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Major: .....

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Prince of Songkla University

Faculty of Engineering

Final Examination Semester 2

Academic Year : 2005

Date : 28 February 2006

Time : 13:30-16:30

Subject : 226-305 Machine Design I

Room : R200

ทูลจรดในการสอบ โทษจันด้าปรบดทในรายวชานัน และพัทการเรยน 1 ภาคการศีกษา

**Instruction**

1. There are 4 questions , 120 points.
2. Attempt to do all questions in test paper. If it isn't enough, you can use other blank pages.
3. Books, sheets of paper note ,a dictionary and a calculator are allowed.
4. Don't write with red pen.

No.	Full Score	Score
1	50	
2	15	
3	25	
4	30	
<b>Total</b>	<b>120</b>	

Asst. Prof. Pichet Trakarnchaisiri



1. In figure 1, a 20 X 50 mm bar is welded to a 100 mm diameter cylinder beam and next to a 200 mm diameter cylinder crank respectively. Define E16012 welding rods, allowable shear stress of 94 MPa and ultimate stress of 160 MPa, are used to join all parts together. Assume the size of each 45° fillet is welded of both weld lines and transverse shear is uniformly distributed in the welds. (50 points)

- 1.1 From weld symbol A, draw and determine the centroid position ( $G_1 (\bar{x}_1, \bar{y}_1)$ ), weld pattern area ( $A_1$ ) and unit moment of inertia ( $I_u$ ) of weld pattern A. (10 points)
- 1.2 Show the process to determine the effective stresses and the required weld leg size,  $h_1$ , based on safety factor of 5.5 at critical point of weld pattern A. (15 points)
- 1.3 From weld symbol B, draw and determine the centroid position ( $G_2 (\bar{x}_2, \bar{y}_2)$ ), weld pattern area ( $A_2$ ) and unit polar of area ( $J_u$ ) of weld pattern B. (10 points)
- 1.4 Show the process to determine the resultant shear stresses and factor of safety at position P on weld pattern B (15 points)

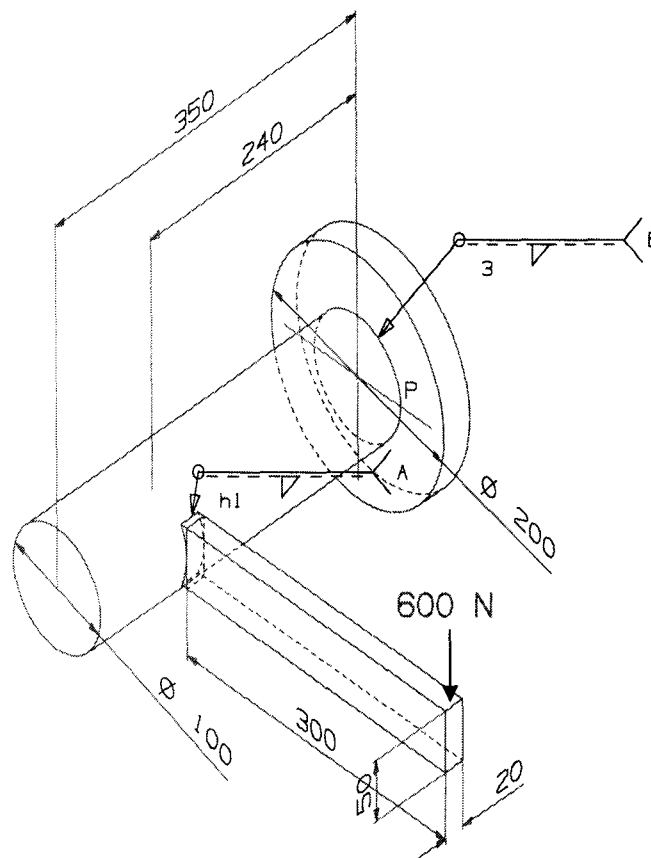


Figure 1 (Dimension unit : mm.)

Figure 2 for question 2-4 , shows the idea of machine design project in order to compress para-rubber block to be a standard size of 20 X 20 X 20 in<sup>3</sup>. In the compressing process, a 1- hp motor rotates a driving spur gear (pinion) at 100 rpm and transfer forces to a couple of driven spur gears. While both driven gears are run, forces flow from the moving press head thorough the screws frame to the ball thrust bearings, and then through the bottom of the frame to the material being compressed.

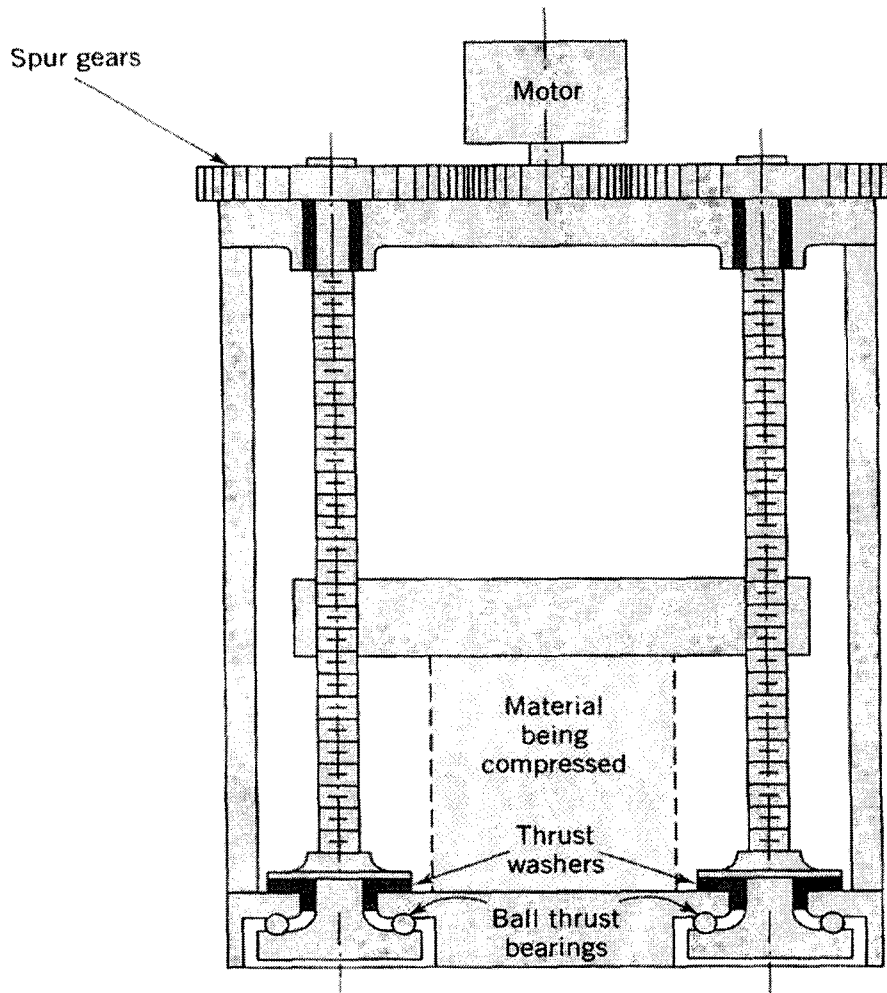


Figure 2

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2. If a spur gear with 10 of diametral pitch, 20 teeth and  $20^\circ$  pressure angle is used to be pinion, please show the steps to select the pitch diameter, the number of teeth and driven torque of each driven spur gear in order to control the steady speed of each screw power at 25 rpm for compressing para-rubber block. (15 points)



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3. Two 1-5 ACME single thread mild steel are chosen to be power screws in order to drive cast iron moving press and screw frame ( $\varnothing$  2 inch collar) for compressing para-rubber block. (25 points)

3.1 Calculate the maximum pressing force from both power screws if moving press and screw frame are same material and are lubricated with machinery oil. (20 points)

3.2 According to rubber mechanical property, rubber plates can compress to be block shape at the least uniform force 100 lb/in. Please compare the compressing force and reaction force in this case and explain that these rubber material can be compressed to be a block by designed machine or not. (5 points)

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4. Please show the methods to determine the most suitable code number of  $L_{10}$  thrust ball bearing (KOYO bearing flat seal type) for supporting each power screw while a rubber block is pressed at maximum load with light impact ( $K_a = 1.3$ ). In condition, the bearing life is 50,000 hr. and the supporting surface diameter of bearing must always be larger than collar diameter. (30 points)

