

Model Question Paper

UG, Sem-VI, B.Sc. Programme, Maths

Paper: DSEMATH- 601 B (i)

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Model Question Paper of B.Sc. Prog (Vg), Sem-VI (2020)

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Full Marks \rightarrow 70

Time \rightarrow 3 hours

Answer from all the Parts as directed.

The figures in the right-hand margin indicate marks.

Part - A

(Compulsory)

1. Choose the correct answer of the following : $2 \times 10 = 20$

(a) A system of coplanar force is in equilibrium, if the sum of the moments about each of three given non-collinear points in the plane is

- (i) Zero (ii) Non-zero

(b) If X and Y are components of forces parallel to axes and Gz is the couple, then the equation of the line of action of the resultant force is

(i) $Gz + Xy + Yx = 0$ (ii) $Gz + Xy - Yx = 0$

(iii) $Gz - Xy - Yx = 0$ (iv) None of these.

(c) A particle moves along a polar curve, then transverse velocity is

(i) $\frac{dr}{dt}$ (ii) $r \frac{d\theta}{dt}$ (iii) $\frac{d^2r}{dt^2}$ (iv) None of these.

(d) Normal velocity of a particle moving along a plane curve is

- (i) 0 (ii) $\frac{ds}{dt}$ (iii) $\frac{dx}{dt}$ (iv) $\frac{dy}{dx}$

(e) The time period of a S.H.M. is given by

- (i) $\frac{\pi}{\sqrt{n}}$ (ii) $\frac{\sqrt{n}}{2\pi}$ (iii) $\frac{2\pi}{\sqrt{n}}$ (iv) $\frac{\pi a^3}{n}$

(f) The force $\vec{F} = x^2yz\vec{i} - xyz^2\vec{k}$ is

- (i) Conservative (ii) non-conservative

(g) Work done in raising a mass of 2 Kg. to a height of 5 meters is equal to

- (i) 98 Joules (ii) 50 Joules (iii) 10 Joules

(h) The statement "every subset of a discrete metric space is open set" is

- (i) True (ii) False

(i) If A and B are any two subsets of a metric space (X, d) , then

- (i) $\overline{A \cup B} = \overline{A} \cup \overline{B}$ (ii) $\overline{A \cap B} \neq \overline{A} \cap \overline{B}$

(j) The statement "a convergent sequence in a discrete metric space cannot have infinite number of distinct points" is

- (i) True (ii) False

Part-B

Answer any four questions:

$$4 \times 5 = 20$$

2. A particle rests on a smooth curve under the action of any force. Find the position of equilibrium.
3. Three forces P, Q, R act along the sides of the triangle formed by the lines $x+y=1$, $y-x=1$ and $y=2$. Find the equation to the line of action of the resultant.
4. Find the radial and transverse acceleration of a particle moving along a plane curve.
5. A particle starts from the origin and the components of its velocity parallel to the axes at time t are $2t+3$ and $4t$. Find the path.
6. State and prove the principle of conservation of energy.
7. Define usual metric space and prove that it is actually a metric space.
8. Prove that the union of a finite number of closed sets in a metric space (X, d) is closed.
9. In a metric space, prove that the limit of convergent sequence is unique.

Part - C

Answer any two questions:

$$2 \times 15 = 30$$

10. (a) Obtain the general conditions of equilibrium of a system of forces acting in one plane upon a rigid body.
 (b) Find the tangential and normal accelerations of a particle moving along a plane curve.

11. (a) If λ is the modulus of elasticity, then prove that the work done in extending an elastic light string to double its length l is $\frac{\lambda l}{2}$.

(b) Define S.H.M. and show that its time period is independent of amplitude.

12. (a) A particle starts with a given velocity V and moves under a retardation equal to K times the space described. Show that the distance traversed before it comes to rest is $\frac{V^2}{2K}$.

(b) Prove that arbitrary union of open sets in a metric space is open.

13. (a) In a metric space, prove that every subsequence of a convergent sequence is convergent and has the same limit.

(b) State and Prove Cantor's intersection theorem

— End —

Remark:

Ans. of Q. (1)

- (a) \rightarrow (i)
- (b) \rightarrow (ii)
- (c) \rightarrow (ii)
- (d) \rightarrow (i)
- (e) \rightarrow (iii)
- (f) \rightarrow (ii)
- (g) \rightarrow (i)
- (h) \rightarrow (i)
- (i) \rightarrow (i)
- (j) \rightarrow (i)