UNIVERSITY OF THE PUNJAB

First Semester – 2019

Examination: B.S. 4 Years Program

Roll No. in Fig. ....

Roll No. in Words. ....

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Signature of Supdt.:

PAPER: Mathematics A-I [Calculus(I)]

Course Code: MATH-101 / MATH 11010   Part – I (Compulsory)

MAX. TIME: 30 Min.

MAX. MARKS: 10

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Attempt this Paper on this Question Sheet only.

Please encircle the correct option. Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1.   Encircle the right answer, cutting and overwriting is not allowed.   (1x10=10)

(i)	$\int x \sin x \, dx =?$ (a) $x(\cos x + 1) + c$ (b) $-x\cos x + \sin x + c$ (c) $x\sin x + \cos x + c$ (d) none of these
(ii)	If $f(x) = \sec x \tan x$, then $f'(\pi) =?$ (a) 0 (b) −1 (c) 1 (d) none of these
(iii)	$\int_0^1 \frac{dx}{\sqrt{1-x^2}} =?$ (a) π (b) $-\pi$ (c) $\frac{\pi}{2}$ (d) none of these
(iv)	Every polynomial function is _____. (a) linear (b) trigonometric (c) differentiable (d) exponential
(v)	$\lim_{x \to 1} \frac{x}{|x|} = ?$ (a) -1 (b) 1 (c) 0 (d) none of these
(vi)	Domain of $\sqrt{x+13} + \sqrt{5-x}$ is (a) $-13 \le x \le 5$ (b) $-5 \le x \le 13$ (c) $5 \le x \le 13$ (d) none of these
(vii)	$\lim_{x \to \infty} \left(1 - \frac{2}{x}\right)^x = ?$ (a) 0 (b) e^2 (c) $\frac{1}{e^2}$ (d) none of these
(viii)	For what value of x, the inequality $4x - 7 > 5(x + 10)$ is satisfied (a) 2 (b) 4 (c) 6 (d) none of these
(ix)	$\lim_{x \to 0} \frac{\sin(2x)}{\sin(3x)} = ?$ (a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) 1 (d) none of these
(x)	$\left(\sqrt{3} - i\right)^3$ is equal to (a) $3\sqrt{3}$ (b) $8i$ (c) $-8i$ (d) none of these

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PAPER: Mathematics A-I [Calculus(I)]

Course Code: MATH-101 / MATH 11010   Part – II

MAX. TIME: 2 Hrs. 30 Min.

MAX. MARKS: 50

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q. 2	SHORT QUESTIONS	
(i)	Evaluate $\lim\limits_{y\to 0} \dfrac{\sin 3y \cot 5y}{y \cot 4y}$.	(4)
(ii)	Evaluate $\int x^5 \sqrt{x^3 + 11}\, dx$.	(4)
(iii)	If $y = \ln(x + \sqrt{x^2 + a^2})$, then prove that $\dfrac{dy}{dx} = \dfrac{1}{\sqrt{x^2+a^2}}$.	(4)
(iv)	Let $I = \int_{-\infty}^{\infty} \dfrac{x}{(x^2+3)^2}\, dx$. Does this integral converge or diverge?.	(4)
(v)	Graph the function $y = |2 - x| + 3$.	(4)

	LONG QUESTIONS	
Q.3	Find the reduction formula of $\int \operatorname{cosec}^n x\, dx$ and use it to evaluate $\int \operatorname{cosec}^3 x\, dx$.	(6)
Q.4	Evaluate $\lim\limits_{y\to 0} \dfrac{(1+y)^{\frac{1}{y}} - e}{y}$.	(6)
Q.5	If $y = a\cos(\ln x) + b\sin(\ln x)$, then prove that $x^2 y^{(n+2)} + (2n+1)xy^{(n+1)} + (n^2+1)y^n = 0$.	(6)
Q.6	Find the Maclaurin series of $f(x) = \ln(1 + x)$ with its remainder term.	(4+2)
Q.7	Evaluate the integral $\int_0^{\pi/2} \dfrac{\sin^2 x\, dx}{(1+\sin x\cos x)}$.	(6)

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Q.1. Encircle the right answer, cutting and overwriting is not allowed.   **(1x10=10)**

(i)	$\lim\limits_{x \to 0^-} \sqrt{x} = ?$ (a) 0 (b) 1 (c) undefined (d) none of these
(ii)	The derivative at $y=1$ for the function $S(y) = \dfrac{y}{y+1}$ is (a) $-\dfrac{1}{2}$ (b) $\dfrac{1}{4}$ (c) $-\dfrac{3}{2}$ (d) $\dfrac{1}{3}$
(iii)	$\lim\limits_{x \to 0} \dfrac{x}{\tan x} = ?$ (a) 0 (b) 1 (c) 2 (d) ∞
(iv)	Differentiation of a function implies _____. (a) existence of limit (b) integrality (c) continuity (d) all a,b and c
(v)	If z is a complex number, then $\bar{z}z$ is (a) real (b) complex (c) zero (d) prime
(vi)	The function $y = |x|$ is not differentiable at (a) (-5,0) (b) (0,5) (c) zero (d) none of these
(vii)	If functions f and g are continuous at x=c, then the algebraic combinations are continuous at x=c (a) $f+g$ (b) f^3 (c) $f \cdot g$ (d) all of these
(viii)	What is the magnitude of the complex number $-1 - i\sqrt{3}$ (a) 2 (b) -2 (c) 0 (d) none of these
(ix)	$\lim\limits_{x \to -4} \dfrac{x^3 + 64}{x + 4} = ?$ (a) (b) 16 (c) 48 (d) ∞
(x)	$\left(\sqrt{3} + i\right)^3$ is equal to (a) $3\sqrt{3}$ (b) $8i$ (c) $-8i$ (d) none of these

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ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.2. **Short Questions.**   (5x4=20)

(i)	Evaluate $\lim\limits_{x \to 5} \dfrac{\sqrt{x}-\sqrt{5}}{x-5}$	(4)
(ii)	Evaluate $\int x^3 \sqrt{x^2 + 16}\, dx$.	(4)
(iii)	Find derivative w.r.t 'x' of $\ln \sqrt{\tan^{-1} 2x}$.	(4)
(iv)	Let $I = \int_{-1}^{+1} \dfrac{1}{x^2}\, dx$. Does this integral converge or diverge?	(4)
(v)	Graph the function $y = |1 - x| - 1$.	(4)

Long Questions.   (5x6=30)

Q.3	Evaluate $\int \dfrac{x}{(x-1)^2(x^2+1)}\, dx$	(6)
Q.4	Find the reduction formula of $\int Sec^n x\, dx$ and use it to evaluate $\int Sec^3 x\, dx$.	(6)
Q.5	Show that $\lim\limits_{x \to 0} \dfrac{Tan^{-1} x^2}{x} = 0$	(6)
Q.6	If $y = tan^{-1}x$, show that $(1 + x^2)y'' + 2xy' = 0$. Hence find the value of $y^{(n)}(x)$.	(6)
Q.7	For what values of a, m and b does the function $$f(x) = \begin{cases} 3, & x = 0 \\ -x^2 + 3x + a, & 0 < x < 1 \\ mx + b, & 1 \leq x \leq 2 \end{cases}$$ Satisfy the hypothesis of the mean value theorem on the interval [0,2].	(6)