Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
300 Level 1st Semester Examination –May/July 2017
SCT 303-1 Mathematical Methods

Uva Wellassa University

Instructions to candidates
Duration: One(01) hour
Number of questions: Two(02) Essay Questions
Mark allocation: 100 mark
Use standard symbols without definition.
Scientific calculators are allowed.
Answer all questions.

1.

a. Find the magnitude and direction cosines of the vector $\mathrm{i}-2\mathrm{j}+3\mathrm{k}$. (05 mark)

b. Find the unit vector, which is parallel to the vector $\mathrm{i}+2\mathrm{j}+4\mathrm{k}$. (04 mark)

c. If $A=\mathrm{i}+2\mathrm{j}+3\mathrm{k}$, and $B=2\mathrm{i}-3\mathrm{j}-5\mathrm{k}$, then determine the

i. scalar product $(A.B)$ (04 mark)
ii. vector product $(A\times B)$ (05 mark)
iii. cosine of the angle between A and B. (06 mark)

d. If $A=3\mathrm{i}-2\mathrm{j}-\mathrm{k}$, $B=\mathrm{i}-2\mathrm{j}+3\mathrm{k}$, and $C=3\mathrm{i}+\mathrm{j}+2\mathrm{k}$, determine

i. the scalar triple product $A.(B\times C)$ (08 mark)
ii. the vector triple product $A\times(B\times C)$. (08 mark)

e. Determine whether the three vectors, $A=2\mathrm{i}+3\mathrm{j}+\mathrm{k}$, $B=\mathrm{i}-2\mathrm{j}+2\mathrm{k}$ and $3\mathrm{i}+\mathrm{j}+3\mathrm{k}$ are coplanar. (10 mark)

2.

a. If $A=2xy\,\mathrm{i}+(x^2y+3yz)\,\mathrm{j}+xz^2\mathrm{k}$, $B=3yz\,\mathrm{i}-3xz\,\mathrm{j}+2xy\,\mathrm{k}$, and $\phi=x^2y+2xyz-y^2z^2-3$. Determine, at the point $(1, 0, -1)$;

i. the gradient of ϕ (i.e., $\nabla\phi$) (06 mark)
ii. the divergence of A (i.e., $\nabla.A$) (06 mark)
iii. the curl of A (i.e., $\nabla\times A$) (07 mark)
iv. grad div A (08 mark)
v. curl curl A. (08 mark)

(21) (95)

b. Determine the directional derivative of $\phi = xe^{y} + yz^{2} + xyz$ at the point $(2, 0, 3)$ in the direction of $A = 3\mathrm{i} - 2\mathrm{j} + \mathrm{k}$. (15 mark)

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