Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE/JULY 2016

SUBJECT: MACHINE TOOL TECHNOLOGY [MME 308]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitably assumed.

1A. A 200 mm long job is to be machined by a plain milling cutter of diameter 40 mm and 10 teeth. If the cutting speed is 30m/min and the feed is 0.08mm/tooth, calculate the feed per minute of the milling cutter. Explain with neat sketch the working motions & parameters defining working motions involved in the above operation. **03**

1B. A gear box with three stage (2x2x3) is to be designed for a drilling machine which is used for drilling the holes in the manufacture of certain bushes. The diameter of the holes varies from minimum diameter of 5 mm to a maximum diameter of 20 mm. The optimum cutting speed to be selected for this drilling operation is 30m/min. Given N_{motor} = 1800rpm with 3 HP motor and the speed variation on the output shaft of gear box is according to G.P. Draw the optimum structural diagram and speed chart. **04**

1C. Explain the working of Faceplate variator with two friction discs used in machine tools with neat sketches. **03**

2A. In a lathe a transmission reduction of 1/8 is provided before entering the feed rod from the spindle. After the feed rod the transmission reduction takes through apron mechanism (apron constant of 50) and rack pinion drive (rack pinion has 18 teeth and module 4mm). Find the carriage feed if the spindle rotates with 250 rpm. Show with a neat sketch feed layout and the mounting of lathe spindle on proper bearings with spindle end. **04**

2B. What kind of disturbances from the drive can cause vibration? Explain. **02**

2C. What is the importance of guide ways in machine tool design? With a neat sketch show the main types of slide ways used in machine tools. **04**

3A. Determine the reaction forces developed in the combination of two flat slide-ways for the case of oblique cutting. **04**

3B. What are the essential requirements for proper functioning of a gear transmission with sliding clusters speed box? **03**

3C. Prove that Range ratio (R_N), is given by the product of Velocity range (R_V) & Diameter range (R_D). Derive the relationship between step ratio, the number of steps & speed range ratio. **03**

4A. Draw the structural diagrams for different structural formulae for the speed step combination of 2 x 2 x 3. **03**

4B. Define "dynamic stiffness" and "amplification factor". How the dynamic stiffness is related to natural frequency of the element of machine tool structure? Explain with an example. **04**

4C. Derive and compare the weights of two cylindrical bars of same length subjected bending and hence define unit strength under bending. **03**

5A. Why a box section is considered to be best for beds and columns of machine tool? However openings and apertures have to be provided in box for housing bearings, chip flow etc. and these have adverse effect. Show schematically how then adverse effect with apertures can be modified? **03**

5B. Explain the methods of controlling vibration in machine tool structures. **04**

5C. What are the important design requirements to machine tool spindle unit? Explain. **03**

6A. The speed chart of a 12 speed gear box is given below (Fig. Q 6A).
(i) Write the structural formula and draw the structural diagram of the gear box, if the gear box is powered by a 16 HP motor running at 1410 rpm.
(ii) Determine the number of teeth on the gears in the gear box,
(iii) Determine the module of the gears in the gear box,
(iv) Determine the diameter of the output shaft,
Assume C-40 steel with design stress = 100 N/mm^2 as shaft material and C-60 steel with material constant = 40 N/mm^2 as gear material. **05**

6B. What is the advantage of taper roller bearings over ball bearings? Sketch a ball bearing arrangement of a machine tool spindle for combined radial and axial load. **02**

6C. Prove that the diameter step ratio of the stepped cone pulleys will be equal to the square root of the GP ratio of the speeds available with stepped cone pulley drive. **03**

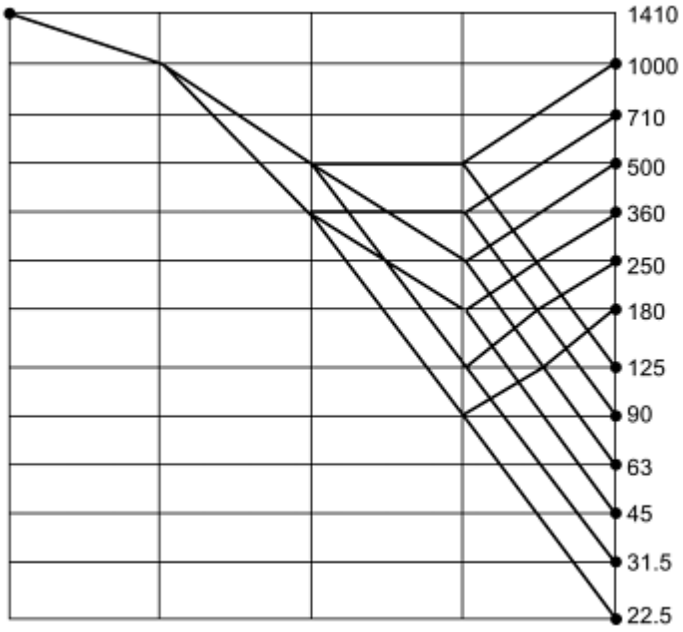

Fig. Q 6A