



MENOUFIA UNIVERSITY  
Faculty of Engineering  
Shebin El-Kom  
Final Examination  
Academic Year : 2019 -2020  
Date : 16 / 8 / 2020



Dept.: Production Eng. & Mech. Design  
Year : Level 500  
Subject : M/c Tool Design  
Code : PRE 516  
Time Allowed : 3 Hours  
Total Marks : 100

Tables & Charts are allowed.

Question No. 1 ( 40 Marks )

Design a 2-stage , 6- speeds gearbox for a center lathe to be used for roughing & finishing turning of Mild – Steel work-piece , speed ranging from 122 to 434 R.P.M. Use standard speeds and standard step ratio for medium duty . The inlet speed of the first shaft in gearbox is 300 R.P.M.

Question No. 2 ( 25 Marks )

- a - What are requirements to design of spindle unit .  
b - A spindle of a cylindrical grinding machine has the following data :  
 $C_F = 300 \text{ N}/\mu\text{m}$  ,  $C_r = 100 \text{ N}/\mu\text{m}$  ,  $a = 51 \text{ mm}$  . &  $d_m = 90 \text{ mm}$  .  
Evaluate  $L_{opt}$  &  $C_n$  .

Note : Solve Question 3 or Question 4 only .

Question No: 3 ( 35 Marks )

Design an antifriction roller guide-way , with 4 faces , if the total load on the guide-way is 520 Kg . Hardened long roller guide-way of ground steel (  $b/d = 2$  ) are to be used. Saddle length is 300 mm. Permissible pressure on guide-way is  $0.08 \text{ Kg} / \text{mm}^2$  .The Min. acceptable stiffness is  $220 \text{ Kg} / \text{micron}$  .

Table 1 Standard Spindle Speeds for Various  $\phi$  Values?

$\phi = 1.12$	$\phi = 1.26$	$\phi = 1.41$	$\phi = 1.58$	$\phi = 1.78$	$\phi = 2$
10	10		10	10	
11.2		11.2			
12.5	12.5				
14					
16	16	16	16		16
18				18	
20	20				
22.4		22.4			
25	25		25		
28					
31.5	31.5	31.5		31.5	31.5
35.5					
40	40		40		
45		45			
50	50				
56				56	
63	63	63	63		63
71					
80	80				
90		90			
100	100		100	100	
112					
125	125	125			125
140					
160	160		160		
180		180		180	
200	200				
224					
250	250	250	250		250
280					
315	315			315	
355		355			
400	400		400		
450					
500	500	500			500
560				560	
630	630		630		
710		710			
800	800				
900					
1000	1000	1000	1000	1000	1000

$\phi = 1.414$  used to Medium duty working.



**Question No. 4 ( 35 Marks )**

A Lathe has Flat- Vee cast – iron slide ways of equal width ( Min. 30 mm. ). While turning a 50 mm. diameter work-piece , the tangential, radial & axial component of the cutting forces were found to be 300 , 130 & 120 Kg respectively. The lathe carriage weighs 50 Kg and is 300 mm. long .

Design the slide ways considering the following parameters :

$h = 150 \text{ mm.}$   $b = 525 \text{ mm.}$  &  $\lambda = 45 \text{ degrees .}$

Cast iron slide ways can withstand a Max. pressure of  $25 \text{ Kg / cm}^2$ . &  $[ K_s ] = 200 \text{ Kg / } \mu\text{m.}$

**Helpful Equation:**

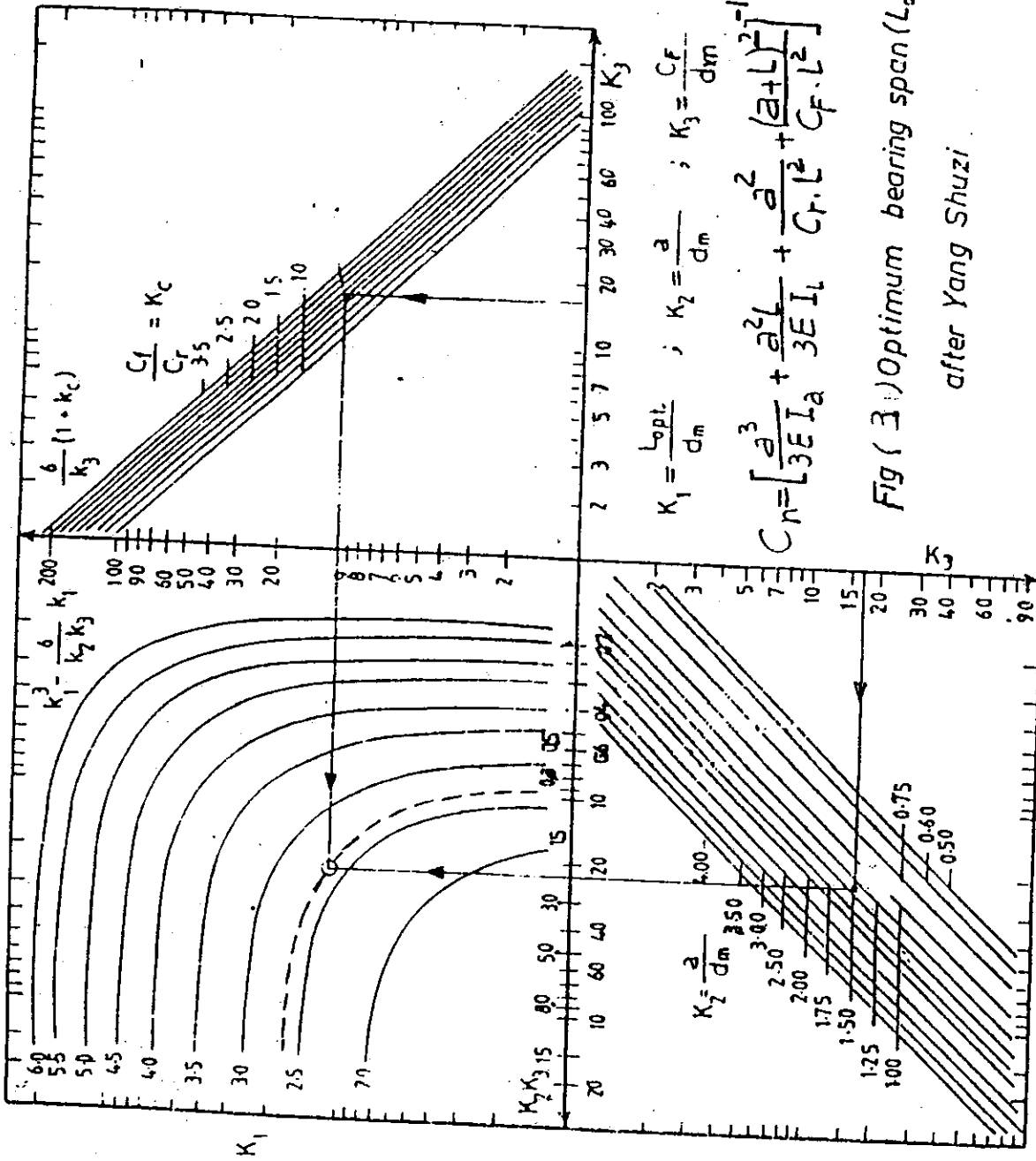
$$F_1 = [F_z(d+b).\cos\lambda]/2b + [F_y.h.\cos\lambda]/b - F_y.\sin\lambda + (W.\cos\lambda)/2$$

$$F_2 = [F_z(d+b).\sin\lambda]/2b + [F_y.h.\sin\lambda]/b + F_y.\cos\lambda + W.\sin\lambda/2$$

$$F_3 = [F_z(d-b)]/2b - [F_y.h]/b + W/2$$

*With our best wishes ...*

This exam contributes "by measuring" in achieving Programme Academic Standards according to NARS														
Question Number	Q1	Q2-a	Q3	Q4		Q1	Q2	Q3	Q4		Q1	Q2-b	Q3	Q4
Skills		a1-1				b2-1						C2-1	C1-1	C1-1
	Knowledge&Understanding Skills					Intellectual Skills					Professional Skills			



$$K_1 = \frac{l_{opt}}{d_m} ; K_2 = \frac{a}{d_m} ; K_3 = \frac{C_r}{d_m}$$

$$C_n = \left[ \frac{a^3}{3EI_a} + \frac{a^2 L}{3EI_L} + \frac{a^2}{C_r L^2} + \frac{(a+L)^2}{C_r L^2} \right]^{-1}$$

Fig (3) Optimum bearing span ( $L_{opt}$ )  
after Yang Shuzi