

GANPAT UNIVERSITY

B.Tech. 1st Semester – (MC/ME/Civil/Electrical),
Regular Examination : Nov- Dec : 2012

2CI 102

Mechanics of Solids

Instructions: -

Invigilator's Sign. _____

- (1) Answer to the two sections must be written in separate answer books.
- (2) Assume suitable data if required.
- (3) Figures to the right indicate full marks.

Exam. No. of the candidate: _____

Max. Marks: 70

Max. Time: 3 Hours

Section - I

1 (A) Draws load and bending moment diagrams for beams shown in shear force diagram in Figure No - 1. Also locate point of contra flexure if any. (08)

OR

1 (A) Draw the shear force and bending moment diagram for the beam as shown in Figure No - 2. Determine the point of contraflexure. (08)

1 (B) I. State the difference between fundamental units and derived units. (02)

II. Draw sketches to show statically indeterminate beams. (02)

2 (A) Some forces are acting on rigid body shown in Figure No 3. Find the resultant of the given force system in terms of magnitude and direction. Find the location of resultant w.r.t. point O in following ways. (a) Perpendicular distance for the point O (b) X-intercept and (c) Y-intercept (08)

2 (B) State and explain Varignon's principle. (04)

OR

- 2 (A) Explain the fundamental principal of mechanics: Law of transmissibility of forces.
- 2 (B) (I) The force P_1 is of 100N magnitudes. The resultant of forces P_1 & unknown force P_2 is 100N in magnitude. Find the magnitude and direction of P_2 if the resultant force is perpendicular to force P_1 (04)
- (II) State and explain: (a) Collinear and concurrent forces and (b) Non coplanar concurrent forces. (04)

3 Attempt any Two:

- (A) Prove: Parallel axis theorem. And Perpendicular axis theorem.
- (B) Determined Centroid of the area shown in Figure No - 4.
- (C) Explain relation between Angle of repose and angel of friction.

Section II

- 4 (A) A single purchase crab winch has the following details: (12)
- Length of lever = 700 mm , Number of pinion teeth = 12 , Number of spur gear teeth = 96 and Diameter of load axle = 200 mm.
- It is observed that an effort of 60N can lift a load of 1800 N and an effort of 120 N can lift a load of 3960 N.
- What is the law of machine? Also find efficiency of the machine in both the cases.
- (B) Define: (1) Tensile stress, (2) Shear stress, (3) Primary strain, (4) Lateral strain, (5) Volumetric strain and (6) Bulk modulus.
- (C) Draw neat labeled sketch of the following machines. Explain their working and workout the formula of its velocity ratio. - Wheel and Differential Axle.

(A) A rectangular bar 200 mm long, 70mm wide and 20mm thick is loaded (06)
with an axial tensile load of 150 kN; together with a normal compressive
force of 1500kN on 70mmX200mm face and tensile force of 250kN on
20mmX200mm face. Calculate change in length, width, thickness and
volume. Assume $E=200\text{Gpa}$ and $\mu=0.3$.

(B) Derive the equation for motion of two bodies connected by a string one of (05)
which is hanging free and other lying on a smooth inclined plane.

OR

5 (A) Derive the equation for the tension in the string, when one body is (05)
hanging free and the other is lying on a rough horizontal plane.

(B) A mild steel column is hollow and circular in cross section with an (06)
external diameter of 350mm and an internal diameter of 300 mm. It carries
a compressive axial load of 2000 kN. Determine the direct stress in the
column and also the shortening of the column if its initial height is 5 m.
Take $E=200\ 000\text{N/mm}^2$.

6 Attempt any Three: (12)

(A) Define: (1) Malleability, (2) Toughness, (3) Hardness and (4) Creep

(B) Write a short note on free body diagram.

(C) Define 'Equilibrant force' and prove Lami's theorem with its statement

(D) Explain in detail: Equivalent couple and Resolution of a force into force
and a couple.

"End of Paper"