Central Staff Training & Research Institute

Designed in August - 1997

Under Apprenticeship Training Scheme

Tool Maintenance
Mechanic Advanced Machine

Syllabus for the Trade of
These instruments require care and precautions to be observed when handling. The machined items using rough tools are typically machined on the bench vice for filing, balancing on file, possibly to the correct position with respect to the vice jaw for filing. Preparation for filing. Grapping the job suitably.

BASIC BENCH WORKING SKILLS


TYPICAL MAINTENANCE & MAINTENANCE IN AN INDUSTRY.

ANALYSIS FOR MECHANIC ADVANCED MACHINING TOOL MAINTENANCE
Marking on the Job Place for Saw Cuts. Gridding the

suitcases. Lining with second cut if to prepare smooth

surface. 0.1 mm using vermicular carbide - hand a feel for machining dimensions within + or

- 0.5 mm. Using parallelism between opposite sides, machining passes 4, 8, or 16 times the

mass & squareness of adjoining faces using flat

- 0.5 mm. Flat surface of chamfer square to the surface of chamfer

- 0.5 mm. chamfer at a tangent of a chamfer main

inching flat surface a changes of 0.5 mm.,

- 0.5 mm. Chamfering parallelism between chamfer and main

3

Angle place & surface plane.

Using vermicular carbide, finishing square.

layout the dimensional features of the work place.

Marking of circle center, centers of circle.

For punching the lines, centers & circles, use of dot & center punch

oriented using dividers. Use of dot & center punching

any horizontal or vertical line or at any sloping

draw by draw. Sketching lines on circle or square to an accuracy

whether final cutting, similar marking blocks, a divider,

using marking tools, such as the angle place on marking-0 set to an accuracy

eases of the work place supported properly &

suit.
Preparing insures by hack sawing a rectangle, round & extraneous projections on 5 mm thick marking, chain drilting & filling to produce drilling machine, to be operated with the working on different drillers using different types of drills & drill holding dummy practice on sensitive drilling machine for correct distance, depending on the position of holes & for punching, marking out the position of holes & for drilling, introduction to drilling, preparations for drilling.

Bar: using cross cut, square for cutting keyway on round.

Cutting of edge & cutting grooves.

Use of file, cross cut, round nose chisel, for

nibbling, hammer practice on very carefully held round job.

Hammer practice on very carefully held round job.

Cutting of sheer metal with chisel.

Pieces by fitting for step & slot, fitting & finishing hack saw cut in 0.5 mm, sawing along the parallel marked lines with 0.5 mm sawing different vertical positions.

Hack sawing different horizontal with hack saw frame in

Chucking & using different accuracy of or.

Different thickness & pattern, rigid & elastic, using hack saw pieces (N.I.D. Sheet, Hack sawing various metallic pieces) & using successfully in the vice jaws for hack sawing to
Drilling practice on varying thicknesses of different materials such as mild steel, copper, brass, aluminium, cast iron, etc.

Drilling on sheet metal. Observations and safety to be noted.

Counter sinking, counter boring,销孔 Facing operations using bench drilling machine.

Exercises on reaming with hand reamers & machine

Internal threading by hand using tap sets. External threading by spirit die & finishing of thread by die

Marking centres on two ends of a found bar with the help of 'V' block & clamp. Drilling & reaming of blind holes along the axis of found bars.

Grinding of drills & chisels to specifications.

Exercises on filing - Radius & angular filing using templates & gauges.

Filing templates & gauges for checking lathe tool angles. Filing to an accuracy of + 0.04 mm.

Checking with outside micrometers. Preparation of various angles & clearances of lathe tools.

Filing of square blanks. Checking with templates & measurement of shaft & hole diameters using outside micrometer.

Filing round on square bar within + 0.1 mm.

Use of Combination & Round Nose Pliers to make different shapes. Profiles by bending wire to match the blue print. Develop manipulative skills, hand control & eye judgment.
Application of Advanced Bench Working Skills

16-18

Application of various measuring instruments to
Gage adjustment and gage master.
Application of use of dial indicators, strip

14

Scrapers setting diamond wheel & tapping stone.
Scraping on flat surface. Making impression for

13

Advanced Bench Working Skills

Making parallel clamp & clamp or micrometer

12

Project work

Lever heads. Lap a brass plate by cold projecting.
In using these tools, it is of vital importance to use care to be taken

Cold projecting. Marking out location, drilling of
Contact points. Marking off. Rectangular spacers, spacers, etc.
Rectangular spacers, square and square, radius and double end.

Using hand tools such as screwdriver, single
Pulling practice in ferrous plating
Preparation of gaskets & other packing materials.
Preparation of holes on leather with bottom punches.

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Pipe cutting using various pipe cutters such as """
Pipe threading &
End cutting using pipe cutter. Pipe threading &
Bending radius. Precautions to avoid wrinkles.
Use of pipe bending fixtures to maintain uniform
Pipe bending with or without filling in the sand.
Metal, pipe. Copper tubes for lubrication system.
Ceramic metal, e.g., hydraulic pipes & non-ferrous
cold & hot bending of pipes of different diameters

Bending of solid sections by using bending fixtures
Pipes & pipe fittings
21-20

Surfaces.

In lap grinding, tapping on face & cylindrical (internal)
perpendicular to tapping on face & cylindrical (internal)
introduction to tapping process. Laps & lapping
or 0.04 mm.

+ tapping faces on cylindrical parts. Tapping square at

the end & in the middle of cylindrical rod with

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CARE AND MAINTENANCE OF LIFTING EQUIPMENT

USE OF Lifting PLANE, HYDRAULIC TOWING DEVICES, ETC.

ROLLERS AND BARS, LEVERS, TAYLORS, AND TACKING AND PACKING.

SHEAVES, CHAINS, PULLEYS, BLOCKS, CRAPS, AND WINDERS.

BASICS AND USE OF DIFFERENT TYPES OF LIFTING TOOLS.

24 LIFTING TOOLS

SAFETY TO BE OBSERVED IN USE OF TOOLS AND MEANS OF USE OF TOOLS.

DETECTION OF DISUSE OF DESTRUCTIVE CONDITIONS OF TOOLS AND MACHINES.

23 ROPE, SLINGS, AND CHAINS

TRANSPORTATION OR MACHINERY / SKILLS INVOLVED IN MECHANICAL HANDLING /
Blanks, simple components etc.

Pulleys, gear, simple parts such as bolts, punch, nuts, etc.

Study of the structure of machines and preventive maintenance.

Safety precautions to be observed while handling grinding of tool bits.

Exercise on eccentric turning.

Different types of screw thread cutting both external and internal of boring and drilling, reaming, boring, countersinking, knurling, etc.

Exercise on planing, grinding, centre drilling, and form cutting.

Study of the methods of holding workpiece and tool centres.

Study of the gear box and drives used on the machine.

Functional relationship of various parts of the lathe machine.

Constitutional features and working principles of turning.

REVISION & TEST

26

Inspection of chain latches.

Use of appropriate length of chains, and weights.

Methods of attaching jobs of various shapes, sizes, and strength.

Constitutional features and working principles.

Use of hobs and cutters for cutting purpose.

HOISTS AND CRANES

25
MILLING

- Study of lubrication system and preventive maintenance.
- Study of lubrication system in milling machine.
- Care and maintenance of machine.
- Grinding of shapting tools.
- Groove cutting on shapting machine.
- Place and regular shapting.
- Different work and tool holding devices.
- Study of clutch return mechanism.
- Functional relationship of various parts of the machine.
- Constructional features and working principles.

SHAPING

31
CUTTING PRACTICE with different types of cutting tools.

Practicising on a taper, lock grooved joints, and hems.

Bending sheet metal to 90 degrees using wooden moulds.

Practicising in cutting sheet metal in simple geometric shapes such as squares and rectangles.

PRINCIPLES OF MACHINE WORKING

MACHINERY - Study of lubrication systems and preventive maintenance.

Safety precautions to be observed while using the machine.

Care and maintenance of the machine.

Study of hydraulic systems used on the machine.

Study of coolant and centre grinding practice.

Grinding - both plain and taper, angular, parallel, and diagonal, external, internal, and cylindrical. Steep and groove grinding.

Exercises on surface grinding - parallel, angular, and diagonal, external, internal, and cylindrical. Grinding wheel specifications.

Mounting, balancing, fitting, and dressing of grinding wheels.

Study of different work holding devices.

Functional relationship of various parts of the machine.

Surface and cylindrical grinding machines.

CONSTRUCTIONAL FEATURES and working principles of machine.

GRINDING
WELDING

40-0 42

Welding, flame and plasma cutting, and study of various materials and their properties. Safety in welding work. Stacking and setting of machines for operation.

MACHINERY

40-0 42

Measurement of various elements of threads. Proper setup of thread cutting machines. Torque wrenches, torque gauges, and other torque measurement devices. Use of various measuring instruments such as micrometers, dial indicators, and comparators. Recognition and use of various measuring instruments.

INSPECTION

39

Grades, shovels, knives, funnels, paper bags, etc. Simple development work. Exercise using pop testers. Test in reversing shear metal of various thicknesses. Softering practice on ferrous and nonferrous metals. Use of hard and soft solder. Removal of dent in simple hollow practice stakes. Forming rectangular, round and contact shapes using slugs. Sheet metal cutting on shearing machine, safety in

Practice in simple arc welding using material of different thickness. Horizontal & vertical position.

Practice in brazing of ferrous & non-ferrous metals, silver brazing, braze welding (dissimilar metals).

Study in metal deposition for joining of cracks, repairing of worn out parts, keys, broken gears, gear teeth filling & padding on shafts.

Practice in flame cutting, care and maintenance of welding equipment.

FORGING

Introduction to forging tools and equipment.
Use of hammers, sledges, set hammers, flatters.

Practice in upsetting, twisting, bending, punching, drilling and forging.

Bending of hot bars.

Making an eye bolt out of a round bar. Local heating and forming the end to form spike.

Drawing down thicker sections, use of fullers, anvil edges and flatters to finish the surfaces.

Use of top and bottom swage. Drawing down and forming to popular sections.

Cold finishing and forging small hammer heads.

Forging common tools such as centre punch, chisels, screwdrivers, puller legs, etc.

Care and maintenance of forging tools.

HEAT TREATMENT

Introduction to various furnaces and tools.

Hardening and tempering of hand tools.
The current, and measurement of voltage drops across the loads &
practices of series & parallel connection of loads.

Coaxial range, Geyser, etc.

Domestic appliances such as washing machines, etc.,
and measurement respectively.

Use of multimeter for voltage, current, and re-
three phase power supply.

Identifying connections of live, neutral and earth wires.

Identification of switches, push buttons, limit switches,

Etc., with their specifications & applications.

Easy identification of wires & cables, color codes, etc.,

Safeguarding applicable to electrical trade.

BASIC ELECTRICITY

Frame hardening of stiles.

Coilings, gears, etc.

Case hardening of spindles, pins, bushes, spacers,

Center punch, etc.

Hardening of common forged bench tools such as

Annealing of hardened components (job) and normal...
BASIC ELECTRONICS

Scope of industrial electronics with reference to its applications in machine tool operation.

Care & Maintenance of batteries - charging of batteries. Series & parallel connection of batteries.

Soldering and desoldering of components on printed circuit boards (PCB). Precautions to be taken while soldering on PCB.

Identification of basic components such as resistors, capacitors, inductors etc. from their color codes. Use of oscilloscope for checking of input and output wave forms.

Study of solid state devices such as Diodes, Transistors, SCRs and ICs available in different packages and their applications. Identification of input and output voltages.

Assembly of simple battery eliminator circuit using bridge rectifier and filter capacitor. Measurement of input and output voltages.
CONSTRUCTION SIMPLIFIED PNEUMATIC CIRCUITS FOR LUBRICATION AND ROCKET MOTION. READING OF OPERATIONAL DIAGRAMS, CIRCUIT DRAWING PRACTICE USING SYMBOLS FOR SIMPLE PNEUMATIC CIRCUITS.

APPLICATION:
Circuit drawing practice from manuals.

IDENTIFICATION OF COMPONENTS:

- Valves and actuators.
- Function and uses of pneumatic components.
replacement, out age, and carrying repairs or
Cleaning and inspection of parts for any
measurements.
Determining clutch mechanisms, study of standard
machines.
Locating and identifying these mechanisms on various
used on various machines.
Study of shafts, axles, couplings and clutches.

SHAPS AND COUPLINGS

and replacement as needed.
Checking of bearings for loss of performance.
Play, setting of play, axial and radial
Checking for spindle runout.

The machine.

beach grinder, drill, milling, lathe and grind.
Study of various spindle drive mechanisms used on

SPOOLING

MAINTENANCE OF BASIC MACHINE TOOL ELEMENTS

stdard less charts.
attainment and preparing least reports comparing with
Checking table, mitting, grinding machines for
data indicators for machine attainment.
concerns, special, fixtures, etc.
gage and
use of less mandrel, master cylinder, straight edge.
Introduction to machine attainment.
parallel and vertical surfaces.
use of leveling tools, taper wedges for leveling of

leveling, grinding machine etc.
levelling of surface plate, marking table, milling
back, straight edge, parallel, and leveling tool.

Introduction to leveling of machines.

LEVELING, ALIGNMENT & GEOMETRICAL TESTING

57-39
BEARING

65

Box, etc.

Approved traverse gear box, intermediate gear-

Milling machine - feed box (column, knee, saddle-

Lathe machine - carriage - apron, feed box, need

Mechanism to be studied -

for operation.

Study of feed mechanism - removing, dismantling-

of fixture guide and draw induction.

Adjustment of guides, wedges, for setting the gap, the
gap. The

Scoring marks and condition of all grooves and

Checking for straightness, flatness, scoring

Inspection of machine guide ways and slide.

SLIDES AND GUIDeways

64

Assembly of gear box and clamping back to the ma-

damage/repairs.

ing and checking/inspection of parts for

various machine elements from the gear box clean-

study of gear box completely. Study of

functional relationship.

Inspection to various gear transmission tech-

study of belt pulley, chain, gear, rack & pinion

DRIVES AND POWER TRANSMISSION

62-63

Preparation of report.

Testing for operation.

The location.
Introduction to programmable logic controller (PLC) and its applications only.

İntroduction to PLC with conventional machine controls.

- Inputs, output, memory, power supply etc.
- Programming logic controller (PLC) instruction set.
- Instruction set such as timer, counter, proportional switches.
- Study of commonly used controllers such as their

ADVANCED ELECTRONICS

78

REVISION & TEST

79

Checking of electromagnetic clutches, brakes, chucks, checks contactor, balance of resistance, body resistance, winding resistance, motors by measuring winding resistance.

Locating faults in power circuits such as fuse down, etc.

Loose connections, faulty settings, etc.

Causes such as fuse blown, mechanical jamming, located.

Locating overloaded motor and finding out the

Replacement of burnout, setting of switches.

Removing electrical motors from machine tools.
Fault Finding by Simulation.

- Check hydraulic equipment and various hydraulic function, setting of various hydraulic elements for proper operation.

- Cooler, filter, breather unit and tank accessories, study of air, oil, and water, oil flow, air flow, suction, and pressure study of filters, etc.

- Study of pressure, temperature, flow, and pressure gauges, pressure pulse and flow.

- Precautions to be taken in storage and handling of oil.

- Use of various types of pipe joints and fittings.

- Practice with metal and hose pipes.

- Repairs and maintenance of hydraulic motors, cylinders, and accumulators.

- Repairs and maintenance of valves, pressure control, and flow control.

- Repairs and maintenance of electric, hydraulic, and electronic devices.

- Trouble shooting in hydraulic drives, actuators, etc.

- Study of machine tool applications of the hydraulic system.

- Study of machine tools, actuators, and hydraulic motors.

- Study of accumulators, accumulators, and gears, pumps, and valves.

- Study of machine tool applications of hydraulic devices.

- Study of various types of hydraulic motors (moderator, etc.).

- Study of hydraulic systems, pressure, and flow control.

- Pressure valve, pressure regulator, valve, pressure control, and feed control, differential control, and feed control, with speed control and hydraulic devices.

- Hydraulic building practice - regenerative (segment) circuit.
EXPLANATION: Use of computer as a CNC workstation, communication between CNC & Computer, communication hardware, software.

Title: Choose a Title, Saving of title etc.

Windows, Application of these software packages, study & practicing them. Introduction to different commands such as create/open a directory, Windows, C directories, etc.

Study of disk operating system, basic DOS commands, read only memory, random access memory, memory, processor, hard disk etc.

Study of computer fundamentals, unit, structure of computer, processor, memory, etc.

Objective: Demonstration and explanation of different units, demonstration of computer in computers, block diagram, representation, classification of computer, digital & electronic computers, first generation to fifth, history of computers.

COMPUTER FUNDAMENTALS

- Hardware, input-output devices, sanders, keyboards, pressure, etc.
- Demonstration of pneumatic circuit, grinders, motors, controls, pneumatic circuit elements, etc.
- Study of pneumatic circuit, pneumatic components and pneumatic hand tools.
- Use of basic pneumatics for the control of pneumatic circuit, pneumatic control, pneumatic control, pneumatic control.

ADVANCED PNEUMATICS

- Control of pneumatics, control of pneumatic circuit, pneumatic control, pneumatic control, pneumatic control.
Available facilities.

Practice on CNC machining center incorporating all

Programs, cutting head simulation facilities, precessing

M/S T/L axes, and tool offsets, zero offset

G- and J- code, execution of part programs, use of

CNC operation - referencing (zeroing), part pro-

duction on CNC vertical machining center.

Study and practice of various CNC operating

BASIC CNC OPERATIONS

Interpolation for 3 to 6 different components.

Extrusion for executing part programs for two axes

(on), interpolation/interfacing of tool point on

(t) reference point, referencing procedure.

Choose tool control, tooling error, position

ballbar, position feedback, open loop,

speed, axis, and interaxial axes.

interference, overtravel limits.

Tool, rapid, feed, jog, manual data

and demonstrating the CNC machine features such as:

Teachable feature.

Practicing or simple jobs programmed on CNC

Practicing of simple jobs programmed on CNC

Pamnet/programming for simple, less jobs, use of CNC

Machine tool design, interaction systems

Study of special constructional and operational

Introduction to CNC technology.
systems. Understanding & coordinating interfacing, study of guarding, interfacing, and -

detection & to optimize stiffness, to reduce proper processing to estimate backlash, to reduce proper interfacing of backlash, tension & compression.

1) Preloading of ball screw
2) Preloading & retainer ball screw
3) Preloading & assembly, external & internal
4) Assembly of ball screw
5) Interference of ball screw, proper interference of ball screw
6) Preloading & assembly, retention & compression
7) Preloading & assembly, external & internal
8) Study of gear box and automatic speed range for constant power & constant torque.
9) Study of gear box, disengagement feature, and automatic speed range for constant power & constant torque.
10) Study of gear box, disengagement feature, and automatic speed range for constant power & constant torque.

system of:

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- study of gear box, disengagement feature, and automatic speed range for constant power & constant torque.
- study of gear box, disengagement feature, and automatic speed range for constant power & constant torque.
- study of gear box, disengagement feature, and automatic speed range for constant power & constant torque.
- study of gear box, disengagement feature, and automatic speed range for constant power & constant torque.

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PHYSICAL TESTS

1) Safety interlocks
2) Machine power supply
3) Programmable logic controller
4) Readback devices
5) Read & spindle drives
6) CNC system hardware
7) Electronic circuits for a CNC

Study of

101-103

CNC system and hydraulic accessories.

Study of hydraulic oil, air, coolant, etc.

M/C

Hydraulic & Pneumatic Power source and CIR

120

12) Coupling and coupling mechanism
11) Incorrections such as backlash, repeat
10) Accuracy & performance of CNC M/C
9) Hydraulic chuck, backlash, quill
8) Movement on CNC lathe, automatic tool
7) Coolant & coolant to atmosphere back lash
6) Mounting of torquave encoder & linear opt
5) Drive to rotary table - using servomotor
4) Servo motor
3) Clamping & declemation by hydraulic or
2) Motral axes, automatic tool changer pallet
1) Coolant & lubrication systems

Study of
ΧΩΡΙΣ ΒΑΣΕΙΣ ΜΟΝΑΔΙΑ

1. Επισήμανση της εγγραφής
2. Εκκίνηση καταγγελίας
3. Επικοινωνία με τον εκδότη
4. Επικοινωνία με την Ε.Ο.
5. Επικοινωνία με την Ε.Δ.
6. Επικοινωνία με τον Ε.Α.
7. Επικοινωνία με τον Ε.Μ.
8. Επικοινωνία με τον Ε.Θ.
9. Επικοινωνία με τον Ε.Ν.
10. Επικοινωνία με τον Ε.Π.

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PRINTING OR PAPER, CONVEYERY OF PAPER - REASONS, REASONS, REASONS.

PILES: - PILE, PARTS & MATERIAL CLASSIFICATION OF PILLES

OF VICES.

DIFFERENT TYPES OF VICES, THEIR USE, CARE & MAINTENANCE

1. WORK BENCH, BENCH VICE - CONSTRUCTIONAL DETAILS,

PILLES AND PILING

VENTER BEVEL PROTRACTOR

VENTER HEIGHT GAUGE - CONSTRUCTION & USE, CARE & MAIN.

CARE & MAINTENANCE ETC.

- PRINCIPLES & CONSTRUCTION, READING A VENTER CALIPER,

MEASUREMENT WITH PROJECTION INSTRUMENT: VENTER CALIPERS

Etc.

MEASUREMENT BY USING TRIM JOINT CALIPER, SPACING JOINT

DEPTH RULE, HOEK RULE & THIN RAY RULE, RULE RULE, ETC ETC.

NON-PROJECTION LINEAR MEASUREMENT BY USING STEEL RULE,

INTRODUCTION TO MEASURING & CHECKING INSTRUMENTS.

LINEAR MEASUREMENT

WHAT IS RELATED INSTRUMENTS - SUBJECTS TO BE TAUGHT.

COUNTY.

IMPORTANCE OF THE TRADE IN THE INDUSTRIAL ECONOMY OF THE

LINES & ORDERMASS & PECULIAR ECONOMY.

LINES & ORGANIZATION & PERSONAL HYGIENE.

LINES & good housekeeping, cleanliness, workplace, elements of health in the industrial economy.

GENERAL SAFETY PRECAUTIONS & PERSONAL SAFETY TO BE OBSERVED WHILE WORKING IN THE INSTITUTE / SECTION.

GENERAL SAFETY PRECAUTIONS & PERSONAL SAFETY.

MEDICAL & OTHER FACILITIES AVAILABLE IN THE INSTITUTE.

INTRODUCTION

TRADE THEORY

SYLLABUS FOR MECHANIC ADVANCED MACHINE TOOL MAINTENANCE.
Method of chipping & safety precautions to be observed.

Different cutting angles & their importance.

Hot chisels & cold chisels.

Application:

6 Types of Chisels - material, specification & Chisels & Chipping

Safety to be observed with chisels.

Breakage of chisel blades.

Precautions to observe when chiseling to avoid reasons for breakage of chisel blades. Care & maintenance.

Types of chisels: blades material, specification & uses.

5 Types of hacksaw frames: special frames, different Hacksaw & Hacksawing

Maintenance.

Fixing the handle to the hammer head, precautions/care.

Hammer parts, types, specification & uses of hammers.

Introduction to punches: material, uses and care of

Punches

Square, etc. "O" clamp, tool maker's clamp, combination set, bevel.

Productive cutting, machining square, parallet block, hammer, punch, marking tables, center drill, surface gauge, etc. larger punch, center punch, etc.

Care and maintenance of surface cutting, use, care & maintenance.

Procedure for marking: types of marking operations.

Introduction to layout marking, marking media & mark.

Layout & Layout Marking Tools

Maintenance of tools, per minute, right method of fixing the handle, care & counting of blades, file card & use.

Introduction to layout marking, marking media & mark.
while Chipping, Use of Proper Hammer

Grinding - Sharpening of Chisel on bench grinding machine.

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DRILLS & DRILLING

7.8 Types of Drills - Flat & twist drills, Straight fluted & special types of drills, parallel & taper shank drills -

Nomenclature of flat & twist drill - specification of drill, Drill angles & their importance, advantages & disadvantages of flat & twist drills.

Drill grinding - sharpening of drills, Web chinning - checking the ground drill, common faults & their ill effects.

Cutting speed & feed - setting / selection for various operations, Countersinking, Spot facing & counter sinking operations on drilling machine.

Cutting fluids (coolants) used in drilling.

DRILLING MACHINES


Study of drill holding devices. Drill chuck, chuck key, drill drift, sockets & sleeves - construction, material & use.

Method of drives, sizes, capacity & specification of a drilling machine. Special features - care & maintenance of drilling machine.

Safety precautions to be observed while working on a drilling machine. Speed changing system, use of simple gear boxes feeding for drilling, standard Speed & feed for various materials, various methods for job holding on drilling machine. Drilling defects & their causes.
Eras & Machine Chasers.

The threading die, use of lubricants, use of hand chasers.

Types of dies, solid & split dies, the stooks & handles.

External Screw Threading

Cutting internal threads, tapping blind holes.

Determination of sizes of drills for tapping standard taps.

Thread wrenches, construction, standard dimensions.

Reasons for breakage of taps & removal of broken taps.

Taps & Materials, lubricants for tapping - tapping blind holes.
Hand & Machine Taps, sizes, tapping on different types.

Internal Screw Threading

Cutting, right & left hand threads.
Elements of screw threads, single & multistrand.

Screw Threads

Ring Reamers etc.

Adjustable reamers, index reamers, loose reamers, chuck.

Construction & use of hand reamers, expansion reamers,
Attentions for reaming, coolant used wth reaming.

Introduction to reamers, types of reamers, pitch of

Reamers And Reaming
MACHINE ELEMENTS - MATERIALS & USES - SOCKET, MONKEY, RATCHET

TUBULAR, HOPE SPANNER ETC.

TYPES OF SPANNERS - THEIR MATERIAL & USES - BOX, SOCKET

II

MAINTENANCE HAND TOOLS

COMPRESSORS, VALVES, CONSTRUCTION, FUNCTION AND METHOD TO USE

PURPOSE & METHOD TO USE TUBE BAR & STRIP GAUGE

CARE & MAINTENANCE

DEPTH GAUGE, SCREW THREAD GAUGE - CONSTRUCTION, USE

MICROMETER, INSTALLO, OCGAUGE - CONSTRUCTION, USE

PRECISION MEASURING INSTRUMENTS

THE ASSEMBLY, ROLE & BASIC BASIS OF SYSTEM

INTERCHANGEABILITY & STANDARDIZATION, METHOD OR SELECT

AGE, LICE, ETC.

THE MOUNTING ETC., TAPER ETC. MEDIUM FORCE, ET CETERA

COMPONENT ASSEMBLY SUCH AS, FREE ETC., REM, ETC.

EXAMPLES OF FIXING JUMPS FOR VARIOUS TYPES OF PIECES

ZERO LINE, TOLERANCE, CLEARANCE IN RELATION WITH CLEARANCE & CLEARANCE ETC.

LIMITS OF SIZE, DEVIATIONS (UPPER, LOWER), FUNCTIONAL, ESSENTIAL, ACUTE SIZE, FAILURE SIZE, SIZING, MEASUREMENTS USED IN PRACTICE AND OTHER DEFINITIONS

SYSTEM OF TOLERANCE, LIMITS, MILLIMETER SYSTEM, MILLIMETER

REASONS OF INTERCHANGEABLE SYSTEM

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LIMIT, FIT & TOLERANCE

I
GENERATION OF PLAST SURFACE

split level.

The surfaces. Checking of ground surface - use of

treatment and methods of surface treatment.

Advantages - different - better

scrapping - importance of scraping.

and remedies.

bolts, screws, nuts, etc. - interference with... sliding

sheet metal, paper, wood, etc.

bolts: types - hex head, square head, round head, cheese


bolts: types - hex, square, ring, round, cheese

types of nuts, hexagonal nut, square nut, lock nut

threads, fasteners.

bolt - permanent and temporary, fastening devices, locking

Fasteners and locking devices.

long nose plier, flat nose plier, combination plier,

Types of pliers - material & uses.

Pipe wrenches etc.
Bending of solid sections by using bending fixtures, copper tubes for lubrication systems, / E. non-ferrous metal, hydraulic presses and non-ferrous metal.

Cold and hot bending of pipes of different diameters of bending dies etc.

Systems (Figure and Non-Figures) use of pipes for hydraulic/pneumatic and lubricating commonly used pipes - steel, cast iron and plastic.

Pipe and fitting with plastic deformation of material.

Pipe and Pipe Fitting

Application use of various engineering materials by toughness etc. with special reference to practical meaning of tenacity, plasticity, materiality, ductility.

Change in mechanical properties of material in hot and cold bending.

Bending of Strips.

Plastic deformation of materials and testing of materials.

Study of physical, chemical and mechanical properties of methods of producing cast iron steel.

Engineering Materials

Place, master cylinder in the process of scraping, use of surface place, strategic edge, angle scrapers - different types as their correct use / apply.

Tools required for scraping.
Surface Finishes

Definition of Surface Finish. Terms used to describe the finishes of machine components include:

- Cylindrical
- Conical
- Flat
- Round
- Square
- Oval
- Rectangular
- Tapered

Types of Gauges:
- Pitch, radius, and other metal gauges
- Types of gauges - plug, ring, snap, taper, center, scriber

Applications:
- Taps, dies, R.S.I. gauges - inspection of working and tooling
- Gauges - precision measuring instruments and gages

Precision measuring instruments and gages

- Micrometers, depth micrometers, etc.
- Thread checking micrometers, thread gauges

Methods of Precisely Replacing Parts

- Use of pipe bending fixtures
- Metal working tooling such as pipe cutting, threading, and flaring tools
- Use of pipe bending fixtures to manufacture unit or bending pipe bending with or without facing in the sand.
Practicing different types of knots and the application
as hemp, manila, nylon, wire etc.

Special considerations and use of different types of ropes such as ropes, slings and chains

22-73

BASIC MAINTENANCE EQUIPMENT

Mounting allowance.
Mounting force - shape of abrasive - grade.
Mounting compound.
Mounting position - the effect on mounting on the efficiency of run.
Mounting cylinder motion in honing cylindrical elements.
The objective of honing - examples, situations where honing is used, and the necessity of honing - description of honing - honing - honing equipment. The objective of honing - examples, situations where honing is used, and the necessity of honing - description of honing - honing - honing equipment. The objective of honing - examples, situations where honing is used, and the necessity of honing - description of honing - honing - honing equipment.

Testing of surface quality after lapping.
Lapping methods & their applications.
Simple examples, practical situations of lapping.
Popular names of abrasives used.
Abrasive material and the form in which it is applied.
Design of laps - cast iron, copper, lead, mild steel.

Defects of lapping - cast iron, copper, lead, mild steel.

LAPPING

Metalization, machining, metal working, metal shaping, casting, etc.
Surface finishing processes, lapping, honing, etc.

Units of surface finish.
Requirements used for testing / measuring surface quality.
Surface quality & its symbolic representation.
Dimensional tolerances of surface finish.
BASIC MACHINE WORKING SKILLS

PREVISION & TEST

Safety in transportation.

Handling and replacement of heavy parts.

General precautions in handling heavy equipment, removal, use of jibbed planes.

Mechanical advantage and velocity.

Working principles & use of other levers & cranes.

Working principles - crane and hoist for lifting purposes.

Other & lifting engines, crane, lifts, etc.

Working principles - screw jacks, chain blocks, etc.

Working principles - different types of apparatus and levers for lifting.

MECHANICAL HANDLING AND TRANSPORTATION OF MACHINES

Safety to be observed in the use of ropes and stocks.

Specifications and correct use of slings.

Methods of joining two ropes together for extension.

Tongs.
Holding of work piece & tools.

Setting of length and position of stroke.

Constructional features, function and uses of shapings.

MACHINING

Machine, working principle - use of quick return mechanism.

Care and maintenance - preventive maintenance.

Cutting speed and feed, use of coolants.

Latches - screw cutting.

Latenums, grinding of lathe tools.

Tool angles, grinding of lathe tools.

Properties and uses - coolants, system types - soluble.

Cutting fluids and coolants.

Study of lathe machine.

Effect of cutting fluids on metal cutting.

Cooling system types - coolants and types.

Cutting, tool life.

Angles, tool geometry and momentary control of cutters.

Cutting, chip formation, types of chips and chip breakers.

Mechanism of metal cutting - orthogonal and oblique.
FACE GRINDING

Various grinding operations - external, internal, etc.

Use of grinding wheels, balancing and truing, dressing

Grinding wheels and their specifications - grits, grades, etc.

Grinding machines.

Constructional features, types, functions and use of

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GRINDING MACHINES

Care and maintenance - preventive maintenance of milling machines.

Safety precautions.

Cutting speed and feed, use of coolant for different materials.

Cutter's cam cutting, cam cutting, various types of gears and elements of gears.

MILLING MACHINES

Detection of common faults, their rectification.

Use of coolant for different materials.

Speeds and feeds.

Various cutting tools and tool angles for carrying out

32-33
INSPECTION

Preparation for the job for soldering, methods of soldering:
- Types and uses of fluxes and sealers, importance and use,
- Soft and hard solder - their composition, properties and methods employed.
- Soldering, brazing, welding, and cutting.
- Materials and allowances for lap joints, grooves, and beads.
- Edges of joint, ruled joint, grooved seams, welded seams.
- Simple developments and method of laying out.

SHEET METAL WORKING

Care and maintenance - preventive maintenance of grind.
- Stone, precautions to be observed in grinding operations.
- Commonly used shears - cold shears, such as Tin.
- Selection of speeds and feeds in grinding.
Heat treatment on metals and alloys – it's necessary.

Structure of materials and iron carbon equilibrium diagram.

HEAT TREATMENT

Deformation in forging.

Bending, extruding, forging, welding, machining, grinding, honing, drilling, tapping, milling.

Plates, rivets, assemblies, and hardware.

Brazing, soldering, brazing, soldering, welding, brazing, soldering.

Effect of heat on grain structure of material.

Types of forging – hand forging.

FORGING

Principle cutting – principle of use of equipment.

Welding defects – causes and how to avoid them.

Safety precautions and maintenance of equipment.

Types of joints and method of welding.

Principle of fusion welding – gas and electric welding – tools and equipment.

WELDING

BASIC HOT WORKING SKILLS

(1) Various types of trends.
(2) Protecting of control charts
(3) Change causes & attributable causes
(4) Control charts
Statistical Process Control

Zero defects – self inspection and applications.
BASIC ELECTRICALS

Temperature chart.

Change in properties of materials due to heat effect.

Importance of time & temperature throughout in transformers.


Hardening, Tempering, Annealing, Normalizing, Case hardening.

Definition, description and process employed for hardening.
Pamphletization with various symbols used in hydraulic.

Study of hydraulic power pack and its control elements.

Cartons, hydraulic fluids — specifications, properties and application.

Pumps, valves, accumulators and power pack.

Conductors, features, principles of operation, function.
Study of block diagram of hydraulic system in general.

Integral, hydraulic — principle, advantage, drawback.

53-55

BASIC TRAINING IN INDUSTRIAL HYDRAULICS

32

REVISION & TEST

Don't use soldering technique as applied to F.E.A.S. and

Soldering technique as applied to PC and related D.C.

Soldering techniques as applied to PC and related D.C.

Take place.

Use of transistor for amplification — how amplification

Use of transistor as a switch in the simple application.

Use of transistor and junction diodes - a transistor, three

P-N-P and N-P-N junction diodes.

Use of P-N junction for rectification, half wave, full

Use of P-N junction as switch.

Use of P-N junction as switch.

Driver, block - two layers and two terminal device.

P-N type semiconductors and P-N junction - p-n junction —

Intrinsic & extrinsic semiconductors.

Basic Electronics

4.8-31
etc.

Foundations: Concreting machines such as bridges, manholes, wooden, isolated foundations, structurally reinforced.

Different types of foundations:

Location and excavation of foundation, erection and heavy duty machines.

Methods employed for installation and excavation of project.

MACHINE FOUNDATION

- Locating and locating machine, testing of operation.
- Constructing simple pneumatic circuit for linear motion.
- Circuit drawing practice using symbols for simple application.
- Extracting practice.
- Electromagnetic circuit reading (from manuals) and circuit diagram.
- Identification of components from their physical appearance.
- Identification of components using symbols and actual.
- Construction features, principles of operation, function.

BASIC TRAINING IN HYDRAULICS

- Construction of simple hydraulic circuit for speed control.
- Constructing simple hydraulic circuit for linear motion and testing for operation.
- Circuit drawing practice using symbols.
- Hydraulic circuit reading and tracing practice.
- Identification of components from their physical appearance.
- Circuit diagram.
MACHINE ALIGNMENT

Leveling of machines

Types of vibration

Important precautions for protection of machine

Machine alignment - different types - procedure

Requirements for aligning machines - use of these

Machine alignment - different types - procedure

Levels, straight edges and spirit gauges for use of spirit level, its construction and use.

Leveing of machine, importance of leveling.

Methods of leveling, precautions to be taken while use of machine leveling screws.

Methods of grinding.

Leveing of machines

Different types of instruments used for checking the machine alignment devices and their locations.

Detection of machine alignment by means of vibration of machine.

Types of vibrations, causes and prevention of vibrations.

Weight, ventilation and moving parts etc.

Lay out of machines - consideration of power, space.

Important precautions in erection of heavy duty machines.

Foundation of isolated foundation.

Foundation of protection machines - special precautions
Pest and loose pulleys.

Worn or damaged pulleys.

Consideration of driver to drive ratio.

- Size, diameter, width, weight, etc. Necessary calculations for determining the applications and selection of pulleys for specific functions.

- Types of pulleys - solid, split, "V" groove, step, cone, etc.

- Paper, guides, and Jockey or other pulleys etc.

- Other pulleys

- Tensioning and lubrication

- Clutches, frictional and hydraulic

- Pneumatic and vacuum drives

- Basic principles and applications

Power Transmission and Drives

- V-belt drives
- V-belt and V-belt pulleys
- Belt drives
- V-belt drives
- Pully drives
- Shafting and pulleys
- Types of drives - rope and chain

62-63
METHODS OF FIXING AND USES. TYPES OF BELT DEVICES.

USE OF CHAINS, WIRE ROPE FOR POWER TRANSMISSION.

CHAIN AND SPROCKET

- Power transmission
- Use of guide pulleys, crowning, use of dressings and return.
- Sticking off the belts - causes & remedies.
- Calculation for the size of the new belt.
- Belt speeds used for commercial belt.
- Geometrical explanation of the belt drives at an angle.
- Angular belt drive.
- Parallel & cross belt drive, open and cross belt drive.

65

BELT DRIVES

- Advantages of each other.
- Belt fasteners - different types, advantages & disadvantages.
- Long belt - standard specifications, advantages & disadvantages.

- Methods of joining the ends / bolting.

- Selection of the type of belt with the consideration of load & tension.
- Materials used for belts - leather, cotton, canvas.

- Object of belts - types / sizes / specifications and

BELTS
Gears and Gearing

Use of Keys in Power Transmission.
Types & Uses of Key Butlers.
Procedure for Removing Keys.
Key Inserting Procedure - Methods.
Preparation of Keys, Allowable Tolerance, Clearances.
Types of Keys & Keyways, Their Uses and Applications.
Eccentric Motion of Machine Parts, Prevention of Grub/Cutoff.

Keys

Types & Uses, Their Function & Application

Clutches

Advantages over each other & their applications.
Protection and Intersect Coupling - Advantages and Disadvantages.
Different uses.
Types - Plain Coupling, Flange Coupling, Hook's Cou-

Couplings
Bearings

Care and maintenance of bearings.

Lubrication of bearings - high speed bearings.
Anti-friction bearings - taper cydes and uses.
Commercially specified bearings of ball & roller bearings.
Method of fitting ball & roller bearings on the shafts.
Bearings & housings - constructional features of ball & roller bearings - use of ball & roller bearings.

Essentials of ordinary type press bearings - process of fitting.
Methods of mounting & dismantling the housings.
Methods of clamping & fitting the bearings in the housings.
Bearing types of loads.
Dimensional relationship of the shaft with bearings.
Materials for the bearings and their properties.
Types - application - different types for high speed & low speed.
Method of reducing friction, use of bearing.

Bearings

Causes of failure of bearings.

Drives, gears, worm and worm wheels in relation to required general causes of the wear of toothed wheels &
Methods of fitting special gears, helical gears, bevel
Preventive Maintenance

- Regular lubrication surveys - System of symbols and colour code.
- Keeping maintenance schedule - Points to be considered.
- Frequency of preventive maintenance - Repairing preventive.

Advantages of Preventive Maintenance:

- Functions involved in Preventive Maintenance.
- Maintenance of records, Log cards etc.
- Scheduling and planning for Preventive maintenance work.
- Inspection, diagnosis and repairing procedures.

Importance of Preventive Maintenance:

- Basic concepts of Routine & Preventive maintenance.
- Methods & tools of maintenance.
- Importance of maintenance.
- Introduction to maintenance work.

Sliders & Guide Ways

69

68
OVERHAULING OF MACHINE

General.

Precautions to be observed during brushing & spraying paint
Brush & spray painting on metal & wooden articles
Procedure to prepare surface, use of protective coating

Cleaning and packing elements.

Preparation of gaskets and their mounting procedures

Materials used for leafook joints

Introduction of special tools used in maintenance

Conservation of wear, forms of wear

- Trench hard chrome plating etc.
- Reconditioning of worn-out parts of cast iron etc. By metal deposit-
- Recommissioning of various parts

Preparation of leafook chart

Reconditioning of machines after repair

- Recondition of tools, wear mandrels, spotting gauges, etc.
- Measuring instruments used in reconditioning

Methods of repairing damaged parts

REPAIRS AND RECONDITIONING
INTER-RELATION BETWEEN THEM.

Understanding of power and control circuit in general

Concept of ladder diagram

and relays.

Development of control circuit diagram using contactors

and relays.

Automatic operation - use of control circuit - total

Speed control of AC induction & DC motors.

Interlocks.

Pressure switches, overload relays etc. Safety

separates, pushbutton switches, limit switches, micro

motor control, interlocking control, ear - detector control,

principle of operation & constructional details. Simple

circuit breakers, fuse, contactors, relays, timers,

safety elements.

Elements of electrical systems - control, power and

measures. Maternier and multimeter - principle of operation.

measures of electrical quantities - use of volt,

both AC and DC motors and applications.

Electrical motors - construction and features, types of

motor effect and generator effect.

Electromagnetic induction.

Use of capacitors to store energy.

Use of a coil in hydraulic and pneumatic solenoids.

Principles of operation.

Concept of a coil (electromagnetic) and capacitors.

Advanced Electrical

Pedestal grinders, sensorite dusting machine etc.

to inspection parts for machines such as bench grinder,

pumps using various hand tools with specific reference

index head, lathe tool, stuffing arrangements & coolant.

Correct function of machinery when there is jaw chuck.

Re-assembly of machines in correct sequence and testing

proper method of removal and fitting of bearings.

Materials, their name and specifications.

Methods of cleaning of parts, solvents and cleaning
Direction control, valves according to their spatial post.

Flow control.

Types of valves: direction control, pressure control, constructional features, working principle of valves.

Constructional features: piston pumps, gear pumps, axial piston pumps, radial pumps, positive displacement pumps, use of pumps.

Study of:

ADVANCED HYDRAULICS

Program of development, function of various components, selection of PLC with constructional machine control, manual blocks, input/output, memory, power supply, control of programmable logic controllers - the fundamentals.

Circuit, photo-electric, relay, temperature controller, converter, PLC, DC/AC, over current relays, DC motor control, etc.

Introduction to commonly used controllers in industries:

Gauge, magnetic, photo, photocells, photo-transistors, etc.

Introduction to commonly used transducers in industries:

Thermocouples, transmitters, LVDT, strain gauges, etc.

Introduction to logic gates: AND, OR, NOT, etc.

ADVANCED ELECTRONICS

REVISION & TEST

Safety in handling and operating electrical equipments.
Servo Valves, Types of Check valves - application
construction & uses. Pilot operated check valves.

Servo, Flapper type servo & jet type servo, Single stage, spool servo,
Pressure control valve, Single relief valve, Compound
recess valve, "P" type relief valve, "K" type relief valve, Other types.

Flow control valves - constructional features & working
principles of flow control valves & their uses.

Meter-out circuit, Meter-out circuit, Bleeding-off
compensating features, pressure, temperature & flow.

Actuators - constructional features & principles of
Hydraulic motor - Rotary actuators, hydraulic cylinders
Hydraulic actuators types & their applications in hydraulic circuits.

Study of stackable (modular) type hydraulic control
valves, Study of manifolds, accumulators, intensifiers, rotary
joints etc.

Study of machine tool applications of the, hydraulic
drives for reciprocating, speed changing, clamping
material, bending of pipes, pipe bending fixtures & pipe
material, bending methods of pipes, pipe bending fixtures & pipe
material, bending methods.

Flexible hoses - types & their specifications, uses
according to the pressure in the line, correct installa-
ion of flexible hoses & its importance.

Construcional details of pipes, heat exchanger, heater, filter/strainer,
Selection of lubricants.
Common lubricating oils and greases, their specifications.
Effect of oil in and on high speed drives.
Lubrication grooves and rings lubrication.
Methods of lubrication by gravity feed, forced feed.
Lubrication.

LUBRICANTS AND LUBRICATION

Regular care of hydraulic systems.
After venting and cavitation.
Installation commissioning.
Methods of fault finding - rectification and remedies.
Storage of seals, filters, and other specifications.
Introduction to seals & packings - types, their functions.

SEALS AND PACKINGS

Study of different types of hydraulic & lubricant oils.
ADVANCED PNEUMATICS

Construction details, specifications, applications of power units, control units, filters, Service units.

Actuating units - single/double acting cylinders, rotary actuators, Sander, Disc Grinder, Nut Turners, etc.

Control units - directional control, Pressure control & flow control valves.

Types of Seals, Packings & Glands.

COMPUTER FUNDAMENTALS

Background - application, block diagram, input devices, output devices, CPU.

Memory - RAM, ROM, PROM, EPROM.

Basic DOS commands, use of computer as CNC work station, communication between CNC & computer.

CNC MACHINES

Introduction to CNC machines.

Difference between NC, CNC and GEM.

Importance of CNC machines over other mass production processes.

Construction details & working principles of CNC machines - machine beds, Ball Screw mechanism, etc.

Axes designation.

Introduction to G and M codes.
(6) Gateways, Study of Gateways, IM & Turture

(5) Assembly of Bollard, Propeller, & Turture

(4) Study of Bollard Assembly, Study of Nut Assembly

(3) Yoke & Rudder, Propeller Rudder, Rudder & Screw

(2) Basic Elements of Rudder & Screw Externally & Internally

Linear Actuators System

Study of:

- Linear Actuators

CNC/MC Maintenance

- Study of CNC/MC Maintenance

Manual Part Programming

CNC Tapping and Drilling
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<th>Week No.</th>
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<tr>
<td>Orthographic Projection. Directional Views by orthographic method.</td>
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<tr>
<td>Dihedral angles and formation of four quadrants.</td>
<td>5</td>
</tr>
<tr>
<td>Picture plane concept, Diverging and converging projections.</td>
<td>4</td>
</tr>
<tr>
<td>Free hand sketching practice curved lines, arcs, circles etc.</td>
<td>3</td>
</tr>
<tr>
<td>Rectangles, squares etc.</td>
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</tr>
<tr>
<td>Free hand sketching practice of inclined lines and polygons.</td>
<td></td>
</tr>
<tr>
<td>Practice of horizontal and vertical lines.</td>
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<tr>
<td>BIS standard sizes of drawing sheets. Free hand sketching</td>
<td></td>
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<tr>
<td>Introduction to graphical language and uses of drawing instruments.</td>
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</tbody>
</table>

**Ability to Read & CNC Drawings**

**Assembly Drawings**

To make this students to perceive working drawing from

**Drawing**

To acquire proficiency in Interpretation of Engineering

**Subject: Engineering Drawing**

(First & Second Year)

Syllabus for Mechanic Advanced Machine Tool Maintenance

- To learn language of engineers

- Aim:
<table>
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<th>Exercise/Topic</th>
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<td>Construction of helix on cylinder and on cone.</td>
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<td>Construction of Archimedean Spiral</td>
<td>65 &amp; 66</td>
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<td>Construction of Cycloidal curves - cycloid, epicycloid, hypocycloid</td>
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<td>Construction of Involute</td>
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<td>Example on sectional views</td>
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<td>Ellipse (4 types of construction) (2 sheets)</td>
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<td>Engineering Curves - Parabola &amp; Hyperbola</td>
<td>60</td>
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<td>Preparation of templates by using tangential arc method.</td>
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<td>Geometrical constructions on tangential arcs and circles.</td>
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<td>Geometrical constructions on described circles in polygons</td>
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<td>Geometrical constructions on inscribed circles in polygons</td>
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<td>Equal division of a straight line</td>
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<td>Geometrical constructions - Bisectioning lines and angles, to make</td>
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<td>Laying out Practice (Vertical and inclined)</td>
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<td>Revision &amp; Test</td>
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<tr>
<td>Dimensioning, Sectioning and Practice Sheets (15/16 sheets)</td>
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<td>Missing views and Practice on above position</td>
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<td>Sectional View exercises (5 to 16 sheets)</td>
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<td>Engineering drawing: Constructions used in engineering drawing.</td>
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<td>Introduction to sections &amp; sectional views. Differences types of exercises on 1st angle, 2nd angle with dimensional (5 sheets)</td>
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<td>Revision &amp; Test</td>
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<td>in Dimensioning</td>
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<td>Dimensioning technique &amp; Systems in Dimensioning, General rules</td>
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<td>Tolerances of forms and positions and their applications:</td>
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<td>Welding symbols, surface roughness symbols and their</td>
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<td>Blue print reading conventions.</td>
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<td>Curved surface to curved surface (2 sheets)</td>
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<td>Surface to curved surface (2 sheets)</td>
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<td>Lines of intersection of surfaces to plane surface. (2 sheets)</td>
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<td>Lines of intersection of planes.</td>
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<td>Interpenetrating curves of solids, Lines of intersection of planes</td>
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<td>Surface development of sphere by zone method and line method.</td>
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<td>Surface development of cones and cut cones and other exercises.</td>
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<td>Development of pyramids and cut pyramids.</td>
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<td>Surface development of cut prisms and cylinders. Surface</td>
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<td>Development of cube, prisms and cylinders.</td>
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<td>Introduction to surface development of various solids. Surface</td>
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<td>Revolution, Practice on primary auxiliary projection, reverse auxiliary and</td>
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<td>Practice on primary auxiliary projection for different solids (2 sheets)</td>
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<tr>
<td>Irregular curves in isometric.</td>
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<tr>
<td>Angles, arcs and circles in isometric. Construction of sphere and</td>
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<tr>
<td>Theory of isometric projection. Preparation of isometric scale.</td>
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<td>10 sheets) Projection of lines, planes and solids (2 sheets)</td>
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<td>103</td>
<td>on CAD (2 components)</td>
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<td>Introduction to CAD / CAM and drawing simple component drawings</td>
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<tr>
<td>101 &amp; 102</td>
<td>Auxiliary views (3/4 sheets)</td>
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<td></td>
<td>Exercises on solid geometry, ortho views, development, intersection</td>
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</table>
ENG. DRG.
TRADE THEORY
TRADE PRACTICAL
THIRD YEAR
SHOP FLOOR TRG.
<table>
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<th>No.</th>
<th>Area of Training Period in Weeks</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>Practice of installation of machine tools - Foundation, installation of machines and special tools/fixtures etc. against vibrations. Use of antivibration mounting pads.</td>
<td></td>
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<tr>
<td>2</td>
<td>Manufacturing and/or repair of worn out parts to be replaced. Reconditioning of general purpose machines. Air compressors, pumps etc.</td>
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<td>3</td>
<td>Preventive maintenance Breakdown maintenance on Hydraulic/Pneumatic systems.</td>
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<td>4</td>
<td>Maintenance of CNC w/c. WTR 10 JMC 50也有一些 crafts and installation of</td>
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<td>5</td>
<td>Maintenance of CNC w/c. WTR 10 JMC 50也有一些 crafts and installation of</td>
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<td>6</td>
<td>Maintenance of CNC w/c. WTR 10 JMC 50也有一些 crafts and installation of</td>
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<td>7</td>
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<td>Maintenance of CNC w/c. WTR 10 JMC 50也有一些 crafts and installation of</td>
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<td>12</td>
<td>Maintenance of CNC w/c. WTR 10 JMC 50也有一些 crafts and installation of</td>
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</tbody>
</table>
Method, study, and work measurement. Shop layout and ma-

116-120

WORK STUDY

Latest trends - use of laser beam.

Definitions and methods.

111-115

INSPECTION AND QUALITY CONTROL

Methods of deriving backlagen, tool offset values.

Study of laser interferometer for axes calibration.

Estimation of the m/c, manual data input mode.

Study of CNC alarm messages, simple part programming for

an emergency stop, job, reference mode, single block mode.

Study of co-ordinate system, m/c operation controls such

107-110

CNC m/c operation & study

Mathematically stock level.

Planning spare parts manufacturing.

Spare parts procurement.

Plant code system.

Performance of machine manuals - how to use them.

and recording the data.

Use of maintenance cards, log cards, history cards.

105-106

MAINTENANCE RECORDS

THEORY

THIRD YEAR INPLANT TRAINING
Types of Jigs & Fixtures
- Safety devices necessary where in use.
- Table fixing arrangements.
- Rigidly and stably to avoid vibrations.
- Foot Provided, flexible to avoid collapsing.
- Clamping types & power devices used for clamping.
- Method of location, loading and unloading.
- Fixtures.
- Ports to be considered while designing jigs and
- definition and precautions.

131-135

JIGS AND FIXTURES

130

PREVISION & TEST

Robots for loading / unloading operations.
- Welding and painting robots.
- Operation.
- Use of manipulators and robots for machining.

INDUSTRIAL AUTOMATION AND ROBOTICS

Application in the construction of machine tools.
- Analysis, physical properties and machining of
- Components, polymers, rubber, foam - in machining.
- Use of non-metallic materials - plastic, nylon.

121-124

ENGINEERING MATERIALS - NON-METALLIC
STILLING MACHINES
Care and maintenance.
Mechanisms and operation.
Work holding devices and tool mounting methods.
Types - horizontal, vertical, drilling machines.

BORING MACHINES
Care and maintenance.
Study of speed and feed changing mechanisms of boring machines.
Drilling machines.
Drilling, multiple spindle drilling, and automatic.
Special features of radial drilling, production.

- TYPES, STYLES, SIZES AND SPECIFICATIONS OF DRILLING MACHINES

BORING MACHINES
- DRESSES AND DIAL INDICATOR.

NEW AND RECONDITIONED MACHINE TOOLS BY USING TEST MAN.

SHAPING, DRILLING MACHINES AS PER ISI SPECIFICATIONS.
- TESTING OF MACHINE TOOLS LIKE LATHE, MILLING.
- CARE AND MAINTENANCE OF MEASURING TOOLS.
- DIAL INDICATOR, ANGULARITY, OPTICAL RULES.
- LEVEL, PLUMB BOM, BRIDGES, STRAIGHT EDGES, SPOTTING GAUGES.
- USE OF TEST CHARTS, MEASURING TOOLS, SPOTTING.
- INTRODUCTION TO TESTING OF MACHINE TOOLS.

TESTING OF MACHINE TOOLS

140-144
139-138
Care and maintenance.

Air Compressors:
- European units
- Pressure control
- Use of safety valves and governors
- Use of compressors, use of coolers
- Compressed air production, rotary and reciprocating type

AIR COMPRESSORS

Chemical machining processes:
- Study or Ultrasonic and Burnishing Industry. Laser cutting machines in an application of spark erosion, wire EDM, and conventional processes. Principles of operation.

NON-COMMERCIAL MACHINE TOOLS

Care and maintenance.

Difference between shaper and planner. Operation of Acme screw and standard camming devices.

Power feed mechanisms by friction disc and zero backlash motor drive, and hydraulic drive.

Types. Specifications and use.

PLANING MACHINES

Care and maintenance.

Study of cutter operation.

Hysteretic drive mechanism.

Variable speed, reversible drive mechanism.

Types. Specifications and functions.
<table>
<thead>
<tr>
<th>Week No.</th>
<th>Course</th>
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</thead>
<tbody>
<tr>
<td>128 to 129</td>
<td>Drawing of bearings - bushed, pedestal, footstep, plunger block.</td>
</tr>
<tr>
<td>127</td>
<td>Piping symbols and its application on drawing.</td>
</tr>
<tr>
<td>126</td>
<td>Hydraulic, pneumatic symbols &amp; circuit.</td>
</tr>
<tr>
<td>125</td>
<td>Free hand sketching of outside micrometer, vernier caliper.</td>
</tr>
<tr>
<td>124</td>
<td>Different types of V &amp; square threads.</td>
</tr>
<tr>
<td>123</td>
<td>Metric screw threads.</td>
</tr>
<tr>
<td>122</td>
<td>Various types of shaft couplings - flanged, cone, multi, universal etc.</td>
</tr>
<tr>
<td>118 &amp; 119</td>
<td>Types of pulleys - flat belt, V belt, rope pulleys.</td>
</tr>
<tr>
<td>117</td>
<td>Hydraulic joints ; C &amp; flanged joint.</td>
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<tr>
<td>116</td>
<td>Pipe joints, socket and spigot joint.</td>
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<tr>
<td>115</td>
<td>Pin or knuckle joint.</td>
</tr>
<tr>
<td>114</td>
<td>Collar joint with sleeve and strap joint with 2 collars.</td>
</tr>
<tr>
<td>113</td>
<td>Collar and collar joints (socket and spigot).</td>
</tr>
<tr>
<td>112</td>
<td>Various types of keys with standard proportion.</td>
</tr>
<tr>
<td>111</td>
<td>Various types of foundation bolts.</td>
</tr>
<tr>
<td>110</td>
<td>Various types of locking arrangements for nuts.</td>
</tr>
<tr>
<td>109</td>
<td>Types of bolts &amp; bolt heads.</td>
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<tr>
<td>108</td>
<td>Types of nuts with their standard proportion.</td>
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<td>107</td>
<td>Forms and ends of set screws.</td>
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<tr>
<td>106</td>
<td>Types of rivet heads.</td>
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<tr>
<td>105</td>
<td>Tolerances dimensionalising.</td>
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<tr>
<td></td>
<td>Dimensioning of tolerated components, dimensioning of keyways.</td>
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</table>

**Subject:** Engineering Drawing  
(Third Year)  
**Syllabus for Mechanical Advanced Machine Tool Maintenance**
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<tr>
<th>Revision</th>
<th>Weeks</th>
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<td>155</td>
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<tr>
<td>153-155</td>
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<tr>
<td>Dimensioning, roughness symbols and Geometric Tolerances.</td>
<td>151-152</td>
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<tr>
<td>Practice on Orthographic Projection and sectional views with</td>
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<tr>
<td>CAD. (2 sheets)</td>
<td>149-150</td>
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<tr>
<td>Preparation of component drawing on practice on missing lines and missing views</td>
<td>148</td>
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<tr>
<td>Practice on concept of co-ordinate axes in CNC. Exercise on system symbols, missing limit size, fits and tolerances etc</td>
<td>147-148</td>
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<tr>
<td>Blue print reading and study on missing dimensions, machining</td>
<td>145</td>
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<tr>
<td>Free hand Sketching Practice of hand tools and trade related tools.</td>
<td>144</td>
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<tr>
<td>Various types of cams</td>
<td>143</td>
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<tr>
<td>Introduction to cams</td>
<td>142</td>
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<tr>
<td>Worm and worm gearing</td>
<td>141-144</td>
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<td>Reel gearing</td>
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<td>Helical gearing</td>
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<td>Spiral gearing</td>
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<td>Gear Terminology</td>
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<tr>
<td>Free hand Sketching of gauges - snap and hang</td>
<td>135</td>
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<tr>
<td>System and coolant system</td>
<td>134</td>
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<tr>
<td>Layout Drawings for installation of machine equipments, lubrication</td>
<td>134</td>
</tr>
<tr>
<td>Machining, Drilling Machine etc. (6 sheets)</td>
<td>133</td>
</tr>
<tr>
<td>Jigs - Foundation drawing of machine tools, e.g. Jig. Lathe, Milling</td>
<td>131-133</td>
</tr>
<tr>
<td>Fixtures, Locating devices. Clamping devices, Types of simple clamping</td>
<td></td>
</tr>
<tr>
<td>Introduction to Jigs and Fixtures and different elements of Jigs and</td>
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<tr>
<td>Revision &amp; Test</td>
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