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) $\frac{1}{2}\sin x.\cos x$
 - (b) $\sqrt{\cos x}$

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

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

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

- None of the above (d)
- (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

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

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

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

$$(c) xy + y^2 + c = 0$$

- (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

$$(x) Yx - Xy + G = 0$$

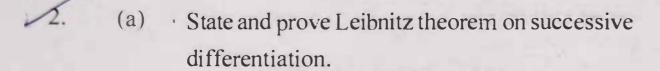
- (c) Xx Yy + G = 0
- (d) None of the above
- Change of velocity with respect to time is: (ix)
 - Force (a)
 - (b) Displacement
 - (c) Acceleration
 - None of the above (d)
- The differential equation of S.H.M. is: (x)

$$\frac{d^2x}{dt^2} = -\mu x$$
(b)
$$\frac{dx}{dt} = -\mu x$$

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

- (c) $\frac{d^2x}{dt^2} = \mu x$
- (d) None of these

Group-A



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

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

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.

[P.T.O.]

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

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