

UG — Math (D – 604) B

2021

Time : 3 hours

Full Marks : 80

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer any four questions in which Q. No.1 is compulsory.

1. Answer all questions of the following :2×10 = 20

(a) Define virtual work.

(b) Define coplanar forces.

(c) Define the common catenary.

(d) Define couple.

(e) Define equilibrium.

(f) Sketch the tangential and normal velocities.

(g) Write the equation of motion of a particle whose acceleration varies as the distance

(b) Four uniform rods are freely jointed at the extremities and form a parallelogram ABCD, which is suspended by the point a and is kept in shape by a string AC. Prove that the tension of the string is equal to half of the whole weight. 10

4 (a) Find the Cartesian equation of the common catenary. 10

(b) A uniform chain of length ℓ is to be suspended from two points A and B in the same horizontal line so that either terminal tension is n times that at the lowest point. Show that the span

AB must be $\frac{1}{\sqrt{(n^2 - 1)}} \log [n + \sqrt{n^2 - 1}]$. 10

5. (a) Find the equation of the null plane of a point. 10

(b) Find the null point of the plane $x + y + z = 0$, for the forces (X, Y, Z, L, M, N). 10

6. (a) Find the Radial and Transverse acceleration components of a particle. 10

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(3)

(Turn over)

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(b) An insect crawls at a constant rate u along the spoke of a cartwheel of radius a , the cart moves with velocity v . Find the acceleration along and perpendicular to the spoke. 10

7. (a) Define SHM and discuss the motion. 10

(b) Show that the time of descent to the centre of force, the force varies inversely as the square of the distance from the centre through the first half of its initial distance is to that through the last half as $\pi + 2 : \pi - 2$. 10

8. (a) Find the equation of central orbit in polar form. 10

(b) A particle moves with a central acceleration

$\frac{\mu}{(\text{distance})^3}$, find the path and distinguish

the cases. 10

