

2ND SEM. / COMMON /2023(S) NEW

TH-3 ENGINEERING MATHEMATICS - II

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

- a. Evaluate $\lim_{x \rightarrow 0} x \sin \frac{1}{x}$
- b. if $f(x) = mx + c, f(0) = f'(0) = 1$
then find the value of $f(1)$
- c. Determine order and Degree of $2 \frac{d^2y}{dx^2} = \sqrt{\left(\frac{dy}{dx}\right)^3 + 5}$
- d. Integrate $\int \frac{\cos x}{1 + \sin x} dx$
- e. Find the unit vector in the direction of the vector $2\hat{i} - \hat{j} + 2\hat{k}$
- f. Find the derivative of $\sqrt{2x^2 + 3x + 5}$
- g. Evaluate $\int_0^3 [x] dx$
- h. Solve $\frac{dy}{dx} = \frac{e^{2x} + 1}{e^x}$
- i. If $Z = \log(x^2 - y^2)$, then find $\frac{\partial Z}{\partial x}$ and $\frac{\partial Z}{\partial y}$
- j. if $x = 2t^2$ and $y = 4t$, then find $\frac{dy}{dx}$ at $t = 1$

2. Answer **Any Six** Questions 6 x 5

- a. Differentiate $x^{\sin x}$
- b. Integrate $\int \frac{\sec^2 \sqrt{x}}{\sqrt{x}} dx$
- c. Test the continuity of the function
$$F(x) = \begin{cases} |x| & \text{when } x \neq 0 \\ 1 & \text{when } x = 0 \end{cases} \text{ at } x = 0$$
- d. prove that $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + C$
- e. Find Scalar and Vector projection of \vec{a} on \vec{b} ,
where $\vec{a} = \hat{i} - \hat{j} - \hat{k}$ and $\vec{b} = 3\hat{i} + \hat{j} + 3\hat{k}$

- f. Evaluate $\int_0^{\frac{\pi}{2}} \frac{dx}{1 + \sqrt{\tan x}}$
- g. Solve $(1 + x^2)dy + (1 + y^2)dx = 0$

3 a) Evaluate $\lim_{x \rightarrow 0} \frac{e^{4x} - e^{3x}}{e^{3x} - e^{2x}}$ 5

b) Find $\frac{dy}{dx}$ if $x^y y^x = 1$ 5

4 a) Find the area of parallelogram whose adjacent sides are the vectors $\hat{i} - 3\hat{j} + \hat{k}$ and $\hat{i} + \hat{j} + \hat{k}$ 5

b) If $y = \tan^{-1} x$ then show that $(1 + x^2)y_2 + 2xy_1 = 0$ 5

5 a) Solve $x \log x \frac{dy}{dx} + y = 2 \log x$ 5

b) Integrate $\int x \tan^{-1} x dx$ 5

6 a) Differentiate $5^{\ln \sin x}$ 5

b) Integrate $\int e^{\cos^2 x} \sin 2x dx$ 5

7 a) Evaluate $\lim_{x \rightarrow 0} \frac{\log(x+1)}{\sqrt{x+1}-1}$ 5

b) Find the area of the circle $x^2 + y^2 = 16$ 5