University of Sargodha

BS 1st Term Examination 2023

Subject: IT/SE/CS **Paper: Calculus & Analytical Geometry (MATH-101/MATH-2213)** **Maximum Marks: 60**

Time Allowed: 02:30 Hours

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory) **(2*12)**

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet.

(i) Find the equation of line that has slope $-\frac{5}{4}$ and y-intercept 6. (ii) Find an equation of circle with center (3, 1/2) and radius 5. (iii) Solve $-\frac{5}{4}$ the equation $|2x-3|=7$. (iv) Evaluate the limit $\lim_{h\to 0}\frac{h}{\sin 3h}$. (v) Evaluate the limit $\lim_{x\to 0}\sqrt{\frac{x+2}{x+1}}$. (vi) Define $g(3)$ in a way that extends $g(x)=\frac{x^2-9}{x-3}$ to be continuous at $x=3$. (vii) At what points is the function $f(x)=\frac{1}{x-2}-3x$ (viii) Find $\frac{d}{dx}\int_0^x \frac{1}{1+t^2}dt$. (ix) Find average value of $f(x)=x^2-1$ on $[0,\sqrt{3}]$. (x) Find the derivative of $r=2\left(\frac{1}{\sqrt{\theta}}+\sqrt{\theta}\right)$ (xi) Find linearization of $f(x)=x+\frac{1}{x}$ at the point a=1. (xii) Define critical points of a function.

Subjective Part **(3*12)**

Q.2. (a) Evaluate the limit $\lim_{x\to 4}\frac{4x-x^2}{2-\sqrt{x}}$.

(b) For what value of b is $f(x)=\begin{cases} x, & \text{if } x<-2 \\ bx^2, & \text{if } x\geq -2 \end{cases}$ continuous at every x?

Q.3. (a) Find the derivative of the function $g(t)=\left(\frac{1+\cos t}{\sin t}\right)^{-1}$.

(b) Find the intervals on which the function $h(x)=-x^3+2x^2$ is increasing and decreasing.

Q.4. (a) Solve the initial value problem $\frac{d^2y}{dx^2}=2e^{-x}$, $y(0)=1$ and $y'(0)=0$.

(b) Find $\frac{dy}{dx}$ if $\ln y=e^x\sin x$.

Q.5. (a) Evaluate the integral $\int \frac{\cos\sqrt{\theta}}{\sqrt{\theta}\sin^2\sqrt{\theta}}d\theta$.

(b) Find the total area of the region and the x-axis if $y=x^{1/3}-x$, $-1\leq x\leq 8$

Q.6. (a) If $u=-i+j$, $v=\sqrt{2}i+\sqrt{3}j+2k$, then find $proj_v u$.

(b) Express $\frac{i}{\sqrt{3}}+\frac{j}{\sqrt{3}}+\frac{k}{\sqrt{3}}$ as a product of its length and direction.