B.Sc. in EEE, 2nd Semester
B. Sc. TE(2-Yr) 2nd Semester

February 23, 2023 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: Math 4221/Math 4629
Course Title: Mathematics III

Summer Semester, A. Y. 2021-2022
Time: 90 Minutes
Full Marks: 75

There are 3 **(three)** questions. Answer all 3 **(three)** questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

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1. (a) Prove that $\mathbf{a} \times \mathbf{b} \times \mathbf{c} = (\mathbf{a}.\mathbf{c})\mathbf{b} - (\mathbf{a}.\mathbf{b})\mathbf{c}$ hence find the value of, $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) + \mathbf{b} \times (\mathbf{c} \times \mathbf{a}) + \mathbf{c} \times (\mathbf{a} \times \mathbf{b})$. **(9) (CO1) (PO1)**

(b) If the volume of the parallelepiped with edges **a**=2i-j-k, **b**=3i+2j+2k and **c**= 5i-mj+3mk is 28 find the value of m. **(8) (CO1) (PO1)**

(c) Explain the physical meaning of $[\mathbf{a}+\mathbf{b}\ \ \mathbf{b}+\mathbf{c}\ \ \mathbf{c}+\mathbf{a}] = 2[\mathbf{abc}]$ and prove this relation. **(8) (CO1) (PO1)**

2. (a) Prove that $\nabla.(\phi\,\mathbf{A}) = (\nabla\phi).\mathbf{A} + \phi(\nabla.\mathbf{A})$ and hence find $\nabla.(r^3\,\mathbf{r})$ **(12) (CO2) (PO2)**

(b) Determine the constant a, b, c so that vector $\mathbf{v}=(-4x-3y+az)i+(bx+3y+5z)j+(4x+cy+3z)k$ is irrotational. Find a scalar function ϕ so that $\mathbf{v}=\nabla\phi$. **(13) (CO2) (PO2)**

3. (a) Evaluate the line integral $\int_C \mathbf{F}.d\mathbf{r}$ where $\mathbf{F}=-3x^2i+5xyj$ and C is the curve $y=4x^2$ in the xy plane from (1, 4) to (2, 16). **(12) (CO3) (PO2)**

(b) Evaluate $\iiint_V \mathbf{F}\,dV$ where $\mathbf{F}=2x^2i-xzj+y^2zk$ and V is the region bounded by the surfaces x=0, x=6, y=0, $z=y^2$, z=4. **(13) (CO3) (PO2)**