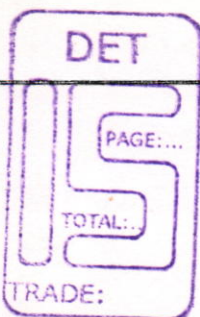


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**SYLLABUS FOR
CNC MACHINE OPERATOR CUM PROGRAMMER**

**DEPARTMENT OF EMPLOYMENT AND TRAINING
CHEPAUK
CHENNAI 600 005**

**UNDER CODE OF REGULATIONS FOR
INDUSTRIAL SCHOOLS**



List Of Committee Members for the trade of CNC Machine Operator Cum Programmer

Members of Committee:

Thiruvallur

1. **T.SUNDAR RAJ** Regional Joint Director, Chennai
2. **T.Thiagarajan** Deputy Director, Govt.ITI (North Chennai)
3. **T.Janakiraman T.O** Govt.ITI (North Chennai)
4. **V.Arumugam** ATO Govt.ITI (North Chennai)
5. **C.Baskaran** JTO Govt.ITI (North Chennai)
6. **S.Senthil kumar** (Member PE) Sundaram Clayton, Chennai-58
7. **G.Krishnaveni** JTO Govt.ITI (North Chennai)
8. **S.K.Lakshmi** JTO Govt.ITI (North Chennai)
9. **K. Lakshminarayanan** ATO Hi-Tech Govt.ITI Ambattur

COURSE DETAILS

Name of Trade	: CNC MACHINE OPERATOR CUM PROGRAMMER
Qualification	: 10TH PASS / FAIL
Age	: 14-40 Years
Duration	: 1 Year
Number of Trainees	: 20
Number of Practical hours	: 32 hrs. per week
Number of Theory Hours	: 8 hrs. per week
Number of Workshop Calculation hours	: 2 hrs. per week.
Number of Engineering Drawing hours	: 2 hrs. per week
Space Required	
Workshop	: 800sq. feet
ClassRoom	: 200 sq. feet
Power Required in KW	: 10 k.w.

SYLLABUS FOR THE TRADE OF CNC MACHINE OPERATOR CUM PROGRAMMER
SUBJECT: PRACTICAL AND THEORY

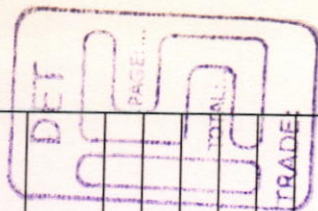
Week No	Practical	Theory
1	Introduction of Trade Machine - Workshop Safety	Introduction of trade
2.	Exercise on Marking , Filing & Hack sawing	Operation safety, machine safety, basic electric safety and tool handling safety
3.	Exercise on Drilling , reaming ,countersinking and counter boring, tapping	Elements of flat file and file grades Nomenclature of Drills, types of drills, using of height gauge
4.	Exercise on Chuck mounting, Tool setting - Job setting and centering, plain turning, facing, drilling, counter boring in center lathe, Measuring and Reading of Vernier Caliper	Principle of lathe, Different types of lathe, Main parts and sub parts of lathe, classification of Lathe, Types of cutting tools nomenclature of cutting tools, tool holders, Types of work holding devices, Description of vernier caliper and micrometer,
5.	Exercise on Shoudering , (internal & external), parting off ,Taper and Thread cutting in center lathe	Different types of Taper and Threads and its calculation.
6.	Exercise on Plain surface milling	Introduction of milling machines- construction and types
7.	Exercise on Stepped and Angular milling	Milling cutter specification – types , construction and nomenclature
8.	Exercise on Grooves and slots in milling	Types of milling operation- work holding and cutter holding devices
9.	Exercise on Blind and through keyway	Uses of vertical milling head -
10.	Exercise on Linear indexing &helical groove milling	Index head and indexing methods
11.	Exercise on Milling gears	Gear calculations- cutting methods
12.	Safety in use of CNC machine. Personal protective equipments usage. Do's and don'ts. Machine on off procedures. Safety interlocks in machine.	Fundamentals of programming. – NC, CNC difference, programming, part programming-History of CNC machines classification. Application of CNC machines Schematic layout, flow chart, Degree of automation, new Generation CNC machines, Advantages and disadvantages of CNC, mass production, application Machine elements(parts), Driver systems, CNC lathe, milling, grinding machines, specification of the CNC machines.

DET
PAGE:
TOTAL:
TRADE:

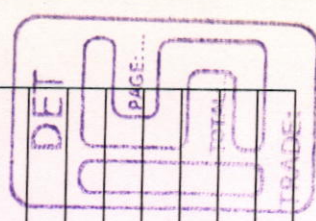
Week No	Practical	Theory
13	Feeding the program to machine, use CRT display for simulation in machine and storing, retrieving, work offset, tool offset, setting cycle time. Date input/output, displaying checking. (Absolute Co-ordination system program).	Geometrical coordinate system, absolute, incremental, relative system, configuration – Blocks, single block, auto mode, program structure.
14.	Feeding the program to machine, use CRT display for simulation in machine and storing, retrieving, work offset, tool offset, setting cycle time. Date input/output, displaying checking. (Incremental Co-ordination system program).	Geometrical coordinate system, absolute, incremental, relative system, configuration – Blocks, single block, auto mode, program structure
15.	Editing of Part program, (Absolute coordinate system.)	Codification-G code, M code, for CNC machines, lathe codes, M codes
16.	Tool setting in machine, removing, use of tool presetter, automatic tool offset, work offset, offset taking using touch probe offset taking by use of master component.	Tool offset, work offset, special functions; spindle, bed, lubrication, clamping, tool changing codes.
17	Dry run the program in manual single block mode	Automatic tool changer – codes to change the tools in ATC
18	Editing of Part program, (Incremental coordinate system.)	Dry run the program in manual single block mode
19	Tool setting in machine, removing, use of tool presetter, automatic tool offset, work offset, offset taking using touch probe offset taking by use of master component.	Process parameter –selection of speed , feed , tool change, automatic tool management , solution of process of parameter



Week No	Practical	Theory
20	Dry run the program in manual single block mode	Part program writing of CNC turning exercises, and Command prompts- rapid and feed movements , spindle orientation
21	Exercise on stepped turning (external).	Part program writing of CNC turning exercises, and Graph sheet representation.
22.	Exercise on stepped turning (external).	Part program writing of CNC turning exercises and Cutter diameter compensation
23.	Exercise on taper turning(external).	Part program writing CNC turning exercises and Cycle time estimation, auto/manual time estimation.
24.	Exercise on taper turning(external).	Cycle time estimation, auto/manual time estimation
25.	Exercise on ball nose turning.	Part program writing on ball nose turning.
26.	Exercise on convex external turning.	Program writing; using sub program, sub routine.
27.	Exercise on concave external turning.	Program writing using coding of another program.
28.	Exercise on stepped boring	Program writing by taking offset from other program.
29.	Exercise on internal taper boring	Measuring the machined component using touch probe.
30.	Exercise on threading external	AC and DC electrical supplies – circuits, Electronics devices, circuits – logic circuits and control system devices.
31.	Exercise on threading internal	Part program writing of CNC milling exercises, and CNC drive system – operation of servo motors, table drive methods – recirculation balls screws.
32.	Exercise on milling flat surfaces	Transducers – infinite variable speed – encoders – open and closed loop system
33.	Exercise on milling angular surfaces	CNC control systems – Fundamentals of PLC and computer controls.
34.	Exercise on milling grooves	Fanuc/ Sinumeric/ Hinumarc in CNC control system.
35.	Exercise on milling slots	Computer Aided machining – programming fundamentals for CAM.
36.	Exercise on milling curved surfaces. (External)	Tool shank standards – types of tools and tool holders – tool tip selection – for turret, tool post, radial and axial tools for CNC operations.
37.	Exercise on milling curved surfaces. (Internal)	CNC – work holding methods in turning operations – different types of chuck, hard and soft jaws, fixtures, collect chucks – between centre operation.
38.	Exercise on drilling through and blind holes.- in Machining centre	CNC – work holding in milling operations – hydraulic and pneumatic clamping methods.
39.	Exercise on counter boring .- in Machining centre	Work holding methods with clamps, fixtures – pallets setting standard – pallet changes – indexing fixtures.
40.	Exercise on threading holes.	PC interface :- machine to PC transfer and storing techniques.



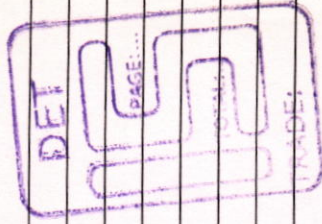
Week No	Practical	Theory
41.	Exercise on linear indexing.	Preventive maintenance- TPM based maintenance- checklist preparation for Daily/ Weekly/ Fortnightly /Monthly / Bi-annual / Annual maintenance
42.	Exercise on linear indexing.	Maintenance of mechanical system and drive elements of CNC machines.
43.	Exercise on angular indexing.	Maintenance of Hydraulic & Pneumatic system of CNC machine.
44.	Exercise on angular indexing.	Maintenance of Electrical system and devices of CNC machine.
45.	Project work (CNC lathe)	Maintenance of Electronic system and devices of CNC machine.
46.	Project work (CNC lathe)	Maintenance of Control devices and systems of CNC machine.
47.	Project work (CNC lathe)	Maintenance of System software of CNC machine.
48.	Project work (CNC Machining centre)	Documentation of programs, offsets, and controlling procedures.
49.	Project work (CNC Machining centre)	Online programming, monitoring and updating of CNC program.
50.	Project work (CNC Machining centre)	Industrial visit.
51.	General Maintenance of CNC machines.	Assignment and review test.
52.	Practical final test.	Final theory test.



SYLLABUS FOR THE TRADE OF CNC MACHINE OPERATOR CUM PROGRAMMER

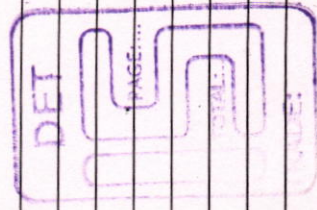
SUBJECT : WORKSHOP CALCULATION

WEEK NO	WORKSHOP CALCULATION
1.	Units of measurement
2.	Units of measurement
3.	Conversion of units from one system to other
4.	Common Fraction
5.	Decimal fraction
6.	Arithmetic operations of fractions
7.	Arithmetic operations of fractions
8.	Arithmetic operations of fractions
9.	Percentage - Problems involving percentage
10.	Percentage - Problems involving percentage
11.	Percentage - Problems involving percentage
12.	Percentage - Problems involving percentage
13.	TEST
14.	Square root of numbers
15.	Square root of numbers
16.	Ratio and Proportion - Problems involving Ratio and Proportion.
17.	Ratio and Proportion - Problems involving Ratio and Proportion.
18.	Ratio and Proportion - Problems involving Ratio and Proportion.
19.	Ratio and Proportion - Problems involving Ratio and Proportion.
20.	Ratio and Proportion - Problems involving Ratio and Proportion.
21.	Simple Algebra - Addition and Subtraction
22.	Simple Algebra - Multiplication and Division
23.	Solution of Simple equation
24.	Solution of Simple equation



WORKSHOP CALCULATION

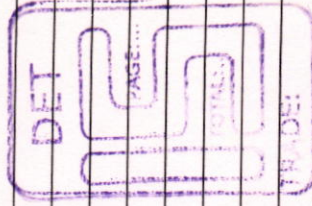
WEEK NO	
25.	Solution of Simple equation
26.	Solution of Simple equation
27.	Factorization
28.	TEST
32.	Problems involving Pythagoras Theorem
33.	Mensuration - Area of plain figures - Square and Rectangle
34.	Mensuration - Area of plain figures - Square and Rectangle
35.	Mensuration - Area of plain figures - Circle and Polygons
36.	Mensuration - Area of plain figures - Circle and Polygons
37.	TEST
38.	Volume of solids
39.	Volume of solids
40.	Volume of solids
41.	Volume of solids
42.	Volume of solids
43.	Volume of solids
44.	Simple shop problems
45.	Simple shop problems
46.	Machining time calculations-drilling
47.	Machining time calculations-turning
48.	Machining time calculations-milling
49	Machining time calculations-gear calculations
50	REVISION
51	REVISION
52	FINAL TEST



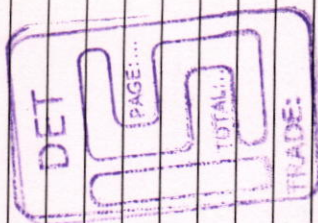
SYLLABUS FOR THE TRADE OF CNC MACHINE OPERATOR CUM PROGRAMMER

SUBJECT: ENGINEERING DRAWING

WEEK NO	ENGINEERING DRAWING
1.	Engineering drawing and its importance and instruments used in Engineering Drawing
2.	Lettering Practice
3.	Lettering Practice
4.	Types of lines and its applications
5.	Types of lines and its applications
6.	Geometrical construction of lines and angles
7.	Geometrical construction of plain figures – Triangle and Square
8.	Geometrical construction of Rectangles and Polygons
9.	Geometrical construction of Polygons
10.	Free hand sketching of solid figures – Cube, Prism, Cylinder
11.	Free hand sketching of solid figures – Cube, Prism, Cylinder
12.	TEST
13.	Free hand sketching of solid figures – Pyramid and cone
14.	Method of dimensioning
15.	Method of dimensioning
16.	Isometric view of simple solids – Cube
17.	Isometric view of simple solids – Rectangular Prism
18.	Isometric view of simple solid blocks
19.	Orthographic projection – First angle and Third angle methods
20.	Orthographic Projection of Cube
21.	Orthographic Projection of Rectangular block
22.	Orthographic views of simple solids
23.	Isometric and Orthographic vies of simple solids
24.	Isometric and Orthographic vies of simple solids



ENGINEERING DRAWING	
WEEK NO	
25.	TEST
26.	Isometric and Orthographic vies of simple solids
27.	Isometric and Orthographic vies of simple solids
28.	Orthographic vies of simple solids
29.	Orthographic vies of simple solids
30.	Orthographic vies of simple solids
31.	Orthographic vies of simple solids
32.	Sectional views
33.	Sectional views of simple solid blocks
34.	Sectional views of simple solid blocks
35.	Sectional views of simple solid blocks
36.	Sectional views of simple solid blocks
37.	TEST
38.	Nomenclatures of V - thread
39.	Types of Thread sections
40.	Types of Thread sections
41.	Blue Print reading Exercises
42.	Blue Print reading Exercises
43.	Blue Print reading Exercises
44.	Blue Print reading Exercises
45.	Sketch of Tools & Equipment related to the trade
46.	Sketch of Tools & Equipment related to the trade
47.	Sketch of Tools & Equipment related to the trade
48.	Sketch of Tools & Equipment related to the trade
49.	Revision
50.	Revision
51.	TEST
52.	Common Examination.



ACHIEVEMENTS:

At the end of this course trainee shall be able to:



- handle marking tools and instruments
- read and measure to an accuracy of 0.01 mm accuracy using precision measuring instruments
- operate individually on drilling, lathe and milling machines
- handle work holding and tool holding devices on lathe and milling machines
- do simple calculations required for doing the job on lathe and milling machines
- understand and read Engineering Drawing
- write the program for machining operations in CNC Turning
- program and operate individually in CNC Machining centre
- understand the various maintenance aspects and safety working in CNC machines.

Industrial School

Long Term Trade - Syllabus – Revised

Name of the Trade : CNC Machine Operator Cum Programmer

Space required:

Workshop / Lab : 800 Sq. ft.

Class Room : 200 Sq. ft.

TOOLS AND EQUIPMENT FOR THE TRADE

CNC MACHINE OPERATOR CUM PROGRAMMER :

S/NO	NAME OF THE ITEM	QUANTITY REVISED
1	CENTRE LATHE	3
2	VERTICAL MILLING MACHINE	1
3	UNIVERSAL MILLING MACHINE	1
4	CNC MACHINING CENTRE	1
5	CNC LATHE	1
6	BENCH VICE	10
7	POWER HACKSAW MACHINE	1
8	PILLAR DRILLING MACHINE	1
9	BENCH GRINDER	2
10	FLAT FILES 250 MM	10
11	FLAT FILES (SECOND CUT) 200 MM	10
12	HALF ROUND FILE 250 MM	10
13	NEEDLE FILE SET	10
14	DRILL BITS SET (3/16" TO 1" AND 5 MM TO 25 MM)	10
15	VERNIER CALIPER 300 MM (UNIVERSAL)	6
16	OUTSIDE MICROMETER 0 TO 25 MM	6
17	OUTSIDE MICROMETER 25 TO 50 MM	3
18	OUTSIDE MICROMETER 0 TO 1"	3
19	UNIVERSAL SURFACE GAUGE	6
20	SURFACE PLATE 600X600 MM WITH STAND	1
21	VERNIER HEIGHT GAUGE 300 MM	1

S/NO	NAME OF THE ITEM	QUANTITY REVISED
22	STEEL RULE 150 MM	20
23	SCRIBER	20
24	COMBINATION SET 300 MM	4
25	TRY SQUARE 200 MM	10
26	VERNIER BEVEL PROTRACTOR	10
27	HACKSAW FRAME	20
28	V BLOCK WITH U CLAMP 100X100X150 MM	3 SET
29	ANGLE PLATE 300X200X25 MM	3
30	ST. SHANK REAMER NUMBER SET 5 TO 25 MM	1 SET
31	TAP AND DIE SET B.S.W 1'4" TO 1"	1 SET
32	TAP AND DIE SET METRIC 6 MM TO 30 MM	1 SET
33	SCREW PITCH GAUGE-METRIC AND BRITISH	1 EACH
34	KNURLING TOOLS (PITCH 0.75,1.25,1.75 MM)	3
35	DE SPANNER SET FROM 6 NOS.TO 33 NUMBERS	1 SET
36	ALLEN KEYS 1.5 MM TO 12 MM AND 1/16" TO 1/2"	1 SET
37	OIL CAN 0.5 PINT	5
38	GREASE GUN	3
39	MALLET HAMMER	3
40	SOFT HAMMER	2
41	BALL PEIN HAMMER 1/2 LB	1
42	BALL PEIN HAMMER 1 LB	1
43	BALL PEIN HAMMER 1.5 LB	1
44	BALL PEIN HAMMER 2LB	1
45	GRINDING WHEEL DRESSER	1
46	SINE BAR 200MM	1
47	SLOP GAUGES SET OF 112 PIECES-GRADE 1	1SET
48	DIAL GAUGE WITH MAGNETIC BASE	2
49	GOGGLES	10
50	SKETCH DEMONSTRATION WORKSHOP BOARD	2
51	CLASS ROOM BOARD	1
52	CLASS ROOM FURNITURE AS REQUIRED.	
53	PREVENTIVE MAINTENANCE BOARD	1
54	HAND DRILLING MACHINE 6 MM CAP	1
55	MAGNIFYING GLASS	1
56	MILLING CUTTERS FOR VERTICAL AND UNIVERSAL MILLING MACHINE ACCORDING MACHINE ARBOR DIA.SIZE	EACH ONE IN EACH CLASSIFICATION
57	STUB ARBOR, ADAPTOR, SPRING COLLET CHUCK SET AND C SPANNER AND DRAW IN BAR	AS REQUIRED