Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – I • EXAMINATION – WINTER 2012**

**Subject code: 712805N** **Date: 12-01-2013**

**Subject Name: Design of Machine Tools**

**Time: 02.30 pm – 05.00 pm** **Total Marks: 70**

## Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

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|---|---|---|---|
| **Q.1** | **(a)** | List and explain the basic requirements of machine tool design. | **07** |
| | **(b)** | Write short note on: Hydraulic transmission and its elements. | **07** |
| **Q.2** | **(a)** | State the main requirements of machine tool structures. Explain the strength and stiffness as design criteria related to machine tool structures. | **07** |
| | **(b)** | Explain the design criteria to be considered for machine bed design. | **07** |
| | | **OR** | |
| | **(b)** | Explain the model techniques in design of machine tool structures. | **07** |
| **Q.3** | **(a)** | Explain the different protecting devices used for guideways / slideways in detail with neat sketches. | **07** |
| | **(b)** | Explain the design considerations to be considered while designing sliding friction power screws. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Explain the strength and stiffness based design of slideways. | **07** |
| | **(b)** | Explain the recirculating ball type lead screw with neat sketches. | **07** |
| **Q.4** | **(a)** | The following data refers to a radial drilling machine gearbox:<br>Electric motor – 10 kW, 1440 r.p.m.<br>Minimum speed -70 r.p.m. Maximum speed – 1800 r.p.m.<br>No. of speed steps – 8<br>Speed reduction from motor shaft to input gearbox shaft = 1.6 : 1<br>Draw the structural diagram, speed chart and layout diagram of gearbox. Find number of teeth also. | **09** |
| | **(b)** | Write short note on: Spindle materials and its selection. | **05** |
| | | **OR** | |
| **Q.4** | **(a)** | Fig 1 shows a schematic diagram of a lathe spindle and the other data are as under:<br>Power – 4.5 kW Speed -700 r.p.m.<br>Ratio of outer to inner diameter (hollow spindle) = 2<br>Peripheral and radial forces acting on spindle: $P_2$ = 215 kgf and $T_2$ = 78 kgf<br>Horizontal and vertical forces acting on spindle nose: $P_1$ = 210 kgf and $T_1$ = 60 kgf<br>Compliance =0.52 Micron/kgf<br>Maximum permissible deflection = 0.017 mm<br>Calculate the main dimensions of lathe spindle. | **09** |

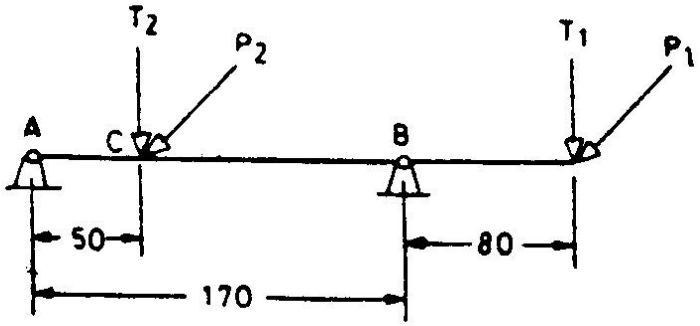


Fig 1 Diagram of lathe spindle All dimensions are in mm

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|---|---|---|---|
| | **(b)** | Explain the structural diagram and their analysis to select the best possible version of gearbox. | **05** |
| **Q.5** | **(a)** | Compare the flat-flat and v-flat type slideways with neat sketch. | **07** |
| | **(b)** | Explain the general procedure for accessing dynamic stability of EES. | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Explain the different methods used to improve the rigidity of machine tool columns with neat sketches. | **07** |
| | **(b)** | Write short note on: Machine tool testing (acceptance tests) – needs, standards and procedure of testing. | **07** |

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