INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

FACULTY OF SCIENCE AND TECHNOLOGY

END OF SEMESTER EXAMINATIONS - MAY 2024/2025

PROGRAMME: BSEM

YEAR/SEM: YEAR 1/SEMESTER 1

COURSE CODE: BSE1101

NAME: MATHEMATICS FOR ENVIRONMENTAL SCIENCE

DATE: 2025-08-07

TIME: 9:00AM-12:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Attempt all (40 Marks, Write the correct alternative in the booklet provided)

Question 1:

1. What will be the value of P(not E) if P(E) = 0.07? A) 0.93 B) 0.07 C) 0 D) 1 2. Given the sample space S={1,2,3,…,10}, what is the probability of obtaining an even number? A) 1/5 B) 1/2 C) 2/3 D) 1/10 3. If X and Y are mutually exclusive events, the probability of X or Y is given by A) P(X or Y)= P(X)-P(Y) B) P(X or Y)= P(X)*P(Y) C) P(X or Y)= P(X)+P(Y) D) P(X or Y)= 0 4. Events A and B are such that P(A)=19/30, P(B)=2/5 and P(A or B)=4/5. Find P(A and B). A) P(A and B)= 38/150 B) P(A and B)= 7/30 C) P(A and B)=1/2 D) P(A and B)=4/5 5. If set A = {1, 2, 3} and set B = {3, 4, 5}, what is A n B? A) {1, 2, 3, 4, 5} B) {3} C) {1,2} D) {4, 5} 6. If set A = {1, 2, 3} and set B = {3, 4, 5}, what is AUB? A) {3} B) {1, 2,3,4,5} C) {1, 2, 3} D) {4, 5} 7. What is the complement of the set A = {apple, banana, orange}? A) {apple, banana, orange} B) Universal set C) {grape, peach, mango} D) { } 8. If A = {1, 2, 3} and B = {3, 4, 5}, what is A - B (A subtract B)? A) {1, 2, 3, 4, 5} B) {3} C) {4,5} D) {1,2} 9. If set A = {1, 2, 3} and set B = {2, 3, 4}, what is A n (A U B)? A) {1, 2, 3} B) {2, 3} C) {1, 2, 3, 4} D) {2, 3, 4} 10. What is the order of the matrix below? $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix}$ A) 3X2 B) 2X3 C) 2X2 D) 3X3 11. Which of the following relations on the set {1,2,3,4} is reflexive? A) {(1,1),(2,2),(3,3)}
B) {(1,2),(2,3),(3,4)}
C) {(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)}
D) {(1,2),(2,1),(3,4),(4,3)} 12. Which of the following relations on {a,b,c} is transitive? A) {(a,a),(b,b),(c,c),(a,b),(b,c)}
B) {(a,b),(b,c),(c,a)}
C) {(a,b),(b,c),(c,b)}
D) {(a,a),(b,b),(c,c),(a,b),(b,a),(b,c),(a,c)} 13. Let $A = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & 2 \\ 1 & 3 \end{pmatrix}$. What is $A \cdot B$?

A) $\begin{pmatrix} 12 & 7 \\ 19 & 14 \end{pmatrix}$

B) $\begin{pmatrix} 7 & 12 \\ 14 & 19 \end{pmatrix}$

C) $\begin{pmatrix} 9 & 4 \\ 14 & 11 \end{pmatrix}$

D) $\begin{pmatrix} 7 & 9 \\ 12 & 14 \end{pmatrix}$

14. Which of the following relations on {1,2,3} is both symmetric and antisymmetric? A) {(1,1),(2,2),(3,3),(1,2),(2,1)}
B) {(1,1),(2,2),(3,3)}
C) {(1,1),(2,2),(3,3),(1,2),(2,1),(2,3)}
D) {(1,1),(2,2),(3,3),(1,2),(2,1),(3,2)} 15. What is the negation of the statement: "It is not sunny, and it is not raining"? A) It is sunny or it is raining B) It is sunny or it is not raining C) It is sunny and it is raining D) It is not sunny or it is raining 16. Floor (1.999) + Ceil(2.988) is equal to _____
A) 1
B) 6
C) 5

A) $\frac{x+2}{3}$

B) $\frac{x-2}{3}$

C) $3x + 2$

D) $\frac{2-x}{3}$

D) 4 17. If f(x)=3x-2, what is $f^{-1}(x)$ 18. In how many ways can 3 books be arranged on a shelf? A) 3
B) 6
C) 9
D) 27 19. In how many ways can a committee of 3 people be selected from a group of 7 people? A) 7
B) 21
C) 35
D) 42 20. How many different ways can the letters in the word "ALGORITHM" be arranged? A) 10! B) 10!/2! C) 10!/(2!x3!) D) 10!/(2!x2!)

Section B Attempt any four (60 Marks)

Question 1:

(a) Use matrix inversion to solve the following

$$3x + 4y = 18$$
$$5x - 2y = 4$$

$$A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

(a) Given the matrices

Find (i) A+B(ii) A-B (iii) AB

Question 2:

(a) In a school, there are two clubs: Sports and Music. 15 students are in both clubs, 20 are only in Sports club and 10 students are only in Music club. Find the total number of students (a) In the Sports club,(b) In the music club, (c) In either Music Club or Sports Club. (b) Using Venn diagrams shade the following regions:

(i) $(A \cap B)^c$

(ii) $(A \cup B)^c$

Question 3:

Use Cramer's rule to solve the following system: $3x - 2y = 1$

$5y+z = 44$

$2z - 3x = 3$

Question 4:

Consider the sets A = {20, 30, 40, 50} and B = {25, 30, 40, 60, 70}. Find

(a) $A \cap B$

(b) $A \cup B$

(c) $A \oplus B$

(d) $A \setminus B$

(e) $B \setminus A$

Question 5:

(a) Prove that the propositions $\neg p \vee \neg q$ and $\neg (p \wedge q)$ are equivalent.

(b) Verify that $p \vee \neg (p \wedge q)$ is a tautology.

Question 6:

(a) Let $f(x) = 0.5(3x+2)$. Find a formula for the inverse function $f^{?1}$. (b) Given that $h(x)=5x^2+2$ and $f(x)=(3x+2)$. Find the composition function $h \circ f$.