Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3161921 Date:13-12-2023

Subject Name: Machine Tool Design

Time:02:30 PM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	State the general requirements of machine tool design.	**03**
	(b)	Explain the procedure for selection of electrical motor in machine tool that works under variable loading condition.	**04**
	(c)	Design a 9-speed gear box to give a minimum speed of 100 rpm and maximum speed of 630 rpm. The power is supplied by an electric motor of 10 kW capacity, running at 1000 rpm, and driving the input shaft through a V-belt drive, having a speed reduction of 2:1. Draw the speed chart and calculate number of teeth on each gear.	**07**
Q.2	**(a)**	Justify the statement: The difference between number teeth of successive gears in change of gearbox must be greater than 4.	**03**
	(b)	Explain its significance "The geometric progression ratio in a multispeed gearbox is selected in a range of 1 and 2."	**04**
	(c)	Describe step by step procedure for the design of 8 speed gearbox for a lathe, giving governing design equations.	**07**
		OR	
	(c)	Explain following speed gear boxes with respect to method of changing speed. 1) Speed boxes with change gears 2) Speed boxes with friction clutches.	**07**
Q.3	**(a)**	State the functions of the spindle unit with their application in machine tool.	**03**
	(b)	Explain combination guideways using anti-friction rolling members for vertical loading and compound loading with neat diagram.	**04**
	(c)	Derive the equation for total deflection of spindle axis due to compliance of spindle supports.	**07**
		OR	
Q.3	**(a)**	State the characteristics of anti-friction guideways.	**03**
	(b)	Justify the statement "The life and smooth working of slide-ways depends significantly upon the clearance between the sliding surfaces".	**04**
	(c)	Derive the equation for forces acting on the mating surfaces in a combination of V and Flat slideways under orthogonal cutting condition for lathe machine with schematic loading diagram.	**07**
Q.4	**(a)**	State the different applications of guideways in machine tool design.	**03**
	(b)	Explain the condition of design for buckling stability and for wear resistance w.r.t. sliding friction power screws.	**04**
	(c)	Describe the basic design procedure for machine tool structure with respect to the role of cutting force, friction force, forces of reactions, forces due to mass of structure and inertial forces due to vibration.	**07**

OR

Q.4	**(a)**	State the materials and its applications for machine tool structures.	**03**
	(b)	During the turning operation on a workpiece held between centres, the tangential cutting force component was 150 kgf and the radial cutting force component was 80 kgf. If the workpiece is 500 mm long and has diameter = 80 mm, determine the deflection when the tool is 200 mm from the headstock. The headstock and tailstock stiffness are 35,000 and 15,000 kgf/cm, respectively.	**04**
	(c)	Derive the equation of (l^2 /h) for simple machine tool bed with two side walls with considering as simply supported beam loaded by concentrated load (P) acting at centre.	**07**
Q.5	**(a)**	Enlist the hydraulic and mechanical transmission and its elements used in machine tools.	**03**
	(b)	Explain the significance of ergonomic considerations in design for following control members of machine tool. 1) Cranks 2) Levers	**04**
	(c)	Describe the general procedure for evaluating the dynamic stability of Equivalent Elastic System (EES)-cutting process closed loop system.	**07**

OR

Q.5	**(a)**	Enlist the different methods to reduce instability in machine tools. Explain its significance.	**03**
	(b)	Differentiate static and dynamic stiffness for the design of machine tools.	**04**
	(c)	Explain Adaptive Control Optimization (ACO) system with neat sketch.	**07**

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