introduction to CNC Technology 2. Advantages & Disadvantages 3. NC & CNC Machine 4. Elements of CNC Machine 5. Positional Data(Absolute & Incremental Dimensioning) 6. Introduction to Programming Words 7. Functions of G- Code & M- Code. 8. Tool Selection & Tool Offset, Tool Nose Radius 9. Compensation (TNRC) 10. ISO Specification for Inset, Cutting Parameters 11. Data Input Panel & their uses 12. Canned Cycles - Roughing, Pattern Repeating, Drilling, Peck Drilling, Threading cycle etc. 13. Boring Cycle, Facing, Grooving 14. Taper Turning**,** Profile boring 15. Sub- Programme & Nesting with example. |  |  |
|  | **Machine Practice** | 1. Concept Of Operating a CNC Machine 2. Operating Practice on CNC Mirac (Turning) Machine, 3. Machine Homing, 4. Tool Offset, 5. Tool Changing, 6. Profiling Practice,   drilling ,Boring etc. Independently do programming and machining the job on the machine. |  |  |
| **CNC Milling (FANUC)** |  | 1. Data Input Panel & their Functions 2. Axis Definition, Main function of M - Code 3. Dimensional Programming 4. Programming of Work piece Contour 5. Tool Offsets 6. Tool Radius Compensation & Tool Definition 7. Path Functions 8. Contour programming 9. Canned Cycles-(Pocket, Circular, Slot, Peck Drilling etc. |  |  |
|  | **Machine Practice** | 1. Concepts Of Operating a CNC Machine 2. Operating Practice on CNC Triac (Vertical spindle Milling) Machine 3. Machine Homing, 4. Work Offset 5. Tool Offset 6. Tool Changing 7. Profile machining, etc. |  |  |

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| **Session Name: AutoCAD** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (0 hours)** | **Activity (40 hours)** |  | **Practical** | **Theory** |
|  | **AutoCAD** | 1. Introduction to computer. 2. System requirements for AutoCAD. 3. Graphics Screen of AutoCAD. 4. Menu Area Setup for drawing. 5. Creation of 2D Drawings: - Point, Line, construction line, multiline, polyline, ray, arcs, circle, rectangle, polygons, ellipse, spline, etc. 6. Modification 2D Drawing: - Fillet, chamfer, trim, mirror, scaling, stretch, copy, move, offset, array, lengthen, extend, break, join, etc. 7. Assigning of different line type to objects: - Dashed line, hidden line, center-line, dotted line, border line, gas line, tracks, zig zag, etc. 8. Transparent Overlay (Layer). 9. Tables, Text, Hatching, Gradient. 10. Block, W Block, Design Center. 11. Modeling 3D Objects: - with the help of box, cylinder, sphere, cone, torus, wedge, extrude, revolve, slice, section, interference, etc. | 40 | 0 |
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| **Session Name: Press Tool Theory & Design** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (24 hours)** | **Activity (24 hours)** |  | **Practical** | **Theory** |
| **Press Tool Theory** |  | 1. Principles of Blanking and Piercing dies. 2. Introducing Terminology, Basic Blanking & Piercing Operation., Description of blanking or Piercing die, Critical Stages of Shearing Action on Metal., Typical Appearance Characteristic, Cutting Force, Stripping Force, Clearance 3. Elementary Blank dies and Pierce dies- Construction | **20** | **20** |
|  | **Press Tool Design** | 1. Bending dies. 2. Basics of Bending, Estimating Flat Blank length, Simple “V” die for punch press operation, spring back. 3. Compound die- Principal of Operation, Construction. 4. Draw die:- Principal of Operation ,no of Strokes, Press Tool design . 5. Design Practice of Progressive die. 6. Design Practice of Compound die. 7. Design Practice of bending die. |  |  |

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| **Session Name: On Job Training** | | | | |
| **Practical competencies**  **(includes demonstration and activity)** | | **Underpinning Knowledge** | Duration (in hours) | |
| **Demonstration (0 hours)** | **Activity (120 hours)** |  | **Practical** | **Theory** |
| **On Job Training** | CNC PROGRAMMING AND CNC MACHINING -  On Job Training | 1. Introduction to CNC technology – CNC machines & controls. 2. History & development of CNC technology. 3. Conventional Vs. non-conventional machine tool. 4. Numerical control on CNC machine tools CNC control and CNC Control and types of CNC control 5. Calculation of technological data for CNC machining. 6. CNC clamping system. 7. Implementation of JH for CNC 8. Basic health and safety 9. CNC programming basics. 10. Introduction to manual NC programming 11. Manual NC programming for lathe & milling machines. 12. Application Numerical Control, Advantages, & Disadvantages, Adoptive Control System. | **120** | **0** |

**External assessments**

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| --- | --- | --- | --- |
| **Comp. NO.** | **ASSESSABLE OUTCOME** | | **ASSESSMENT RESULT** |
| **GENERIC** | | | |
| 1 | | Follow work ethics and identify necessary materials and tools | 5 |
| 2 | | Perform task with due consideration to safety rules in coordination with team and following government regulations | 5 |
| 3 | | Apply professional knowledge & technical knowledge while performing the task | 5 |
| 4 | | Should be able to work effectively in team to deliver desired results at workplace | 5 |
| 5 | | Maintain regularity at the workplace. | 5 |
| 6 | | Able to work observing personal health, safety & environmental protocol at Workshop | 5 |
| SPECIFIC | | | |
| 1 | | Precision Machining Capability | 35 |
| 2 | | Tool Assembly Capability | 35 |
|  | | **External Assessment Result** | **100** |

**EXAMINATION**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sl.No.** | **COURSE CODE** | **COURSE NAME** | **Examination Scheme** | | | | | | | | **Total Marks** |
| **Theory** | | | | **Practice** | | | |
| **Sessional** | | **Semester Exam** | | **Sessional** | | **Semester Exam** | |
| **Max. Marks** | **Min. to Pass** | **Max. Marks** | **Min. to Pass** | **Max. Marks** | **Min. to Pass** | **Max. Marks** | **Min. to Pass** |
| 1 | CTDM-01 | English Communication (Theory) | 10 | 4 | 30 | 12 | - | - | - | - | 40 |
| 2 | CTDM-02 | English Communication (Practical) | - | - | - | - | 20 | 12 | 40 | 24 | 60 |
| 3 | CTDM-03 | Workshop Calculation | 40 | 16 | 60 | 24 | - | - | - | - | 100 |
| 4 | CTDM-04 | Workshop Technology - Theory | 10 | 4 | 30 | 12 | - | - | - | - | 40 |
| 5 | CTDM-05 | Workshop Technology - Practical | - | - | - | - | 20 | 12 | 40 | 24 | 60 |
| 6 | CTDM-06 | Engineering Metrology -Theory | 10 | 4 | 30 | 12 | - | - | - | - | 40 |
| 7 | CTDM-07 | Engineering Metrology - Practical | - | - | - | - | 20 | 12 | 40 | 24 | 60 |
| 8 | CTDM-08 | Engineering Drawing-Theory | 10 | 4 | 30 | 12 | - | - | - | - | 40 |
| 9 | CTDM-09 | Engineering Drawing-Practical | - | - | - | - | 20 | 12 | 40 | 24 | 60 |
| 10 | CTDM-10 | Material Science | 40 | 16 | 60 | 24 | - | - | - | - | 100 |
| 11 | CTDM-11 | Workshop Practice Bench Work & CNC Machine | - | - | - | - | 40 | 24 | 60 | 36 | 100 |
| 12 | CTDM-12 | AutoCAD | - | - | - | - | 40 | 24 | 60 | 36 | 100 |
| 13 | CTDM-13 | Press Tool Theory & Design | 10 | 4 | 30 | 12 | - | - | - | - | - |
| 14 | CTDM-14 | Press Tool Theory & Design (Practical) | - | - | - | - | 20 | 12 | 40 | 24 | 60 |
| 15 | CTDM-15 | On Job Training | - | - | - | - | 40 | 24 | 60 | 36 | 100 |

**Evidence of level**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **LEVEL** | **Process required** | **Professional knowledge** | **Professional skill** | **Core skill** | **Responsibility** |
| 3 | Person may carry out a job which may require limited range of activities routine and predictable. | Basic facts, process and principle applied in trade of employment. | Recall and demonstrate  practical skill, routine and repetitive in narrow range of application | Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment. | Under close supervision.  Some responsibility for own work within defined limit. |
| Level 4 | Level 4 | Level 4 | Level 4 | Level 4 |