



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
DIPLOMA IN MARINE ENGINEERING
EMR 2301 : ENGINEERING MATH V
SPECIAL/ SUPPLIMENTARY EXAMINATIONS
SERIES: SEPTEMBER2018
TIME: 2 HOURS
DATE: Pick DateSep2018

Instruction to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt question **ONE** and any other **TWO** questions.

Maximum marks for each part of a question are as shown.

Do not write on the question paper.

Question ONE(30mks)

a) Evaluate $\int_0^{0.4} x \ln(1+x) dx$ using Maclaurin theorem correct to 3dp
(8mks)

b) Given $\vec{A} = 3i - 2j + k$, $\vec{B} = 5i - 7j - 6k$ Find

i) A.B (2mks)

AXB (3mks)

c) If $A = (y^4 - x^2z^2)i + (x^2 + y^2)j - x^2yzk$ determine curl A at the point
(1,3,-2) (6mks)

d) Given $A = \begin{pmatrix} 2 & 8 & 6 \\ 3 & 4 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 0 \\ 3 & 5 \\ 1 & 9 \end{pmatrix}$

Find $(B.A)^T$ (2mks)

e) Use Newton Gregory formula of backward interpolation to calculate
 $f(1.9)$

X	0.1	0.6	1.1	1.6	2.1
F(x)	1.1052	1.8221	3.0042	4.953	8.1662

(6mks)

f) Given $\vec{A} = 2i - 3j - k$

$\vec{B} = 2i + j + 3k$

$\vec{C} = 3i + j + 4k$

Determine $(A.C) B$ (3mks)

Question TWO (20mks)

a) Given $A = \begin{pmatrix} 4 & 5 & 1 \\ 1 & -2 & -3 \\ 3 & -1 & -2 \end{pmatrix}$

Find A^{-1} (10mks)

b) Find the Taylor series of $\frac{1}{1-x}$ about $a=2$ (7mks)

c) Given $\vec{A} = 2\mathbf{i} + \mathbf{j} + 3\mathbf{k}$

$$\vec{B} = -3\mathbf{i} + 2\mathbf{j} + \mathbf{k}$$

$$\vec{C} = \mathbf{i} - \mathbf{j} + 3\mathbf{k}$$

Determine $(\vec{A} \cdot \vec{C}) \vec{B} - (\vec{A} \cdot \vec{B}) \vec{C}$ (3mks) Type equation here.

Question THREE (20mks)

a) Forces in three members of framework are F_1 , F_2 and F_3 and related as below solve for F_1 , F_2 and F_3 using Cramer's rule

$$2F_1 + 3F_2 - 4F_3 = 26$$

$$F_1 - 5F_2 - 3F_3 = 87$$

$$-7F_1 + 2F_2 + 6F_3 = 12 \text{ (14mks)}$$

b) Use Maclaurin series to find the expansion of $(2+x)^4$ (6mks)

Question FOUR (20mks)

a) Find the root of the equation $x^3 - 5x - 40 = 0$ using Newton Raphson method. Take $x_0 = 4$ (12mks)

b) Given $A = x^2y^2\mathbf{i} + x^3y\mathbf{j} - y\mathbf{k}$

Find

i) Div A (3mks)

$$\text{II) } \nabla \times A \text{ at } (1, -1, 2)$$

(5mks)

Question FIVE (20mks)

a) Using determinant method solve the following simultaneous equation

$$3x + 4y + z = 10$$

$$2x - 3y + 5z + 9 = 0$$

$$x + 2y - z = 6$$

(15mks)

b) Given $\vec{A} = -2\mathbf{i} + \mathbf{j} - 2\mathbf{k}$

$$\vec{B} = 6\mathbf{i} - 4\mathbf{j} + \mathbf{k}$$

$$\vec{C} = -5\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$$

Determine $(\vec{A} \times \vec{B}) \times \vec{C}$ (5mks)