

FACULTY OF ENGINEERING  
DESIGN AND PRODUCTION ENGINEERING DEPARTMENT

Composite lab II  
Credit hour system

Report On:

Thread Measurements using  
Tool maker Microscope



Metrology laboratory

Student Name	Remark
Class No:	Signature
B.N.	

2014/2015

## EXPERIMENT D

### Objective

The objective of this experiment is to find out:

- The major diameter.
- The minor diameter
- The simple effective diameter
- The pitch of the screw and its types of errors.
- The included angle of the screw.
- The flank angle
- The helix angle of the screw .

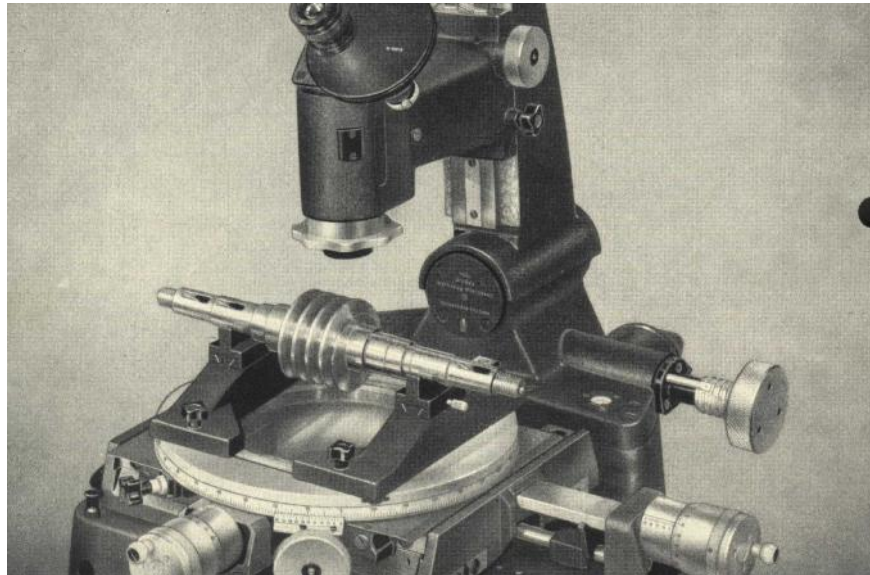
### Equipment

The measuring equipment used in this experiment are:

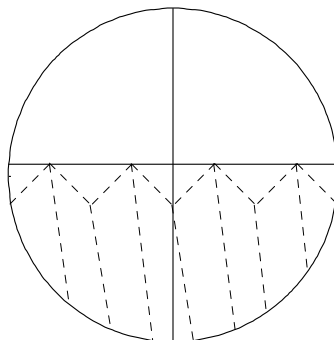
Tool maker microscope

## 1. Measurement of Outer Diameter

- Mount the two centers brackets on the table of the tool room and place the screw between the two centers.



- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Move the micrometers until the longitudinal line touches the crests of the screw.



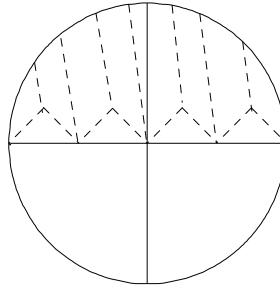
## Report No: Thread Measurements

- Take the reading of the cross micrometer; let it be

R1

R1 =

- Move the cross micrometer until the longitudinal line touches the crests of the screw on the other side.



- Take the reading of the cross micrometer; let it be

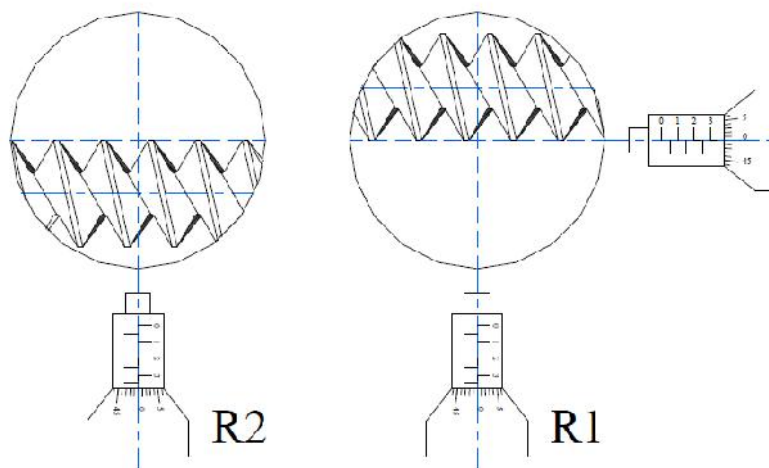
R2.

R2 =

- Calculate the major diameter =  $R2 - R1$

$R2 - R1 =$

- Repeat this reading at least five times and determine the average value and its limits.



**Report No: Thread Measurements**

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R1=

R2=

R2-R1=

R1=

R2=

R2-R1=

R1=

R2=

R2-R1=

R1=

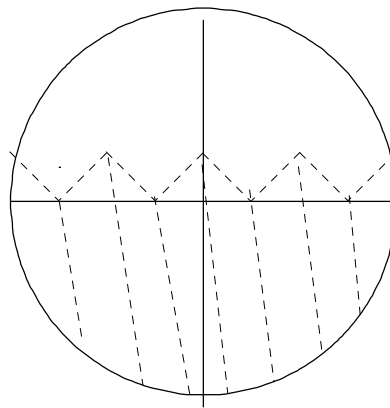
R2=

R2-R1=

Average

## 2. Measurement of Inner Diameter

- Mount the two centers brackets on the table of the tool room and place the screw between the two centers.
- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Tilt the column of the tool room by the helix angle.
- Move the micrometers until the longitudinal line touches the roots of the screw.



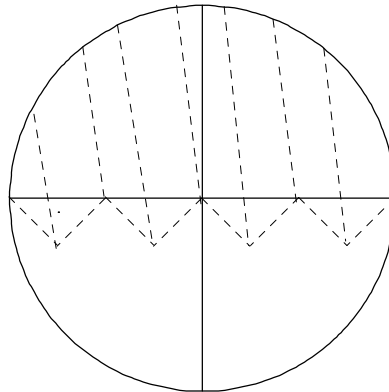
- Take the reading of the cross micrometer; let it be R1
- R1 =
- Move the cross micrometer until the longitudinal line touches the roots of the screw on the other side.

## Report No: Thread Measurements

- Take the reading of the cross micrometer; let it be

R2.

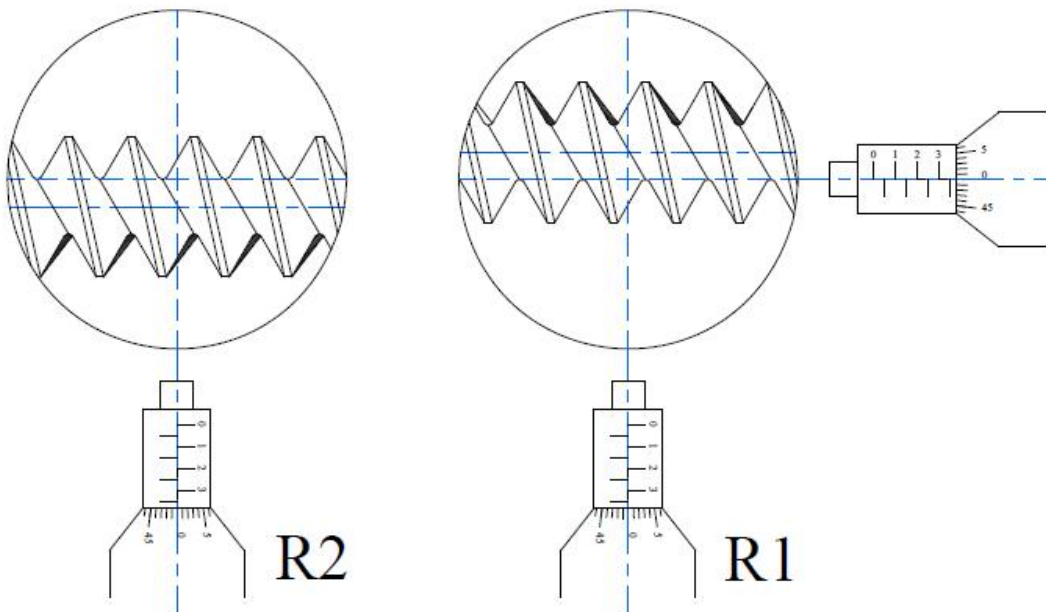
R2=



- Calculate the minor diameter =  $R2 - R1$

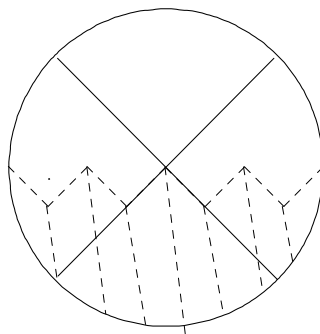
$R2 - R1 =$

- Repeat this reading at least five times and determine the average value and its limits.



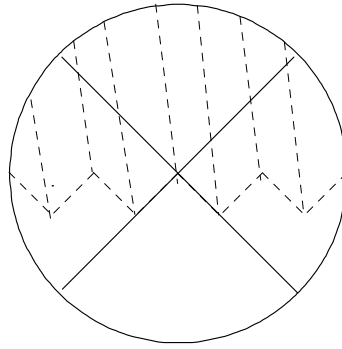
### 3. Measurement of the simple effective Diameter

- Mount the two centers brackets on the table of the tool room and place the screw between the two centers.
- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Tilt the column of the tool room by the helix angle.
- Move the micrometers until the longitudinal line touches the crests of the screw and the two V lines touches the two flanks of the first tooth.



- Take the reading of the cross micrometer; let it be R1
- R2=
- Move the cross micrometer then the longitudinal micrometer until the V lines touches coincide with the tooth on the opposite side.





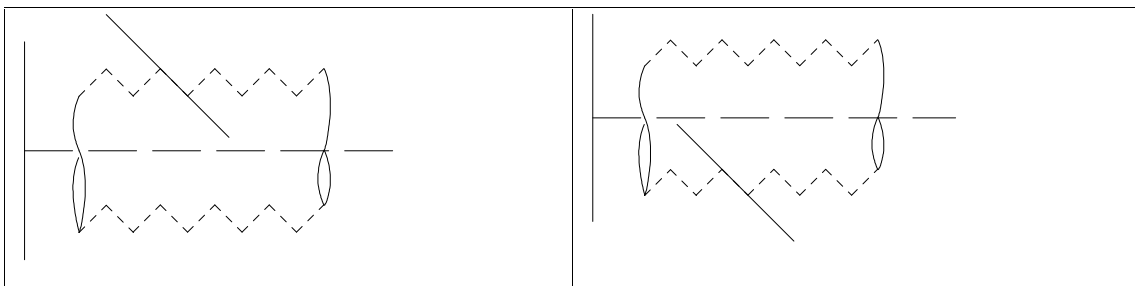
- Take the reading of the cross micrometer; let it be R2.

R2 =

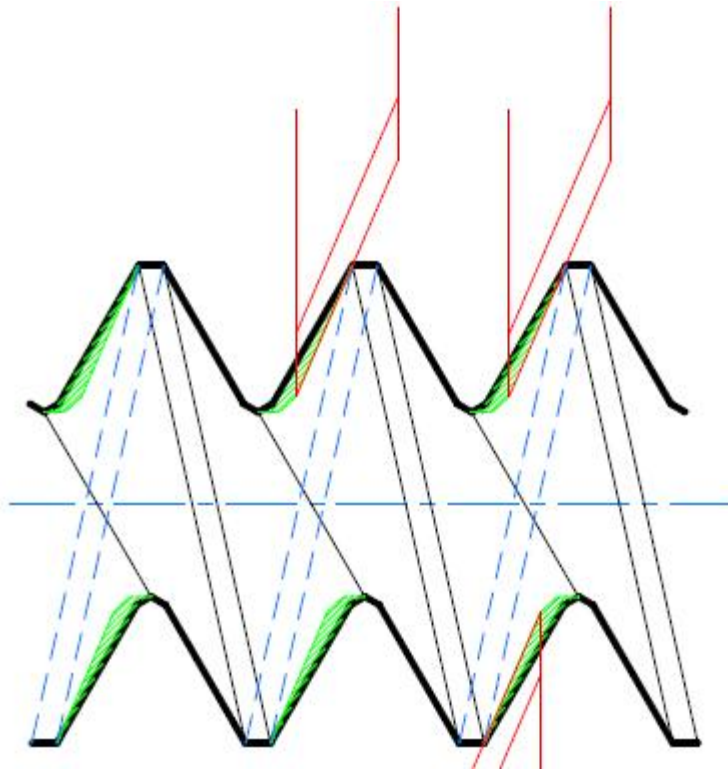
- Calculate the simple effective diameter =  $R2 - R1$

R2 - R1 =

- Repeat this reading at least five times and determine the average value and its limits.



Effective diameter using knife edge



#### 4. Measurement of the helix angle

- Mount the two centers brackets on the table of the tool room and place the screw between the two centers.
- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Move the micrometers until the V lines coincide with the flanks of the first tooth on one side.
- Take the reading of both cross and longitudinal micrometers; let them be R1 and R2.

R1 =

R2 =

- Move the longitudinal micrometer until the two V lines coincide with the following flanks on the second tooth.
- Take the reading of the cross micrometer; let it be R3.
- Calculate the pitch  $P1 = R3 - R1$

R3 =

P1 =

- Move the cross and longitudinal micrometers until the V lines touches coincide with the opposite flanks on the opposite r side.

- Take the reading of the cross micrometer; let it be R4.

R4 =

- Calculate the simple effective diameter = R4 – R2

Diameter =

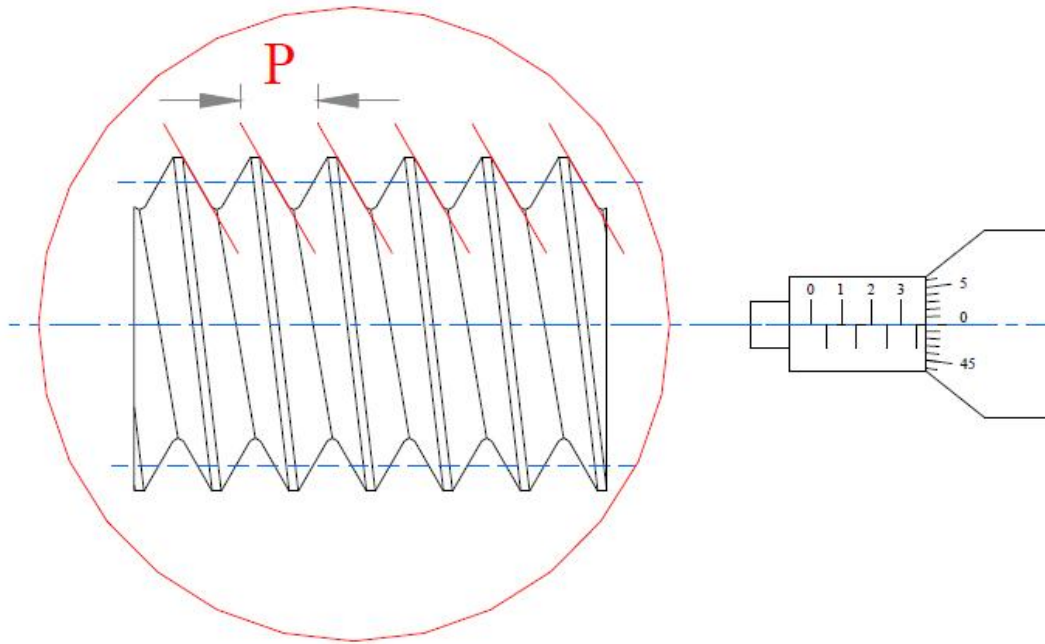
- Calculate the helix angle (  $\alpha$  ) from the following relation:

- $\tan \alpha = P1 / ( \pi * D_{e1} )$

$\alpha =$

- This value is not the exact helix angle since both P1 and  $D_{e1}$  has errors due to the shadow effect. For this reason the column of the Tool room will be tilted by an angle  $\alpha$  1. Repeat for measuring P2 and  $D_{e2}$  and calculate  $\alpha$  2.
- Re tilt the column by  $\alpha$  2 and repeat until no change are noticed in the measurement of the pitch and the effective diameter.
- The final  $\alpha$  n is the correct helix angle.

$\alpha$  n =



B) Readings:-

5. Measurement of the included angle

Mount the two centers brackets on the table of the tool room and place the screw between the two centers.

- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Tilt the column of Tool room by the helix angle.
- Move the micrometers until the longitudinal line touches the crests of the screw and the two V lines touches the two flanks of the first tooth.
- Read the angle of the template; let it be  $\alpha_1$ .
- Rotate the template till one of the V lines replaces the second on the second flank.
- Read the angle on the template, let it be  $\alpha_2$ .
- Take the reading of the cross micrometer; let it be  $R_1$

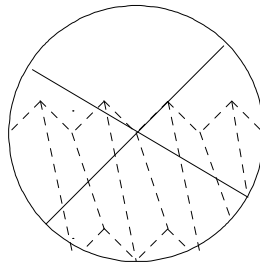
$$R_1 =$$

Calculate the included angle =  $\alpha_2 - \alpha_1$

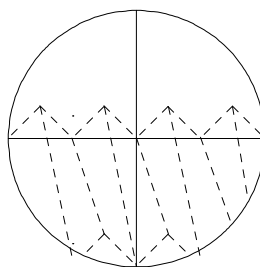
Repeat at least five times on different teeth.

## 6. Measurement of the flank angle

- Mount the two centers brackets on the table of the tool room and place the screw between the two centers.
- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Tilt the column of Tool room by the helix angle.
- Move the micrometers until the longitudinal line touches the crests of the screw and the two V lines touches the two flanks of the first tooth.

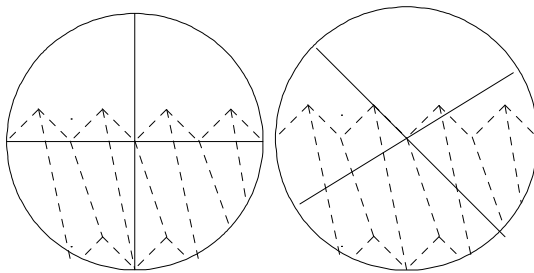


- Read the angle of the template; let it be  $\alpha$ .
- Rotate the template till one of the V lines became normal to the axis of the screw.





- Read the angle on the template, let it be  $\alpha$ .
- Calculate the right hand flank angle  $\phi = 90^\circ - \alpha$
- Repeat for the left hand flank and determine  $\phi_1, \phi_2$
- Calculate the left hand flank angle  $\phi = 90^\circ - \alpha$

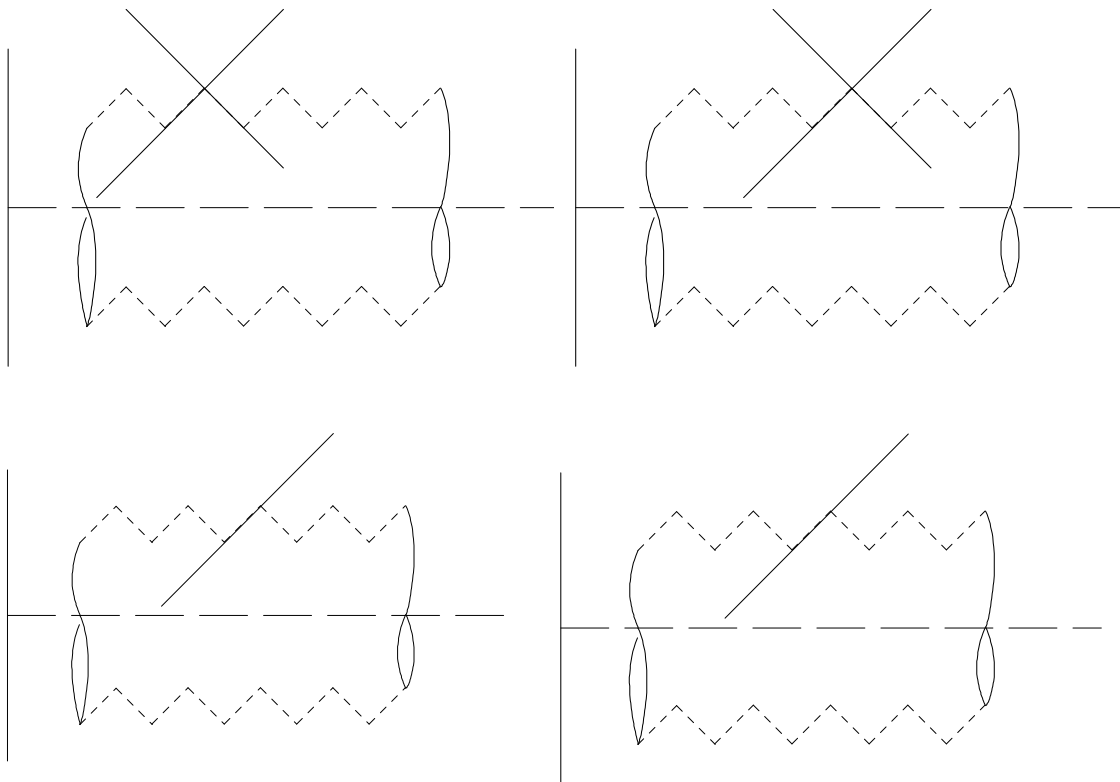


Repeat at least five times on different teeth.

## 7. Measurement of the Pitch

Mount the two centers brackets on the table of the tool room and place the screw between the two centers.

- Adjust the angles of the protractors on the table and in the graticula to Zero. This ensures that the two perpendicular wires seen in the eyepiece are parallel and perpendicular to the screw axis.
- Tilt the column of the tool room by the helix angle.
- Move the micrometers until the longitudinal line touches the crests of the screw and the two V lines touches the two flanks of the first tooth.
- Take the reading of the longitudinal micrometer; let it be P1
- Move the longitudinal micrometer until the V lines coincide with the corresponding flank on the second projected tooth.
- Take the reading of the micrometer; let it be P2.
- Repeat the last step several times until the last tooth. Let the readings be; P3, P4, P5 .....
- Repeat the same procedure on a flank on the opposite side of the screw; let the readings be; Q1, Q2, Q3, Q4 ....



C) Results:-

P1	P2	P3	P4	P5	P6	P7

The pitch error  $\delta P_i = P_i - P_s$

Where:-

$\delta P_i$  is the error at tooth No i.

$P_i$  is the measure pitch at tooth No i

$P_s$  is the standard pitch of the measured screw.

$\delta P_1$	$\delta P_2$	$\delta P_3$	$\delta P_4$	$\delta P_5$	$\delta P_6$	$\delta P_7$

The average pitch ( $P_{av}$ ) =

$R1 =$		mm
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