UG-A-1173 **BMS–21X/ BMC–21X**

U.G. DEGREE EXAMINATION — JULY, 2022.

Mathematics

(From CY – 2020 onwards)

Second Year

GROUPS AND RINGS

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions.

1. Define binary operation * on a set A.

2. Show that in a group, $x^2 = x$ if and only if $x = e$.

3. State Lagrange's theorem on a group G.

4. Define a commutative ring.

5. Define an Euclidean domain.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions.

6. Show that $f : R - \{3\} \to R - \{1\}$ given $f(x) = \dfrac{x-2}{x-3}$ is a bijection and find its inverse.

7. Let H be a non-empty finite subset of G. If H is closed under the operation G then prove that H is subgroup of G.

8. State and prove fundamental theorem of homomorphism.

9. The set R of all matrices of the form $\begin{bmatrix} a & b \\ -b & a \end{bmatrix}$ where $a, b \in R$ prove R is ring under matrix addition and matrix multiplication.

10. Prove that the ring of Gaussian integers $R = \{a + bi / a, b \in z\}$ is a Euclidean domain where we define $d(a+ib) = a^2 + b^2$.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions.

11. Define function and explain types of function.

12. Let H be a subgroup of G. Then prove that the number of left coset of H is the same as the number of right coset of H.

13. Let $G = \{1, i, -1, -i\}$ prove that G is group under usual multiplication.

14. State and prove Cayley's theorem.

15. Prove that any finite cyclic group of order n is isomorphic to $(z_n, \oplus)$.

16. Prove that z_n is a integral domain if and only if n is prime.

17. Let R is a commutative ring with identity any ideal M of R is maximal if and only if R/M is a field.

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UG-A-1174	BMS–22X

U.G. DEGREE EXAMINATION — JULY, 2022.

Mathematics

(From CY 2020 onwards)

Second Year

STATISTICS AND MECHANICS

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words.

All questions carry equal marks.

1. Find the median of the following frequency distribution.

Daily wages in Rs.	5	10	15	20	25	30
No. of persons	7	12	37	25	22	11

2. Find the coefficient of correlation between x and y from the following data :

$n = 0, \Sigma x = 50, \Sigma y = 30, \Sigma xy = -115, \Sigma x^2 = 290$, $\Sigma y^2 = 300$.

3. Three coins are tossed. Find the probability of getting at least one head and exactly 2 heads.

4. What are the uses of $t-$test?

5. Define simple harmonic motion and central orbit.

PART B — ($3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words.

All questions carry equal marks.

6. Find the quartiles from the following distribution :

Age (years)	Below 20	20-25	25-30	30-35
No. of employees	13	29	46	60
Age (years)	35-40	40-45	45-50	55 and above
No. of employees	112	94	45	21

7. The following table gives the normal weight of a baby during the six months of life.

Age in months	0	2	3	5	6
Weight in lbs.	5	7	8	10	12

Estimate the weight of a baby at the age of 4 months using Lagrange's formula.

8. Calculate price index number for 1945 by (a) Bowley's method and (b) Fisher's method.

	1935		1945	
Commodity	Price (in Rs.)	Quantity	Price (in Rs.)	Quantity
A	4	50	10	40
B	3	10	9	2
C	2	5	4	3

9. Apply χ^2 test to find out if the following table provide evidence of the effectiveness of inoculations.

	Attacked	Not-attacked
Inoculated	83	57
Not inoculated	45	68

10. Derive the Pedal equation or p-r equation of a central orbit.

PART C — (4 × 10 = 40 marks)

Answer any FOUR questions out of Seven questions in 500 words.

All questions carry equal marks.

11. Calculate the Person's coefficient of Skewness for the following data.

Class	3-7	8-12	13-17	18-22
Frequency	2	108	580	175
Class	23-27	28-32	33-37	38-42
Frequency	80	32	18	5

12. Find the coefficient of correlation between x and y from the following data.

x	10	14	15	28	35	48
y	74	61	50	54	43	26

13. For two variables X and Y the equations of the regression lines are $5X - Y = 22$ and $64X - 45Y = 24$. Find (a) Mean value of X and Y (b) Coefficient of correlation between X and Y. (c) Standard deviation of Y.

14. State and prove Chebychev's inequality.

15. A random sample of 10 boys has the following IQ's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean IQ of 100?

16. There are three main brands of a certain powder. A set of 120 sample value is examined and found to be allocated among four groups (A, B, C and D) and three bands (I, II, III) as shown here under.

	Groups			
Brands	A	B	C	D
I	0	4	8	15
II	5	8	13	6
III	18	19	11	13

Is there any significant difference in brands preference? Using ANOVA (one-way).

17. Find the resultant of two simple harmonic motions of the same period in the same straight line.

UG–A-1175 **BMS–23X**

U.G. DEGREE EXAMINATION — JULY, 2022.

Mathematics

(From CY – 2020 Onwards)

Second Year

CLASSICAL ALGEBRA AND NUMERICAL METHODS

Time : 3 hours Maximum marks : 70

PART A — (3 × 3 = 9 marks)

Answer any THREE questions out of Five questions

All questions carry equal marks.

1. Sum the series

$$\frac{3}{1^2 2^2} + \frac{5}{2^2 3^2} + \frac{7}{3^2 4^2} + \cdots + \frac{2n}{n^2 (n+1)^2}.$$

2. Find the quotient and remainder when $2x^6 + 3x^5 - 15x^2 + 2x - 4$ is divided by $x + 5$.

3. Solve the linear system $x - 4y = -2$; $3x + y = 7$ by Gauss-Jordon method.

4. Write the Newton's backward interpolation formula.

5. Using Euler's method find y for $x = 0.1$ given $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions

All questions carry equal marks.

6. Find the sum to infinite of the series $1 + \frac{3}{4} + \frac{3.5}{4.8} + \frac{3.5.7}{4.8.12} + \cdots$.

7. Solve the equation

$x^4 + 20x^3 - 143x^2 + 430x + 462 = 0$ by removing its second term.

8. Find the negative root of $x^3 - 2x + 5 = 0$ by Newton-Raphson method correct to 3 decimals.

9. Using Lagrange's interpolation formula find $f(9)$ given that $f(5) = 150$, $f(7) = 392$, $f(11) = 1452$, $f(13) = 2366$, $f(17) = 5202$.

10. Divide the range into 10 equal parts, find the approximate value of $\int_0^{\pi} \sin x \, dx$ by trapezoidal rule.

PART C — (4 × 10 = 40 marks)

Answer any FOUR questions out of Seven questions

All questions carry equal marks.

11. Sum the series $\sum_{n=1}^{\infty} \frac{n^2+3}{n+2} \cdot \frac{x^n}{n!}$.

12. Solve the equation

$6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.

13. Solve the following equation by Gauss – Seidel method. $x + 17y - 2z = 48$; $30x - 2y + 3z = 75$; $2x + 2y + 18z = 30$.

14. Find the positive root of $x - \cos x = 0$ by false position method.

15. Using the following data, find $f'(5)$ and $f''(6)$.

x	0	2	3	4	7	9
y	4	26	58	112	466	922

16. If $f(0) = 0$, $f(1) = 0$, $f(2) = -12$, $f(4) = 0$, $f(5) = 600$, $f(7) = 7308$, find a polynomial that satisfies this data using Newton's divided difference formula. Hence find $f(6)$.

17. Apply fourth order Runge-Kutta method to find an approximate value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y$, $y(0) = 1$, $h = 0.1$.
