REV-01
BMT/07/12

2025/12

SET A

B.Sc. MATHEMATICS
FIRST SEMESTER
ALGEBRA
BMT-MIN-911
[USE OMR FOR OBJECTIVE PART]

Duration: 3 hrs. **Full Marks: 70**

(Objective)

Time: 30 min. **Marks: 20**

Choose the correct answer from the following: ***1×20=20***

1. The determinant of a 3x3 matrix is non-zero then the rank of the matrix is
   a. 0 b. 3
   c. 2 d. 1

2. The inverse of a matrix A exists if
   a. $A=0$ b. $|A|=1$
   c. $A\neq 0$ d. $|A|\neq 1$

3. The order of the product of a 3x2 and 2x3 matrices is
   a. 2x2 b. 3x2
   c. 3x3 d. 2x3

4. "S and T" is a true statement where S is a true statement then T is
   a. False b. True
   c. Data insufficient d. None

5. According to De-Moivre's theorem $(\cos\theta + i\sin\theta)^n$ is equal to
   a. $\cos n\theta + i\sin n\theta$ b. $\sin\theta + i\cos\theta$
   c. $\cos\theta - i\sin\theta$ d. $\sin n\theta + i\cos n\theta$

6. The function $f: \mathbb{N} \to \mathbb{N}$ defined by $f(x) = x$ is
   a. one-one only b. onto only
   c. bijective d. many-one

7. If $a \Longrightarrow b$ and $b \Longrightarrow c$ then $a \Longrightarrow c$, this relation is known as
   a. symmetric b. anti-symmetric
   c. reflexive d. transitive

8. The rank of a matrix is equal to
   a. Number of rows b. Number of columns
   c. Number of non-zero rows in echelon form d. Number of zero rows in echelon form

9. If A is an nxn matrix then A^{-1}
   a. $\frac{adj\ A}{|A|}$ b. $-\frac{adj\ A}{|A|}$
   c. $\frac{|A|}{adj\ A}$ d. $-\frac{|A|}{adj\ A}$

10. For $z = 1 + i$, θ is equal to

a. $\frac{\pi}{2}$ b. $\frac{\pi}{4}$

c. 0 d. $\frac{\pi}{3}$

11. The polar form of $z = -2i$ is

a. $2\left(cos\,\frac{\pi}{2} + isin\,\frac{\pi}{2}\right)$ b. $2(cos\,0 + isin\,0)$

c. $2\left(cos\,\frac{\pi}{3} + isin\,\frac{\pi}{3}\right)$ d. $2\left(cos\,\frac{\pi}{2} - isin\,\frac{\pi}{2}\right)$

12. If $z_1 = 3 - i$ and $z_2 = 2 + 2i$ then $z_1 + z_2$ is

a. $5+i$ b. $5 - 3i$

c. $5-i$ d. $5 + 3i$

13. De Moivre's theorem states

a. $(\cos\,\theta + i\sin\theta)^n = \cos\,n\theta + i\sin n\theta$ b. $(\cos\,\theta + i\sin\theta)^n = \cos\,n\theta$

c. $(\cos\,\theta + i\sin\theta)^n = \cos\,n\theta - i\sin n\theta$ d. $(\cos\,\theta + i\sin\theta)^n = i\sin n\theta$

14. The imaginary part of $z = 2 - i$ is

a. 1 b. -2

c. -1 d. 2

15. A function is called bijective if it is

a. One-one only b. Both one-one and onto

c. Onto only d. constant

16. If a function f is onto then

a. Range(f) = domain b. Range(f) = codomain

c. No relation d. domain = codomain

17. If the universal set U={1,2,3,4,5}and A={2,4}, then A^c is equal to

a. {1,3,5} b. {2,4}

c. {3,5} d. {1,2,5}

18. If A= {1,2,3} and B={3,4,5} then A\B is equal to

a. {4,5} b. {1,2,3,4,5}

c. {1,2} d. {1,3}

19. If $A \subset B$ then

a. A contains all elements of B b. A=B

c. No relation d. B contains all elements of A

20. If $A \subset B$ and $B \subset C$ then

a. $A \subset C$ b. $A = B$

c. $C \subset B$ d. $C \subset A$

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Descriptive

Time : 2hrs. 30mins. **Marks : 50**

[Answer question no.1 & any four (4) from the rest]

1. Define reflexive, symmetric, anti-symmetric and transitive relations. **10**
Consider the following relation on the set $A=\{1,2,3,4\}$

$R_1=\{(1,1),(1,2),(2,3),(1,3),(4,4)\}$

$R_2=\{(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)\}$

$R_3=\{(1,3),(2,1)\}$

$R_4=A\times A$

Determine which of the following are reflexive, symmetric, anti-symmetric and transitive.

2. Do as directed: **10**

a) Find the roots of $z^n=1$

b) Find the roots of $z^3=1$

3. Using De-Movire's Theorem find the values of: **10**

a) $z=(\cos\frac{\pi}{6}+i\sin\frac{\pi}{6})^{12}$

b) $z=(\cos\frac{\pi}{3}+i\sin\frac{\pi}{3})^{\frac{1}{3}}$

c) $z=(\sqrt{3}+i)^5$

d) $z=(\sqrt{3}+i)^{\frac{1}{5}}$

e) $z=(\cos\frac{\pi}{2}+i\sin\frac{\pi}{2})^2$

4. Find the rank of the matrices: **10**

a) $\begin{bmatrix}2 & 2\\ 1 & -1\end{bmatrix}$ b) $\begin{bmatrix}2 & 1 & 2\\ 1 & 0 & 1\\ 3 & 2 & 1\end{bmatrix}$ c) $\begin{bmatrix}1 & 0 & 1\\ 2 & 3 & 2\\ 0 & 1 & 1\end{bmatrix}$ d) $\begin{bmatrix}1 & 2 & 1\\ 1 & 2 & 1\\ 2 & 1 & 1\end{bmatrix}$

e) $\begin{bmatrix}2 & 0 & 1\\ 2 & 1 & 1\\ 1 & 1 & 1\end{bmatrix}$

5. Solve the following pair of equations using Inverse Matrix Method **10**

$2x+3y-z=9$

$x+y+z=9$

$3x-y-z=-1$

6. Expand $\tan n\theta$ in terms of $\tan \theta$. **10**

7. Check if the given functions are bijective **10**

(a) f: $R \rightarrow R$ where $f(x)=e^x$

(b) f: $[0, \frac{\pi}{2}] \rightarrow [-1,1]$ where $f(x)=\sin x$

(c) f: $R \rightarrow R$ where $f(x)=\cos x$

(d) f: $R \rightarrow R$ where $f(x)=x^2$

(e) f: $N \rightarrow N$ where $f(x)=x$

8. Represent the following complex numbers in polar form: **10**

a) $z = 3 + i$

b) $z = 2 + 2i$

c) $z = -3 + i$

d) $z = 3i$

e) $z = \sqrt{3} + i$

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