

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BE
BRANCH: PRODUCTION**

**SEMESTER : VII
SESSION : MO/2023**

SUBJECT: PE311 MACHINE TOOL DESIGN

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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		CO	BL
Q.1(a)	What function does a machine tool's chain drive serve? Note down the benefits and drawbacks of it.	[5] 1	2
Q.1(b)	Under what circumstances are the following power sources used in machine tool drives? i. Line shaft group drive ii. Several motor drives	[5] 1	3
Q.2(a)	What qualities of geometric progression lead designers to choose it over other options when creating machine tools gear box?	[4] 2	4
Q.2(b)	It is possible to have a 2x3 (X) or 3x2 (X) ray diagram in a 6-speed gearbox. If $\phi=1.68$ which of the above two diagrams is suitable and why? Assume that gear box is designed to transmit 10 HP and the shafts are made of c-20 material and $\tau_s=120\text{kg/cm}^2$. For the optimal ray diagram, also calculate the gear size.	[6] 2	5
Q.3	On a lathe, a workpiece of diameter d and length L is being turned. The workpiece is kept in place with a force of k while being mounted between the two centers. Derive the equation for forces and torques.	3	4
(a)	Acting at the head stock,	[3] 3	4
(b)	Under the tail stock,	[4] 3	4
(c)	Under the saddle,	[3] 3	4
Q.4	A steel workpiece is cut at a speed of 24 m/min on a lathe machine. The tool thrust force accounts for 30% of the cutting force, whereas the tool axial force accounts for 50% of the cutting force. A 5.5 kW motor powers the machine tool. The center distance between the guideways is 400 mm. The height of the center over the bed is 110 mm. The saddle measures 250 mm in length and weighs 40 kg. Assume, $y_p = 90 \text{ mm}$; $\mu = 0.1$. Determine	4	5
(a)	Forces on the flat guideways if the guideways are 25 mm thick and 50 mm wide.	[5] 4	5
(b)	If the right-hand slideway is replaced by a Vee guideway, with angle $\alpha=60^\circ$, $\beta=30^\circ$, Determine the forces on the guideways.	[5] 4	5
Q.5(a)	What are the sources of vibration in a machine tool and how it can be reduced.	[5] 5	3
Q.5(b)	Make a brief note on the general rules and special rules for designing the control system in machine tools. Explain the conditions to use the lever control system in the machine tools.	[5] 5	3

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