Model Question Set

New Course : 2021 (Diploma in Engineering All)
Year: II | **F.M.** = 80
Semester: I | **P.M.** = 32
Subject: Engineering Mathematics III | **Time:** 3 hrs

Group 'A' $[7 \times (2+2) = 28]$

Attempt All Question

1. (a) Find the derivative of $sin^{-1}(3x-4)$.

   (b) Find the slope of the curve $y = 2x^2 - x$ at $(1,0)$.

2. (a) Find the points of stationary points $f(x) = x^3 - 3x^2 + 9$.

   (b) State L' Hospitals's Theorem and use it to evaluate
$$\lim_{x \to 4} \frac{x^2 - 16}{x - 4}$$

3. (a) Find first order partial derivatives of
$$f(x,y) = ax^2 + 2hxy + by^2.$$

   (b) Find $\frac{\partial y}{\partial x}$ if $y = x^2 - 5x + 7$ and $x + 9rs + 2r^2s^2$.

4. (a) Test whether the given function is even, odd or neither where,
$$f(x) = \sqrt{1+x^2} - \sqrt{1-x^2}$$

   (b) Find the smallest period of $f(x) = \sin 2x$.

5. (a) Find the area bounded by the curve $y = 4x^2, x - axis$ and the ordinates $x = 0, x = 2$.

   (b) Determine the order and degree of the differential equation:
$$\frac{dy}{dx} = (x + y + 1)^2$$

6. (a) Solve by separation of variable method of

$$(1 + cosx)dy = (1 - cosx)dx \, .$$

(b) Text the exactness of $(x + y^2)\, dx - 2xy\, dy = 0.$

7. (a) State Langrange's Linear Differential Equation with an example.

(b) Define Orthogonality of two function with example.

Group 'B' $[\mathbf{13 \times 4 = 52}]$

Attempt All Questions

8. Find the equation of tangent and normal to the curve

$$f(x) = x^2 + 3x + 1 \text{ at } (0, 1).$$

9. Find the local maxima and local minima of the function $f(x) = 2x^3 - 15x^2 + 36x + 5$. Also, find the point of inflection.

10. Evaluate: $\displaystyle\lim_{x \to 0} \frac{\tan x - x}{x^2 \tan x}$

11. If $u = \log(x^2 + y^2)$ then show that $\dfrac{\partial^2 u}{\partial x^2} - \dfrac{\partial^2 y}{\partial y^2} = 0.$

12. State the Euler's theorem of homogenous function and show that

$$\mathrm{u} = \sin^{-1}\frac{\mathrm{x}^2+\mathrm{y}^2}{\mathrm{x}+\mathrm{y}}, \text{Prove that } x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u.$$

13. Integrate the standard integral: $\displaystyle\int \frac{dx}{a\, sin\, x + b\, cos\, x}.$

14. Find the area of the plane region bounded by the x-axis the curve $y = e^x$ and the ordinates $x = 0, x = b$ using the limit of sum.

15. Find the area of the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1.$

16. Define linear equation and solve $2\, cos\, x\dfrac{dy}{dx} + 4y\, sin\, x = sin\, 2x.$

17. Show that the differential equation exact and solve:

$$(x + y - 1)\, dx + (x - y - 2)dy = 0$$

18. If the normal at every point of a curve passes through a fixed point, using first order differential equation so that the curve is circle.

19. Solve: $(mz - ny)p + (nx - lz)q = ly - mx.$

20. Find the Fourier series of $f(x)$ which is defined by

$$f(x) = \begin{cases} 0 \quad for - \pi \le x \le 0 \\ \frac{\pi}{4}x \quad for\ 0 < x \le \pi \end{cases}$$

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Model Question Set

New Course - 2021 (Three Years Diploma in Engineering All Programmes)
Year - II
Semester - I
Subject: Engineering Mathematics - III

F.M. : 80
P.M. : 32
Time: 3 hrs

Group 'A'

Attempt All questions. **[(7 × 2) × 2 = 28]**

1. (a) Find the derivative of $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$.
   (b) Find the slope of the curve $y = 2x + x^2$ at $(0, 1)$.
2. (a) Define stationery points in a curve and find the points of stationary in the curve $5x^3 - 135x + 22$.
   (b) State L'Hospital's Theorem and use it to evaluate $\lim_{x \to 3} \frac{x^3 - 27}{x - 3}$.
3. (a) Define partial derivative of a function and find fx for $f(x, y) = x^2 y^2 + 2y$
   (b) Find $\frac{\partial y}{\partial x}$ if $y = x^2 - 5x + 7$ and $x = 9rs + 2r^2s^2$.
4. (a) Test whether the given function is even, odd or neither where $f(x) = \sqrt{1 + x^2} - \sqrt{1 - x^2}$
   (b) Test the periodicity and find the smallest period of $f(x) = \cos 2x$.
5. (a) Find the area bounded by the curve $y = 3x^2$, x-axis and the ordinates $x = 1, x = 2$.
   (b) Determine the order and degree of the differential equation: $\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^2 = xy$.
6. (a) Solve by separation of variable method of : $(1 + x)\, y dx + (1 + y)\, x\, dy = 0$.
   (b) Define exact differentiate equation and test the exactness of $(x + y - 1)\, dx + (x - y - z)\, dy = 0$
7. (a) Define the Langrange's Linear Partial Differential Equation with an example.
   (b) Define Fourier Series and write the formulae to find the Fourier coefficients.

Group 'B'

Attempt All questions. **[13 × 4 = 52]**

8. Find the equation of tangent and normal to the curve $x^2 - y^2 = 7$ at $(1, 2)$.
   OR
   If the area of a circle increases at a uniform rate prove that the rate of increase of the perimeter varies inversely as the radius.
9. Find the local maxima and local minima of the function below and also find the point of inflection $f(x) = 2x^3 - 15x^2 + 36x + 11$.
10. Evaluate : $\lim_{x \to 0} \frac{x \cos x - \log(1 + x)}{x^2}$
11. If $u = \log(x^2 + y^2)$ then show that $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 v}{\partial y^2} = 0$.

12. State the Euler's theorem of homogeneous function and show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$ for $u=\tan^{-1}\frac{x^3+y^3}{x-y}$.

13. Integrate the standard integral : $\int \frac{dx}{3\sin x+4\cos x}$.

14. Find the area of the plane region bounded by the x-axis the curve $y=e^{3x}$ and the ordinates $x=0, x=b$ using the limit of sum.

15. Find the area of the circle $x^2+y^2=16$.

16. Solve the differential equation $x\frac{dy}{dx}=y-x\tan\frac{y}{x}$.

17. Show that the differential equation exact and solve:
$(5x^4+3x^2y^2-2xy^3)\,dx+(2x^3y-3x^2y^2-5y^4)\,dy=0$

18. Define linear differential equation and solve: $x\frac{dy}{dx}+y=x^4$.

19. Solve: $(xz-ny)p+(nx-lz)\,q=ly-mx$.

OR

If the portion of a tangent to a curve included between the co-ordinate axes is bisected by the point of contact then show that the curve is rectangular hyperbola.

20. Find the Fourier series of $f(x)$ which is defined by $f(x)=\begin{cases}1 & \text{for } -\pi<x<0\\ -1 & \text{for } 0\le x<\pi\end{cases}$

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