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# Daffodil International University

**Faculty of Science & Information Technology**
**Department of Computer Science & Engineering**
**Midterm Examination, Summer 2026**
**Course Code: MAT101, Course Title: Mathematics I**
**Level: L1 Term: T1 Batch: 72**

**Time: 01:30 Hrs** **Marks: 25**

## Answer ALL Questions

***[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]***

| | | | | |
|---|---|---|---|---|
| 1. | a) | Demonstrate the Continuity and Differentiability of the following function at the point $x=0$<br>$f(x)=\begin{cases} e^x-1; x<0 \\ \sin x; 0\le x\le \pi \\ x-\pi; x>\pi \end{cases}$ | 4 | CO1 |
| | b) | If $y=\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2+.....}}}}$ then demonstrate the value of $y$. | 3 | |
| 2. | | Interpret the solution of the inequality $\frac{x^2+x}{x^2-4x-45}\le 0$ using sign table. | 3 | CO1 |
| 3. | | To determine the exact time complexity of the algorithm, the engineer derives the following characteristic polynomial equation:<br>$x^4-3x^3-7x^2-13x-10=0$<br>Where the largest real root $x$, represents the growth factor of the algorithm's execution time. Apply the Factor Theorem for Solving this equation to find the growth factor. | 5 | CO2 |
| 4. | a) | Inspect the rate of change of y with respect to x, or $\frac{dy}{dx}$ of the function<br>$y=e^{-3x}+\log_a x+\sec^{-1}x+\operatorname{cosec}5x+a^x+\sec x$. | 3 | CO3 |
| | b) | A motorcycle moves along a hill road. If the equation of the path is<br>$y=\ln\sqrt{\frac{1-\cos x}{1+\cos x}}+\left(\ln e^x\right)^x$ then, inspect the slope of the path at $x=0.5$ | 4 | |
| | c) | If $y=\sin\left(\sin^{-1}\left(\cos\left(\sec\left(\sqrt{1+x^2}\right)\right)\right)\right)$ and $z=10^{\ln(\sin x+\sec x)}$ then, Inspect the rate of change of z with respect to y, or $\frac{dz}{dy}$. | 3 | |