# BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: VIth Date: ……..……..

Subject with Code: PE311 MACHINE TOOL DESIGN

| Marks Obtained | Section A (30) | Section B (20) | Total Marks (50) |
|---|---|---|---|
| | | | |

**INSTRUCTION TO CANDIDATE**

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

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

**CLASS: B. TECH** **SEMESTER: VI**
**BRANCH: PRODUCTION** **SESSION: SP/2022**

**SUBJECT: PE 311 MACHINE TOOL DESIGN**

**TIME: 2 HOURS** **FULL MARKS: 50**

INSTRUCTIONS:
*Read the instructions carefully before you begin answering: -*
1. The question paper contains section A of 30 marks and section B of 20 marks and total 50 marks.
2. If there are ambiguities in the facts, make whatever assumptions are necessary to resolve an issue.
3. If additional facts are needed, state what these facts are and why they are needed.
4. Write legibly and be as concise as possible.

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**Section A**
Attempt all questions (30 x 1)

1. The gears used to connect non-parallel and non-intersecting shafts is
(a) bevel gears
(b) double helical gears
(c) worm gears
(d) spur gears

2. The compound kinematic structure is
(a) combination of elementary structures
(b) combination of elementary and complex structure
(c) combination of complex structures
(d) combination of compound structures

3. The number of primary motions required in a taper turning operation is
(a) Three
(b) Two
(c) Single
(d) Four

4. The design of a machine tool can be made simple by
(a) reducing the size of the machine tool
(b) reducing the degree of its universality
(c) reducing standard parts in a machine tool
(d) all of these

5. The selection of drives depends on
(a) Operational environment
(b) Extent of speed regulation available
(c) Maintenance and reliability
(d) All the above

6. The hydraulic circuit has a pressure valve to
(a) change the direction of the fluid flow
(b) regulate the oil flow
(c) to drain of excessive oil
(d) fulfil all these requirements

7. Find the value of N3 for speed steps arranged in Geometric for the following conditions: N1 = 30 rpm; Nz = 375 rpm and Z =12
(a) 37.5 rpm
(b) 47.5 rpm
(c) 57.5 rpm
(d) 67.5 rpm

8. In ISA designation of preferred numbers, the ‘R’ stands for
(a) Rynold
(b) Rapshon
(c) Renard
(d) Rational

9. The average speed loss in a gearbox designed by considering the preferred number R20 is
(a) 3%
(b) 10%
(c) 12%
(d) 5%

10. The structure diagram depicts
(a) the distributive connections patterns between input and outputs
(b) actual transformation ratios between input and outputs
(c) exact location of speeds and input and output points
(d) all of the above

11. The minimum number of teeth in a set of gear for the spindle drive should be greater than
(a) 17
(b) 20
(c) 27
(d) 37

12. Number of gears in 2x2 gear box transmitting 10 HP
(a) 4
(b) 12
(c) 10
(d) 8

(a)

13. For the same cross-sectional area, the structure with ..... section has the greater strength and stiffness under bending
(a) Box
(b) Circular
(c) Rectangular
(d) I-section

14. The adverse effect of apertures and openings in the structure upon its strength and stiffness can be compensated by
(a) the use of cover plates
(b) the arrangement of ribs
(c) proper arrangement of fastening bolts
(d) the use of stiffeners

15. Maximum normal (bending) stress occurs on structures at that point where
(a) the one of the two normal stresses is maximum
(b) the algebraic sum of the two normal stresses is maximum
(c) the mean of the two normal stresses is maximum
(d) any one of these situations

16. $I_t = \beta.(1/3)\, ab^3$ ; $\beta$ is a coefficient that depends upon
(a) ratio of the arms of the rectangle
(b) width of the section
(c) shape of the section
(d) all the above

17. The volume ratio for the optimum design condition for mild steel and cast iron is
(a) 7:1
(b) 1:7
(c) 7:23
(d) 23:7

18. This ratio (E/γ) is called ……. (E = modulus of elasticity, γ = specific weight of the material)
(b) unit strength
(c) unit compliance
(d) unit rigidity
(e) unit volume

19. The major problems associated with the application of antifriction guideways is
(a) that the rolling elements move ahead the moving member
(b) that the rolling elements lag behind the moving member
(c) that the rolling elements slides over the moving member
(d) that the rolling elements stuck to the moving member

20. Slideway with hydraulic relief - type combination guideways can be treated as the intermediate between
(a) an antifrictionway and a hydrostatic slideway
(b) a conventional slideway and a hydrodynamic slideway
(c) a conventional slideway and a hydraulic relief valve
(d) a conventional slideway and a hydrostatic slideway

21. Cast iron is not used in antifrictionways because of its
(a) poor damping properties
(b) poor contact strength
(c) high coefficient of friction
(d) all of the above

22. Conventional slideway in slow moving speed experience
(a) semi-liquid friction
(b) liquid friction
(c) dry friction
(d) rolling friction

23. The hydrodynamic force increases with increase in
(a) lubrication between two bodies
(b) sliding velocity
(c) weight of sliding body
(d) all the above

24. The slideway profile and combination used in a general-purpose lathe is
(a) closed flat + colsed vee
(b) closed vee + colsed vee
(c) closed flat + colsed flat
(d) open flat + open vee

25. Machine tool chatter causes
(a) Unacceptable machining finish
(b) Shortens the machine life
(c) Decreases tool life
(d) All the above

26. The operation of the push button which placed in the middle of a row or column of push buttons,
(a) produce a movement to the away
(b) produce a movement to the upward
(c) is the stop button
(d) produce a movement to the right

27. The height of the letters or figures in a display may be calculated from the expression ….. (if H = height of the letter, mm; A = expected maximum reading distance, mm)
(a) H = A / 600
(b) H = A / 100
(c) H = A / 200
(d) H = A / 50

28. A Cranks is used as a control member when
(a) high turning speeds are required
(b) rapid complete turn is required
(c) heavy loads have to be moved manually
(d) all of these

29. The push buttons diameter lies between……
(a) 5 to 15 mm
(b) 12 to 30 mm
(c) 12 to 15 mm
(d) 10 to 25 mm

30. The objective of considering ergonomics in machine design is to
(a) Decrease physical stresses
(b) Make user adapt to the machine
(c) Improve appearance of the product
(d) All the above

**Section B**

Answer any four questions (4 x 5)

Q1 What are the various components of a translatory hydraulic drive? How can a single piston rod type cylinder-piston be used for symmetrical reciprocating motion? [2+3]

Q2 The optimum ray diagram for a 4-speed gear box for transmitting 10 HP is given in Fig. 1. Calculate the number of teeth in all gears of the gearbox. [5]

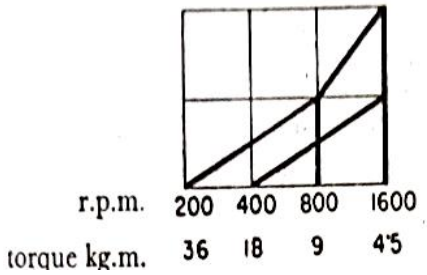



Fig. 1

Q3 What do you mean by machine tool structure? Determine the maximum shear stress and the angle of twist for a box section as shown in Fig. 2, if it is subjected to a twisting moment of 200 kg.m. (Dimensions are in cm) [1+4]

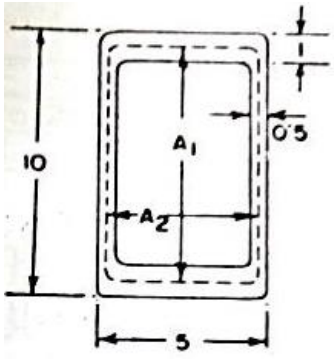



Fig. 2

Q3 A lathe is subjected to 120 kg cutting force, 100 kg feed force and 80 kg radial force, at the cutting point on the 50 mm diameter round work piece. Determine the deflection of tool (cutting edge) in radial direction for a combination of two flat guideways if the saddle width is 150 mm. Height of the spindle centre above the flat guideways = 150 mm, saddle weight = 50 kg. $k$ = 1 micron.cm$^2$/kgf. [5]

Q5 Describe how machine tool chatter is caused. How does machine tool vibration affect the machining process and machine tools? [2+3]

:::: 25/04/2022::::







