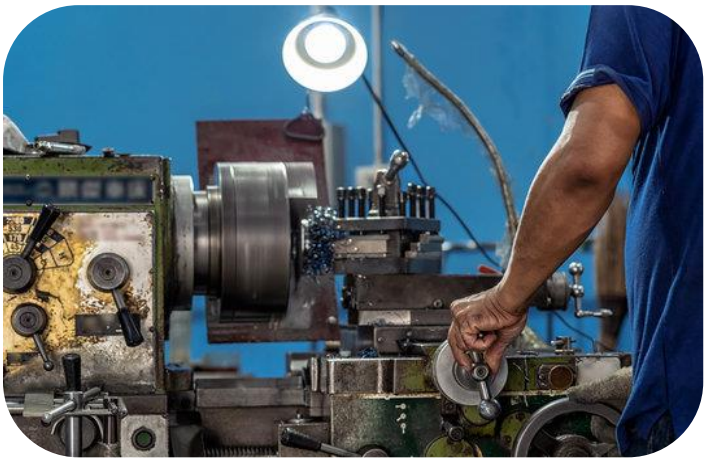
MECHANIC MACHINE TOOL MAINTENANCE (MMTM)

NSQF LEVEL – 4.5



SECTOR- CAPITAL GOODS AND MANUFACTURING

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

MECHANIC MACHINE TOOL MAINTENANCE (MMTM)

(Engineering Trade)

SECTOR – CAPITAL GOODS AND MANUFACTURING

(Revised in 2024)

Version 2.1

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Developed By
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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960 by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. “Mechanic Machine Tool Maintenance (MMTM)” CITS trade is applicable for Instructors of “Mechanic Machine Tool Maintenance (MMTM)” CTS Trade.

The main objective of Crafts Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	480
	Professional Knowledge (Trade Theory)	270
2.	**Training Methodology**	
	TM Practical	270
	TM Theory	180
	Total	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

3	On the Job Training (OJT)/ Group Project	150
4	Optional Courses	240

CITS Trainees of optional courses of up to 240 hours in each year short term courses.

2.3 PROGRESSION PATHWAYS

- Can join as an instructor in a vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to

maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

Allotment of Marks among the subjects for Examination:

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming yearly examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A high level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**MECHANIC MACHINE TOOL MAINTENANCE (MMTM) – CITS**
Trade code	DGT/4033
Reference NCO 2015	2356.0100, 8211.1000, 8211.0100, 3115.0102
NOS Covered	CSC/N9521, CSC/N9523, CSC/N9534, CSC/N9469, CSC/N9470, CSC/N9471, CSC/N9472, CSC/N9474, CSC/N9492, CSC/N9493, CSC/N9501, CSC/N9502, CSC/N9503, CSC/N9488, CSC/N9504, CSC/N9505, ASC/N9410, ASC/N9411
NSQF Level	Level-4.5
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in Mechanical/Production Engineering from AICTE/ UGC recognized Engineering College/ University. OR 03 years Diploma in Mechanical/Production Engineering after class 10th from AICTE/ recognized board of technical education. OR Ex-serviceman from Indian Armed forces with 15 years of service in related field as per equivalency through DGR. OR 10th Class with 02-year NTC/NAC in Mechanic Machine Tool Maintenance.
Minimum Age	16 years as on first day of academic session.
Space Norms	360 Sq. m.
Power Norms	9 KW
Instructors Qualification for	
1. MMTM - CITS Trade	B.Voc/Degree in appropriate branches of Mechanical/ Production Engineering from AICTE/UGC recognized University with two years experience in relevant field. OR 03 years Diploma in appropriate branches of Mechanical/ Production Engineering from AICTE/ recognized Board/ University with five years experience in relevant field. OR Ex-serviceman from Indian Armed Forces with 15 years of service in related field as per equivalency through DGR. Candidate should have undergone methods of Instruction of course with minimum 02 years of experience in technical training institute of Indian Armed Forces. OR NTC/ NAC passed in **Mechanic Machine Tool Maintenance** trade with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in **Mechanic Machine Tool Maintenance** trade, in any of the variants under DGT.

2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any Engineering trade with seven years experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT
4. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 Years

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools & equipment of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Assembler, Workshop Machines and Equipment; assembles finished mechanical components to form specific unit or machine such as lathe, grinder, milling machine, pump etc. using hand tools and machines. Studies drawing or sketch for fitting and assembly details. Places different finished metal components of machines like frames, cross members, bearings, bottom and top plates, etc. on floor and assembles them together in prescribed sequence, using nuts, bolts etc. Carries out further tooling, if necessary while assembling. Fits different parts together to form complete unit or part of unit. Checks during assembly stages for accuracy of fitting and to correspond to specifications. Finishes fitting and files off edges or ends of parts where necessary using hand files, chisels etc. Tests either finished main assembly or sub assembly parts for specified performance and makes necessary adjustment to parts using hand tools. May install assembled units at site or in factories for actual running. May repair and overhaul machines.

Erector, Machine and Equipment; installs, erects and changes layout of machines and equipments in mills, factories, workshops etc. according to instructions or specifications. Studies drawings and lay out sketches of machines or equipment to be erected. Calculates available floor area in relation to dimension of machines, working space required etc. and marks areas on floor for foundations of machines. Guides' construction of foundations and setting of foundation bolts and fixtures according to type of machines to be installed and allows foundations to dry up and settle for required number of days. Places base or holding device of machines through foundation bolts or on fixture one by one, using lifting equipment and aligns and levels them with spirit level. Fastens or secures machines tightly to foundation bolts or fixtures and rechecks alignment and leveling to ensure correctness. Makes adjustment if necessary and gets grouting of foundations done. Allows grouting to dry up and adjust position of different parts of machine for efficient operation. Gives necessary power supply to machine or connects machine to line shaft. May run machine and observe performance. May assemble, repair and overhaul machines. May specialize in erecting particular type of machine or equipment such as printing machine, lathe, pneumatic hammer, grinder, pumps, etc.

Maintenance Technician - Mechanical; is responsible for maintaining the mechanical systems of equipment and machinery. They use laid down procedures, and knowledge of the equipment to conduct routine maintenance and organize repairs. They are also involved in control and monitoring devices and occasionally in the manufacture of items that will help in maintenance.

Reference NCO:

a) 2356.0100 Manual Training Teacher/Craft Instructor
b) 8211.0100 Assembler, Workshop Machine and Equipment
c) 8211.1000 Erector, Machine and Equipment
d) 3115.0102 Maintenance Technician, Mechanical

Reference NOS:

i) CSC/N9521
ii) CSC/N9523
iii) CSC/N9534
iv) CSC/N9469
v) CSC/N9470
vi) CSC/N9471
vii) CSC/N9472
viii) CSC/N9474
ix) CSC/N9492
x) CSC/N9493
xi) CSC/N9501
xii) CSC/N9502
xiii) CSC/N9503
xiv) CSC/N9488
xv) CSC/N9504
xvi) CSC/N9505
xvii) ASC/N9410
xviii) ASC/N9411

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 TRADE TECHNOLOGY

1. Demonstrate workshop safety measures and maintenance of precision measuring instruments. (NOS: CSC/N9469)
2. Evaluate components for assembly by carrying out surface finishing operations like scrapping, lapping etc. and different Heat Treatment like Hardening, tempering case hardening etc. (NOS: CSC/N9521)
3. Monitor dismantling, repair and assembling of mechanical power transmission elements in machine tools and check for functionality. (NOS: CSC/N9470)
4. Check preventive maintenance of lubrication & cooling system of different machines like lathe, drilling, grinding as per manufactures' guidelines. (NOS: CSC/N9471)
5. Monitor compliance to preventive maintenance during dismantling & assembly of indexing head, tail stock, saddle etc. and test for accuracy. (NOS: CSC/N9492)
6. Evaluate different joints made by setting up of gas & arc welding machines and using Sheet Metal Work tools. (NOS: CSC/N9493)
7. Monitor the work of dismantling, replace and assembling of machine parts of shaping, milling, lathe and drilling machines. (NOS: CSC/N9472)
8. Monitor the work of foundation and installation of machines and material handling process. (NOS: CSC/N9501)
9. Monitor the work of dismantling, replace and assembling of machine parts including spindle drive mechanism, Shafts, Axles, Couplings and Clutches. (NOS: CSC/N9502)
10. Demonstrate making of Simple Machine parts involving sliding, scraping and alignment. (NOS: CSC/N9503)
11. Analyse circuit construction of pneumatics and hydraulics observing standard operating procedure & safety aspect. (NOS: CSC/N9488)
12. Demonstrate basic functioning of different electrical equipment DC/ AC motors, passive & active electronic components, SCRS & ICS, proximity & ultrasonic sensors etc including basic maintenance work. (NOS: CSC/N9534)
13. Demonstrate PLC Programme and interface with other devices to check its Applications, evaluate part programme, test on simulation software and provide solutions to different errors. (NOS: CSC/N9504)
14. Evaluate fault to carryout maintenance work of different machineries/ equipment viz., shaper, surface grinder, lathe machines etc in the shop floor, using appropriate tools & equipment to ensure its functionality. (NOS: CSC/N9474)
15. Demonstrate CAD software commands and operational features of CNC machine using CNC codes (G & M codes) and programming. (NOS: CSC/N9523)
16. Monitor Overhauling, preventive maintenance and Troubleshooting of Machine tools, pumps, fans, blowers & compressors. (NOS: CSC/N9505)
17. Read and apply engineering drawing for different application in the field of work. (NOS: ASC/N9410)
18. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: ASC/N9411)

6. COURSE CONTENT

SYLLABUS FOR MMTM - CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skill (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 30 Hrs Theory 15 Hrs	Demonstrate workshop safety measures and maintenance of precision measuring instruments.	1. **Occupational Safety & Health** **Importance of housekeeping & good shop floor practices.** Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. 2. Basic safety introduction, Personal protective Equipment (PPE): - Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. 3. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers. 4. **Technical English:** Demonstrate different types of documentation as per industrial need by different methods of recording information. 5. **Basic Life support training:** Be able to perform DRSABCD: D: Check for Danger R: Check for a Response S: Send for help A: Open the Airway B: Check for normal Breathing C: Perform CPR (Cardio Pulmonary Resuscitation) D: Attach Defibrillator /	Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure **Soft Skills:** its importance and Job area after completion of training. **Introduction to 5S** concept & its application. Importance of 5S implementation throughout CITS course-workplace cleaning, machine cleaning, signage, proper storage of equipment etc. **Importance of Technical English** terms used in industry -(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards. **Basic Life support (BLS): -** Basic Life Support (BLS) techniques for drowning, choking, electrocution, neck and spinal injury, including CPR (cardiopulmonary resuscitation).

		Monitor as soon as available.	
		6. Monitor and Demonstrate on care and maintenance of precision measuring instruments.	Care and maintenance of measuring instruments - steel rule, vernier caliper, height gauge, vernier bevel protractor, flange, inside, outside micrometers, slip gauges, sine bar.
Practical 30 Hrs Theory 15 Hrs	Evaluate components for assembly by carrying out surface finishing operations like scrapping, lapping etc. and different Heat Treatment like Hardening, Tempering case hardening etc.	7. Scrap on flat &curved surface taking impression for high spot using Prussian blue. 8. Sharpening of scrapers using diamond wheel and oil stone / Lappers stone. 9. Inspection and checking of scraped surfaces. 10. Demonstrate heat treatment processes in muffle Furnace. Testing of hardness. 11. Demonstrate use of dial test indicator slip gauges, height gauge and other measuring instruments for checking, centre distance, Angle, concentricity, eccentricity, Dovetail, slot. 12. Measurement of various elements of threads, spur gear etc.	Scrapers-different types and their correct uses. Importance of scraping, Difference method of scraping checking of scrapped surfaces, use of sprite level. Hand tools uses for dismantling and re-assembly and their specifications: - Types of spanner -Materials and uses (Box, socket, tubular, hook-spanner) Thread fastener-Nut and lock nut-Types and function. Bolt - types and function. Screws - types and application, washers, cir clips and split pin-types and their application key and cotters - classification, comparison and uses. Heat treatment processes, effects & methods. Definition of surface Finish-terms used to describe the surface finish dimensional. Tolerance of surface finish, surface quality and symbolic, Representation. Instruments used for testing and measuring surface quality. Unit of surface finish. Surface finishing process-Lapping, honing, Electra-plating, Method spraying galvanizing, Packing and Metallization, Introduction to thread and gear Measurements.

Practical 70 Hrs Theory 20 Hrs	Monitor dismantling, repair and assembling of mechanical power transmission elements in machine tools and check for functionality.	13. Dismantle and assemble of various parts of different types of drilling machines and lathe machines. Inspection of parts for repair. 14. Assemble and remove matched set of belts. Tension adjustments. 15. Remove gear box from various machines for inspection and demonstrate gear trains and their functional relationship. 16. Assemble gear box and remounting on the machine. 17. Demonstrate on coupling keys-fitting procedure and removing. 18. Use of keys in power transmission. 19. Dismantle and assemble various clutches, brakes and couplings. Testing after assembly. 20. Dimensional relationship of the shaft with bearing. 21. Type of load, Method of clamping and fitting the bearing in the housing. 22. Method of mounting and dismantling, uses of pulleys and extractors, maintenance and inspection of bearing. 23. Demonstrate angular contact ball bearing in respect of handling, cleaning and lubrication.	Drill machine types, functioning, construction and maintenance. Lathe types, functioning, construction and maintenance. Clutches, brakes and couplings. Power transmission elements -shafting -line shaft &types of shaft -rigid, flexible and hollow. types of pulleys-solid split, v-grooved, step cone taper guided and jokey or rider pulleys their functions and uses consideration of drive to driven ratio. Crowing of pulley. Fast and loose pulley. Function, types, specification and use of belts. Belt fasteners and materials use for belt. Frictional and universal coupling, advantages and disadvantages over each other and their application. Friction -Its effects and types. Sources of reduction of friction. Wear-Its effects and types, Wear and damage. Indication of wear. Method of finding the amount of wear prevention of wear. Bearings -Its types and use, bearing materials and their properties, construction feature of anti-friction bearing -ball & rollers, housing and lubrication specification of rolling bearing -IS-examples, preparation selection of fit for bearing mounting. Angular contact ball bearings, specifications, visual inspection, leveling, clearing, lubricating, fitting

			and satisfaction test.
Practical 30 Hrs Theory 15 Hrs	Check preventive maintenance of lubrication & cooling system of different machines like lathe, drilling, grinding as per manufactures' guidelines	24. Demonstrate Coolant preparation, cleaning of coolant tank, filters, replacing coolant, identifies lubrication points, clean and lubricate. 25. Check the lubrication line for proper suction and delivery at end points.	Viscosity and its measurement using various apparatus, cutting fluids and coolants, various types, composition, health hazards of coolants, grades and designation systems. Types of lubricants, colour coding such as high speed long life grease, heat resistant and water resistant grease. Centralized lubrication system - parts, functioning and mechanism.
Practical 20 Hrs Theory 10 Hrs	Monitor compliance to preventive maintenance during dismantling & assembly of indexing head, tail stock, saddle etc. and test for accuracy.	26. Dismantle machine vice, three jaw chucks, Indexing head, tail stock, slotting attachment, coolant pumps, using various hand tools with specific reference to functional part of their machine and oiling of dismantled parts. 27. Assemble and testing for operation.	Maintenance Activity - Maintenance Definition. Different types of maintenance. Work Procedures, job cards, Schedule, History record sheet.
Practical 45 Hrs Theory 15 Hrs	Evaluate different joints made by setting up of gas & arc welding machines and using Sheet Metal Work tools.	28. Connect and set Arc welding plant and gas welding plant. 29. Hand on practice on Arc, gas and Spot welding. 30. Safety to be observed in welding work. 31. Demonstrate uses of hand tools in the SMW trade. 32. Development of surface from working drawing. 33. Marking out location and drilling of holes for riveting. 34. Use of dolly and snap forming river heads. 35. Lap and butt joint by cold riveting.	**ALLIED SKILL Welder (G & E)** Flame cutting principle and use of equipments, safety precaution and maintenance of equipments, symbols of welding. Sheet Metal Worker (SMW) Over view of SMW, Name and description of common tools and equipments. Different type of joints employed in sheet metal work. Rivet and riveting. The object of riveting, relation between size of rivet and thickness of sheet, pitch of rivet, types, uses, method of riveting using snap and dolly Rivet joints, defects in riveting and their remedies.

Practical 45 Hrs Theory 15 Hrs	Monitor the work of dismantling, replace and assembling of machine parts of shaping, milling, lathe and drilling machines.	36. Sample case studies to be discussed based on theory. 37. Demonstrate total cleaning of machine tool after total inspection. 38. **Planning of overhauling:** Method of dismantling, precaution to be taken while dismantling. 39. Sequence of operations, marking of the parts, methods of cleaning of parts. 40. Proper method of removal and remounting of bearings. 41. Dismantle & Re-assemble machine-sub assemblies in correct sequence, testing of correct functioning of machines (shaping, milling, lathe and drilling machines), coolant and lubrication pumps. 42. Solvent and cleaning materials - their names and specification. Preparation of test chart.	Concept of KAIZEN, Just-in-Time (JIT), Total Productive Maintenance (TPM) and Small Group Activity (SGA). Concept of routine, preventive and breakdown maintenance. Inspection, diagnosing & repairing procedure. Schedule and planning for preventive maintenance work. Maintenance of records, log book and history sheet. Functions involving preventive maintenance. Advantage of preventive maintenance. Frequency of preventive maintenance, preparing preventive maintenance schedule - points to be considered. Method of repairing damage parts, Major overhauling, Method of reconditioning of machine tools using -special tools, test mandrel, template- patterns, gauges, bridges. Testing of m/c after repair. Concept of test chart.
Practical 30 Hrs Theory 15 Hrs	Monitor the work of foundation and installation of machines and material handling process.	43. Introduction to leveling of Machines. 44. Demonstrate leveling - use of spirit level, camel back, straight edge, bridge, parallel block. 45. Leveling of surface plates, Marking table. Milling machine. 46. Lathe machine - preparation of test report indicating degree of flatness. 47. Use of leveling bolts. Taper wedges for leveling of the horizontal and vertical surfaces. 48. Demonstrate foundation.	Methods employed for installation and erection of precision and heavy duty machines. Location and excavation of foundation. Different types of foundation: Structural, reinforced, wooden and isolated. Requirement of good foundation, different types of foundation & foundation bolts. Foundation for heavy duty machine and precision machine. Special process

		49. Demonstrate different types of fits following inter changeability system. Process of fitting ordinary type Brass Bearing Method of fitting ball and roller bearing on the shaft. 50. Demonstrate use of different type of lifting tackles both mechanical and hydraulics - such as screw jacks, chain pulley block, crabs and winches, rollers, bars and levers. 51. Demonstrate use of inclined plane. Hydraulic trolleys. 52. Maintenance of lifting equipments. Demonstrate method of lifting jobs of various shape, size and weight. Use of appropriate length of chains. Inspection of chain links and lifting tackles. 53. Demonstrate on the shop floor.	involving in erection of heavy duty machines. Layout of machines - Consideration of power, space, weight, ventilation and moving parts. Types of vibrations, causes and prevention of vibrations. Method of insulation of machine against vibration. Anti-vibration devices and their locations. Different types of instruments used for checking the vibrations. Elements of Interchange able system its terms & application. Method of selective assembly, Hole & shaft basis of system. Different type of appliances and tackles for lifting, shifting, loading and unloading of machines and equipments. Screw jack - their use and working principles. Chain pulley block and hook - their uses and working principles. Concept of lifting, crane and hoist - working principles and main constructional features. Working principles and use of other tackles like crabs, winches, slings (wire rope & elastic), roller and bars, levers, lashing and packing. Importance of testing of lifting tackles. Use of inclined plain. Special precaution in handling heavy equipments, removal and replacement of heavy parts. Safety in transportation.
Practical 20 Hrs Theory	Monitor the work of dismantling, replace and assembling of	54. Demonstrate dismantling, replace and assembling of various spindle drive mechanism used on pedestal	Machine Alignment - different types - procedure. Equipment for aligning machines - use of test

10 Hrs	machine parts including spindle drive mechanism, Shafts, Axles, Couplings and Clutches.	grinder, drilling, milling, shaper, lathe and grinding machines. 55. Checking for spindle run-out, axial and radial play. Setting of play as per standard chart. 56. Checking of bearing performance - repairs and replacement as needed. 57. Demonstrate assembling of Shafts, Axles, Couplings and Clutches used on various machines.	mandrel, master cylinder, straight edge, slip gauges and dial indicators. Precaution to be observed in the use of equipments while aligning. Special precautions necessary for erection, leveling and aligning precision machines. Testing for correct functioning of machine parts and commissioning of machine. Geometrical testing of machine tools.
Practical 20 Hrs Theory 10 Hrs	Demonstrate making of Simple Machine parts involving sliding, scraping and alignment.	58. Demonstrate Alignment - Types, alignment of axes. Different position of misalignment, alignment of reference planes, alignment of surfaces. 59. Checking straightness, flatness, parallelisms, equidistance, squareness, checking methods for rotary elements. 60. Demonstrate on exercises involving making of Simple Machine parts which have certain functional relationship to other parts such as driving mechanism, dovetail, assembling parts using bolts, dowel pin, locking devices. Precision fittings - involving sliding, scraping and alignment.	Need of Machine Tool Testing, Advantages of testing. Acceptance Test. Geometrical check. Measuring equipment use, checking methods.
Practical 20 Hrs Theory 10 Hrs	Analyse circuit construction of pneumatics and hydraulics observing standard operating procedure & safety aspect.	61. Application of different types of valves in Hydraulic and Pneumatics circuits. Demonstrate on machine tool application of the hydraulic drives for rotary, reciprocating, speed changing, clamping, unclamping and feed motions.	Constructional features, working principles and uses of fluid moving machineries. Non-positive and Positive displacement pumps viz. centrifugal and propeller pumps, gear pump, vane pump, piston pump. **Valve:** Constructional features and working

		62. Setting of various hydraulic elements for proper functioning. Repairs of hydraulic presses and various hydraulically operated equipment, fault finding by simulation. 63. Setting of pneumatic circuit elements for proper functioning -adjusting, cushioning of the cylinders flow and pressure. 64. Practice on simple hydraulic & pneumatic circuits. 65. Maintenance of hydraulic power pack. Maintenance of air preparation unit, FRL (Filter-regulator-lubricator) unit.	principles, types viz. directional control, pressure control, flow control and non-return valve. Actuators: types & constructional features and principles of hydraulic Actuator. Fluid power symbols. Hydraulic and pneumatic power source and circuits. Study of different hydraulic and pneumatic circuits. Study of hydraulic oil, air preparation system, hydraulic accessories. Types of hydraulic oils, preservation, analysis contaminations and minimization of contaminations. Performance testing of hydraulic pumps.
Practical 40 Hrs Theory 20 Hrs	Demonstrate basic functioning of different electrical equipment DC/ AC motors, passive & active electronic components, SCRS & ICS, proximity & ultrasonic sensors etc including basic maintenance work. Demonstrate PLC Programme and interface with other devices to	66. Demonstrate common tools and testing equipments. 67. Selection and replacement of switches, fuses, preventers etc. 68. Testing of single & three phase supply. 69. Test and overhauling of induction motor and starter. 70. Common faults and remedies of motor and starter. 71. Testing of components like resistors, capacitors, diodes and transistors. 72. Verification of Logic Gates. 73. Practice on Bridge rectifier and simple inverter circuit. 74. Measurement of voltage & current at different test points. 75. Demonstration of PLC program using ladder diagram and statement list.	Electrical Safety rules and precautions. Starters - Concept of DOL, star-delta and auto transformer. Concept of variable voltage - variable frequency drive. Basic electronics, concept of PCB, conductors, semi conductors, resistance, condenser, diodes, transistors, SCR, UJT. Different types of rectifiers, regulated power supply, SMPS. Use of a transistor as a switch & its simple applications. Use of thyristor, diode and IGBT (insulated gate bipolar transistor). Concept of power electronics, Concept of IC, Concept of micro processor. Concept of AC-DC and DC-AC

	check its Applications, evaluate part programme, test on simulation software and provide solutions to different errors.		converter. CNC machine drives, difference between servo motor, stepper motor - DC and AC. **Logic gates:** AND, OR, INVERTER, NAND, NOR, EX-OR etc.- Combination of series & parallel switches. Related application. CPU Memory - RAM, ROM, PROM, EPROM. **PLC:** Introduction, main components and types. PLC programming - Ladder diagram and Statement List (STL), symbols use in PLC programming, application of PLC in automation industry.
Practical 20 Hrs Theory 10 Hrs	Evaluate fault to carryout maintenance work and break down of different machineries/ equipments viz., shaper, surface grinding, drilling, lathe, milling, in the shop floor, using appropriate tools & equipments to ensure its functionality.	76. Demonstrate various machines tools such as Lathe, Milling, Radial drilling, Grinding shaping, and slotting machine with special attention to transmission mechanism. 77. Demonstrate machine accessories, their function in operation. 78. Repairs of gear teeth by binding up and dovetail insert method. 79. Method of fixing gear, wheels for various drives.	**Gear:** Types and terminology of different types of gears, worm & worm wheel and rack & pinion. Method of repairing gear teeth by binding up and dovetail insert method. Method of fixing gear, wheels for various drives. General causes of the wear and tear of the toothed wheels and their remedies.
Practical 40 Hrs Theory 20 Hrs	Demonstrate CAD software commands and operational features of CNC machine using CNC codes (G & M codes) and	80. CAD software commands and using different menu of CAD. Drafting of simple machine parts with the help of different menu. Perform on plotting. 81. Demonstrate CNC machine. Practice on operational features with reference to driving mechanism,	Concept of Auto CAD software. Elementary commands of CAD software. Details of different menu & plotting. Introduction to CNC Machines. Difference between CNC and SPM. Importance of CNC

	programming.	centralized lubrication system. 82. Familiarization with co-ordinate system, use of CNC codes (G & M codes) and programming, simulation, dry run & cutting for simple test jobs. 83. Perform basic features of CAM software.	machines over other mass production processes. Concepts of architecture and Working principles of CNC Machines - Machine beds - ball screw mechanism - servo drives - feedback Mechanism. LM guides mechanism. Concept of ATC & APC. Axes designation. Introduction to G and M codes, CNC tooling and fixtures Simple manual part programming commands. Introduction to CAM software.
Practical 20 Hrs Theory 10 Hrs	Monitor Overhauling, preventive maintenance and Troubleshooting of Machine tools, pumps, fans, blowers & compressors.	84. Demonstrate Trouble shooting, fault finding and rectification of machine tools and other machines like pumps, fans, blowers & compressors. Test for operation.	**Preventive maintenance:** Advantages of preventive maintenance, Aim - Basic Activity, Planning, Schedule Basic aspects. Periodical Inspection - Frequency- Schedule-Types of schedule, Checklist, Preparation of Checklist. Record Maintenance-Record Register, Form, Instruction, Chart for Abbreviation, History sheet, General Maintenance Register. Inventory management of sectional stores. Layout of Maintenance Section: -Fault Finding Method.
Engineering Drawing: 30 Hrs.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work.	**CIRCLES, TANGENTS AND ELLIPSE:** Practical applications procedure for constructing tangent to given circle-lines- loop pattern-- tangential circles- external tangents- internal tangents ellipse **PARABOLIC CURVES, HYPERBOLA:** Involutes - Properties and their application. Procedure for constructing parabolic curve-hyperbolic curve-in volute curve. epicycloids, hypocycloid, Involutes, spiral & Archimedes spiral **TECHNICAL DRAWING/ SKETCHING OF COMPONENTS' PARTS:** Views of object Importance of technical sketching-types of	

		sketches-Isometric drawing sketching- Oblique drawing sketching. **PROJECTIONS**: Theory of projections (Elaborate theoretical instructions), Reference planes, orthographic projections concept 1st Angle and 3rd Angle, Projections of points, Projections of Lines–determination of true lengths & inclinations. Projections of plane, determination of true shape. Exercises on missing surfaces and views. Orthographic drawing or interpretation of views. Introduction to first angle projections of solids. **ISOMETRIC VIEWS**: Fundamentals of isometric projections (Theoretical Projections) Isometric views from 2 to 3 given orthographic views. Preparation of simple working drawing of Furniture items like table, stool and any job prepared in the workshop. **SECTIONAL VIEWS:** Importance and salient features, Methods of representing sections, conventional sections of various materials, classification of sections, conventional in sectioning. Drawing of full section, half section, partial or broken out sections, offset sections, revolved sections and removed sections. Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, Rectangular, square angle, channel, rolled sections. Exercises on sectional views of different objects. - **DEVELOPMENT AND INTERSECTIONS:** Development of surfaces-Types of surface- Methods of development-Intersection-Methods of drawing intersection lines-critical point or key point. **FASTENERS**: Sketches of elements of screw threads, Sketches of studs, cap screws machine screws, set screws, Locking devices, bolts, Hexagonal & square nuts & nut bolt & washer assembly. Sketches of plain spring lock, toothed lock, washers, cap nut, check nut, slotted nut, cassel nut, sawn nut, wing nut, eye blot, tee bolt & foundation bolt. Sketches of various types of rivet heads (snap–pan–conical– countersunk) Sketches of keys (sunk, flat, saddle, gib head, woodruff) Sketches of hole & shaft assembly. **DETAIL DRAWING AND ASSEMBLY DRAWING:** Details of machine drawing- Assembly drawing- surface quality-surface finish standard- Method of indicating surface roughness for general engineering drawing-symbols used for indication of surface roughness-symbols for direction of lay. Geometrical tolerance. Detail drawing of the following with complete dimensioning, tolerances, material and Surface finish specifications 1. Universal couplings

		2. Ball bearing and roller bearing. 3. Fast and loose pulley. 4. Stepped and V belt pulley. 5. Flanged Pipe joints, right angle bend. 6. Tool Post of Lathe Machine. 7. Tail Stock of Lathe Machine 8. Stepped and V belt pulley. 9. Flanged Pipe joints, right angle bend. 10. Tool Post of Lathe Machine. 11. Tail Stock of Lathe Machine Practice of blue print reading on limit, size, fits, tolerance, machining symbols, and reading out of assembly drawing etc., ISO Standards. **READING OF ENGINEERING DRAWING:** Blue print and machine drawing reading exercises. **GRAPHS & CHARTS**: Types (Bar, Pie, Percentage bar, Logarithmic), Preparation & interpretation of the graphs and charts. **AUTO CAD:** Familiarization with AutoCAD application in engineering drawing. Practice on AutoCAD using Draw & Modify commands. Practice on AutoCAD with Rectangular snap using Draw, Modify, Inquiry commands. Practice on AutoCAD using text dimensioning& dimensioning styles Practice on AutoCAD to draw nuts, bolts & washers. Isometric views-isometric views with square, taper and radial surface-simple & complex views. Perspective views. Practice on AutoCAD using isometric snap to make isometric drawings Practice on AutoCAD using Hatch command and application. Practice on AutoCAD using 3D primitives with UCS (User Co-ordinate system).
WORKSHOP CALCULATION & SCIENCE: 30 Hrs.		
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**<u>WORKSHOP CALCULATION:</u>** **Fraction:** Concept of Fraction, Numbers, Variable, Constant, **Ratio & Proportion**: - Trade related problems **Percentage:** Definition, changing percentage to decimal and fraction and vice versa. Applied problems related to trade. Estimation and cost of product. **Algebra:** Fundamental Algebraic formulae for multiplication and factorization. Algebraic equations, simple & simultaneous equations, quadratic equations and their applications. **Mensuration 2D:** Concept on basic geometrical definitions, basic geometrical theorems. Determination of areas, perimeters of triangles, quadrilaterals, polygons, circle, sector etc.

		Mensuration 3D: Determination of volumes, surface areas of cube, cuboids cylinders, hollow cylinder, sphere prisms, pyramids cone spheres, frustums etc. Mass, Weight, Volume, Density, Viscosity, Specific gravity and related problems. **Trigonometry:** Concept of angles, measurement of angles in degrees, grades and radians and their conversions. Trigonometrical ratios and their relations. Review of ratios of some standard angles (0, 30, 45, 60, 90 degrees), Height & Distances, Simple problems. **Graphs:** basic concept, importance. Plotting of graphs of simple linear equation. Related problems on ohm's law, series-parallel combination. **Statistics:** Frequency tables, normal distribution, measure of central tendency – Mean, Median & Mode. Concept of probability. Charts like pie chart, bar chart, line diagram, Histogram and frequency polygon. **WORKSHOP SCIENCE:** **Units and Dimensions:** Conversions between British & Metric system of Units. Fundamental and derived units in SI System, Dimensions of Physical Quantities (MLT)-Fundamental & Derived. **Engineering Materials:** Classification properties and uses of ferrous metals, non-ferrous metals, alloys etc. Properties and uses of non-metals such as wood, plastic, rubber, ceramics industrial adhesives. **Heat & Temperature:** Concepts, differences, effects of heat, different units, relation, specific heat, thermal capacity, latent heat, water equivalent, mechanical equivalent of heat. Different Temperature measuring scales and their relation. Transference of heat, conduction, convection and radiation. Thermal Expansion related calculations. **Force and Motion**: Newton's laws of motion, displacement, velocity, acceleration, retardation, rest & motion such as linear, angular. Force – units, different laws for composition and resolution of forces. Concept on centre of gravity and equilibrium of forces in plane. Concept of moment of inertia and torque. **Work, power & energy**: Definitions, units, calculation & application. Concept of HP, IHP, BHP and FHP – related calculations with mechanical efficiency. S.I. unit of power and their relations.

		Friction: Concept of friction, laws of friction, limiting friction, coefficient of friction and angle of friction. Rolling friction & sliding friction with examples. Friction on inclined surfaces **Stress & Strain:** Concepts of stress, strain, modulus of elasticity. Stress- strain curve. Hook's law, different module of elasticity like Young's modulus, modulus of rigidity, bulk modulus and their relations. Poisson's ratio. **Simple machines:** Concept of Mechanical Advantage, Velocity Ratio, Efficiency and their relations. Working principles of inclined plane, lever, screw jack, wheel and axle, differential wheel and axle, worm and worm wheel, rack and pinion. Gear train. **Electricity:** Basic definitions like emf, current, resistance, potential difference, etc. Uses of electricity. Difference between ac and dc. Safety devices. Difference between conductors and semiconductors and resistors, Materials used for conductors, semiconductors and resistors. Ohm's Law. Series, parallel and series-parallel combination of resistances. Concept, definitions and units of electrical work, power and energy with related problems. **Fluid Mechanics:** Properties of fluid (density, viscosity, specific weight, specific volume, specific gravity) with their units. Concept of atmospheric pressure, gauge pressure, absolute pressure, vacuum and differential pressure.

SYLLABUS FOR CORE SKILLS
1. Training Methodology (Common for all CITS trades) (270Hrs + 180Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for all the CITS trades, provided separately in www.bharatskills.gov.in./ dgt.gov.in

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY (TT)	
1. Demonstrate workshop safety measures and maintenance of precision measuring instruments. (NOS: CSC/N9469)	Demonstrate tools, instruments and equipments for marking and make this available for use in a timely manner.
	Assess raw materials and visual inspect for defects.
	Evaluate specification as per desired mathematical calculation and observing standard procedure.
	Demonstrate measurement of all dimensions in accordance with standard specifications and tolerances.
	Demonstrate Hand Tools for different fitting operations and make these available for use in a timely manner.
	Comply with safety procedure during above operation as per standard norms and company guidelines.
2. Evaluate components for assembly by carrying out surface finishing operations like scrapping, lapping etc. and different Heat Treatment like Hardening, Tempering case hardening etc. (NOS: CSC/N9521)	Demonstrate tools & equipment required for surface finish operations like scrapping, lapping etc.
	Evaluate heat treatment operated by maintaining appropriate temperature.
	Demonstrate safety procedure during the heat treatment and observing standard procedure.
	Evaluate surface finishing operation observing standard procedure.
3. Monitor dismantling, Repair and Assembling of mechanical power transmission elements in machine tools and check for functionality. (NOS: CSC/N9470)	Monitor dismantling of shaft, coupling, gears, belt, clutch, pulley, chain & sprockets, etc from the power transmission system.
	Demonstrate functions and constructional features of various mechanical power transmission elements and drives.
	Check draining out lubrication oil from the power transmission system.
	Monitor selection of proper tools for the required task.
	Access repair / replacement of damaged parts adhering to safety aspects while working with power transmission system.
	Monitor assembling in sequence of dismantled parts of power transmission system.
4. Check preventive maintenance of lubrication & cooling system of different machines like lathe, drilling, grinding as per manufactures guidelines. (NOS: CSC/N9471)	Monitor relevant information from manufacturing guidelines to carryout preventive maintenance.
	Monitor preventive maintenance of lubrication and cooling system as per standard guidelines.
	Access filling of lubrication oil into the system and check functionality.

5. Monitor compliance to preventive maintenance during dismantling & assembly of indexing head, tail stock, saddle etc. and test for accuracy. (NOS: CSC/N9492)	Monitor relevant information to conduct preventive maintenance of lathe operation.
	Evaluate different tools and materials required to carry out preventive maintenance.
	Monitor advance lathe operation viz., taper turning, thread cutting to check for functionality and accuracy.
	Demonstrate dismantling and assembly of different components i.e. head stock, tail stock etc as per stand procedure.
	Demonstrate safety procedure while carrying out above task.
6. Evaluate different joints by setting up of gas and arc welding machines and using sheet metal work tools. (NOS: CSC/N9493)	Monitor set up of gas plant & arc welding machines for welding.
	Evaluate set up of welding machine as per standard parameters and selection of electrode and welding torch adjustments according to the assigned task.
	Demonstrate operation of the welding machine and perform different welding joints, check visually for common welding defects.
	Evaluate the applications of different welding joints like lap and butt joints with respect to machine tool maintenance.
	Exhibit development of surface from working drawing with drilling and riveting as per marking out location.
7. Monitor the work of dismantling, replace and assembling of machine parts of shaping, milling, lathe and drilling machines. (NOS: CSC/N9472)	Check for correct functioning of machines like shaping, milling, lathe and drilling machines.
	Monitor dismantling and replacing of different components with accuracy applying range of skills and standard operating procedure.
	Check Assembling and functionality of these different components.
	Comply with safety rules when performing the above operations.
8. Monitor the work of foundation and installation of machines and material handling process. (NOS: CSC/N9501)	Ensure safety aspects related to the erection & installation of heavy machines during pipe/tube fittings.
	Check electrical power connections as per the requirement
	Monitor geometrical test as per standards for installed machine.
	Monitor component trial machining test and check the dimensional accuracy of the component.
	Monitor working of different material handling equipments
9. Monitor the work of dismantling, replace and assembling of machine parts including spindle drive mechanism, Shafts, Axles,	Demonstrate dismantling, replace and assembling of spindle drive mechanism used on different machines.
	Exhibit checking for spindle run-out, axial and radial play and Setting of play as per standard chart.
	Demonstrate checking of bearing performance - repairs and

Couplings and Clutches. (NOS: CSC/N9502)	replacement.
	Demonstrate assembling of Shafts, Axles, Couplings and Clutches used on various machines
10. Demonstrate making of Simple Machine parts involving sliding, scraping and alignment. (NOS: CSC/N9503)	Demonstrate making of Simple Machine parts with functional relationship to other parts such as driving mechanism, dovetail assembling involving sliding, scraping and alignment.
	Demonstrate checking of Alignment, alignment of axes, mark position of misalignment, alignment of surfaces.
	Exhibit checking of straightness, flatness, parallelisms, equidistance, squareness, checking methods for rotary elements.
11. Analyse circuit construction of pneumatics and hydraulics observing standard operating procedure & safety aspect. (NOS: CSC/N9488)	Check construction of pneumatics & hydraulics circuit as per drawing and collect necessary information.
	Monitor machine tool application of the hydraulic drives for rotary, reciprocating, speed changing, clamping, unclamping and feed motions.
	Evaluate setting of various hydraulic elements for proper functioning.
	Analyse construction of circuit of pneumatics and hydraulics for proper functioning, observing standard procedure.
	Check different parameters and functionality of the system.
12. Demonstrate basic functioning of different electrical equipment DC/ AC motors, passive & active electronic components, SCRS & ICS, proximity & ultrasonic sensors etc including basic maintenance work. (NOS: CSC/N9534)	Examine functioning of different electrical equipment, sensors and their utilization in industrial application.
	Demonstrate different sensors viz, proximity &ultrasonic etc.
	Check straightness, flatness, parallelism etc for rotary elements.
	Evaluate precision fittings involving sliding, scraping and alignment.
	Observe safety precautions during examination of electrical equipment and sensors.
13. Demonstrate PLC Programme and interface with other devices to check its Applications, evaluate part programme, test on simulation software and provide solutions to different errors. (NOS: CSC/N9504)	Demonstrate a PLC Programme as per application requirement.
	Interface PLC with other devices observing standard procedure and safety.
	Testing and overhauling of induction motor and starter.
	Demonstrate part programme as per drawing.
	Demonstrate possible solution within the team.
	Test the part programme using simulation.
14. Evaluate fault to carryout maintenance work and break	Demonstrate various machine tools like lathe, milling, radial drilling, grinding shaping etc. used during break down.

down of different machineries/ equipments viz., shaper, surface grinding, drilling, lathe, milling, in the shop floor, using appropriate tools & equipments to ensure its functionality. (NOS: CSC/N9474)	Check the faults aroused in the machine tools.
	Check the repair of gear teeth by binding up and dovetail insert method.
	Monitor fixing of gear, wheels for various drives.
	Check the break down maintenance of faulty machine.
15. Demonstrate CAD software commands and operational features of CNC machine using CNC codes (G & M codes) and programming. (NOS: CSC/N9523)	Demonstrate different CAD commands.
	Demonstrate different components of CNC machines.
	Explain job drawing in CAD software using elementary commands.
	Demonstrate part programme as per drawing.
	Simulate for its correctness with simulation software.
	Solve problems during simulation by selecting and applying basic methods, information and using quality concept.
	Check accuracy/ correctness of part program.
	Observe safety/ precaution during simulation.
16. Monitor Overhauling, preventive maintenance and Troubleshooting & of Machine tools, pumps, fans, blowers & compressors. (NOS: CSC/N9505)	Demonstrate the safety practices related to the pumps, fans, blowers & compressors.
	Demonstrate the different types of pumps, fans, blowers, compressors etc and the safety practices related to it.
	Demonstrate trouble shoot chart for pumps, fans, blowers & compressors and perform the task.
	Check preventive maintenance of pumps, fans, blowers and compressors.
	Demonstrate the industrial applications of pumps, fans, blowers and compressors in different machine tools.
17. Read and apply engineering drawing for different application in the field of work. (*NOS:* ASC/N9410)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
18. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (*NOS:* ASC/N9411)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR MMTM CITS TRADE			
for batch of 25 candidates			
A. TRAINEES TOOL KIT			
S No.	**Name of the Tool & Equipments**	**Specification**	**Quantity**
1.	Steel rule	300 mm	25+1 Nos.
2.	Inside Caliper	150 mm (spring)	25+1 Nos.
3.	Outside Caliper	150 mm. (spring)	25+1 Nos.
4.	Divider	150 mm. (spring)	25+1 Nos.
5.	Hermaphrodite caliper	150 mm.	25+1 Nos.
6.	Try Square	150 mm.	25+1 Nos.
7.	Hacksaw Frame adjustable Type.		25+1 Nos.
8.	Hammer Ball Peen	200gm.with handle.	25+1 Nos.
9.	Hammer Ball Peen	400.with handle.	25+1 Nos.
10.	Cold Chisel	20x200 mm	25+1 Nos.
11.	Cross cut Chisel	10x150 mm.	25+1 Nos.
12.	Half round Chisel	10x150 mm.	25+1 Nos.
13.	Diamond point Chisel	10x150 mm.	25+1 Nos.
14.	Centre Punch	100mm.	25+1 Nos.
15.	Prick Punch	100mm.	25+1 Nos.
16.	File Flat Bastard	300mm.	25+1 Nos.
17.	File Flat	2nd cut 250 mm	25+1 Nos.
18.	File Flat Bastard	350mm.	25+1 Nos.
19.	File Flat smooth	200mm.	25+1 Nos.
20.	Round Nose Pliers	200mm.	25+1 Nos.
21.	Combination Pliers	200mm.	25+1 Nos.
22.	File half Round	2nd cut 250mm.	25+1 Nos.
23.	File Three sq. Smooth.	200mm	25+1 Nos.
24.	File Round Smooth.	200mm	25+1 Nos.
25.	File Square Smooth.	200mm	25+1 Nos.
26.	File Needle Set of	12 nos.	25+1 Nos.
27.	Scraper A	250mm. (Flat)	25+1 Nos.
28.	Scraper B	250 mm (Triangular)	25+1 Nos.
29.	Scraper D	250 mm (Half Round)	25+1 Nos.
30.	Spindle Blade Screw Driver	100mm	25+1 Nos.
31.	Screw Driver	200 mm.	25+1 Nos.
32.	Allen Hexagonal keys	2 to 16 mm.	25+1 Nos.
33.	File Card		25+1 Nos.
34.	Scriber	150x3 mm. (one side offset)	25+1 Nos.
35.	Offset Screw Driver		25+1 Nos.
36.	Screw Driver	300 mm heavy duty	25+1 Nos.
B. INSTRUMENT AND GENERAL SHOP OUTFIT			
37.	Vernier height Gauge	0-300mm, Accuracy	2 Nos.

		0.02mm.	
38.	Vernier Bevel Protractor	150 mm blade, L.C=5 (5 min)	4 Nos.
39.	Vernier Caliper	200mm (0-200mm), L.C=0.02mm.	8 Nos.
40.	Digital Caliper	200mm (0-200mm)	2 Nos.
41.	Dial Caliper	200mm (0-200mm), L.C=0.02mm, 2mm/Rev.	2 Nos.
42.	Outside Micrometer and Outside Vernier Micrometer	0 to 25 mm. L.C=0.01mm L.C.=0.001mm	Each 2 Nos.
43.	Outside Micrometer and Outside Vernier Micrometer	25 to 50mm. L.C=0.01mm L.C.=0.001mm	Each 2 Nos.
44.	Outside Micrometer & Outside Vernier Micrometer	50 to 75 mm. L.C=0.01mm L.C.=0.001mm	Each 1 No.
45.	Outside Micrometer & Outside Vernier Micrometer	75 to100 mm. L.C=0.01mm L.C.=0.001mm	Each 1 No.
46.	Combination Set	300 mm	8 Nos.
47.	Sine Bar.	200 mm	2 Nos.
48.	Slip gauge	Tungsten carbide, Grade I 112 nos.	1 Set
49.	Internal Micrometer	12 to 20 mm. (3 point)	2 Nos.
50.	Gear Tooth Vernier Caliper (Metric)		1 No.
51.	Bevel Gauge	200	1 No.
52.	Plunger Dial Gauge 0-10mm L.C=0.01mm with magnetic stand		2 Nos.
53.	Plunger Dial Gauge	0-1 mm L.C=0.001mm with magnetic stand.	2 Nos.
54.	Feeler Gauge	(0.05mm to 1.0mm)-No. of leaves =20	3 Sets.
55.	Radius Gauge up to	7.0mm & 1. 0 to 7mm., 7.5mm to 15mm.	2 sets each.
56.	Screw pitch gauge for metric pitches	0.35 to 6mm	1 No.
57.	Centre gauge	60 Deg.	1 No.
58.	Plug Gauge Plain	(5 to 25 by 2.5mm) (Go & No Go)	1 No.
59.	Ring gauge Morse	Taper No. 1, 2, 3, 4	1 Set
60.	Drill sleeves Morse	Taper 1-2, 2-3, 3-4, 4-5	1 Set
61.	Ring Gauge	5 to 25 by 2.5 mm. (Go & No Go)	1 Set
62.	Standard Wire Gauge (swg)		1 No.
63.	Dial Bore Gauge to	(20-25mm) L.C.=0.01mm	2 Nos.
64.	Straight Edge	485mm to 1445mm.	1 Set

C. GENERAL SHOP OUTFIT: 1. TOOLS & INSTRUMENTS FOR MAINTENANCE SHOP			
65.	Master Flat-scraping test bar in cross section all sizes	600mm length, 75 x 75 mm sq. scraped to an accuracy of 0.02 mm. per 300mm. seasoned.	1 No.
66.	Tap and die set with necessary tap wrench and die holder	M6 to M12	1 Set
67.	Spanner Socket	set of 25 pieces (10 to 25, 27, 30, 32mm =18 pcs. and accessories =7 Nos.)	1 Set
68.	Hammer Soft	faced 30 mm dia. Plastic tipped	4 Nos.
69.	Pipe Wrench	450 mm	2 Nos.
70.	Chain Pipe Wrench	650 mm.	1 No.
71.	Self alignment Roller ball bearing		1 No.
72.	Telescopic gauges	13 mm to 300 mm	1 Set
73.	Lubricant trolley	2400x200x1200mm (8 chamber)	1 No.
74.	Collapsible tool Kit	5 compartments	1 No.
75.	Tap Extractor		2 Nos.
76.	Linear Actuator (single & double acting Cylinder)		1 Each
77.	Vibrometer		1 No.
78.	Machine tool calibrator		1 No.
79.	Lathe tool Dynamometer		1 No.
80.	Stud Extractor.		2 Nos.
81.	Magnifying glass	75 mm.	2 Nos.
82.	Pin spanner set.		1 Set
83.	Hand keyway broacher		1 No.
84.	C.I. Surface plate with wooden stand and cover	400x400 mm	1 No.
85.	Head lamp		2 Nos.
86.	Pneumatic scraper with adjustable stroke		2 Nos.
87.	Hydraulic wheel and bearing puller		1 No.
88.	Master test Bar (Different sizes)		1 Set
89.	Spirit level	150 mm	2 Nos.
90.	Gasket Hollow Punches	5, 6, 8, 10, 12, 19, 25 mm. dia	1 Each
91.	Bar Type Torque Wrench up to	14 kg f-m.	1 No.
92.	Cam Lock Type Screw Driver		1 No.
93.	Flaring Tool		1 No.
94.	Tube Expander up to 62 mm.		1 Set
95.	Circlip Pliers	150mm (inside and outside, straight & Bend)	2 Each
96.	SRDG Ball Bearing, DRDG Ball Bearing, Self aligning Ball Bearing, SRAC Ball Bearing, Needle Bearing, Single Row Cylindrical Roller Bearing, Tapered Roller Bearing, Plain Bush		1 Each

	Bearing, Thin walled Bearing.		
97.	Viscometer (Red Wood)		1 No.
98.	Adjustable spanner	12''	2 Nos.
99.	Adjustable spanner	8''	2 Nos.
100.	Adjustable spanner	6''	2 Nos.
101.	Screw driver medium duty	10''	4 Nos.
102.	Screw driver light		4 Nos.
103.	Master Bar 45 Degree, scraping Bar., all sides to an accuracy of	600 x 75 x 25 mm 0.02 mm seasoned.	1 No.
104.	Vane pump fixed and variable delivery		1 each
105.	Hydro motor		1 No.
106.	Accumulator (gas)		1 No.
107.	Pneumatic tools (Portable nut spanner /Runner, chisel, grinder sander and hammer)		1 each
108.	Hydraulic trainer with necessary aggregates for different machine circuit.		1 set
109.	Pneumatic trainer with necessary aggregates for different machine circuit.		1 set
110.	Hydraulic valves (Relief, Sequence, Unloading, Pressure-reducing, Check, flow control, Directional Control Valves etc).		1 each
111.	Transparent Hydraulic cylinder		1 No.
112.	Cut model of pneumatic valve		1 No.
113.	Flow detector (Magnetic crack detector)		1 No.
114.	Engineering Stethoscope		1 No.
115.	Tool picker collets type		1 No.
116.	Tool picker magnetic type		1 No.
117.	Granite surface plate with stand and cover	1600X1000	1 No.
118.	Bearing and gear tester		1 each.
119.	Pneumatic scraper with adjustable stroke		2 Nos.
120.	Torch (3Cells)		2 Nos.
121.	Sledge Hammer	5 kgs.	1 No.
122.	Straight edge(steel)	1000 mm.	1 No.
C. GENERAL SHOP OUTFIT: 2. Machine Tools			
123.	Cylindrical Milling Cutter	90X63X27	1 No.
124.	Side and Face Milling Cutter	10X 1000X 27	1 No.
125.	Side and Face Cutter	160 X 12X 27	1 No.
126.	Slot Milling Cutter	100 X 10 X 6 X 27	1 No.
127.	Equal angular Cutter	80 X 16 X 27 in 45 deg.	1 No.
128.	Equal angular Cutter	80 X 20 X 27 in 60 deg .	1 No.
129.	Single angle Cutter	63X18X 27 X 45 dg. (LH) and (RH)	1 Each
130.	Single Angle Cutter	63X18X27X60 deg. (LH) and (RH)	1 Each
131.	End mill cutter	3, 4, 5, 6, 8, 12, 16, 18, 22 mm. parallel shank.	1 Set
132.	Slitting Saw	80X3X27 MIN	1 No.

133.	Slitting Saw	100X4X27 MIN	1 No.
134.	T-Slot Cutter to suit T headed bolt of	10, 12 mm S.S	1 Each
135.	Convex Milling Cutter	4, 10, 20 circle radius	1 Each
136.	Concave Milling Cutter	4, 10, 20 circle radius	1 Each
137.	Corner rounding milling cutter	2.5, 4, 10, 16 circle radius	1 Each
138.	Woodruff key seating	cutter A 13.5X3, A 16X4, A 19.5X5, A 19.5X6	1 Each
139.	Milling gear Cutter (In volute)	1, 2, 3, 5-3 module of 8 cutter	1 Set each
140.	Fly Cutter Holder		1 No.
141.	Engineers Parallel		1 Set
142.	Scribing block universal.	300mm	4 Nos.
143.	V-Block	100/7-80-A	1 Pair
144.	Table Chuck	3 Jaw with tightening arrangement and graduated in degrees.	1 No.
145.	Machine Vice	200mm Swivel Base	1 No.
146.	Machine Vice	Swivel Base 160 mm.	1 No.
147.	Angle plate size.	4 with slots	1 No.
148.	Angle plate adjustable.	250X150X175 mm	1 No.
149.	Twist drill	3 to 13mm. (SS)	1 Set
150.	Twist drill	13 to 25mm by 1mm step. (TS)	1 Set
151.	Grinding wheel dresser	(Diamond) 1.5 carret.	1 Set
152.	"C" clamp	150mm. and 200mm.	1 Pair each
153.	Hand reamer	6to 25 mm. by 1mm.	1 Set
154.	Engraving / Etching machine		1 No
155.	Mandrel	120 mm. long different sizes.	1 No.
156.	Wheel balancing stand	with its accessories.	1 Set
157.	Prick punch	3 to 10 mm by 1 mm step.	1 Set
158.	Deep cutting hacksaw frame	300mm.	4 Nos.
159.	Machine reamer	6to 25 mm. by 1 mm step.	1 Set
C. GENERAL SHOP OUTFIT: 3. Lathe Tools			
160.	Drill Chuck	13 mm.	1 No.
161.	Reduction Sleeve and Extension Sockets	0-1, 1-2, 2-3, 3-4, 4-5	1 Each
162.	Centre Drill	1-5	1 Set
163.	Revolving Centres with Arbor		2 Nos.
164.	Knurling Tool with holder (straight, & diamond)		1 Set each.
165.	Lathe Carriers	up to 7 mm (10 to 75mm)	1 Set
166.	Oil Stone (consumable)	150X50X25 mm.	4 Nos.
167.	Oil can	250 ml.	2 Nos.
168.	Hand grease gun		2 Nos.
169.	Boring Tool Holder	Armstrong L.H 8 and 10	2 each.

		sq. Bit Size X Length 200mm.	
170.	Tool Holder	8 and 10 sq. bit 2 straight	2 Nos.
D. GENERAL MACHINERY SHOP OUTFIT			
171.	SS and SC centre lathe (all geared)	with minimum specification as: centre height 150 mm and centre distance 1000 mm along with 4 jaw chuck, auto feed system, safety guard, motorized coolant system and lighting arrangement.	2 Nos.
172.	Universal Milling machine with minimum specification as: having motorized up &down movement along with auto feed arrangement and with following attachments such as: a. Vertical head b. Slotting attachment c. Rack cutting attachment d. Rotary table e. Dividing head f. Adaptors, arbors and collects etc. for holding straight shank drills and cutters from 3 mm to 25 mm.	Table Length x width 1200 x 300 mm	1 No.
173.	Surface Grinding Machine Wheel dia reciprocating table longitudinal table traverse full motorized supplied with magnet chuck and necessary accessories.	180 mm. 200mm 250 x 120mm	1 No.
174.	Grinding machine hydraulic external cylindrical, universal type with internal grinding attachment fully motorized and standard accessories. Centre height - Distance between centers- Least in-feed - Accessories:	150mm 800 mm 0.0025 mm 3 jaw self-centering chuck, 4-jaw independent chuck, tailstock.	1 No.
175.	Pillar Drilling Machine:	20 mm capacity with drill chuck & key.	1 No.
176.	Pedestal grinder	250 mm wheel Diameter.	1 No.
177.	Flexible Hand Grinder	100 mm. dia.	1 No.
178.	Portable Drilling Machine	10 mm. capacity	1 No.
179.	Shaping machine	450 mm stroke (motorized)with all attachments	1 No.
180.	Pipe bending machine (Hydraulic)		1 No.
181.	Equipment for conducting BLS (Basic Life Saving) training.		1 set

182.	CNC turn Centre with minimum specification as: Chuck size: Between centre distance: Travel in X: Travel in Z: No. of tool stations: 8 station turret Spindle power:	1 35mm 250mm 100mm 200mm 3.7kW (continuous rating) preferably with popular control system like Fanuc/Sinumeric along with motorized coolant system.	1 No.
D. GENERAL MACHINERY SHOP OUTFIT MACHINE FOR REPAIR AND RECONDITIONING			
183.	Old centre Lathe		2 Nos.
184.	Old Milling Machine (Universal)		1 No.
185.	Old Grinding Machine (Universal)		1 No.
186.	Old Shaping Machine		1 No.
187.	Old Press (power)		1 No.
188.	Old Turret & capstan Lathe		1 No.
189.	Universal Indexing head		1 No.
190.	Revolving Centre		1 No.
191.	Tail stock		4 Nos.
192.	Gear Box (old)		4 Nos.
D. GENERAL MACHINERY SHOP OUTFIT WELDING WORK			
193.	Oxy-Acetylene Welding Cylinder Trolley		1 No.
194.	Welding Hose of P.V.C. flexible	1.D=6mm Blue & Red	5 mtr. each
195.	Hose Coupling Nipples		2 Nos.
196.	Hose protractor		2 Nos.
197.	Double stage pressure regulator (oxygen.) and double stage pressure Regular (acety).		1 Each
198.	High PR. Blow pipe with Tips.		1 No.
199.	Gas Cutting Torch with cutting tips		1 No.
200.	Welding gloves pair (Leather)		4 Pairs
201.	Goggles (4 A) for Gas welding		4 Nos.
202.	Spark Lighter		4 Nos.
203.	Spindle key		1 No.
204.	Gas welding table with fire bricks		1 No.
205.	DC Welding Generator	150-300 amps. Capacity with all accessories.	1 No.
D. GENERAL MACHINERY SHOP OUTFIT : SHEET METAL WORK			
206.	Forge Power Operated	45 mm. dia.150 mm blower	1 No.
207.	Soldering Copper Bit	450 gm, hatchet Type & straight type.	1 Each
208.	Metal Cutting Shears	350mm.	2 Nos.
209.	Mallet (plastic or rose wood) rod. and rectangular	75*75*100 mm.	2 each.
210.	Conical Mallet		1 No.
211.	Half Moon Stake		1 No.

212.	Beak Iron		1 No.
213.	Funnel Stake		1 No.
214.	Hatchet Stake		1 No.
215.	Snap Rivet	set A-3, B-4.	1 No.
D. GENERAL MACHINERY SHOPOUTFIT: ERECTION TOOLS & EQUIPMENT			
216.	Plum bob		1 No.
217.	Square box wrenches		1 No.
218.	Square Tee wrenches		1 No.
219.	Engineers square	700 mm.	1 No.
220.	Threaded fastener	type-B	1 No.
221.	Threaded fastener	type-C	1 No.
222.	Threaded fastener	type-F	1 No.
223.	Fork lift max.	capacity 1 Ton	1 No.
224.	Manila ropes dia.	12, 20, 30 mm (5 mtr. Length)	1 Each
225.	Crow Bar		4 Nos.
226.	Rollers (steel tubes)	from dia. 40, 50 & 60 mm (500 mm length)	5 Nos each.
227.	Block of Timber (various sizes)		13 Nos.
228.	Portable jack		1 No.
229.	Cargo Winches	3, 5 Ton.	1 each.
230.	Wall Hoist		1 No.
231.	Shear Legs (tripod)		1 No.
232.	Hand Operated Chain Pulley block		1 No.
233.	Conveyor		1 No.
234.	Ratchet chain Pulley block		1 No.
235.	Foundation Bolt (different Types)		4 Nos each.
D. GENERAL MACHINERY SHOPOUTFIT: ELECTRICAL TECHNOLOGY & ELECTRONICS			
236.	Screw Driver (electrician)	150 mm with Tester detachable (flat two nos. & star head two nos.).	04 Nos.
237.	Screw Driver Philips	Nos.860, 861 & 862	02 Sets
238.	Long Nose Pliers	150 mm Insulated	04 Nos.
239.	Combination pliers	150 mm	04 Nos.
240.	Diagonal Cutter	150 mm	04 Nos.
241.	Tweezers		04 Nos.
242.	Knife	100 mm	04 Nos.
243.	Neon Tester	A/C 230V	04 Nos.
244.	Scissors	150 mm	02 Nos.
245.	Soldering Iron	25 W	02 Nos.
246.	Soldering Iron	65 W	02 Nos.
247.	Digital Multi meter		02 Nos.
248.	Ammeter	0 to 500 ma = (10 amps) A/C	01 No.
249.	Ammeter	0-Ia DC (0-5 amp)	01 No.
250.	Voltmeter	0-300-600 V AC	01 No.
251.	Discrete component Trainer		1 No.

252.	P.F. Meter		1 No.
253.	Frequency meter		1 No.
254.	Megger	500 V	1 No.
255.	A.C. Squirrel Cage induction motor 3 phase with D.O.L. Starter		1 No.
256.	Star Delta 3 phase starter		1 No.
257.	C.T. Single Phase		2 Nos.
258.	P.T. Single Phase		2 Nos.
259.	Auto Transformer	0-300 V 8 Amp	2 Nos.
260.	C.R.O.	50 MHZ	1 No.
261.	Digital I.C. Tester		1 No.
262.	Digital I.C. Trainer Kit		1 No.
263.	Audio single Generator with Sine wave, Square wave and Triangular wave.		1 No.
264.	DUAL D.C. Power supply	0-30 V,2 Amp and 0-5V, 5 Am, ± 15 V,2 Amp with indicator.	2 Nos.
265.	Demonstration model for Thyristorised	D.C. Motor Drive (1 H.P.) Set up	1 No.
266.	Demonstration model for Thyristorised	A.C. Motor drive (1 H.P.) Set up	1 No.
267.	Linear I.C. Trainer Kit		1 No.
268.	Digital Millimeter	2.5 Amps/5 Amps	2 Nos.
269.	Transducer		2 Nos.
270.	Thermocouples Kit		2 Nos.
271.	L.D.R.S Kit		2 Nos.
272.	Thermostat Kit		2 Nos.
273.	L.V.D.T Kit		2 Nos.
274.	Strain gauge		2 Nos.
275.	Photo Diode (component)		2 Nos.
276.	Photo Transistor Kit		2 Nos.
277.	A.C Timer Kit		2 Nos.
278.	D.C. Timer Kit		2 Nos.
279.	Decimal count Kit		2 Nos.
280.	D.C. Motor control Kit		2 Nos.
281.	Hand Tachometer		1 No.
282.	Ammeter portable type	0-15 Amps. A.C	1 No.
283.	Insulated Screw Driver	200 mm.	4 Nos.
284.	Insulated combination side cutting pliers	200 mm.	4 Nos.
285.	Tang Tester)	(0-15 amps	1 No.
286.	Cutter cum stripper		4 Nos.
D. GENERAL MACHINERY SHOP OUTFIT: HEAT TREATMENT			
287.	Blacksmith's Anvil,	100 kg.	1 No.
288.	Smiths tongs hollow bit, smiths Tongs flat	30 mm)	1 Each
289.	Water tank	450 x 300 x 250 mm).	1 No.
290.	Brass Rule	300 mm.	1 No.
291.	Furnace for Heat treatment		1 No.

292.	Oil Bath (for quenching)	45 x 45 x 45 cm, 6 mm thick plate	1 No.
E. CLASS ROOM FURNITURE			
293.	Instructor's table and Chair (Steel)		1 set
294.	Students chairs with writing pads		25 Nos.
295.	White board size	1200mm X 900 mm	1 No.
296.	Instructors lap top with latest (vista & above).	configuration pre-loaded with operating system and MS Office package	1 No.
297.	LCD projector with screen.		1 No.
298.	Video of different machine operation and maintenance procedures		1 set each (optional)
299.	Visualizer (latest configuration)		1 No.


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