SM	
EM	
FM	

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

B Eng Tech.
MINING ENGINEERING & MINERAL SURVEY

MODULE **MATM1B1**

CAMPUS **DFC**

JANUARY EXAMINATION

DATE : **06/01/2020** **SESSION : 08H00 – 10H00**

ASSESSOR
MR EZ MORAPELI

INTERNAL MODERATOR
DR P DLAMINI

DURATION **2 HOURS** **MARKS** **60**

SURNAME AND INITIALS: _____

STUDENT NUMBER: _____

CONTACT NO: _____

NUMBER OF PAGES: 11

INSTRUCTIONS : ANSWER ALL THE QUESTIONS IN THE SPACES PROVIDED
REQUIREMENTS : NON-PROGRAMMABLE SCIENTIFIC CALCULATOR

QUESTION 1 [9 marks]

1.

1.1 If $A=\begin{bmatrix} 1 & 2 & 2 \\ 3 & 7 & 9 \\ -1 & -4 & -7 \end{bmatrix}$.

Find A^{-1} (**using elementary row operations**) (6)

1.2 Use Elementary Row Operations to solve the following system:

$$\begin{aligned} 2u + v + 3w &= 0 \\ u + 2v \quad\quad &= 0 \\ v + \ w &= 0 \end{aligned} \qquad (3)$$

QUESTION 2 [12 marks]

2. The inverse of the matrix

$$A=\begin{bmatrix}1 & -1 & 0\\ 1 & 0 & -1\\ -6 & 2 & 3\end{bmatrix} \quad \text{is } A^{-1}=\begin{bmatrix}-2 & -3 & -1\\ -3 & -3 & -1\\ -2 & -4 & -1\end{bmatrix}$$

2.1 Use A to write a cryptogram for the message "**PLEASE SEND MONEY**" (7)

2.2 use A^{-1} to decode the cryptogram
-52. 10. 27. -49. 3. 34. -49. 13. 27. -94. 22. 54. 1. 1. -7. 0. -12. 9. -121. 41. 55 (5)

QUESTION 3 [15 marks]

3. Let $p(x) = 2x^4 - 11x^3 + 14x^2 + 2x - 4$.

3.1 Use DESCARTES'S RULE OF SIGNS to find the possible number of positive and negative roots of $p(x)$. (4)

3.2 Use RATIONAL ROOTS THEOREM to find all possible rational roots of $p(x)$. (2)

3. 3 Use trial and error to find **one** (rational) root $x = a$, of $p(x)$. (3)

3. 4 Use FACTOR THEOREM (and possibly long division) to partially factorize into the form $p(x) = (x - a)q(x)$. (3)

3.5 Use trial error and 3.1.3 above to find the one (rational) root of $q(x)$. (2)

3.6 Find the complete (explain why its complete) factorization of $p(x)$. (3)

QUESTION 4 [12 marks]

4.1 You have invested R500 in an account that pays 6,75% interest per year, compounded weekly. How long will it take your money to trible? (4)

4.2 On a DFC campus with 5000 students, one student returns from vacation with a contagious and long lasting flu virus. The spread of the virus is modeled by

$$y = \frac{5000}{1+4999e^{-0,8t}}, t \geq 0.$$

Where y is the total number of students infected after t days. The university will cancel classes when 40% or more of the students are infected

4.2.1 How many students are infected after 5 days? (5)

4.2.2 After how many days will the university cancel classes? (3)

QUESTION 5 [12 marks]

5.1 How much money should be invested every quarter at 10% per year, compounded quarterly, in order to have R5000 in 2 years? (4)

5.2 A couple borrows R500000 at 9% interest per year as a mortgage loan on a house. They expect to make monthly payments for 20 years to repay the loan. What is the size of each payment? (4)

5.3 what is the present value of an annuity that consists of 20 semi annual payments of R1000 at the interest rate of 9% per year? (4)

DO ANY QUESTION YOU MAY HAVE CANCELLED HERE: