BACHELOR OF PRODUCTION ENGG. 3rd YEAR EXAMINATION, 2022
(2nd Semester)
SUBJECT – MACHINE TOOL SYSTEMS

Time: Three hours

Full Marks: 100

No of Questions		Marks
	Answer any *five* questions	
1.	(a) Define a "metal cutting machine tool".	4
	(b) Identify principal objectives of machine tool systems.	4
	(c) What are the different types of "machine tools"?	4
	(d) Prepare a table for representing different metal machining operations performed by machine tools.	8
2.	(a) With one example of each; describe the following: (i) Ruled surface, (ii) Non ruled surface, and (iii) Invertible ruled surface	6
	(b) Explain following mechanisms utilized in machine tools: (i) Rack and pinion.; (ii) Crank-Rocker mechanism;	6
	(c) Describe the condition of reversibility of the machine tool drives with an example. How worm-worm wheel mechanism can be utilized in reversible operation?	6+2
3.	(a) How Kinematic chains are classified?	6
	(b) Explain with neat sketch the kinematic stucture of machine tool utilized for relieve grinding of taper taps.	6
	(c) What is differential mechanism in machine tools? Explain in brief the "Sun-planet Mechanism" utilized in machine tools for speed changing.	2+6
4.	(a) Describe briefly the kinematic structure of "Hobbing Machine" to be utilized for generating helical gears.	8
	(b) The kinematic structure of Fellow's Gear Shapping is shown in Fig. 1. The gear to be cut has 2 module and 50 teeth. The pinion cutter has 25 teeth. The permissible cutting velocity is 80 stroke/minute while circumferential feed is 0.1 mm and radial in feed is 0.08 mm per stroke. Calculate the following: (i) Velocity change gears (U_v) (ii) Index change gears (U_i) (iii) Feed change gears (U_s) (iv) Radial in-feed gears (U_r). Xerox copy of Fig.1 attached.	12

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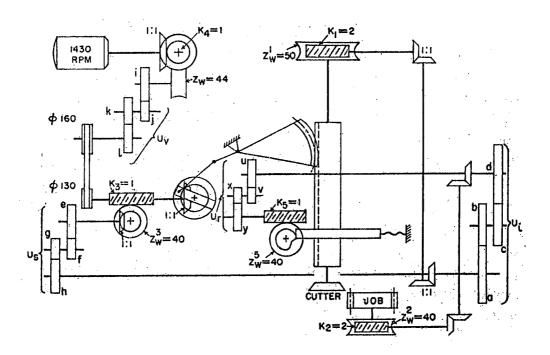| No of Questions		Marks
5.	(a) State reasons which necessitate the variation of spindle speed in machine tools.	4
	(b) Identify and describe the main constraints on which objectives of high Metal Removal Rate (MRR) in machine tools depends.	6
	(c) Fine out the speed range of a milling machine wherein the cutter size ranges from 25 mm to 250 mm in diameter while the range of application of cutting speed would vary between 10 m/min to 70 m/min.	4
	(d) What is productivity loss in stepped drive system? Explain the speed loss analysis and find out the desirable condition for designing the ratio of two neighboring RPM steps.	6
6.	For a particular centre lame it is desired to design a nine speed gear box for a speed range of 90 rpm to 1440 rpm. The power requirements of the machine is estimated as 8 HP. Determine the following: (i) Identify the best ray diagram, (ii) Calculate the number of teem of all gears, (iii) Calculate shaft diameters, (iv) Calculate module and width of gears. Assume necessary data if required for the design calculations.	4+8+4+4
7.	Write short notes on any two of the following: (a) Feed drive scheme in Drilling and Milling machine, (b) Apron Mechanism, (c) Basic rules for designing sliding cluster of gears, and (d) Clutch as speed reducer for backgear Drives.	2X10

Fig. 1