TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MECHANICAL ENGINEERING

AMA 2250: ENGINEERING MATHEMATICS III

SPECIAL/ SUPPLIMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME:2HOURS

DATE: Pick DateSep2018

Instructions to Candidates

You should have the following for this examination

-*Answer Booklet, examination pass and student ID, Scientific calculator, a ruler*

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

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Question 1

a) Given A = 2i-3j+k , B =i+2j-k, C = 3i+j+3k

Determine the vector triple product

A× (B×C) (6 Marks)

b) Three numbers are in arithmetic progression. Their sum is 15 and their product is 45. Determine the three numbers. (6 Marks)

c) When a number of mass and spring systems are connected together and have a mode of oscillation and all masses oscillate with a frequency $\frac{n}{2\pi}$ but having different amplitudes, n can be given interms of Eigen values λ ($where \quad \lambda = n^2$) by the determinant.

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$$\begin{vmatrix} 1-\lambda & -{}^{1}/_{2} & 0 \\ -{}^{3}/_{4} & {}^{6}/_{4}-\lambda & -{}^{3}/_{4} \\ 0 & -{}^{3}/_{4} & 1-\lambda \end{vmatrix} = 0$$

i) Show that $16\lambda^3 - 56\lambda^2 + 49\lambda - 9 = 0$

ii) Verify that $\lambda=1$ is one of the solutions for λ (8 Marks)

d) Forces (-3-j5) N, (13+j2) N, (-8+j4) N and (x+jy) N are in equilibrium. Determine X and Y (4 Marks)

e) Convert to exponential form, the complex number Z=- 3+j4 (3 Marks)

f) Given A = 4+j3, B= -2+j, C=2-j5

Determine $\frac{A}{BC}$ (3 Marks)

Question 2

a) Determine the angle between the vectors A and B given

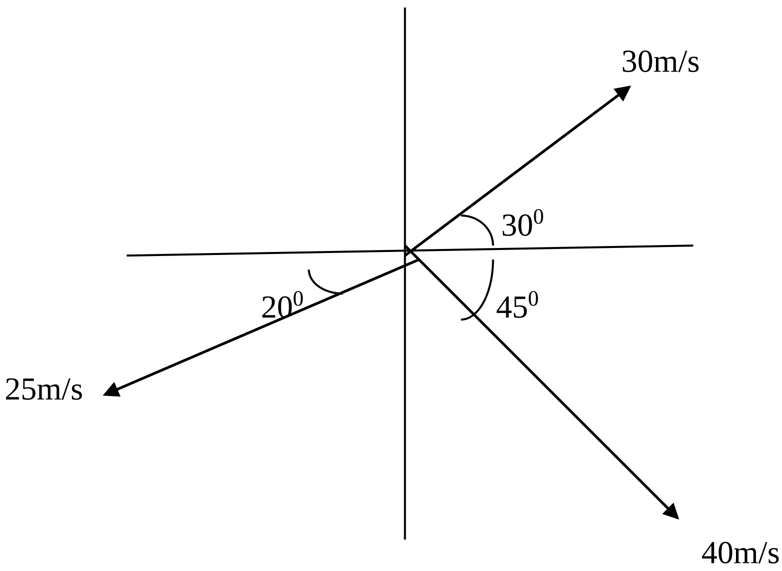
Vector A =2i+3j+4k

Vector B = i-2j+3k

i) A.B (6 Marks)

b) Determine the resultant of the velocities in diagram 1

(6 Marks)



c) If Ø= $x^2yz^3 + xy^2z^2$, determine grad Ø at the point p(1,2,3) (8 Marks)

Question 3

a) Insert four terms between 5 and 22.5 to form an arithmetic progression, 4 being the first term and 22.5 being the sixth term (5 Marks)

b) The 1^{st}, 12^{th} and the last term of an arithmetic progression are 4, 31.5 and 376.5. Determine the sum of the series up to the last term (5 Marks)

c) In a hardware store, cylindrical shaped pipes are stacked in layers .Each layer contains one pipe less than the layer below it. There are 4 pipes in the top most layers.
If there n layers in total, determine the expression for the total number of pipes stacked. (4 Marks)

d) A business is expected to have a yearly profit of Kshs 27500 for the year 2016.The profit is expected to increase by 10% per year.
   i) Show that the difference between expected profit for the year 2020 and 2021 is Kshs 40300 to the nearest hundred shillings.
   ii) Determine the first year the expected yearly profit will be more than Kshs 1 million (6 Marks)

Question 4

a) The currents flowing through an electrical system are given by the following system of equations. The three currents I_1, I_2 and I_3 are measured in amps.

$I_1+2I_2-I_3=8.4$

$3I_1-I_2+2I_3=2.225$

$5I_1+I_2+2I_3=3.775$

The three currents I_1, I_2 and I_3 are measured in amps.

Solve the system of equations using Inverse Matrix method to determine the currents I, I and I flowing through this circuits. (10 Marks)

b) Solve using determinants method the following system of equations.

c) $4x+9y+2z=21$

$13x+5y+7z=1$

d) $17x+19y+8z=26$ (10 Marks)

Question 5

a) Given $Z_1 = 2+j$, $Z_2=1-j$, $Z_3=2+j2$

Obtain using Argand diagram (5 Marks)

$Z_1+Z_3-Z_2$

b) Obtain the cube roots of the complex number $Z= -3+j4$ in Cartesian form (8Marks)

c) Obtain in exponential form $(1+j)^{2+j}$ (7 Marks)