Total Pages – 2

II – Sem/COMMON/2019(S)(New)

ENGG. MATH - II

Full Marks : 80 (Theory : 3)

Time : 3 hours

Answer any five questions including **Q. Nos. 1 & 2**

Figures in the right-hand margin indicate marks

1. Answer *all* questions : 2 × 10

(*a*) Evaluate :

$$\lim_{x\to 1}\left(\frac{\frac{1}{x^2}-\frac{1}{4}}{x-2}\right)$$

(*b*) If $u = t^2$ and $v = \sin t^2$, then find $\frac{dv}{du}$.

(*c*) If $f(x, y) = e^{xy}$, then find $y\cdot\frac{\partial f}{\partial y}$.

(*d*) Find derivative of $\sqrt{x}$ w.r.t. x^2.

(*e*) Examine the existence of

$$\lim_{x\to \frac{5}{2}} [x]$$

(*f*) If $y = c_1e^x + c_2e^{-x}$, then find $\frac{d^2y}{dx^2}$.

(*g*) Evaluate

$$\int e^{(5x+3)}\cdot dx$$

(*h*) The two forces act on a particle at a point. Find their resultant if they are $(4\hat{i}+\hat{j}-3\hat{k})$ and $(3\hat{i}+\hat{j}-\hat{k})$.

(*i*) Solve

$$\frac{dy}{dx}=\frac{x}{y}.$$

(*j*) Find the derivative of $\sin^{-1}(3x)$.

2. Answer any *six* questions : 5 × 6

(*a*) If $f(x)=\begin{cases}\frac{x-|x|}{x}, & x\neq 0\\ 2, & x=0\end{cases}$ at $x = 0$.

Show that $\lim_{x\to 0} f(x)$ does not exist.

(Turn Over)

(*b*) Evaluate

$$\lim_{x \to 0} \left(\frac{x - x\cos 2x}{\sin^3 2x} \right).$$

(*c*) If $y = \tan^{-1}x$, prove that

$$(1+x^2)\, y_2 + 2xy_1 = 0 .$$

(*d*) If $f(x, y) = \dfrac{2x - 3y}{x^2 + y^2}$, find $f_x(1, 2)$ and $f_y(1, 2)$.

(*e*) Solve the differential equation,

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

(*f*) Evaluate

$$\int e^x \left(\frac{1}{x} - \frac{1}{x^2} \right) dx.$$

(*g*) Find the area bounded by the curve $xy = c^2$, the x-axis and $x = 2$, $x = 3$.

(*h*) Evaluate

$$\int_0^{\pi/2} \frac{dx}{1 + \cot x} .$$

3. Find the value of 'a' if

$$\lim_{x \to 2} \frac{\log_e(2x-3)}{a(x-2)} = 1. \qquad 10$$

4. Differentiate, $\tan^{-1}(\sec x + \tan x)$. 10

5. Evaluate

$$\int \log(1+x^2)\, dx. \qquad 10$$

6. If $y = (\sin^{-1} x)^2$, show that

$$(1-x^2)\, y_2 - xy_1 - 2 = 0. \qquad 10$$

7. Find sine of the angle between the vectors $\vec{a}$ and $\vec{b}$ where

$$\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k} \text{ and } \vec{b} = \hat{i} + 3\hat{j} + 2\hat{k} . \qquad 10$$

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