Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 level 2nd Semester Examination – Dec./Jan. 2017/18
SCT 378 – 1 Vector Calculus

Uva Wellassa University

Instructions to candidates
Duration: 01 hour
Mark allocation: 100
Answer all the questions

01. Let $\phi = 4xyz^3 - 3x^2y^2z$ and $\varphi = x^2yz^2 + xy^2z$.

a) Determine $grad\,\phi$ at the point (1,3,2). (marks 10)

b) Find the directional derivative of φ at the point (1,3,2) in the direction of the vector $\vec{i} + 2\vec{j} - 3\vec{k}$. (marks 15)

c) Evaluate $\nabla(\phi\varphi)$ at the point (1,3,2).

[Hint : You can use the property $\nabla(\phi\varphi) = \phi(\nabla\varphi) + \varphi(\nabla\phi)$] (marks 15)

02. a) Evaluate the line integral $\int_C \vec{F}\cdot d\vec{r}$, where $\vec{F}(x,y,z) = x\vec{i} - z\vec{j} + y\vec{k}$ and C is given by $\vec{r}(t) = 2t\,\vec{i} + 3t\,\vec{j} - t^2\,\vec{k}$, $-1 \le t \le 1$. (marks 20)

b) Show that $div(curl\,\vec{u}) = 0$, for the vector $\vec{u} = x^2y\,\vec{i} - xyz\,\vec{j} + yz^2\,\vec{k}$. (marks 20)

c) Use the Stoke's Theorem to evaluate $\iint_S curl\,\vec{F}\cdot ds$, where $\vec{F}(x,y,z) = xz\,\vec{i} + yz\,\vec{j} + xy\,\vec{k}$ and S is the part of the sphere $x^2 + y^2 + z^2 = 4$ that lies inside the cylinder $x^2 + y^2 = 1$ above the xy – plane. (marks 20)