

GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – VIII • EXAMINATION – SUMMER 2016

Subject Code: 182503**Date: 07/05/2016****Subject Name: Design of Product and Machine Tools****Time: 10:30 AM to 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of PSG Design Data book is permitted.

- Q.1** Design a gear box to give 18 speeds for a spindle of a milling machine. The drive is from an electric motor of 3.75 KW at 1440 rpm. Maximum and minimum speeds of the spindle are to be 650 & 35 rpm respectively. **14**
1. Draw structural & Speed diagram
 2. Sketch the kinematic arrangement of the gear box.
- Q.2 (a)** If the bed of machine tool with two side wall having length l and height h is loaded with a point load p acting at the center of a bed having permissible value of deflection is $[\delta]$, permissible value of normal stress is $[\sigma]$ and material having modulus of elasticity E , then prove that optimum design criterion for machine tool structure is, $(l^2/h)_{\text{opt}} = 6E[\delta]/[\sigma]$ **07**
- (b)** Explain working of following variators with neat sketch: **07**
1. Face plate variator
 2. Cone variator with swiveling friction discs
- OR**
- (b)** Discuss general requirements of machine tool design. **07**
- Q.3 (a)** Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for rating life of 5 years at 10 hrs/day. Assume uniform and steady load. **10**
- (b)** Explain various types of radial ball bearing used in industry. **04**
- OR**
- Q.3 (a)** Give functions of machine tool beds. Discuss various shapes of machine tool beds with application using neat sketch. **07**
- (b)** Give requirements of protecting devices for slide ways and explain various types of protecting devices with neat sketch. **07**
- Q.4 (a)** Design a journal bearing for a centrifugal pump from the following data. **10**
- Load on journal = 20000 N
 - Speed of journal = 900 rpm
 - Types of oil = SAE 10
 - Absolute viscosity of oil at 55°C = 0.017 kg/m-s
 - Ambient temperature = 15.5°C
 - Maximum bearing pressure for pump = 1.5 N/mm^2
- Calculate also mass of lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C . Heat dissipation coefficient is $1232 \text{ W/m}^2/^\circ\text{C}$.
- (b)** Explain properties of sliding contact bearing materials. **04**
- OR**
- Q.4 (a)** Discuss various criteria to be considered for selection of bearings. **07**
- (b)** Explain static and dynamic stiffness in reference to machine tool structure. **07**
- Q.5 (a)** Give classification of steel wire ropes. How numbers of band are determined for **07**

steel wire ropes while designing material handling systems?

- (b) Enlist and explain any seven factors to be considered for preparing product design specification for Fully Automatic Washing Machine. **07**

OR

- Q.5** (a) Design crane hook for lifting capacity of 12 tonnes, having triangular section. Take permissible tensile stress as 130 N/mm^2 for forged steel. **07**
- (b) Discuss various methods for reducing vibrations in machine tools. **07**
