Roll No. _____ **NLCS/11/ Mathematics Core (041)/15**

Half Yearly Examination 2024 – 2025

Time - 3:00 Hrs. **M.M. 80**

General Instructions:

1. This Question paper contains - **five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. **Section A** has 18 **MCQ's** and 02 Assertion-Reason based questions of 1 mark each.
3. **Section B** has 5 **Very Short Answer (VSA)**-type questions of 2 marks each.
4. **Section C** has 6 **Short Answer (SA)**-type questions of 3 marks each.
5. **Section D** has 4 **Long Answer (LA)**-type questions of 5 marks each.
6. **Section E** has 3 **source based/case based/passage based/integrated units of assessment** (4 marks each) with sub parts.

SECTION – A

Questions 1 to 20 carry 1 mark each.

Q.1 Find the total number of parallelogram in an 8 by 8 chess board respectively.

(a) 234 (b) 46 (c) 130 (d) 1296

Q.2 If (x + 1 , y – 4 = (4, 11) then write the value of x and y.

(a) x = 3, y = 3 (b) x = 3, y = 2 (c) x = 2, y = 2 (d) $x=3, y=15$

Q.3 Let A = {x,y,z} and B ={4,2} .Find the number of relations from A to B.

(a) 0 (b) 5 (c) 45 (d) 64

Q.4 If tan A = $\frac{1}{3}$ and tan B = $\frac{1}{4}$, then the value of A + B is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) 0 (d) not

Q.5 Let $f(x) = x^2$ and g(x) = 2x - 1 be two real functions. then (f + g) (x) equals.

(a) 2x +1 (b) 3x+7 (c) 4x + 9 (d) x^2+2x-1

Q.6 If the letter of the word 'CHALK be arranged in all possible order in English dictionary, what is the rank of word 'CHALK'

(a) 111 (b) 211 (c)143 (d) NOT

Q.7 $(1.00)^{10000}$ is _____1000.

(a) grater than (b) less than (c) equal to (d) greater than or equal to

Q. 8 $\tan 765^0$ equals :

(a) 1 (b) 4 (c) 7 (d) –1

Q. 9 Evaluate i^{1000}

(a) 1 (b) 2 (c) 27 (d) 6

Q.10 The multiplicative inverse of 4 – 3i is

(a) 2 + 3i (b) 4+6i (c) 9+8i (d) $\frac{4+3i}{25}$

Q.11 the value of $\tan 15^0$ is

(a) 6 (b) $\frac{3}{5}$ (c) $\frac{2}{5}$ (d) $2-\sqrt{3}$

Q.12 factorial 7 equals

(a) 5040 (b) 40320 (c) 3241 (d) 40320

Q.13 99^3 equals :

(a) 62345 (b) 223145 (c) 78965 (d) 970299

Q.14 Find the number of permutation of letter of word' FATHER'

(a) 344 (b) 977 (c) 720 (d) not

Q.15 The number of ways 10 digit numbers can be written using the digits 1 and 2 if repeatation of digit is allowed :

(a) 2^{10} (b) 10^2 (c) 3^{10} (d) 2^{11}

Q.16 The number of ways in which 6 students can be seated in a line is :

(a) 40320 (b) 3248 (c) 720 (d) 712

Q.17 How many elements are there in the complement of set A?

(a) 0 (b) 1 (c) All the elements of A (d) 6 elements

Q.18 Total number of terms in the expantion of $(x + a)^n$ is

(a) n terms (b) (n +1) terms (c) (n - 1) terms (d) 10 term

Assertion-Reason Based Questions (Question No. 19 & 20):

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is false and R is false.

(d) A is false but R is true.

Q.19. **Assertion (A):** : $(1 +i)^n/(1 –i)^n$ =1 least positive integral value of n is1

Reason (R) : since a + ib is complex number

Q.20**.** **Assertion (A):** factorial 7 is 5040

Reason (R): factorial means the continuous product of first n natural number.

SECTION – B

Questions 21 to 25 carry 2 marks each.

Q.21 Solve 5x + 3 < 2x + 9. Show the graph of the solutions on number line.

OR

Solve 3x + 3 < 5x + 6. Show the graph of the solutions on number line.

Q.22 A wheel makes 360 revolutions in one minute, Through how many radians does it turn in one second.

Q.23 Prove that $\cos 4x = 1 - 8\sin^2 x \cos^2 x$.

Q.24 Find the domain of the function $f(x) = (x^2 + 4x + 5)/(x^{22} - 5x + 4)$.

OR

Find the domain of the function $f(x) = (x^{22} + 3x + 5)/(x^{22} - 8x + 12)$

Q.25 Solve $12x < 100$, when x is a natural number.

SECTION – C

Questions 26 to 31 carry 3 marks each.

Q.26 . Prove that $\pi^c = 180^0$

OR

Prove that $\tan 70^0 = \tan 20^0 + 2\tan 50^0$

Q.27 Find all pairs of consecutive even natural numbers , both of which are larger than 5, such that their sum is less than 23.

Q.28 Let A = {0, 1, 2, 3, 4, 5}, B = {2, 4, 6, 8} and C = {1, 3, 5, 7}

Verify $(A \cup B) \cup C = A \cup (B \cup C)$

Q.29 Find real θ such that $(3+62i\sin\theta) / (1 - 72i\sin\theta)$ is purely imagenary.

OR

Find the real numbers x and y if $(x - iy)(53 + 59i)$ the conjugate of $-86 - 294i$

Q.30 For any two complex numbers z_1 and z_2 prove that $\text{Re}(z_1 z_2) = \text{Re}z_1 \text{Re}z_2 - \text{Im}z_1 \text{Im}z_2$

OR

If $a = \cos\theta + i\sin\theta$, then prove that $\left(\frac{1+a}{1-a}\right) = i\cot\frac{\theta}{2}$.

Q.31 Show that $9^{n+1} - 8n - 9$ is divisible by 64 ,whenever n is positive integer.

SECTION – D

Questions 32 to 35 carry 5 marks each.

Q.32 Find the value of $\tan\frac{\pi}{8}$.

Q.33 In how many ways can the letters of the word PERMUTATIONS be arranged if the

(i) Words start with P and end with S,

(ii) Vowels are all together,

OR

A committee of 7 has to be formed from 8 boys and 4 girls. In how many ways can this be done when the committee consists of:

(i) Exactly 2 girls?

(ii) At least 3 girls?

Q.34 If $(x + iy)^3 = u + iv$ then show that $\frac{u}{x}+\frac{v}{y}=4\left(x^2-y^2\right)$.

OR

Find the number of non-zero integral solutions of the equation $1-i^x = 2^x$

Q.35 How many 3-digit even numbers can be made using the digits 1, 2, 3, 4, 6, 7, if (i) no digit is repeated (ii) if digit is repeated?

SECTION – E (Case Study Based Questions)

Questions 36 to 38 carry 4 marks each.

Q.36 Case Study 1 : During the mathematics class, a teacher clears the concept of permutation and combination to the 11" standard students. After the class he asks the students some questions, one of the question was in how many ways numbers between 99 and 1000 (both excluding) can be formed such that

Based on the above data, answer the following questions.

(i) every digit is either 4 or 8

(ii) there is no restriction

(iii) No digit is repeated

OR

(iv) The digit at hundred's place is 7.

Q.37 Case-Study 2:

(i) $x+iy=\frac{(a+ib)}{(a-ib)}$ then find x^2+y^2.

(ii) Find i^{1028}.

(iii) Find modulus of 4 + 3i.

OR

(iv) Evaluate $(1 - i)^4$.

Q.38 Case-Study 3 2+2

(i) Find $\cot 75^0$ equals.

(ii) Prove that $\cot X\cot 2X - \cot 2X\cot 3X - \cot 3X\cot X =$

(a) 6 (b) $\frac{3}{5}$ (c) 1 (d) not

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