



Mid Term Examination, Spring 2023
Department of Electrical and Electronic Engineering (EEE)
Level-1, Term-II
Course Code: MATH 121
Course Title: Calculus-II

Notes:

Time: 1 hr
Full Marks: 60

- a. Figure on the right of each question indicate marks for respective question.
b. Answer any 02 (Two) of the following 03 (Three) questions.

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1. a. Compute the angles that the vector $\underline{A} = 4\underline{i} - 8\underline{j} + \underline{k}$ makes with the coordinate axes. 10
- b. Explain whether the vectors are $\underline{A} = 2\underline{i} + \underline{j} - 3\underline{k}$; $\underline{B} = \underline{i} - 4\underline{k}$; $\underline{C} = 4\underline{i} + 3\underline{j} - \underline{k}$ linearly dependent or independent? 12
- c. Prove that the law of sines for plane triangle. 08
2. a. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is the time, determine the components of its velocity and acceleration at time $t = 1$ in the direction $\underline{i} - 2\underline{j} + 2\underline{k}$. 10
- b. Indicate the directional derivative at the point P (2, -1, 3) for the scalar function $\varphi(x, y, z) = x^2 + y^2 + xz$ in the direction of $\underline{A} = \underline{i} + 2\underline{j} + \underline{k}$ and magnitude of its maximum. 10
- c. Prove that $\nabla\left(\frac{1}{r}\right) = -\frac{\underline{r}}{r^3}$, where \underline{r} is a position vector. 10
3. a. Write the statement of Green's Theorem with figure. 05
- b. Illustrate the Green's theorem in the plane for $\oint_C (xy + y^2) dx + x^2 dy$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$. 15
- c. Obtain the value $\oint_C \underline{F} \cdot d\underline{r}$, where C is the curve in the xy-plane, $y = 2x^2$ from (0, 0) to (1, 2). 10