17632

BRAINWARE UNIVERSITY

Term End Examination 2025-2026
Programme – Dip.ME-2024
Course Name – Design of Machine Elements
Course Code - DME30101
(Semester III)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) The common cause of stress concentration is ________________.

a) Introducing sharp corners
b) Using notches
c) Adding holes
d) Providing fillets

(ii) The primary purpose of a cotter joint is to________________.

a) Transmit axial tensile or compressive force between two coaxial rods
b) Transmit torque between two shafts
c) Connect two intersecting shafts at right angles
d) Join two plates subjected to shear forces

(iii) In a knuckle joint, the pin is primarily subjected to________________.

a) Shear stress
b) Bending stress
c) Torsional stress
d) Compressive stress

(iv) Leaf springs are commonly used in____________.

a) Clocks
b) Vehicle suspension systems
c) Ballpoint pens
d) Door hinges

(v) State the main advantage of a concentric spring arrangement.

a) Increased load-bearing capacity
b) Reduced manufacturing cost
c) Simplified design
d) Improved damping characteristics

(vi) In a screw jack,name the material commonly used for the screw.

a) Cast iron
b) Low carbon steel
c) High carbon steel
d) Bronze

(vii) Choose the primary function of a bearing in machinery.

a) Transmit power between shafts
b) Reduce friction between moving parts
c) Increase rotational speed
d) Support axial loads only

(viii) The basic dynamic load rating of a bearing indicates____________________.

a) The maximum static load it can withstand

b) The constant radial load a group of identical bearings can endure for a rating life of one million revolutions

c) The maximum speed at which it can operate

d) The axial load capacity during static conditions

(ix) State the primary disadvantage of a plain journal bearing compared to a rolling element bearing.

a) Higher friction at startup
b) Lower load-carrying capacity
c) Higher cost
d) Larger physical size

(x) Name the component that holds the eye and fork together in a knuckle joint.

a) Bolt
b) Cotter
c) Pin
d) Key

(xi) Select the primary aesthetic factor in machine design.

a) Noise level
b) Color and shape
c) Load-carrying capacity
d) Manufacturing process

(xii) Select the correct term used to describe machine-user interaction improvement.

a) Safety engineering
b) Ergonomics
c) Mechanical design
d) Kinematics

(xiii) Select the design aspect that ensures easy maintenance of a machine.

a) Complicated assembly
b) Easily accessible parts
c) Heavy components
d) Poor user manual

(xiv) Name the safety feature in ergonomically designed machines.

a) Increased working speed
b) Poor lighting
c) Emergency stop button
d) Non-slip flooring

(xv) Select the correct statement about aesthetics in industrial design.

a) It only concerns color
b) It improves functionality and user experience
c) It reduces material strength
d) It has no impact on the market value

Group-B

(Short Answer Type Questions) 3 x 5=15

2. State the applications of a Knuckle joint. (3)
3. Calculate the dynamic load rating for a ball bearing if it is subjected to an equivalent load of 5 kN and a required life of 10 million revolutions. (3)
4. State the importance of factor of safety in machine design. (3)
5. State the factors to be considered while designing any mechanical element. (3)
6. Explain Maximum Distortion Energy Theory of failure. (3)

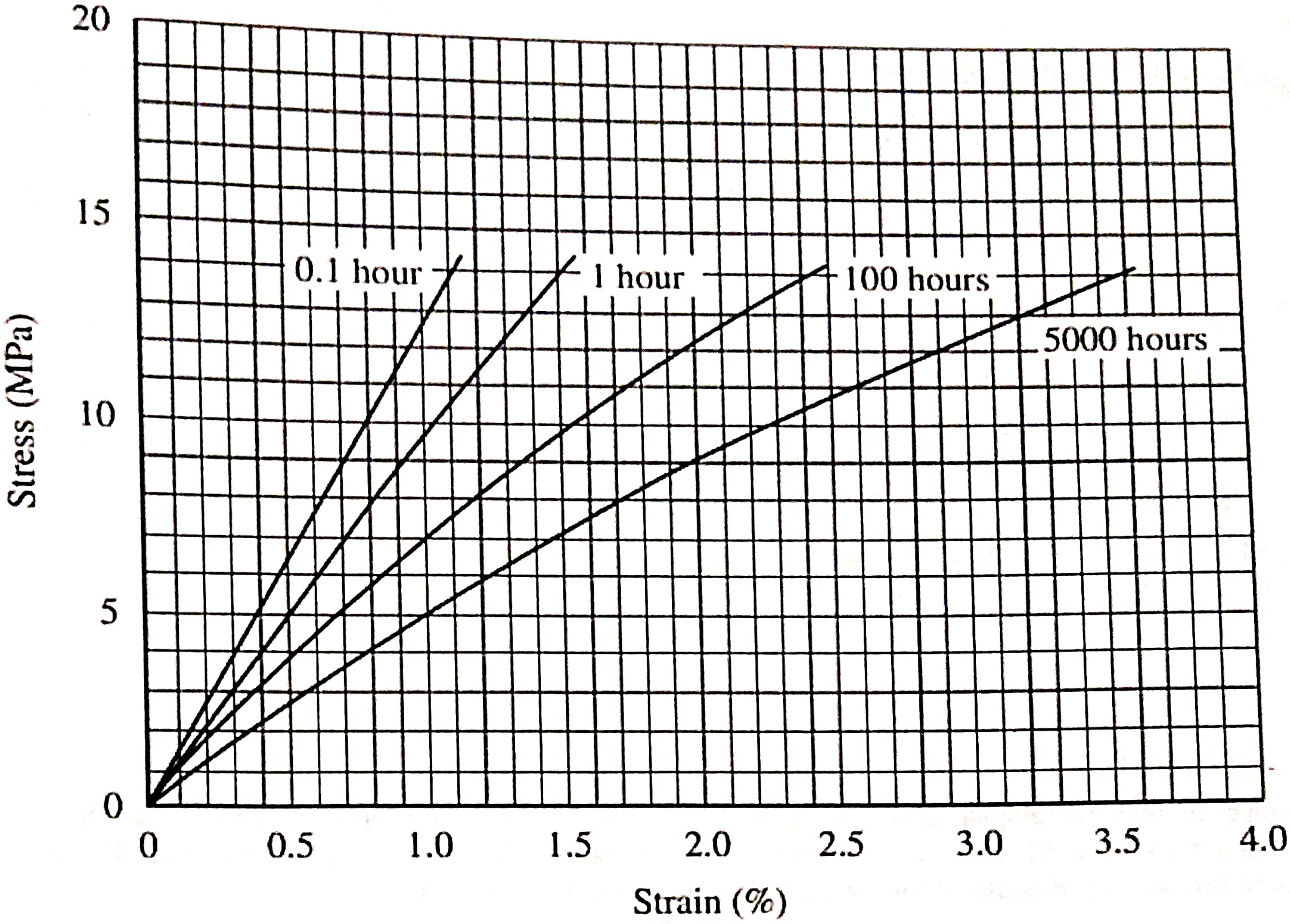
OR

With the help of neat sketches explain the different types of key. (3)

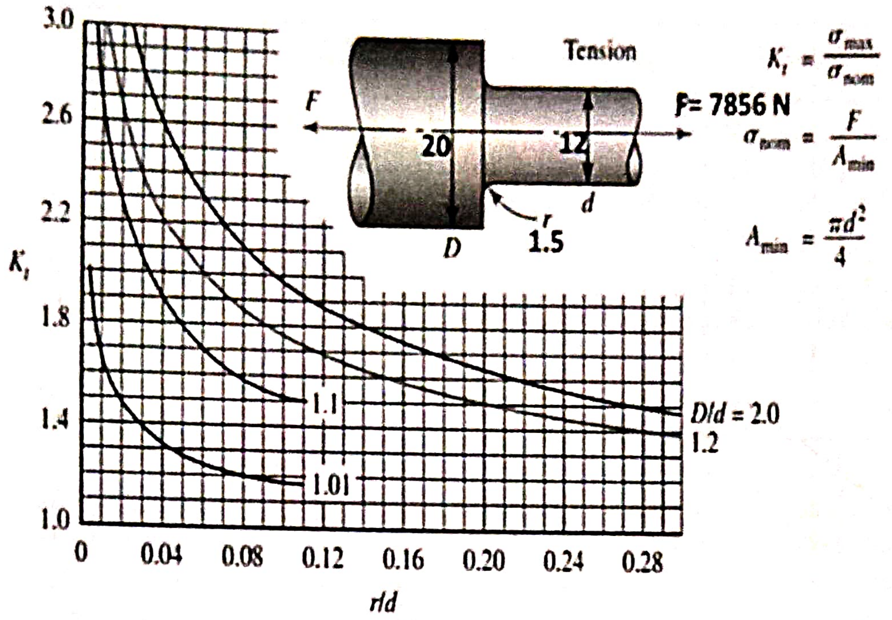
Group-C

(Long Answer Type Questions) 5 x 6=30

7. A solid circular bar has a diameter of 5.0 mm and a length of 250 mm. It is made from nylon 66 plastic (30% Glass, 50% R.H.) and subjected to a steady tensile load of 240 N. Estimate the elongation of the bar immediately after the load is applied and after 5000 hours (approximately seven months). Stress strain curve is given below for the reference. Take E= 5500 Mpa for nylon. (5)



8. A rotating bar made of steel 45C8 (Sut = 630 N/mm2) is subjected to a completely reserved bending stress. The corrected endurance limit of the bar is 315 N/mm2. Calculate the fatigue strength of the bar for a life of 90,000 cycles. (5)
9. A spur gear with 20 teeth and a module of 5 mm is made of steel with an allowable bending stress of 200 MPa. The gear has a face width of 50 mm and a pressure angle of 20°. Calculate the maximum allowable tangential load (W) using the Lewis equation. (5)
10. Write a short note on multi-leaf spring. (5)
11. Compute the maximum stress developed in the stepped shaft shown below. All dimensions are in mm. (5)



12. A beam of uniform rectangular cross-section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 40 MPa. Evaluate the width and depth of the beam, if depth is twice that of width. (5)

OR

Calculate the design load for a bolted joint subjected to an eccentric load of 10 kN at 100 mm from the bolt center. Assume two bolts at 200 mm spacing. (5)

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