Menoufia University
Faculty of Engineering,
Dept: Prod. Eng. & Mech. Design
Year: 4th Production
Academic Year 2014/2015

Subject: Machine Tool Design
Time Allowed: 4 hours
Final Exam
Date: 12/01/2015
Total Marks = 140

Answer all the following questions *Assume any missed data*

Q1: 70 Marks

A gearbox has a structural formula (flow chart formula) in the form: 3(1) * 2(3), and driven by a double speed electric motor 1500/750 rpm. The gearbox delivers speeds in a geometrical series with a ratio (f= 1.26). For this system Draw:

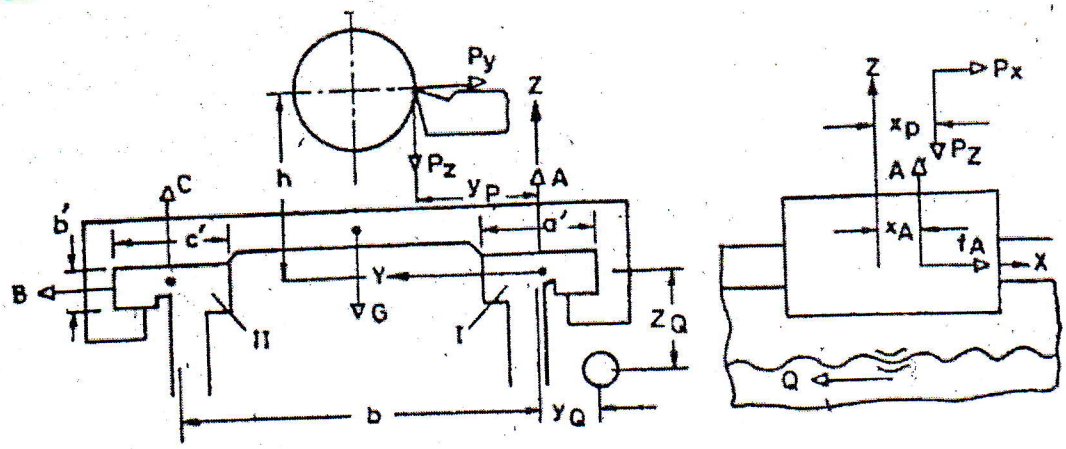
- The best structural diagram (flow chart),
- Kinematic diagram,
- The best speed chart.

Also, calculate:

- No. of teeth for all gears,
- The actual speeds,
- Gears dimensions,
- Design the first shaft, considering a suitable transmission ratio for the pulleys.

Q 2: 25 Marks

Design an anti-friction roller guide way, with 4 faces, if the load on the guide way (Fy) = 400 kgf, weight of saddle and work (W) =80 kgf, and feed force (Fx) = 40 kgf. Hardened and ground guide ways are to be used. Saddle length =350 mm. The saddle operates at a cutting speed of 20 m/min. Find the frictional force for (a) open, (b) closed guide ways. Permissible pressure [p] = 0.08 kgf/mm^2.



Q3: 25 marks

A double start acme thread sliding friction power screw has the following dimensions:

Outer diameter = 80 mm , pitch = 12 mm, effective diameter = 72 mm and length of nut = 120 mm, and subjected to the following forces:
P_z = 180 kg_f , P_y = 60 kg_f, and P_x = 50 kg_f ,
The weight of the carriage = 60 kg_f , and Coefficient of sliding friction between the carriage and guide ways = 0.2
Calculate the average pressure, maximum shearing stress and pitch error in the power screw.

Q4: 20 Marks

With the aide of net sketches discuss the following:

a) Open and closed guide ways in case of sliding and anti-friction types,
b) The type of sideways suitable for:
   * Orthogonal cutting, and * Oblique cutting.
c) Stick- slip phenomena and how to eliminate it.
d) Anti-friction guide ways; shape, advantages, and disadvantages.

Best Wishes