

End Semester/Reappear (Semester I) Examination December,2024

Programme: Diploma (MiE/CSE)
Course: Basic Mathematics I
Course Code: 8DBSC101/3DBS C101
Enrolment no. _____

Full Marks: 70
Time: 3 Hrs.

Section I

1. **Short Answer type questions. Answer any four.** **4 x 5 = 20**
- Prove that $\sin 70^\circ \cos 10^\circ - \cos 70^\circ \sin 10^\circ = \sqrt{3}/2$
 - Write a vector of magnitude 15 units in the direction of the vector $(\hat{i} - 2\hat{j} + 2\hat{k})$.
 - If $y = x^4 + 4x^3 + 5x - 6$, then find $\frac{dy}{dx}$
 - Evaluate a) $\int 3x^2 dx$ b) $\int (\sin 3x + \sec x + \tan 2x) dx$
 - How many numbers of four digits can be formed with the digits 1, 2, 3, 4 and 5. Repetition of digits is not allowed.
 - Find the unit vector in the direction of the vector $\vec{a} = (\hat{i} + 2\hat{j} + 3\hat{k})$.

Section II

- Long Answer type questions. Answer any three.** **3 x 10 = 30**
- Find the a unit vector parallel to the sum of the vectors $(\hat{i} + \hat{j} + \hat{k})$ and $(2\hat{i} - 3\hat{j} + 5\hat{k})$.
 - Prove that $\tan 3A \cdot \tan 2A \cdot \tan A = \tan 3A - \tan 2A - \tan A$
 - Let $A = \begin{bmatrix} 1 & -2 \\ 5 & 4 \\ 3 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 \\ 0 & 2 \\ -3 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 4 & 3 \\ -2 & 2 \\ 1 & 6 \end{bmatrix}$ Verify that $(A + B) + C = A + (B + C)$
 - a. If $y = x \log x - x$ then find $\frac{dy}{dx}$. b. If $x \cos y = \sin(x+y)$, find $\frac{dy}{dx}$
 - Prove that $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{16}$

Section III

- Application based questions. Answer any one.** **1 x 20 = 20**
- If in a triangle ABC, (i) $A = \tan^{-1} 2$ and $B = \tan^{-1} 3$ Prove that $C = \frac{\pi}{4}$ (ii) Use the formula and Prove that $2 \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{7} = \frac{\pi}{4}$
 - Find the Value of Integration
 - $\int \sqrt{1 - \sin 2x} dx$
 - $\int \frac{\sec x}{\sec x + \tan x} dx$
 - (a) For what value of λ the vectors $\vec{a} = (2\hat{i} + \lambda\hat{j} + \hat{k})$ and $\vec{b} = (\hat{i} - 2\hat{j} + 3\hat{k})$ are perpendicular to each other.
(b) Find a unit vector in the direction of $(AB)^\rightarrow$, where A (1,2,3) and B(4,5,6) are the given points.
