

# Mangalore University

## Entrance Examination for Admission to M. Sc. Mathematics Programme 2022-23

Time : **60 minutes**

Max. marks : **50**

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### Details of the Candidate

| Application Number | Name of the Candidate | Signature of the Candidate | Signature of the Invigilator |
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### Note

- Answer all questions. Each question carries **2 marks**.
  - Choose/Tick the **most appropriate response** from the given four alternatives.
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1. The rank of the  $4 \times 6$  matrix  $\begin{pmatrix} 1 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{pmatrix}$

- (a) 1.                      (b) 2.                      (c) 3.                      (d) 4. ✓

2. The dimension of the vector space of all skew symmetric matrices of order  $2 \times 2$  with real entries is

- (a) 2.                      (b) 3.                      (c) 1. ✓                      (d) 4.

3. The number of maps from a set of 4 elements to a set of 3 elements is

- (a) 36.                      (b) 69.                      (c) 64.                      (d) 81. ✓

4. Which of the following is TRUE?

- (a) Every proper subgroup of  $\mathbb{Z}_n$  is cyclic. ✓      (c) Every proper subgroup of  $S_4$  is cyclic.  
(b)  $\mathbb{Z}_n$  is cyclic iff  $n$  is prime.                      (d) Every subgroup of an abelian group is cyclic.

5. The number of generators of the additive group  $\mathbb{Z}_{36}$  is

- (a) 6.                      (b) 12. ✓                      (c) 36.                      (d) 18.

6. Let  $\sigma$  be an element of the permutation group  $S_3$ . Then the maximum possible order of  $\sigma$  is

- (a) 5.                      (b) 3. ✓                      (c) 6.                      (d) 2.

7. What is the value of  $\phi(500)$ , where  $\phi$  represents Euler totient function.
- (a) 100. (b) 500. (c) 250. (d) 200. ✓
8. For  $0 < a < b$ ,  $\lim_{n \rightarrow \infty} \frac{a^{n+1} + b^{n+1}}{a^n + b^n}$  equals
- (a)  $a$  (b)  $b$  ✓ (c) 1 (d) 0
9.  $\lim_{x \rightarrow \infty} \frac{x}{e^x}$  equals
- (a) 0. ✓ (b) 1. (c)  $e$ . (d)  $\infty$ .
10. Let  $R$  be a commutative ring with identity, whose only ideals are  $(0)$  and  $R$  itself. Then  $R$  is
- (a) integral domain. (b) field. ✓ (c) division ring. (d) none.
11. The general solution of  $y'' + y = 0$  is
- (a)  $y = C_1 \sin x + C_2 \cos x$ . ✓ (c)  $y = e^x(C_1 \sin x + C_2 \cos x)$ .  
 (b)  $y = C_1 x^{-1} \sin x + C_2 x^{-1} \cos x$ . (d)  $y = x^{-1}(C_1 \sin \log x + C_2 \cos \log x)$ .
12. The set of all points  $(x, y)$  satisfying  $x, y \geq 0$ ,  $y + x \geq 2$ ,  $y + 4x \geq 4$  is
- (a) Bounded. (c) Empty.  
 (b) Open. (d) Unbounded. ✓
13. If zero is a root of the characteristic equation of a matrix  $A$ , then  $A$  is
- (a) singular matrix. ✓ (c) non singular matrix.  
 (b) symmetric matrix. (d) identity matrix.
14. Which of the following is an exact differential equation?
- (a)  $(y^2 - 4xy - y)dx + (y^2 - 4xy - 2x^2)dy = 0$ .  
 (b)  $(y^2 - 4xy - 2x^2)dx + (x^2 - 4xy - 2y^2)dy = 0$ .  
 (c)  $(x^2 - 2x^2y - 2y^2)dx + (y - 4xy - 2x^2)dy = 0$ .  
 (d)  $(x^2 - 2xy - y^2)dx - (x + y)^2dy = 0$ . ✓
15. The function  $f(x) = \begin{cases} x \sin \frac{1}{x} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0. \end{cases}$  Then  $f$  is
- (a) continuous and differentiable. (c) discontinuous but differentiable.  
 (b) continuous but not differentiable. ✓ (d) none.

16. Total number of edges in the complete graph  $K_7$  is

- (a) 21. ✓ (b) 18. (c) 49. (d) 28.

17. The Simpson's one-third rule for approximating the value of  $I = \int_{x_0}^{x_0+nh} f(x)dx$  is given by

- (a)  $I \approx \frac{h}{3} [f(x_0) + f(x_n) + 2\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 4\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$ .  
 (b)  $I \approx \frac{h}{3} [f(x_0) + f(x_n) + 4\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 2\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$ . ✓  
 (c)  $I \approx \frac{h}{2} [f(x_0) + f(x_n) + 4\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 2\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$ .  
 (d)  $I \approx \frac{h}{2} [f(x_0) + f(x_n) + 2\{f(x_1) + f(x_3) + \cdots + f(x_{n-1})\} + 4\{f(x_2) + f(x_4) + \cdots + f(x_{n-2})\}]$ .

18.  $\lim_{n \rightarrow \infty} (n)^{1/n}$  equals

- (a) 0. (b) 1. ✓ (c)  $e$  (d)  $\infty$

19. The unit digit of  $4^{2020}$  is

- (a) 2. (b) 4. (c) 6. ✓ (d) 8.

20. The solution of the initial value problem  $4y'' - 8y' + 3y = 0$ ;  $y(0) = 1$ ,  $y'(0) = 3$

- (a)  $-\frac{3}{2}e^{\frac{x}{2}} + \frac{5}{2}e^{\frac{3x}{2}}$ . ✓ (b)  $\frac{3}{2}e^{\frac{x}{2}} - \frac{5}{2}e^{\frac{3x}{2}}$ . (c)  $-\frac{3}{2}e^{\frac{-x}{2}} + \frac{5}{2}e^{\frac{-3x}{2}}$ . (d)  $\frac{3}{2}e^{\frac{-x}{2}} - \frac{5}{2}e^{\frac{-3x}{2}}$ .

21. The number of 3 digit numbers formed with  $S = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$  last digit being odd are

- (a) 400. (b) 450. ✓ (c) 350. (d) 300.

22. In  $\mathbb{Z}_5$ , order of 2 is

- (a) 1. (b) 5. ✓ (c) 2. (d) 4.

23. For the sequence  $\{\frac{n}{n+1}\}$ , which of the statement is not true.

- (a) The sequence is convergent. (c) The sequence is bounded.  
 (b) The sequence is increasing. (d) The sequence is divergent. ✓

24. Let  $x_1 = 1$  and  $x_{n+1} = \frac{1}{2}x_n^2$ . Then  $\lim_{n \rightarrow \infty} x_n$  equals

- (a) 0. ✓ (b) 2. (c) 1/2. (d)  $\infty$ .

25. If every edge of the graph  $G$  appears exactly once in a path, then it is

- (a) Hamiltonian path (b) Simple path. (c) Eulerian path. ✓ (d) Shortest path.

Application Number:

Name:

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## Space for Rough Work