MRCET CAMPUS

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS INSTITUTION - UGC, GOVT. OF INDIA)

Affiliated to JNTUH; Approved by AICTE, NBA-Tier 1 & NAAC with A-GRADE | ISO 9001:2015

Maisammaguda, Dhulapally, Komaplly, Secunderabad - 500100, Telangana State, India

AIRCRAFT PRODUCTION TECHNOLOGY MANUAL

Name:..

Roll No:...............Branch:..

Year:..................Sem:..

MRCET CAMPUS

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS INSTITUTION - UGC, GOVT. OF INDIA)

Affiliated to JNTUH; Approved by AICTE, NBA-Tier 1 & NAAC with A-GRADE | ISO 9001:2015
Maisammaguda, Dhulapally, Komaplly, Secunderabad - 500100, Telangana State, India

Certificate

Certified that this is the Bonafide Record of the work done by

Mr./Ms.. Roll No. .... of

B.Tech II Year .... Semester for the Academic Year 2024-25

in ....Manual.

Date: Faculty Incharge HOD

Internal Examiner External Examiner

INDEX

No	Date	Name of the Activity/Experiment	Grade/ Marks	Faculty Signature

MRCETVISION

TobecomeamodelinstitutioninthefieldsofEngineering,TechnologyandManagement.

To have a perfect synchronization of the ideologies of MRCET with challengingdemandsofInternationalPioneeringOrganizations.

MRCETMISSION

Toestablishapedestalfortheintegralinnovation,teamspirit,originalityandcompetence in the students, expose them to face the global challenges and becomepioneersofIndianvisionofmodernsociety.

MRCETQUALITYPOLICY.

To pursue continual improvement of teaching learning process of UndergraduateandPostGraduateprograms inEngineering&Managementvigorously.

Toprovidestateofartinfrastructureandexpertisetoimpartthequalityeducation.

PROGRAMOUTCOMES(PO's)

EngineeringGraduateswill be ableto:

1. **Engineeringknowledge**:Applytheknowledgeofmathematics,science,engineeringfundamentals,andanengineeringspecializationtothesolutionofcomplexengineering problems.
2. **Problemanalysis**:Identify,formulate,reviewresearchliterature,andanalyzecomplexengineeringproblemsreachingsubstantiatedconclusionsusingfirstprinciplesofmathematics,naturalsciences,and engineeringsciences.
3. **Design/developmentofsolutions**:Designsolutionsforcomplexengineeringproblemsand design system componentsorprocessesthatmeetthe specifiedneeds with appropriate consideration for the public health andsafety, and thecultural,societal,andenvironmentalconsiderations.
4. **Conduct investigations of complex problems**: Use research-based knowledge andresearch methods including design of experiments, analysis and interpretation ofdata,and synthesisoftheinformationtoprovidevalidconclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources,and modern engineering and IT tools including prediction and modeling to complexengineeringactivitieswithanunderstandingofthelimitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledgetoassesssocietal,health,safety,legalandculturalissuesandtheconsequentresponsibilitiesrelevanttotheprofessionalengineeringpractice.
7. **Environmentandsustainability**:Understandtheimpactoftheprofessionalengineering solutions in societal and environmental contexts, and demonstrate theknowledge of,andneedforsustainable development.
8. **Ethics**:Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesandnormsoftheengineeringpractice.
9. **Individualandteamwork**:Functioneffectivelyasanindividual,andasamemberorleader indiverseteams,and inmultidisciplinarysettings.
10. **Communication**: Communicate effectively on complex engineering activities withtheengineeringcommunityandwithsocietyatlarge,suchas,beingabletocomprehend and write effective reports and design documentation, make effectivepresentations,and giveand receive clearinstructions.
11. **Project management and finance**: Demonstrate knowledge and understanding ofthe engineering and management principles and apply these to one's own work, asamemberandleaderinateam,tomanageprojectsandinmultidisciplinaryenvironments.
12. **Life- long learning**: Recognize the need for, and have the preparation and ability toengageinindependentandlife-longlearninginthebroadestcontextoftechnologicalchange.

PROGRAMEDUCATIONALOBJECTIVES–AeronauticalEngineering

1. **PEO1 (PROFESSIONALISM & CITIZENSHIP):** To create and sustain a community oflearning in which students acquire knowledge and learn to apply it professionallywithdueconsiderationforethical,ecologicalandeconomicissues.
2. **PEO2 (TECHNICAL ACCOMPLISHMENTS):** To provide knowledge based services tosatisfy the needs of society and the industry by providing hands on experience invarioustechnologiesincorefield.
3. **PEO3(INVENTION,INNOVATIONANDCREATIVITY):**Tomakethestudentstodesign, experiment, analyze, and interpret in the core field with the help of othermultidisciplinaryconceptswhereverapplicable.
4. **PEO4(PROFESSIONALDEVELOPMENT):**To educate the students to disseminateresearchfindingswithgoodsoftskillsandbecomeasuccessfulentrepreneur.
5. **PEO5 (HUMAN RESOURCE DEVELOPMENT):** To graduate the students in buildingnationalcapabilitiesintechnology,educationandresearch

PROGRAMSPECIFICOUTCOMES–AeronauticalEngineering

1. To mould students to become a professional with all necessary skills, personalityandsoundknowledge inbasicand advancetechnologicalareas.
2. To promote understanding of concepts and develop ability in design manufactureandmaintenanceofaircraft,aerospace vehiclesand associatedequipmentanddevelop application capability of the concepts sciences to engineering design andprocesses.
3. Understanding the current scenario in the field of aeronautics and acquire ability toapply knowledge of engineering, science and mathematics to design and conductexperimentsinthefieldofAeronautical Engineering.
4. To develop leadership skills in our students necessary to shape the social,intellectual,businessand technicalworlds.

MALLAREDDYCOLLEGE OFENGINEERING&TECHNOLOGY

IIYearB.Tech.ANE.-ISemester T PC

03 1.5

(R22A2181) AIRCRAFT PRODUCTION TECHNOLOGY LAB

OBJECTIVES Basic exercises In Lathe , Shaper, Milling ,Slotting ,CNC and Grindingmachines,WeldingEquipmentCompressingmicroscopespolishingDiskGrinderasunder

LISTOFEXPERIMENTS

1. Plainturning,Taperturning,Facing,Knurling,Threadcutting.
2. Drilling,Boring,Counterboring,countersinking.
3. SimpleexerciseonShaping
4. Simpleexerciseonplanning
5. PlainMilling.
6. GearMilling(stepmilling&slotmilling)
7. Sheetmetaljoiningbysoldering
8. SimpleexercisesonCNCmachinesandprogrammegeneration.
9. SimpleexercisesinGaswelding
10. Simpleexercisesinarcwelding
11. Aircraftwoodgluingpractice.
12. Studyofpropertiesofsandwichstructures

REFERENCE:

1. Aircraftproductiontechniques‘keshuS.C,GanapathyK.KInterlinePublishinghouseBangalore1993.

2. ManufacturingEngineeringandtechnologybyKalpakajam-AddisonWesley.

CONTENTS

S.NO	TITLE	PAGENO
1	LATHE	2
2.	LATHEOPERATIONS (EXP-1)	10
3.	DRILLING MACHINE	12
4.	DRILLING OPERATIONS (EXP-2)	15
5.	SHAPING	17
6.	SHAPING OPERATIONS(EXP-3)	20
7.	PLANER	22
8.	PLANEROPERATIONS (EXP-4)	23
9.	MILLING	25
10.	MILLING OPERATIONS(EXP-5)	28
11.	MILLING OPERATIONS(EXP-6)	31
12.	SHEETMETALJOININGBYSOLDERING	36
13.	SHEETMETALJOINING BY SOLDERING(EXP-7)	37
14.	COMPUTERNUMERICALCONTROL	38
15.	COMPUTERNUMERICALCONTROLOPERATIONS(EXP-8)	46
16.	WELDING	48
17.	GAS WELDING (EXP-9)	51
18.	ARCWELDING (EXP-10)	52
19.	WOODGLUING PRACTICE(EXP-11)	53
20.	PROPERTIESOF SANDWICHSTRUCTURES(EXP-12)	55

LATHE

INTRODUCTION:

The lathe, probably one of the earliest machine tools, is one of the most versatile andwidelyusedmachinetool,soalsoknownasmothermachinetool.

An engine lathe is the most basic and simplest form of the lathe. It is called so because in earlylathes,powerwasobtained fromengines.

The job to be machined is held and rotated in a lathe chuck; a cutting tool is advancedwhich isstationary against the rotating job. Since the cutting tool material is harder than thework piece,sometaliseasilyremoved fromthejob.

Some of thecommon operationsperformed on alathe arefacing,turning, drilling,threading,knurling,andboringetc.

NOMICULATEOFSINGLEPOINTCUTTINGTOOL:

1:SideCuttingEdgeAngle:

Theanglebetweensidecuttingedgeandthesideofthetoolshankiscalledsidecuttinge dgeangle.Itisoftenreferredtoastheleadangle.

2:EndCuttingEdgeAngle:

Theanglebetweentheendcuttingedgeandalineperpendiculartotheshankofthetoolshankiscalled endcuttingedge angle.

3:SideReliefAngle:

Theanglebetweentheportionofthesideflankimmediatelybelowthesidecuttingedgeandalineperpendic ularto thebaseofthetool.

4:EndReliefAngle:

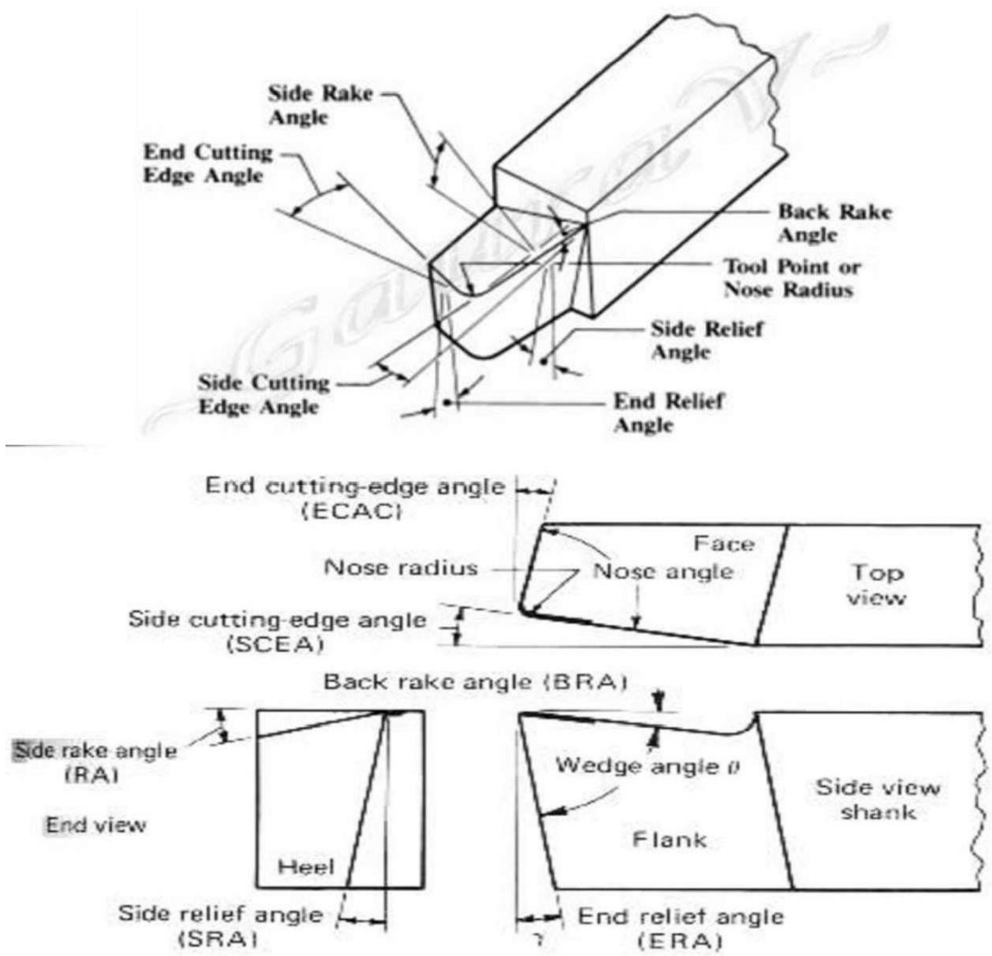
Theanglebetweentheendflankandthelineperpendicular tothebaseofthetooliscalledendreliefangle.

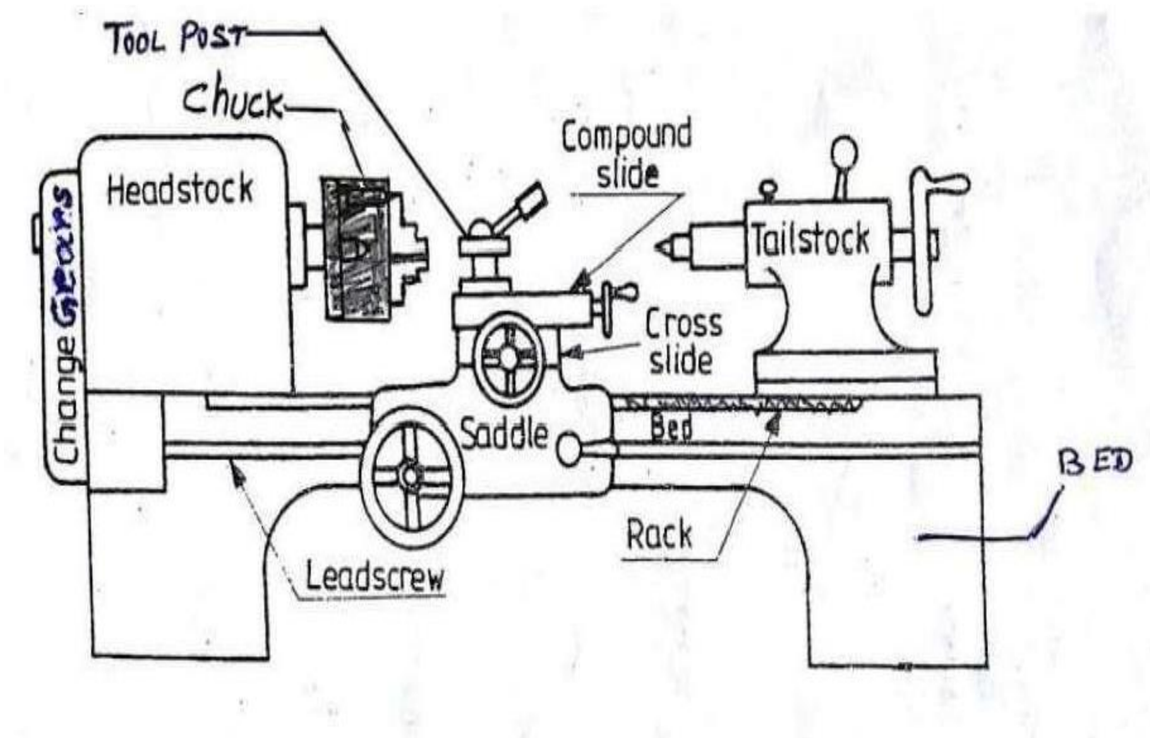
5:BackRakeAngle:

The angle between the face of the tool and line perpendicular to the base of the tool measures onperpendicular plane through the side cutting edge. It is the angle which measures the slope of theface of the toolfrom the nose, towards the rack. If the slope is downward the nose itis negativebackrake.

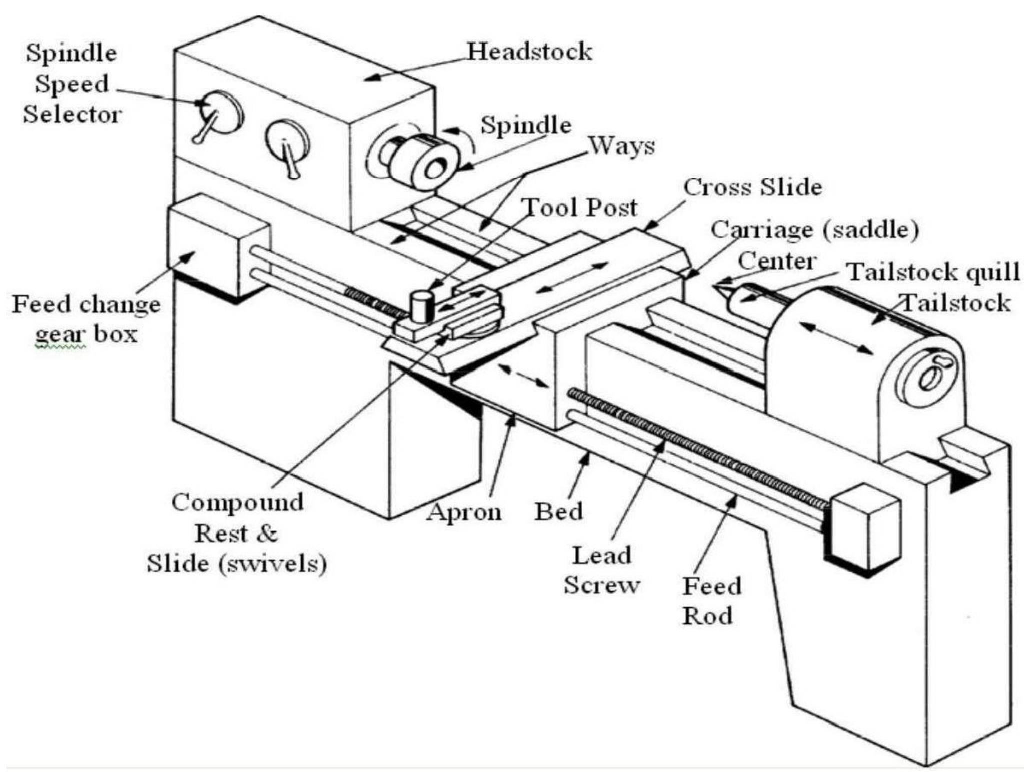
6:SideRakeAngle:

The angle between the face of the tool and a line parallel to the base of the tool measured onplane perpendicular to the base and the side edge. It is the angles that measure the slope of thetool face from the cutting edge, if the slope is towards the cutting edge it is negative side rakeangle and if the slope is away from the cutting edge, it is positive side rake angle. If there is noslopethesiderakeangle iszero.





LATHEMACHINE:



A lathe is a machine tool which rotates the work piece on its axis to perform variousoperations such as cutting, sanding, knurling, drilling, or deformation with tools that are appliedtothework piecetocreateanobjectwhichhassymmetryaboutanaxisofrotation.

Lathes areusedinwoodturning,metalworking,metalspinning,andglass working.Lathes can be used to shape pottery, the best-known design being the potter's wheel. Mostsuitably equipped metalworking lathes can also be used to produce most solids of revolution,plane surfaces and screw threads or helices. Ornamental lathes can produce three-dimensionalsolids of incredible complexity. The material can be held in place by either one or two centers, atleast one of which can be moved horizontally to accommodate varying material lengths. Otherwork holding methods include clamping the work about the axis of rotation using a chuck to afaceplate,usingclampsordogs.

PARTSOFLATHEMACHINE:

Bed: Supportsallothermachineparts.

Carriage: Slidesalongthemachineways.

Headstock: Power trainofsystem(spindleincluded).

TailStock: Fixespieceatendoppositetotheheadstock.

Swing: Maximumdiameterofthemachinablepiece.

Leadscrew: Controlsthefeedperrevolutionwithagreatdealofprecision.

TYPESOFOPERATION:

FacingOperation

Facing is the operation of machining the ends of a piece of work to produce a flat surfacesquare withtheaxis.The operationinvolvesfeedingthe toolperpendiculartotheaxisofrotationofthe work piece.

Aregularturningtoolmaybeusedforfacingalargework piece.Thecuttingedge shouldbesetatthesameheightasthecenteroftheworkpiece.Thetoolisbroughtintoworkpiece from around the center for the desired depth of cut and then is fed outward, generally by handperpendiculartotheaxisofrotation ofthe workpiece.

RoughTurningOperation

Rough turning is the operation of removal of excess material from the work piece in aminimum time by applying high rate of feed and heavy depth of cut. The depth of cut forroughingoperationsinmachiningtheworkrangesfrom2to5mmandtherateoffeedisfrom 0.3 to1.5mmperrevolutionofthework.

FinishTurningOperation

It requires high cutting speed, small feed, and a very small depth of cut to generate asmooth surface. The depth of cut ranges from 0.5 to 1 mm and feed from 0.1 to 0.3 mm perrevolution ofthe workpiece.

StepTurning

This is the operation of making different diameters of desired length. The diameters andlengthsaremeasuredbymeansofoutside caliperandsteelrulerespectively.

TaperTurning

A taper may be defined as a uniform increase or decrease in diameter of a piece of work measured along its length. In a lathe, taper turning means to produce a conical surface by gradual reduction in diameter from a cylindrical workpiece.

The amount of taper in a work piece is usually specified by the ratio of the difference indiametersofthetapertoitslength.Thisistermedastheconicitydesignated bytheletter'K'.

$$K=(D-d)/L$$

Where,D= Largediameter oftaperinmmd

= small diameter of taper in

mmL=lengthoftaperedpartinmm

Atapermaybeturnedbyanyoneofthefollowingmethods:

a) Formtoolmethod
b) Tailstocksetovermethod
c) Swivelingthecompoundrestand
d) Taperturningattachment

Taperturningbyswivelingthecompoundrest:

This method employs the principle of turning taper by rotating the work piece on thelathe axis and feeding the tool at an angle to the axis of rotation of the work piece. The toolmounted on the compound rest is attached to a circular base, graduated in degrees, which may beswiveled and clamped at any desired angle. Once the compound rest is set at the desired halftaper angle, rotation of the compound slide screw will cause the tool to be fed at that angle andgenerateacorrespondingtaper.

Thesettingofthecompoundrestisdonebyswivelingtherestatthehalftaperangle.Thisiscalculatedbythe equation.

$$\mathbf{Tan\alpha=(D-d)/2L}$$

Whereα=Halftaperangle

Knurling

Knurling is the process of embossing a diamond shaped pattern of the surface of a workpiece. The purpose of knurling is to provide an effective gripping surface on a work piece toproven it from slipping when operated by hand. Knurling is performed by a special knurling toolwhich consists of a set of hardened steel rollers in a holder with the teeth cut on their surface in adefinite pattern. The tool is held rigidly on the tool post and the rollers are pressed against therevolvingsurfaceofworkpiecetosqueezethemetalagainstthemultiplecuttingedges,producing depressionsinaregularpattern onthesurfaceoftheworkpiece.

Knurling is done at the slowest speed and oil is flowed on the tool and work piece.Knurling is done at the slowest speed and oil is flowed on the tool and work piece to dissipateheatgeneratedduringknurling.Thefeedvaries from1to2mmperrevolution.

Chamfering

Chamfering is the operation of beveling the extreme end of a work piece. This is done toremove the burrs, to protect the end of the work piece from being damaged and to have a betterlook. The operation may be performed after the completion of all operations. It is an essentialoperationafterthreadcuttingsothatthenutmaypassfreelyonthethreadedworkpiece.

METALCUTTINGPARAMETERS

Thecuttingspeedofatoolisthespeedatwhichthemetalisremovedbythetoolfromtheworkpiece.

Inalathe,itistheperipheralspeedoftheworkpastthecuttingtoolexpressedinmeters/minute

(i) Cuttingspeed(V)= πDN/1000,m/min

Where, D =Diameter oftheworkinmin
N=RPMofthework

(ii) Feed:

ThefeedofacuttingtoolinaLatheworkisthedistancethetooladvancesforeachrevolutionoft hework.Feedisexpressedinmm/rev.

(iii) Depthofcut:

Thedepthistheperpendiculardistancemeasuredfromthemachinedsurfacetotheuncuts urfaceofthework piece.

Depthofcut=$(d_1-d_2)/2$

Where,d_1=Diameteroftheworksurfacebeforemachiningd_2=Diam

eterofthe worksurfaceaftermachining

WhileusingHSStoolforturningmildsteelworkpiece.Thefollowingparametersareto bechosen.

(iv) Rough Turning

Operation: Cuttingspeed(V)=

25m/min,feed(f)=0.2

mm/rev,

Depthofcut(t)=1mm

(v) Finishturningoperation:

Cuttingspeed(V)=40m/min,fe

ed(f)=0.1 mm/rev,

Depthofcut(t)=0.2mm

(vi) Toolgeometry:

Back rake angle =

7^0,End relief angle =

6^0Sidereliefangle=6^0,

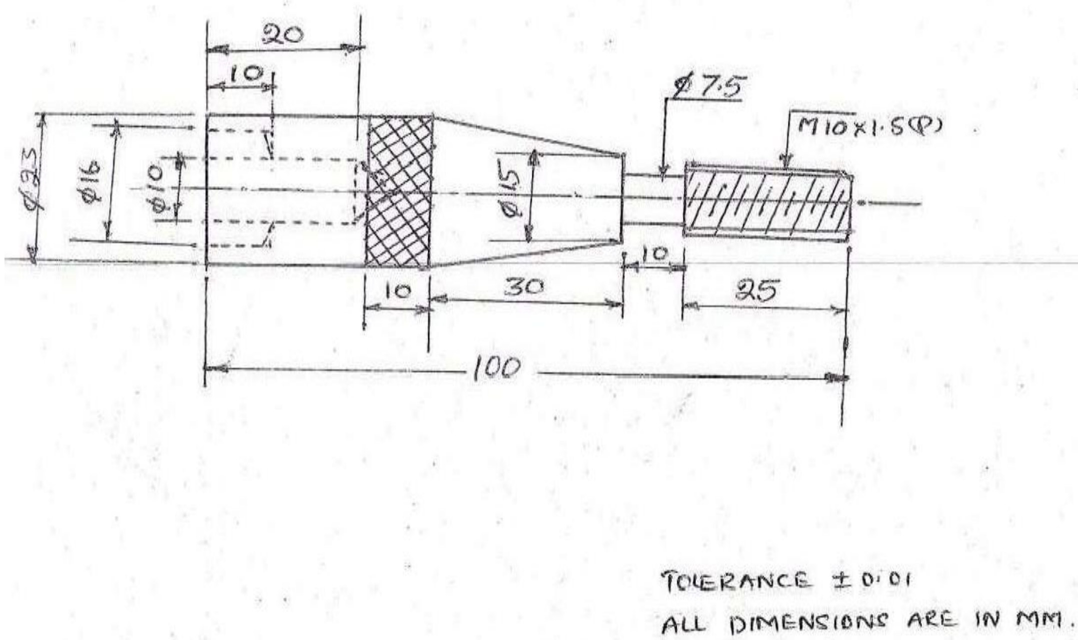
Endcuttingedgeangle=15^0

Sidecuttingedgeangle=15^0,N

oseradius=2mm

EXPERIMENT-1

Aim: To perform various lathe operations such as "**Facing, Plain turning, Step turning. Taper turning, under cut, Knurling, Thread cutting** and **chamfering**. "On a given materialmadeofmildsteel.



Materialrequired:Amildsteelbarof25mmdiameterand100mmlong.

ToolsusedH.S.S.singlepointcuttingtool,partingtool,V-toolforthreading,Knurlingtool,Chuck key,toolpostkey.

Measuringinstruments:outsidecaliper,steelrule,pitchgageetc.

Procedure:

1. Settheworkpieceonthechuckandtool onthetoolpost.
2. Operationssuchasfacing&plainturningareperformedona givenM.S.bar.Thenthestep&undercutturningisperformedusingpartingtool.(Finalcut).

   Oneafteranotherinthesequenceuponthedimensionsasshown.
3. Now the compound rest is swiveled by calculated half taper angle and taper isgeneratedonthework piece,byrotatingthecompoundslidescreen willcausethetoolto be feed atthehalftaperangle (α).
4. H.S.S. tool is replacedby Knurling tool in toolpost.Knurling generationisperformedattheslowestspeedofthe spindle.
5. Knurlingmustbedoneatlowspeedavailableandapplylubricatingoilwhileknurling.
6. H.S.S.V- Shape threadcuring toolfixthe toolpost and set the workpiece on thechuck.
7. Thechangegearsofcorrectsizearecalculatedandthenfittedtotheendofthebedbetweenthe spindleand the lead screw.
8. Thetopofthetoolnoseshouldbesetatthesameheightasthecenterofthejob.
9. Threadcuttinggenerationisperformedattheslowestspeedofthespindle.
10. Engagetheleadscrewleverandstarttheoperation.Applypropercoolantduringcuttingpoint.
11. Thedepthofcutusuallyvaries from0.05mmto0.2mm.

Precautions:

1. Operatethemachineatspecificspeed.
2. Donotdepthofcut morethan2mm.
3. Applylubricatingoilwhilealloperations
4. Makesurethattheworkplaceisneatandclean.

Result:Therequiredoperationsaresuccessivelycompleted.

VIVAQUESTIONS:

1. Whatisalathe?

2. Whatarethevariousoperationscanbeperformedonalathe?
3. Whatareprinciplepartsofthelathe?
4. Whatarethetypesofheadstock?
5. Statethevariouspartsmountedonthecarriage?
6. Whatarethefourtypesoftoolpost?
7. Whatisanapron?
8. Stateanytwospecificationoflathe?
9. Listanyfourtypesoflathe?

OBSERVATIONS