Total No. of Printed Pages:03

SUBJECT CODE NO:- 2117
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y Sem-III
Examination March/April-2022 (To be held in June/July-2022)
Mathematics MAT - 303
Mechanics-I

[Time: 1:30 Hours] **[Max. Marks:50]**

Please check whether you have got the right question paper.

N.B i) All questions are compulsory.
ii) Figures to the right indicate full marks.
iii) Draw well labelled diagrams whenever necessary.

Q.1 (a) Attempt any one of the following: 08

i. Determine the magnitude and direction of the resultant $\vec{R}$ of the two forces $\vec{P}$ and $\vec{Q}$ acting at an angle θ.

ii. If the three forces acting on a particle are in equilibrium, then prove that they can be represented both in magnitude and direction by the sides of any triangle taken in order, and drawn in parallel to the given forces.

(b) Attempt any one of the following: 07

i. Find the smaller force, when the two forces act at an angle of 120°, the greater force is 30 kg and the resultant is perpendicular to smaller one.

ii. If A and *B* are two smooth pegs in a horizontal line at a distance 5 m apart. Two light enextensible strings CA and *CB* of lengths 3 m and 4 m respectively attached to pegs. Find the tensions in the strings, when a weight of 10 kg is suspended from C.

Q.2 (a) Attempt any one of the following: 08

i. Define couple and prove that the magnitude of the moment of the couple equals to the product of magnitude of a force in the couple and arm of the couple.

ii. If a system of parallel forces of magnitudes F_1, F_2, ... F_n act at some given n points, then prove that the resultant of these forces act through their centre.

(b) Attempt any one of the following: 07

i. Find the vector moment of a force $\vec{F}$ of the magnitude 10 units acting at a point (1, 2, 3) about origin in the direction of the vector $2\vec{\imath} + \vec{\jmath} + 2\,\vec{k}$ about the point (2, 3, 1).

ii. Perpendiculars are drawn from the vertices A, *B, C* of a triangle to the opposite sides *a, b, c* and another triangle is formed by joining the feet of these perpendic ulars. If *p, q, r* be the distances of the C.G. of this triangle from the sides *BC, CA, AB*. Show that

$$\frac{p}{a^2\cos(B-C)} = \frac{q}{b^2\cos(C-A)} = \frac{r}{c^2\cos(A-B)}$$

Q.3 (a) Attempt any one of the following: 05

i. Show that centroid of the weighted points exists and is unique.

ii. Prove that the sum of the vector moments of a system of the forces acting on a particle about any point equals to the vector moment of their resultant about the same point.

(b) Attempt any one of the following: 05

i. Find the angle between two equal forces *P,* when their resultant is (i) equal to *P* and (ii) equal to $\frac{p}{2}$

ii. A uniform string 24 cm. long is bent into the form of a triangle, the sides being 3:4: 5. Particles of weights W*1, W2, W3* are placed at the angular points and it is observed that C.G. is unchanged. Show that wi : *W2 : W3* = 9:8:*7.*

Q.4 Choose the correct alternative and rewrite the sentence : 10

(a) If two forces $\vec{P}$ and $\vec{Q}$ acting along same line and in the same direction then the magnitude *R* of their resultant force is given by

i. $R= P +Q$
ii. $R = \sqrt{P-Q}$
iii. $R = \sqrt{P+Q}$
iv. $R=P-Q$

(b) Center of Gravity of the uniform triangular lamina is at .....

i. any of the three vertices of the triagle
ii. the pole of uniform triangular lamina
iii. the point of intersection of the medians of the triangle
iv. the mid-point of any side of the triagle

(c) The effect of the couple acting on a body produces .....

i. no motion
ii. both motion of traslation and motion of rotation
iii. only motion of traslation
iv. only motion of rotation

(d) A system of coplanar forces acting at a point is in equilibrium if and only if the algebraic

sum of the resolved parts of the given forces along any two mutually perpendicular directions must ...

i. separately vanish
ii. be doubled
iii. remains same
iv. constant

(e) The vector moment of the resultant couple of two couples acting upon a rigid body is the ..... of the vector moments of the given couples.

i. product
ii. sum
iii. difference
iv. scalar product