Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B. TECH (MECHANICAL / I.P. ENGG.) END SEMESTER EXAMINATIONS, APRIL 2019

SUBJECT: MACHINE TOOL TECHNOLOGY [MME 4008]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Define working motions. With neat sketches, comment on the working motions in a (i) Lathe machine, (ii) Shaping machine. **4**

1B. A 95 mm diameter, 250 mm long steel rod is being turned down on a lathe machine with a depth of cut of 2 mm The spindle rotates at 450 rev/min and the feed is 0.55 mm/rev. Calculate, (i) Cutting time, (ii) Material removal rate. **3**

1C. Prove that range ratio (R_N) is given as a product of velocity ratio (R_V) and diameter ratio (R_D). **3**

2A. A machine spindle is to operate on ferrous metals at 30 m/min and is required to have four speeds. The spindle can accommodate H.S.S. cutters ranging from 10 mm to 30 mm. Determine the spindle speeds and tool diameters. Plot the speed diagram using D-lines. **3**

2B. Head stock gear box of a turret lathe provides nine spindle speeds of 80, 100, 125, 160, 200, 250, 315, 400, 500 rev/min respectively. The drive to the input shaft is from a 1 kW motor running at 500 rev/min. (i) Plot the speed chart. (ii) Find the number of teeth on each gear and (iii) Draw the gearing diagram. **4**

2C. With a neat sketch explain the working of a step cone pulley with back gear arrangement. **3**

3A. Illustrate the working of a feed box provided with Norton's gear. State its advantages and limitations. **3**

3B. It is required to cut a screw thread of pitch 1.5 mm on a lathe with lead screw having BSW thread of 2 TPI. Determine the change gear ratio and the required change gears. **3**

3C. Define static stiffness. Show that minimum volume of material (V_σ) needed to ensure sufficient strength of the beam is directly proportional to L^2/D of a beam for a given load P and allowable stress σ_{per}. (L = length and D = depth of structure) **4**

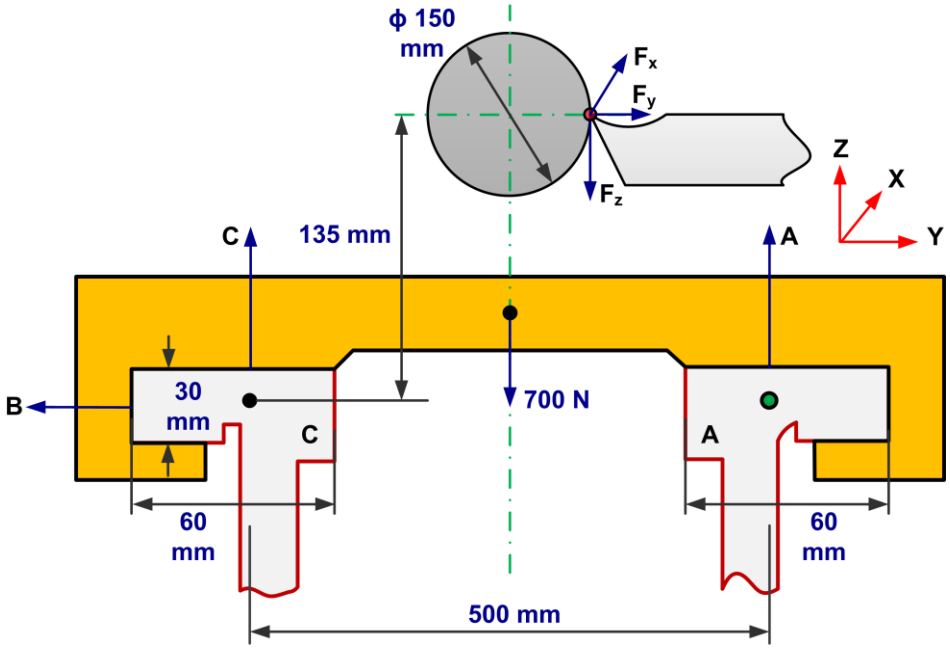
4A. Sketch the profiles of four types of guideways. Comment on the usage of taper gibs in flat and dovetail guideways? **3**

4B. As a machine tool manufacturer, you are tasked with the design of a guideway. You are provided with a choice of using the materials listed in the Table. Which material will you choose? Justify your selection.

Material	E (x10^3 N/mm^2)	γ (x10^{-6} N/mm^3)	E/γ (x10^9 mm)
Low carbon steel	200	78	2.56
Duraluminum	75	28	2.68
Alloyed steel	210	78	2.69

E = Modulus of elasticity
γ = Specific weight **3**

4C. A cold-worked tool steel is turned using an insert tool. The machining was carried out with a depth of cut of 1.5 mm, cutting velocity of 230 m/min and a feed of 0.4 mm. The three force components, i.e., cutting, feed and thrust forces are 2600 N, 1500 N and 850 N respectively. The length of the carriage is 800 mm. Determine the normal forces acting on the mating surfaces, pulling force and the average pressure values for the combination flat guideway shown in the Figure assuming a friction coefficient of 0.2.



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5A. Sketch the spindle ends used in milling machine and drilling machine. Comment on why the milling machine spindle end is provided with a steep taper whereas the drilling machine ones has a Morse taper? **3**

5B. When are sliding bearings preferred over anti-friction bearings? Also, with sketches elaborate on the differences between hydrostatic and hydrodynamic lubrication bearing. **4**

5C. How does in-homogeneities in the workpiece and intermittent cutting influence the vibration in machine tools? **3**