

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2023.

First Semester Mathematics

Foundation Course — BRIDGE MATHEMATICS

(For those who joined in July 2023 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

- 1. 1C1 = ... (a) 0 (b) 1 (c) 2 (d) None of the above
2. (a + b)^n, n in N = ... (a) sum nCk a^{n-k} b^k (b) sum (n+1)Ck a^{n-k} b^k (c) sum (n-1)Ck a^{n-k} b^k (d) sum nC_{k+1} a^{n-k} b^k

3. e^x =

- (a) sum_{n=0}^{\infty} x^n/n! (b) sum_{n=1}^{\infty} x^n/n! (c) sum_{n=0}^{\infty} x^n/(n+1)! (d) sum_{n=0}^{\infty} x^n/(n-1)!

4. When |x| < 1, sum_{n=0}^{\infty} x^n =

- (a) (1+x)^{-1} (b) (1-x)^{-1} (c) (1-x)^{-2} (d) (1+x)^{-2}

5. 5P3 =

- (a) 16 (b) 61 (c) 60 (d) 160

6. 6P2 / 6C2 =

- (a) 6 (b) 2 (c) 8 (d) 4

7. sin 2theta =

- (a) 2 tan theta / (1 - tan^2 theta) (b) 2 tan theta / (1 + tan^2 theta) (c) tan theta / (1 - tan^2 theta) (d) tan theta / (1 + tan^2 theta)

8. sin 18 degrees =

- (a) cos 18 degrees (b) cos 36 degrees (c) cos 72 degrees (d) sin 54 degrees

9. lim_{x to 0} |x| =

- (a) infinity (b) x (c) -x (d) 0

10. If y = x^4 - 6x^2 - 5x + 3, then y'' =

where y'' = d^2y/dx^2

- (a) 3x^2 - 12x - 5 (b) 6x - 12 (c) 6 (d) 3x^2 + 12x + 5

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Prove that nC_r + nC_{r-1} = (n+1)C_r

Or

(b) Prove that nC_0 + nC_1 + nC_2 + ... + nC_n = 2^n

12. (a) Expand 1/(1+3x)^2

Or

(b) Prove that e + e^{-1} / 2 = 1 + 1/2! + 1/4! + 1/6! + ...

13. (a) A salad at a certain restaurant consists of 4 of the following fruits : apple, banana, guava, grapes, pomegranate, papaya and pineapple. Find the total possible number of fruit salads.

Or

(b) Find (i) 5P_3 (ii) 8P_4 (iii) 6P_5

14. (a) Prove that 1 - 1/2 sin 2x = (sin^3 x + cos^3 x) / (sin x + cos x)

Or

(b) Prove that sin 4A = 4 sin A cos^3 A - 4 cos A sin^3 A

15. (a) Find d/dx (2^x)

Or

(b) Find integral of sqrt(15-2x) dx

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Find $\sqrt[3]{65}$.

Or

(b) Compute 102^4 .

17. (a) Write the first 6 terms of the sequences whose n^{th} term a_n is given below :

(i) $a_n = \begin{cases} n+1 & \text{if } n \text{ is odd} \\ n & \text{if } n \text{ is even} \end{cases}$

(ii) $a_n = \begin{cases} n & \text{if } n \text{ is } 1, 2 \text{ or } 3 \\ a_{n-1} + a_{n-2} + a_{n-3} & \text{if } n > 3 \end{cases}$

(iii) $a_n = \frac{(-1)^n}{n}$.

Or

(b) Evaluate $\frac{n!}{r!(n-r)!}$ when

(i) $n = 7, r = 5$

(ii) $n = 50, r = 47$

(iii) For any n , with $r = 3$.

18. (a) Prove that $10C_2 + 2 \times 10C_3 + 10C_4 = 12C_4$.

Or

(b) If $10P_r = 7P_{r+2}$, find r .

19. (a) Find $\tan(A+B+C)$.

Or

(b) Simplify : $\frac{\sin 75^\circ - \sin 15^\circ}{\cos 75^\circ + \cos 15^\circ}$.

20. (a) If $y = \frac{\cos x}{x^3}$, find $\frac{dy}{dx}$.

Or

(b) Evaluate $\int \log x \, dx$.