



ANSWER ALL THE FOLLOWING QUESTIONS:

Question (1)

Explain :

(25marks)

"Design of machine tool structure based on analytical technique."

- a-What is the main source of inaccuracies of this method.
- b-Damping properties which is unknown in design stage, how can be solved by experimental test of machine tool.
- c-How can you modify the frame of machine tool structure
- d- Effect of tool holder elasticity on the accuracy of cutting process.

Question(2)

(25marks)

a- Chatter is undesirable phenomena in machine tool during operation, it affect work surface finish, machining accuracy and tool life.

1 -What are factors affecting chatter?

2 -How can the designer of machine tool reduce chatter in design stage?

b-Give short account to explain the relation between structure of machine tool and cutting process using example, chart, equations.

c- What is the task of performing the frequency analysis for a machine tool during operation (operation modal analysis (OMA)).

d- Define: coefficient of merit(C.O.M)- Active magnetic bearing and its usefulness in design of machine tool

Q3 (30 Marks):

A gear box [3*3] driven by a double speed electric motor through a pulley belt drive with the following specifications:

$N_m = 5 \text{ kW}$, $n_m = 1440/720 \text{ rpm}$, $n_{1(\max)} = 1000 \text{ rpm}$, and

$n_{18(\min)} = 31.5 \text{ rpm}$.

Draw:

- Kinematic diagram for the given system.
- Speed charts for two options.

Determine:

- Number of teeth for all gears .
- Actual speeds
- Design the second shaft

Q4 (20 marks):

In a turning operation, the force components at the cutting point of a work piece has 120 mm diameter was 120 kg_f ; vertical force (P_z) and 40 kg_f ; horizontal force (P_y) . The lathe has the following specifications:

The saddle length (L) = 150 mm.

Height of the spindle center above the flat guide way = 180 mm, saddle wt. = 45 kg_f .

Design a V and Flat combination guide way assuming:

$\alpha = 60^\circ$, $\beta = 30^\circ$ and $b = 3.5 h$.

(For a cast iron to cast iron slide way, the recommended pressure

[P] =

0.125 kg/mm^2 .