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

CLASS: BE **SEMESTER : V**
BRANCH: PROD. **SESSION : MO/18**

SUBJECT: PE5003 MACHINE TOOL DESIGN

TIME: 3 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
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.

Q.1(a) How machining time for a blind hole drilling is estimated? [2]

Q.1(b) A 250 mm long job is to be machined by a plain milling cutter of diameter D = 60 mm and 15 teeth. If the cutting speed is 50 m/min and feed is 0.1 mm/tooth, calculate the machining time for a depth of cut of 5 mm. Assume 10 mm approach length and 10 mm over travel. [4]

Q.1(c) Explain the working principle of a Clutch? Differentiate in terms of construction and operations between positive-action clutch and friction clutch. [6]

Q.2(a) Why variation of spindle speed is a necessity? [2]

Q.2(b) Derive the expression for calculating maximum productivity loss in stepped speed regulations. [4]

Q.2(c) How Norton's gear mechanism is used for speed regulations in feed boxes? [6]

Q.3(a) Classify stepless drives. [2]

Q.3(b) Design a 2- stage, 9 speed gear box, for 30 to 500 rpm spindle speeds. Draw a ray diagram for a 1500 rpm input motor, and calculate the number of teeth for all gears, minimum no of teeth=20. Use belt transmission for reducing motor speed to a level, suitable for the gear box input shaft. [10]

i. Draw optimum structural and ray diagrams.
ii. Determine the number of teeth of different gears and shaft sizes.

Use standard value of φ

Q.4(a) What are the different types of forces generally act on a machine tool structure? [2]

Q.4(b) Prove that if the failure of the beam is determined by the normal stresses under tensile loading, the volume of the mild steel beam required to withstand the same load is 7 times less than that of cast iron beam. [10]

Mild steel – $E = 2.3 \times 10^4$ kg/mm^2, $\sigma = 8$ kg/mm^2, $\delta = 0.0025$ mm
Cast Iron – $E = 1.0 \times 10^4$ kg/mm^2, $\sigma = 2$ kg/mm^2, $\delta = 0.0025$ mm
E = Modulus of elasticity, σ = Allowable stress, δ = Allowable deflection.

Q.5(a) What do you mean by hydrostatic slideways? [2]

Q.5(b) Find out the forces acting on the mating surfaces in a combination of 'V' and 'Flat' slideways in a turning operation. [10]

Q.6(a) Define rigidity and stability. [2]

Q.6(b) What are the measures can be taken to reduce vibration in machine tools? [4]

Q.6(c) Explain the single degree of freedom chatter based on velocity principle. [6]

Q.7(a) Discuss the various ergonomic consideration applied to the design of push buttons. [2]

Q.7(b) What are the basic functions and requirements of control elements in machine tool? [4]

Q.7(c) What do you understand by individual control system and centralized control system? [6]

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