



Manipal Institute of Technology, Manipal



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V SEMESTER B.TECH (INDUSTRIAL PRODUCTION) END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: MACHINE TOOL TECHNOLOGY [MME 319]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ANY FIVE FULL the questions.
- ✤ Missing data may be suitable assumed.
- 1A. Define working motions in machine tools. A 100 mm wide and 200 mm long surface is to be machined on a shaper, using feed per stroke of 0.3 mm. If the cutting speed is 200m/min and the ratio of return time to cutting time is 1: 1.25, calculate the feed per minute of the shaper. Explain with neat sketch the working motions involved during the above operation.
- **1B.** Explain the shaft size minimization criterion in the decision making for the **03** best structural diagram of a gear box
- 1C. The speed chart of a 12 speed gear box is given below (Fig Q1C). (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/mm² as shaft material and C-60 steel with material constant = 40 N/mm² as gear material.
- 2A. What is productivity loss in stepped drive system? Explain the speed loss analysis and find out the desirable conditions for designing the ratio of two neighboring rpm steps in a speed spectrum.
- 2B. A stepped cone pulley with back gearing arrangement is used to obtain the eight spindle speeds are in GP. The diameters of the steps of the stepped cone pulley are in the ratio of 1.12. (i) Draw the layout of the stepped cone pulley with back gearing arrangement. (ii) Draw the speed diagram & calculate the speeds of the spindle with a maximum speed of 200 rpm.
- **2C.** With a neat sketch show how the longitudinal feed of carriage in a lathe is **03** obtain by apron mechanism.

- 3A. Show the arrangement of feed box with Meander's mechanism to obtain six feeds and show that feed rates obtained at the feed rod form a geometric progression
- 3B. Explain With the help of a neat sketch thread cutting on lathe by employing 03 change gears. How to cut metric thread of 1.5 mm pitch with a whit worth lead screw of 2 TPI by employing change gears.
- 3C. Derive the relationship between step ratio, the number of steps & speed range ratio. (ii) Prove that Range ratio (RN), is given by the product of Velocity range (RV) & Diameter range (RD). How does the range ratio change for special purpose & general purpose machine tool?
- **4A.** Briefly explain the design procedure of machine tool spindle and represent **04** schematic, design and deflected axis diagram of spindle axis due to bending.
- 4B. In the design of machine tool structure, "The larger the unit stiffness 03 of material, smaller is weight of the structure to withstand deflection". Justify
- **4C.** Explain briefly the important geometrical tests carried out on spindle of a **03** lathe during the acceptance test.
- 5A. Briefly explain with example control system with simple centralized control. 04
- **5B.** Outline the design considerations of Toggle Switch and Push Button used **04** in control system of machine tool.
- **5C.** List any four major requirements of Guide ways. **02**
- 6A. Explain with neat sketch how to determine the forces acting on the mating surfaces in a combination of V and Flat slide-ways under orthogonal cutting conditions
- **6B.** Briefly explain Stick Slip phenomena. What are the factors influencing **02** the occurrence of Stick Slip.
- 6C. Calculate the diameter of the spindle shown in FIG Q6 C if the horizontal force 250 kgf and a vertical force of 90 kgf are acting on the spindle nose. The peripheral force is 210 kgf and radial force is 88 kgf. The various forces acting on the spindle are as shown in figure. Outer to inner diameter ratio is 1.5, power on the spindle is 5.5 kw rotating at 900 rpm. Assume maximum allowable stress of steel spindle to be 120N/mm².







FIG Q6 C