Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code: 3161921 **Date: 30-05-2025**

Subject Name: Machine Tool Design

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. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	State the functions of the spindle unit with their application in machine tool	**03**
	(b)	Explain the basic types of machine tools and their constructional features.	**04**
	(c)	Prove that the loss of economic cutting speed is constant over the whole range of spindle speed in GP series	**07**
Q.2	**(a)**	What is the role of adaptive control systems in modern machine tools?	**03**
	(b)	Explain the step by step procedure for constructing structure diagram for speed box.	**04**
	(c)	Explain hydraulic step less regulation of speed and feed rates	**07**
		OR	
	(c)	What are the principles behind speed and feed regulation in machine tools? How do these impact the overall performance of the machine?	**07**
Q.3	**(a)**	What is a Ray Diagram in gearbox design, and how is it used?	**03**
	(b)	Discuss various shapes of slide ways and justify their application for machine tools	**04**
	(c)	Explain the factors affecting stiffness of machine tool structure and methods of improving it	**07**
		OR	
Q.3	**(a)**	What is a speed gearbox, and why is it important in machine tools?	**03**
	(b)	Illustrate anti friction guideways	**04**
	(c)	Describe step by step procedure for the design of 8 speed gearbox for a lathe, giving governing design equations	**07**
Q.4	**(a)**	State the different applications of guideways in machine tool design	**03**
	(b)	State the functions and requirements of the spindle unit along with the materials.	**04**
	(c)	Explain the design of rolling friction power screws	**07**
		OR	
Q.4	**(a)**	What are the primary motions in machine tools?	**03**
	(b)	Explain the factors affecting on design of sliding-friction power screws	**04**
	(c)	Explain factors affecting stiffness of machine tool structure and methods to improve it	**07**
Q.5	**(a)**	Define the concept of feed rate in the context of machine tools.	**03**
	(b)	Draw general layout of knee type vertical milling machine with relative motion	**04**
	(c)	Write a note on machine tool chatter	**07**
		OR	
Q.5	**(a)**	How does spindle stiffness affect machining accuracy?	**03**
	(b)	Explain simple centralized control system for speed changing	**04**
	(c)	What are the methods to reduce instability in machine tools	**07**

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2024

Subject Code:3161921 Date:24-05-2024

Subject Name:Machine Tool Design

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. **Simple and non-programmable scientific calculators are allowed**.

			MARKS
Q.1	(a)	What are different progression ratios.	03
	(b)	Differentiate between rotary and translator hydraulic drive.	04
	(c)	Explain about the "working and auxiliary different motions" in machine tools.	07
Q.2	(a)	Explain Harmonic Progression?	03
	(b)	What are the information required to design a speed Box.	04
	(c)	Explain the following. (1) Gear Pump (2) constant delivery vane pump (3) Direction control valves.	07
		OR	
	(c)	A 2 x 2 drive is required to be designed for transmitting speeds starting from 400 rpm with a geometric progression of 1.4. Draw a suitable structure and speed diagram. Also draw the layout of the gearbox and determine the number of teeth on each gear.	07
Q.3	(a)	Enlist profiles of machine tool structures.	03
	(b)	Evaluate the applicability of cast Iron and Mild steed as a material of Machine tool.	04
	(c)	List types of feed boxes and explain any one with neat sketch.	07
		OR	
Q.3	(a)	Enlist commonly used column sections and its applications.	03
	(b)	Discuss various types of Bed structure.	04
	(c)	Draw the structure diagram for following formulae. (i) 3(2)2(1) (ii) 2(3)3(1)	07
Q.4	(a)	Explain Re-circulating ball screws.	03
	(b)	Suggest the material for rolling bearing with reasons.	04
	(c)	Factors Affecting Stiffness of Machine Tool Structure and methods of Improving it.	07
		OR	
Q.4	(a)	Enlist the various spindle ends with simple sketch.	03
	(b)	Explain Anti friction guideways and Aero static guideways.	04
	(c)	Explain the various forces to be considered for design of machine tool structure.	07
Q.5	(a)	Identify the machine tool components where ergonomic consideration can be applied ?	03
	(b)	Explain vibration absorbers.	04
	(c)	Classify control system of machine tool? Explain any one in detail.	07
		OR	
Q.5	(a)	Enlist different control system for speed changing.	03
	(b)	Identify the machine tool components where aesthetic consideration can be applied?	04

(c) Explain in brief 07

1. Machine tool chatter. 2. Adaptive Control

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3161921 Date:14-07-2023

Subject Name:Machine Tool Design

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. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	(a)	Explain hydraulic transmission system in brief.	**03**
	(b)	Give the drive and feed motions for the following machines (1) Lathe (2) Boring (3) Drilling (4) shaping	**04**
	(c)	Explain various laws of stepped regulation with its applications.	**07**
Q.2	(a)	Compare arithmetic and geometrical progression ratio for speed selection.	**03**
	(b)	What are structure diagrams? Which information can be obtained from structure diagrams?	**04**
	(c)	Explain the function of machine tool structures.	**07**
		OR	
	(c)	Draw the structure diagram and gear box arrangement for the following structural formulae. (i) 2(1) 3(2) (ii) 2(3) 3(1) (iii) 3(1) 2(3) (iv) 3(2)2(1)	**07**
Q.3	(a)	Explain the different design criteria for design of machine tool structure.	**03**
	(b)	On which basis you will select the Cast Iron and Steel as the material of machine tool structure.	**04**
	(c)	Explain the design procedure of machine tool structure on the basis of strength.	**07**
		OR	
Q.3	(a)	Enlist the major requirements that the guide ways must satisfy.	**03**
	(b)	Illustrate with sketch the symmetrical V, dovetail and cylindrical sideways.	**04**
	(c)	Explain methods of adjusting clearances in sideways.	**07**
Q.4	(a)	What are the design requirements of spindle units?	**03**
	(b)	Suggest the material for following spindles 1. Normal accuracy spindle 2. Precision machine tools 3. Heavy duty spindles.	**04**

	(c)	Explain the design procedure of power screws.	**07**

OR

Q.4	(a)	Write the general design procedure of column structure.	**03**
	(b)	What are the desirable properties for material of spindle and Bearing? Suggest material for spindle and bearing.	**04**
	(c)	Why preloading is carried in antifriction bearing? What are the methods of preloading of ball bearing?	**07**
Q.5	(a)	How will you use aesthetic considerations for effective design of Machine tools?	**03**
	(b)	Explain the importance of ergonomic consideration applied to the design of control members of machine tools.	**04**
	(c)	What are the effects of vibration on performance of design of machine tools and how these can be minimized?	**07**

OR

Q.5	(a)	What are the advantages of adaptive control system?	**03**
	(b)	What is anthropometric Data? How it is useful in design of machine tool.	**04**
	(c)	Explain selective control system for speed changing.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3161921 Date:10/06/2022

Subject Name:Machine Tool Design

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. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Differentiate between hydraulic transmission and mechanical transmission.	**03**
	(b)	List types of feed boxes and explain any one with neat sketch.	**04**
	(c)	Prove that the loss of economic cutting speed is constant over the whole range of spindle speed in GP series.	**07**
Q.2	**(a)**	Write advantages of geometrical progression.	**03**
	(b)	Explain hydraulic step less regulation of speed and feed rates.	**04**
	(c)	Explain the step by step procedure for constructing structure diagram for speed box.	**07**
		OR	
	(c)	Draw speed diagram and layout for a six speed gear box having the following structural formulae: (i) 2(3) 3(1) (ii) 2(1) 3(2) The output sppeds are 160 rpm minimum and 1000 rpm maximum. The motor shaft speed is 1440 rpm.	**07**
Q.3	**(a)**	Give functions of machine tool structures and their requirements.	**03**
	(b)	Explain the factors affecting stiffness of machine tool structure and methods of improving it.	**04**
	(c)	Explain in details static and dynamic stiffness for machine tool structures.	**07**
		OR	
Q.3	**(a)**	With suitable figure show various profiles of slide ways.	**03**
	(b)	Illustrate anti friction guideways.	**04**
	(c)	Give requirement of Protecting devices for slide ways and explain various types of protecting devices with neat sketch.	**07**
Q.4	**(a)**	What is spindle? Explain functions of spindle unit.	**03**
	(b)	Enlist the material for spindles.	**04**
	(c)	Explain the design of rolling friction power screws.	**07**
		OR	
Q.4	**(a)**	what are the commonly used bed sections and wall arrangements.Also state its applications.	**03**
	(b)	Explain the factors affecting on design of sliding-friction power screws.	**04**
	(c)	The rolling contact ball bearing are to be selected to support the overhung countershaft. The shaft speed is720 r.p.m. The bearings are to have 99% reliability corresponding to a life of 24 000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life	**07**

adjustment factors for operating condition and material as 0.9 and 0.85 respectively.
Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability.

Q.5	**(a)**	What are the aesthetics considerations applied to design of machine tools.	**03**
	(b)	Write a note on machine tool chatter.	**04**
	(c)	Explain the adaptive control system for machine tools.	**07**

OR

Q.5	**(a)**	Explain simple centralized control system for speed changing.	**03**
	(b)	What are the methods to reduce instability in machine tools.	**04**
	(c)	Explain the ergonomic consideration applied to the design of control members of machine tools.	**07**

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