Root Crest

Expt 4 B

Group S3C.

190100110	Shiven Amol Barbare	19D100009	Lagwankar Atharva Nilesh
190100088	Parag Bajaj	[redacted]	
190100105	Satdhruti Paul	190010068	Tejas Vibhakar Shinde.

ME392 Expt 4B.

Aim :- To inspect spur gears for their parameters specified.

Theory :-

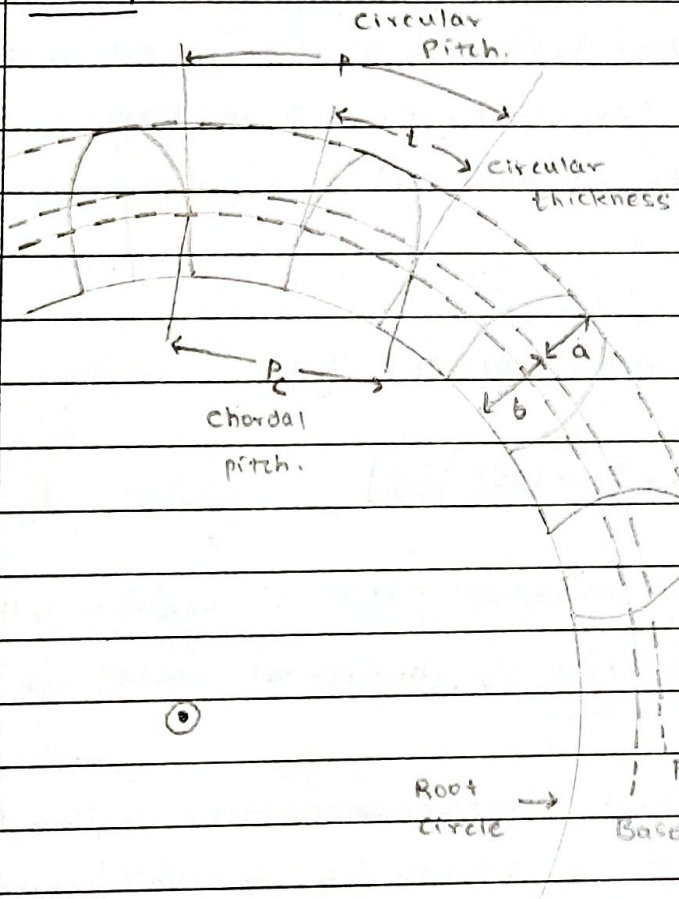

Fig 1

a :- Addendum

b : Dedendum.

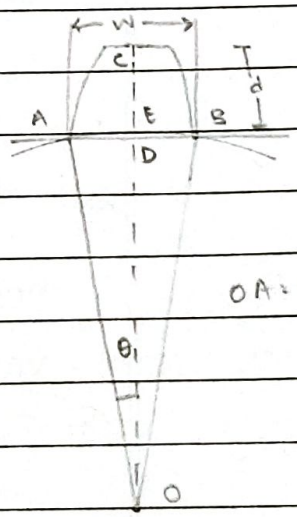

Fig 2

Diametral pitch $= \frac{N}{D}$ module, $m = \frac{D}{N}$

circular pitch, $P_c = \frac{\pi D}{N}$; Addendum $= m$.

Derivation

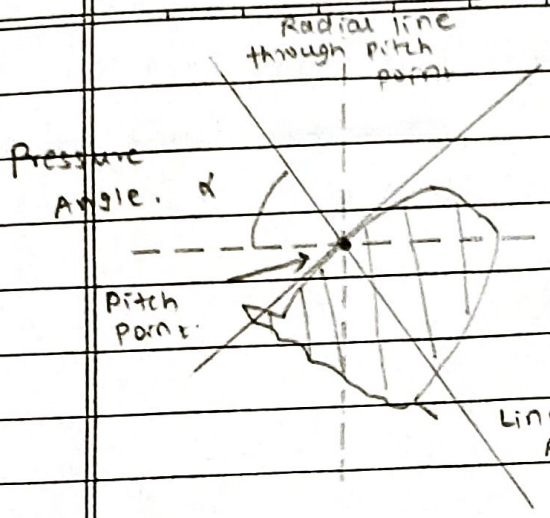

Fig 3

From Fig 2.

$$W = 2\,\frac{Nm}{2}\sin\left(\frac{360}{4N}\right)$$

$$W = Nm\sin\left(\frac{90}{N}\right).$$

$$OD = R\cos\theta = \frac{Nm}{2}\cos\left(\frac{90}{N}\right)$$

$$OC = OE + \text{addendum}$$
$$= R + m = Nm/2 + m.$$

$$OC - OD = d = \frac{Nm}{2} + m - \frac{Nm}{2}\cos\left(\frac{90}{N}\right).$$

Procedure

① First D_a (Addendum diameter) is calculated with vernier callipers (averaged over 3 readings)

② Following calculations are performed.

$$m = \frac{D_a}{2+N}.$$

W, Theoretical chordal width $= Nm\sin\left(\frac{90}{N}\right)$

$$d = \frac{Nm}{2}\left[1 + \frac{2}{N} - \cos\left(\frac{90}{N}\right)\right].$$

③ setting this depth on vertical scale of vernier callipers. measure tooth thickness by horizontal scale of vernier callipers.

④ Take readings over entire circumference so that chordal thickness error can be calculated.

Observations

SL NO.	MSR	VSR	D_a
1	112	17	112.034
2	112	6	112.012
3	112	17	112.034

$$\text{Least count} = \frac{1\,mm}{50} = 0.02\,mm$$

$$\therefore \text{Average } D_a = 112.2667\,mm$$

$$m = \frac{D_a}{2+N} = \frac{112.2667}{2+36} = 2.954\,mm$$

$$\text{Theoretical chordal width} = N m \sin\left(\frac{90}{N}\right)$$

$$= 36 \times 2.954 \times \sin\left(\frac{90}{36}\right)$$

$$= 4.64\,mm$$

$$d = \frac{Nm}{2}\left[1 + \frac{2}{N} - \cos\left(\frac{90}{N}\right)\right]$$

$$= \frac{36 \times 2.954}{2}\left[1 + \frac{2}{36} - \cos\left(\frac{90}{36}\right)\right]$$

$$= 3\,mm$$ which is used to set vertical scale of V.C.

$$AC = \frac{109.625 \times 210}{109.625 + 86.514} = 117.37$$

$$\alpha = \sin^{-1}\left(\frac{AB}{AC}\right) = 69.07^{\circ}$$

$$\phi = 90 - \alpha = 20.93^{\circ}$$

Actual pressure angle = 20.93°

Tooth Thickness (Chordal width W_{expt})

No.	W_{expt} (mm)	No.	W_{expt} (mm)
1	4.38	19	4.70
2	4.62	20	4.68
3	4.64	21	4.52
4	5.32	22	4.48
5	4.42	23	4.52
6	4.62	24	4.38
7	4.68	25	4.36
8	4.72	26	4.54
9	4.28	27	4.62
10	4.58	28	4.48
11	5.06	29	4.60
12	4.80	30	4.40
13	4.64	31	4.52
14	4.50	32	4.60
15	4.50	33	4.52
16	4.60	34	4.620
17	4.54	35	4.40
18	4.64	36	4.42

Average $W_{expt} = 4.57$ mm

$$\text{Error} = \frac{|4.64 - 4.57|}{4.64} \quad \left(\frac{|W_{expt} - W_{theo}|}{W_{theo}}\right)$$

$$= 1.5\%$$

Sources of error

i) Vernier calliper not kept tangential to addendum circle while measuring chordal width.

ii) Parallax error while reading verniers callipers.

Conclusions

i) We see that the error between measured chordal width and experimental is only 1.5% which is very small and can be attributed to the above causes.