B.E. PRODUCTION ENGINEERING THIRD YEAR SECOND SEMESTER - 2024
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". Define "Machine Tool" with reference to metal cutting.	6
	(b) Describe principal objectives of metal cutting machine tools.	4
	(c) Define "Generatrix" and "Directrix". Describe "Turning" and "Shaping" operations with respect to generatrix and directrix.	6
	(d) Classify various factors on which the form of surface produced in machine tool depends.	4
2.	(a) With one example of each, describe the following: (i) Ruled Surface, (ii) Non-Ruled surface, and (iii) Surface of higher order.	6
	(b) Explain following mechanisms utilized in machine tools: (i) Crank-Rocker mechanism, (ii) Slider-Crank mechanism, (iii) Cam mechanism.	9
	(c) Describe the condition of reversibility of the machine tool drives.	5
3.	(a) Draw a kinematic structure of any standard machine tool having a K-25 type of structure.	6
	(b) Define "Differential Mechanism". Draw the scheme of any standard differential unit.	2+4
	(c) A thread having a pitch of 2.15 mm is to be cut with a single point cutting tool having a pitch error differential unit. The pitch of the lead screw is 6 mm. Calculate the inclination of the correction bar, considering the module and teeth number of the pinion utilized for the purpose are 2 and 18 respectively. Draw the sketch of the setup.	8
4.	(a) Explain briefly the kinematic structure of "Hobbing machine" to be utilized for generating helical gears. Answer should include basic scheme and a neat sketch.	8
	(b) Why general purpose machine tools are required to be provided with a large member of discrete cutting speeds whereas special purpose machine tools are required to be usually provided with two speeds.	4
	(c) What is test line in saw diagram? Describe in brief the significance of test lines in saw diagram analysis with AP and GP series.	8
5.	(a) Explain three constraints that influence the design process of the ray diagrams of gear box..	8
	(b) In a four speed gear box, it is possible to have either 2x2(0) or 2x2 (X) ray diagram. The drive is required to be designed from 200 rpm with common ratio as 2 and transmit 10 H.P. Consider the best ray diagram from two types each. Calculate all the design considerations. Select the best ray diagram considering various strategies utilized for the gear box design.	12

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Subject: MACHINE TOOL SYSTEMS

Part: II

Time: 3 hours   **Fullmarks: 100**

Answers any two questions

1. (a) Briefly Explain the velocity profile of modified slider crank mechanism using suitable diagram when L>>R.

(b) Draw the velocity diagram and velocity profile of Whitworth quick return mechanism and from the respective diagram prove that $R_n = [R_V][R_S]$.

(c) Calculate the angle traversed during cutting stroke for an oscillating lever mechanism while operating at the maximum stroke of 400 mm. Given, $Q_{max} = \frac{3}{2}$.   **(8+8+4=20)**

2. (a) Design an oscillating lever mechanism for a shaping machine for a design stroke of 600 mm and $Q_{max} = \frac{3}{2}$.

(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.

                                                 (5+5+10=20)

3. (a) Draw the schematic feed drives for a milling machine and explain how different clutch is used for feed.

(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?

                                                 (8+6+6=20)