Kafrelsheikh University
Faculty of Engineering
Department of Mechanical Engineering
4th year of Mechanical Production
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Date: 10 / 1 / 2019
Time allowed: 3 Hours
Full mark: 90 Marks
Final year exam, 1 Pages
Course code: MDP4129

Machines Tool Design

Question 1 **(15 Marks)**

a. Explain the following terms with reference to machine tool gear box.
   i) Range ratio ii) Number of transmission stages iii) Transmission range

b. Draw the structure and gear box diagrams for the following equations of 12 speed gear box and determine the maximum transmission range for each equation;
   i) Z=2(6) 2(1) 3(2) ii) Z=2(3) 2(6) 3(1) iii) Z = 2(6) 2(3) 3(1)

Question 2 **(15 Marks)**

Find the speed steps arranged in geometric progressions and draw the Saw-tooth diagram for the following conditions; V_{min} = 30 m/min, V_{max} = 120 m/min, d_{min} = 10 mm, d_{max} = 80 mm, and Z = 6. Consider that, the economical cutting speed is 60 m/min.

Question 3 **(30 Marks)**

A Three-stages,18 step, speed box with n_{min} = 16 rpm and φ = 1.26 is powered by an ac motor running at 1440 rpm.

a. Write all possible structure equations
b. Draw the optimum structure diagram and speed chart of the speed box.
c. Determine the number of teeth of the gears assuming N_{min} = 22 teeth.

Question 4 **(15 Marks)**

a. What is the concept of strength and stiffness in machine spindles?
b. What is the classification of machine tool guide ways?
c. What is the main function of guide ways and the requirements?
d. Show how wear is compensated for in machine tool guide ways?

Question 5 **(15 Marks)**

a. What are functions and requirements of machine tool structure?
b. Derive an expression for the optimum ratio (L/h) of the simply supported beam, machine tool structure shown in the figure. The structure is loaded under bending due to force F as shown.