

B.E. PRODUCTION ENGINEERING THIRD YEAR SECOND SEMESTER - 2025
SUBJECT – MACHINE TOOL SYSTEMS

Time: Three hours

Full Marks: 100

Use Separate Answer scripts for each PART

PART-I

Marks: 60

No of Questions		Marks
	Answer any three questions	
1.	(a) Differentiate between 'Machine' and 'Mechanism'. Explain the answer with the help of a simple example. (b) Describe various factors on which the form of surface produced in a particular machine tool depends. (c) Identify principal features of construction of machine tools and briefly explain those features with reference to the following machine tools: (i) Grinding machine, (ii) Milling machine, and (iii) Slotting machine.	4 4 3+9
2.	(a) Classify and explain surfaces produced by machine tools. (b) Identify types of machine tool's basic motions. (c) Explain following conversion mechanisms: (i) R-T-R (ii) R ² -R (iii) R-T and (iv) R ² -/-T. (d) How worm-worm wheel mechanism can be utilized in reversible operation?	6 4 8 2
3.	(a) Explain with neat sketch the kinematic structure of machine tool utilized for relieve grinding of taper taps. (b) Explain with neat sketch the kinematic structure, <i>k</i> -23 for double feed taper turning machine and also develop the formulation for setting angle. (c) What is differential mechanism in machine tools? Explain in brief the "Sun-planet Mechanism" utilized in machine tools for speed changing.	6 6 2+6
4.	(a) Explain basic scheme of kinematic structure of the gear shaping machine and also differentiate between radial feed and circumferential feed. (b) The kinematic structure of a hobbing machine is shown in Fig. 1. The machine is used for producing helical gears having 40 teeth, normal module 2 and lead of 1000mm. The hob is to be rotated at 100 rpm and is of single start. The desired finish allows the use of a maximum feed of 0.1 mm/revolution of the gear blank. Determine the following: (i) Speed change gears, (ii) Index change gears, (iii) Feed change gears, and (iv) Lead change gears. (Xerox copy of Fig.1 attached.)	12

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No of Questions		Marks
5.	For a particular centre lathe, it is desired to design a speed gear box with a back gear arrangement to provide for 12 speeds ranging between 10 and 450 rpm. The power requirement of the lathe is estimated as 10 HP. Determine the following: (i) Identify the best ray diagram, (ii) Calculate the number of teeth of all gears, (iii) Calculate the back gear ratio, (iv) Calculate the shaft diameters, and (v) Calculate the module and width of gears. Assume necessary data if required for the design calculations.	4+6+2+3+5

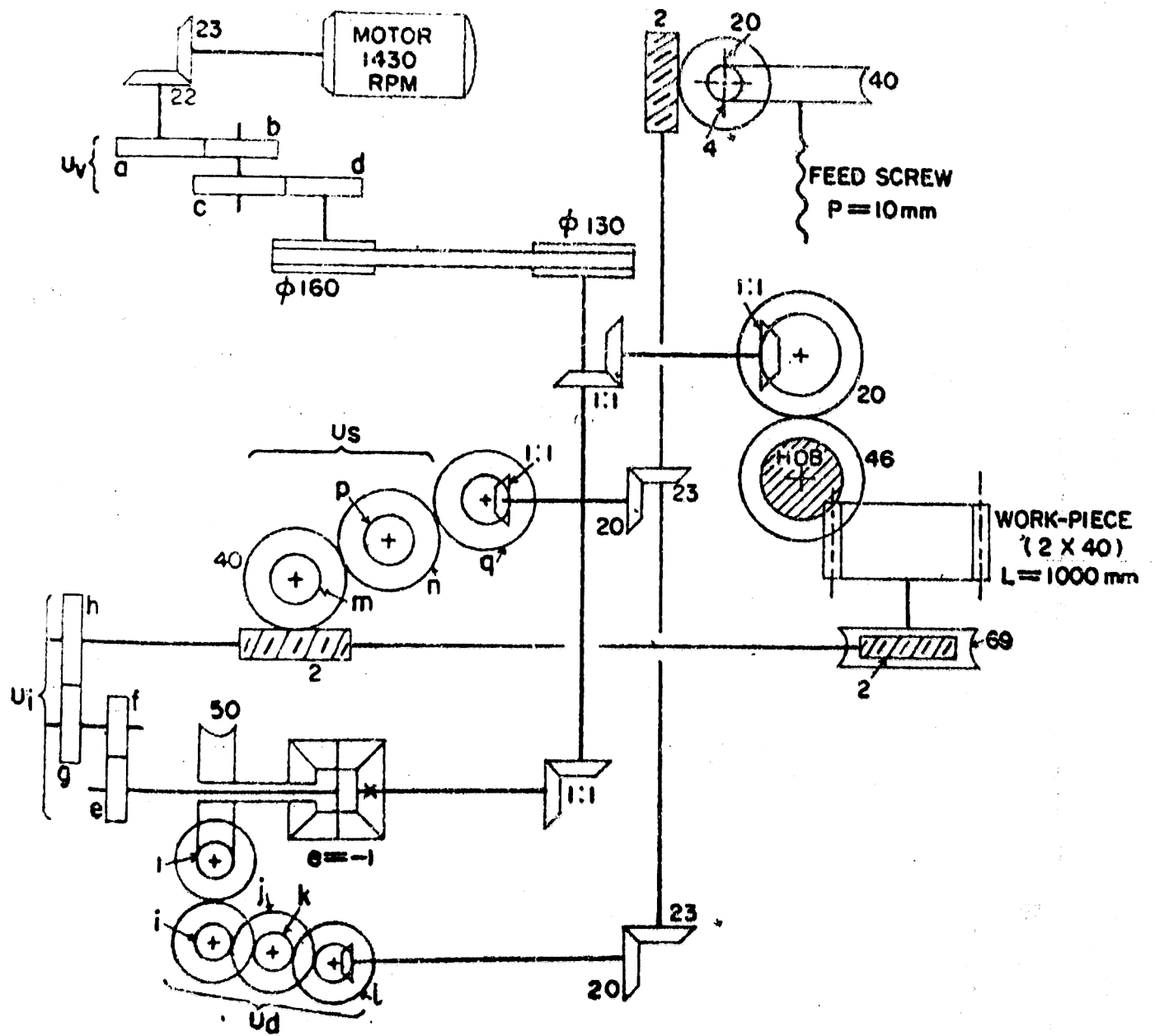


Fig. 1

Ref. No.: Ex/PROD/PC/B/T/325/2025

B.E. PRODUCTION ENGINEERING THIRD YEAR SECOND SEMESTER EXAM 2025

Subject: MACHINE TOOL SYSTEMS

Part: II

Time: 3 hours

(Marks : 40)

Fullmarks:100

(Use Separate Answer scripts for each Group)

Answers any two questions

1. (a) Briefly Explain the velocity profile of modified slider crank mechanism using suitable diagram when $L \gg R$.
 (b) Draw the velocity profile of slotted arm mechanism following the kinematic configuration of slotted arm and prove that $R_n = [R_V][R_S][f(R_S)]$
 (c) Calculate the angle traversed during cutting stroke for an oscillating lever mechanism while operating at the maximum stroke of 400 mm. Given, $Q_{max} = \frac{3}{2}$. **(5+10+5=20)**

2. (a) Draw the feed layout in a radial drilling machine and define the transmission ratio and standard common ratio.
 (b) While machining a cast iron block of 180 mm length with a goose-necked H.S.S. shaping tool, it is desirable to select a 200 mm stroke with a permissible cutting speed of 25 m/min. If the specification of the shaping machine (Oscillating lever type) provides for a Q_{max} of 3:2 at the design value of the stroke of 400 mm, calculate the required r.p.m. of the crank.
 (c) Explain the slotted liver quick return mechanism using suitable diagram. **(7+6+7=20)**

3. (a) What is the purpose of feed motion for gear drives?
 (b) Explain and draw the structural format for feed in case of turning where T is the translation and R is the rotation also write down the structural balance equation if the reduction of speed gear box considers in right side of the node.
 (c) Why 3 pulley drive is considering over 4 pulley drive for quick return effect draw and explain elaborately. **(4+8+8=20)**

4. (a) Draw the structural format for feed drives for a milling machine and write down the value of feed and structural balance equation.
 (b) Why back lash eliminator is used in down milling process? What is the effect of screw-nut back lash during down milling process?
 (c) If number of cutter teeth, $Z_c = 8$, Diameter of cutter, $D = 40$ mm and $S_o = 0.1$ mm/tooth, then find out the maximum feed rate (F_{max})? From the given problem justify that what type of cutter is suitable and what is the effect of diameter over feed? **(6+8+6=20)**