Thapar Institute of Engineering and Technology, Patiala

Semester Final Examination

CD-013, Machine Tool Design

ME CAD/CAM and Robotics (Final year)   Instructor: Gaurav Bartarya
Time: 3 hrs.   M.Marks:45
Attempt all questions. Assume the relevant data, if missing.

Q. 1
(a)   Write about mechanical stepless speed regulators in machine tools   3
(b)   Describe Meander mechanism used in feed box with neat sketch.   3
(c)   Discuss about shapes and profiles of the guideways and their features.   3

Q. 2   Draw the speed chart for the optimality for the speed box if the number   9
of steps are 18, N_{max}=1000, N_{min}= 20, no. of stages = 3. Motor rpm is
1440. Elaborate each of your decision taken while designing.

Q. 3
(a)   Discuss about combination guideways in details with types and sketches.   3

(b)   While turning a 750mm long workpiece of 100 mm diameter between   6
centres, cutting force was found to be 150 kgf when the tool was 200 mm
from tail stock. Calculate the machine tool system compliance if the
stiffness of the saddle head stock and tail stock are 3000, 4000 and 2500
kgf/mm respectively. Also find deflection of workpiece at this point of
contact. Also find minimum deflection and its distance from head stock.

Q. 4
(a)   Describe about anti friction guidways. What are the types of antifriction   4.5
slide ways? Described with neat sketches. Also describe about protecting
devices used in slideways.

(b)   Calculate the deflection of the spindle nose due to compliance of spindle   4.5
if it is running under the conditions as given in the figure below. P_1 = 400
N, P_2 = 300 N , M_r = 150Nm, lengths shown in figure 1 are in mm,
stiffness at points A and B are K_A = 2.0 x 10^4 N/mm , K_B = 3.5 x 10^4
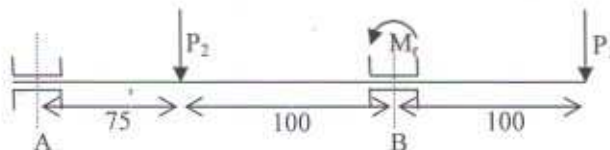N/mm.

Figure:1

Q. 5

(a)   Discuss about sources of vibrations in machine tools in details   4.5

(b)   If the tool life equation is $TV^{4.54} = 60 \times 10^7$ where T is in min. and V is in   4.5
        m/min. If at the cutting velocity of 30 m/min the vibration amplitude
        measured is 0.2 mm having a frequency of vibration of 200hz, find out
        the effect (in percentage) on tool life due to this vibration.

Copies of final exam may be seen on 11/12/06 at 11.00 AM
-en the office of undersigned