

1404-02

Total Pages : 8

Degree (Part-II) Examination, 2022

(Vocational - Subsidiary)

MATHEMATICS

[PPU-D-II-(SUB)-MATH]

Time : Three Hours]

[Maximum Marks : 100

Note : Candidates are required to give their answers in their own words as far as practicable. The questions are of **equal** value. Answer **any five** questions in all. Question no.1 is **compulsory**. Besides this, attempt one question from each Group.

1. Choose the correct option of the following :

(i) If $y = \sqrt{\sin x}$ then $\frac{dy}{dx}$ is :

(a) $\frac{1}{2} \sin x \cdot \cos x$

(b) $\sqrt{\cos x}$

(c) $\sqrt{\sin x} \cdot \cos x$

(d) None of these

(ii) If $y = x \sin(a + y)$ then $\frac{dy}{dx}$ is

(a) $\frac{\sin^2(a + y)}{\sin a}$

(b) $\frac{\sin a}{\sin^2(a + y)}$

(c) $\frac{\sin(a + y)}{\cos a}$

(d) None of the above

(iii) If $y = \sin(\log x)$ then $\frac{dy}{dx}$ is :

(a) $\frac{\log x}{\sin x}$

(b) $\frac{1}{x} \cdot \cos(\log x)$

(c) $\cos(\log x)$

(d) None of these

(iv) If $x^x = y^y$ then $\frac{dy}{dx}$ is :

(a) $-\frac{y}{x}$

(b) $-\frac{x}{y}$

(c) $\frac{1 + \log x}{1 + \log y}$

(d) None of the above

(v) $\int \log x \, dx$ is equal to :

☒ (a) $x \log x - x + c$

(b) $\frac{1}{x} + c$

(c) $x \log x + c$

(d) None of the above

(vi) If $x \frac{dy}{dx} + 3y = x$ then solution is :

(a) $x^3 y = \frac{x^4}{4} + c$

(b) $x^2 y^2 = c$

☒ (c) $xy + y^2 + c = 0$

(d) None of the above

(vii) If $\frac{dy}{dx} + y \log x = x^2$ then solution is :

(a) $y = \frac{x^3}{4} + c$

(b) $y = \frac{x^4}{4} + c$

(c) $y = x + c$

(d) None of the above

(viii) The equation of line of action of the resultant of coplanar forces is :

(a) $Yx - Xy = 0$

~~(b)~~ $Yx - Xy + G = 0$

(c) $Xx - Yy + G = 0$

(d) None of the above

(ix) Change of velocity with respect to time is :

(a) Force

(b) Displacement

~~(c)~~ Acceleration

(d) None of the above

(x) The differential equation of S.H.M. is :

~~(a)~~ $\frac{d^2x}{dt^2} = -\mu x$

(b) $\frac{dx}{dt} = -\mu x$

(c) $\frac{d^2x}{dt^2} = \mu x$

(d) None of these

Group-A

2.

(a) State and prove Leibnitz theorem on successive differentiation.

(b) If $y = \sin(ax + b)$ then find y_n .

3.

(a) Evaluate $\int \frac{x \sin^{-1} x}{\sqrt{1-x^2}} dx$.

(b) Show that $\int_0^1 \frac{\log(1+x)}{1+x^2} dx = \frac{\pi}{8} \log 2$.

4.

(a) Solve $\frac{dy}{dx}(1+x^2) \cdot \tan^{-1} x + y = 0$.

(b) Solve $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$.

5.

(a) Solve $x \frac{dy}{dx} + 3y = x$.

(b) Solve $(x+1) \cdot \frac{dy}{dx} + 1 = 2e^{-x}$.

Group-B

6. (a) Write down the necessary and sufficient condition that the three non-parallel, non-zero vectors $\vec{a}, \vec{b}, \vec{c}$ be coplanar.

(b) Prove that $(\vec{a} \times \vec{b}) \times \vec{c} = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{b} \cdot \vec{c})\vec{a}$.

 If $\vec{a}, \vec{b}, \vec{c}$ are three non-coplanar vectors then prove that $\vec{b} \times \vec{c}, \vec{c} \times \vec{a}, \vec{a} \times \vec{b}$ are also non-coplanar.

Group-C

8. (a) Find the equation of the line of action of the resultant of coplanar system of forces acting on a rigid body.
- (b) Obtain necessary and sufficient conditions for the equilibrium of a system of coplanar forces acting on a rigid body.
9. (a) Find the radial velocity of a particle $P(r, \theta)$ describing a smooth curve.

- (b) Find the radial acceleration of a particle $P(r, \theta)$ describing a smooth curve.

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