GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER–II(New course) EXAMINATION(Remedial) –WINTER 2015

Subject Code: 2720903   **Date:10/12/2015**
Subject Name: Machine Tool Design
Time:2:30 Pm to 5:00 Pm   **Total Marks: 70**
Instructions:
   1. **Attempt all questions.**
   2. **Make suitable assumptions wherever necessary.**
   3. **Figures to the right indicate full marks.**

Q.1	(a)	Explain design procedure of speed gear box.	07
	(b)	A Ø40 and 210 mm long step is to be machined on a cylindrical grinding machine. Grinding wheel diameter is 600 mm and its width 63 mm. Allowance is 0.2 mm and radial feed 0.005 mm per stroke. Transverse feed (mm per revolution of work) s_1= kB, where k = 0.3. If peripheral speed of the grinding wheel and work piece is 30 m/s and 35 m/min, respectively, determine the machining time.	07
Q.2	(a)	Explain AIM of Speed and Feed Rate of Regulation.	07
	(b)	Explain Design for Strength.	07
		OR	
	(b)	Explain Design for Stiffness.	07
Q.3	(a)	State and explain the functions and requirements of spindle units and justify the same.	07
	(b)	Derive the equation for total deflection of spindle axis due to compliance of spindle supports.	07
		OR	
Q.3	(a)	State the function of pressure valve and throttle valve in the hydraulic system and compare the ball type and spool type pressure valve.	07
	(b)	State the different shapes of slide-ways used in machine tools and discuss the application of each of them with due justification.	07
Q.4	(a)	Explain functions and types of Guideways.	07
	(b)	Find out the specific pressure on a lead screw assuming a M. S. material being cut by H.S.S. tool on a lathe machine using a depth of cut equal to 0.2 cm. and feed 0.02 cm/rev. Permissible intensity of pressure on the lead screw is 30 kg/cm². Weight of the carriage is 50 Kg. and the coefficient of friction between carriage and the guide is 0.20. Find out, further , the errors in pitch of the lead screw arising out of the loading condition, if the thread profile is of trapezoidal type. Also determine the efficiency under (a) no lubrication and (b) lubrication having coefficient of kinetic viscosity= 0.0067 Kg.sec/M² at a speed of 300 R.P.M. The screw dimensions are : Outside diameter = 70 mm. $D_{average}$ = 65 mm: pitch p=10; depth of thread t_2= 5 mm. Δ = average gap (average clearance) between the non working surfaces of the thread profile of the screw and the nut = 0.182 mm. $P_x : P_y : P_z :: 0.25 : 0.40 : 1$, Length of cut = 1.5 D_{av} = 97.5 mm	07

OR

Q.4 (a) Explain Effect of Machine tool compliance on Machining accuracy. **07**

(b) A part diameter 200 mm and length 1500 mm is supported between centres **07** with a tightening load of 5000 N and machined on a lathe. The cutting force components were recorded with a dynamometer as $P_x = 2500$ N, $P_y = 5000$ N and $P_z = 10000$ N. The lathe bed is a composite section comprising of two I-sections connected with cross beams. The dimensions of the bed section are as follows: $b_1 = 110$ mm, $b_2 = 20$ mm, $b_3 = 115$ mm, $d_1 = 30$ mm, $d_2 = 315$ mm, $d_3 = 25$ mm, $A = 365$ mm, $B = 145$ mm, $C = 275$ mm , $D = 235$ mm, $E = 370$ mm, $F = 140$ mm. The data related to the machine tool is as follows: Height of centres $h = 300$ mm, distance of the feed pinion from the bed surface $h_{fp} = 50$ mm. Ignoring the weight of the workpiece, check the strength of the bed if the allowable stress of the bed material is 12 N/mm^2.

Q.5 (a) Explain the ergonomic considerations used in machine tool design in detail. **07**

(b) Explain the recent developments in machine tool elements design. **07**

OR

Q.5 (a) What do you mean by pre-selective control system? Explain pre-selective **07** control system with a typical example.

(b) Show that $\sigma_b^{2/3}/\gamma$ is an index of the ability of a material to resist bending. **07**