UG-C-2284	**BMS-21X/ BMC-21X**

U.G. DEGREE EXAMINATION –
DECEMBER, 2023.

Mathematics

Second Year

GROUPS AND RINGS

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. Write a note on equivalence relation.

2. Show that in a group G, $x^2 = x$ iff $x = e$.

3. Define isomorphism of a group.

4. Write a short note on maximal ideal.

5. What is meant by euclidean domain?

PART B — ($3 \times 7 = 21$ marks)

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

Al! questions carry equal marks.

6. Let $f : A \to B$, $g : B \to C$ be bijection and then prove that $g \circ f : A \to C$ is also a bijection.

7. Show that a non-empty subset H of a group G is a subgroup of G, iff $a, b \in H \Rightarrow a\, b^{-1} \in H$.

8. Let H and k be two finite subgroups of a group G, then prove that $|H\ K| = \dfrac{|H|\,|K|}{|H \cap K|}$.

9. Show that the intersection of two subrings of a ring R is a subring of R.

10. Show that the field of complex number is not an ordered field.

PART C — ($4 \times 10 = 40$ marks)

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

All questions carry equal marks.

11. Show that any partition of a set S determines an equivalence relation ρ such that the members of the partition are precisely the equivalence classes define by ρ.

12. Show that the union of two subgroup of a group G is a subgroup, if one is contained in the other.

13. State and prove Lagrange's Theorem.

14. State and prove Fundamental theorem of homomorphism of a group.

15. Let R and R' be rings and $f: R \to R'$ be an isomorphism. Then prove that the following:

    (a) R is commutative $\Rightarrow R'$ is commutative

    (b) R is an ring with identity $\Rightarrow R'$ is a ring with identity

    (c) R is an integral domain $\Rightarrow R'$ is an integral domain

    (d) R is a field $\Rightarrow R'$ is a field.

16. State and prove Cayley's theorem.

17. Prove that any euclidean domain R is a unique factorization domain.

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UG-C-2285	**BMS-22X**

U.G. DEGREE EXAMINATION –
DECEMBER, 2023.

Mathematics

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. Define kurtosis.

2. Write a regression line of equation.

3. What is meant by index number?

4. Write a short note on test of hypothesis.

5. Define central orbits.

PART B — ($3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words

All questions carry equal marks

6. Compute quartile deviation for the following data.

Weights	60	61	62	63	65	70	75	80
No of works	1	3	5	7	10	1	3	1

7. Calculate the rank correlation for the following data

X	52	63	45	36	72	65	47	25
Y	62	53	51	25	79	43	60	33

8. The diameter of an electric cable, say X is assumed to be a continuous random variable with pdf $f(x) = 6x(1-x)$, $0 \leq x \leq 1$.

   (a) Check that above is pdf

   (b) Determine a number 'b' such that $P(X < b) = P(X > b)$.

9. A sample of 400 male students is found to have a mean height of 171.38 cm. Can it be reasonably regarded as a sample from a large population with mean height 171.17 cm and standard deviation 3.30 cm? (use 5% significance level is 1.96).

10. Find the law of force towards the pole under which the curve $r^n = a^n \cos n\theta$ can be described.

PART C — (4 × 10 = 40 marks)

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

All questions carry equal marks.

11. Calculate mean, median and mode for the following data

Marks :	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency :	10	20	35	40	25	25	15

12. Compute the correlation coefficient from the following data of marks in commerce and economics.

Marks in Commerce :	50	60	58	47	49	33	65	43	46	68
Marks in Economics :	48	65	50	48	55	58	63	48	50	70

13. Construct the index numbers of price from the following data by applying

(a) Laspeyre's Method

(b) Paasche's method

(c) Bowley's Method

(d) Fisher's ideal method

Commodities	1984		1985	
	Price	Quantity	Price	Quantity
A	4	8	8	6
B	10	10	12	5
C	8	14	10	10
D	4	19	4	13

14. The following data collected on two characteristics

Category	Vaccinated	Not Vaccinated
Attacked	35	333
Not Attacked	308	806

Can vaccination be regarded as preventive measure of small box evidenced by the above data. Given that chi-square value at 5% level of significance for 1 df is3.84.

15. Show that the greatest height which a particle with initial velocity V can reach on a vertical wall at a distance 'a' from the point of projection is $\frac{v^2}{2g} - \frac{ga^2}{2v^2}$. Prove that the greatest height above the point of projection attained by the particle in its flight is $\frac{v^6}{2g\,(v^4 + g^2\ a^2)}$.

16. Use Newton formula to find y when $x = 142$ given that

x	140	150	160	170	180
y	3.685	4.854	6.302	8.076	10.225

17. Compute the skewness and kurtosis for the following distribution

Wages (Rs. Hundreds)	40-50	50-60	60-70	70-80	80-90
No. of works	10	25	30	23	12

UG–C–2286	BMS–23X/ BMC–22X

U.G. DEGREE EXAMINATION – DECEMBER, 2023.

Mathematics

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 in 100 words.

All questions carry equal marks.

1. Prove that

$$\frac{a-x}{a}+\frac{1}{2}\left(\frac{a-x}{a}\right)^2+\frac{1}{3}\left(\frac{a-x}{a}\right)^3+\ldots=\log a-\log x .$$

2. If α and β are the roots of $2x^2+3x+5=0$, find $\alpha+\beta, \alpha\beta$.

3. What is the condition for the convergence of the iterative method for solving $x=\phi(x)$?

4. Prove that:

(a) $E = 1 + \Delta$

(b) $E = (1 - \nabla)^{-1}$

5. Given $u_0 = 1$, $u_1 = 15$, $u_2 = 57$ find $\frac{dy}{dx}$ at $x = 2$.

PART B — (3 × 7 = 21 marks)

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

All questions carry equal marks.

6. Sum the series $1 - \frac{1}{4} + \frac{1.3}{4.8} - \frac{1.3.5}{4.8.12} + ...\infty$.

7. Solve the equation $x^3 - 12x^2 + 39x - 28 = 0$ whose roots are in A.P.

8. Find the value of $\sqrt{5}$ by Newton-Raphson method.

9. Use Lagrange's interpolation formula to fit a polynomial to the data and find the value of y when $x = 2$

x	0	1	3	4
y	–12	0	6	12

10. Solve $y' = x + y$ given $y(1) = 0$ and get $y(1.1), h = 0.1$ by Taylor's series method.

PART C — (4 × 10 = 40 marks)

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

All questions carry equal marks.

11. Prove that $\sum_{n=0}^{\infty} \frac{5n+1}{(2n+1)!} = \frac{e}{2} + \frac{2}{e}$.

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

13. Solve the system of equations by Gauss Jordan method

$2x + 3y - z = 5$.

$4x + 4y - 3z = 3$

$2x - 3y + 2z = 2$

14. Using Laplace-Everett's formula find $\log 337.5$ given that

x	310	320	330	340	350	360
$\log x$	2.491	2.505	2.518	2.531	2.544	2.556

15. By dividing the range into six equal parts, evaluate $\int_0^6 \frac{1}{1+x}\,dx$ using Trapezoidal rule, Simpson's $\frac{1}{3}^{rd}$ rule and Simpson's $\frac{3}{8}^{th}$ rule.

16. (a) Find the value of x when $y=7$ by Lagrange's Interpolation formula.

x	1	3	4
y	4	12	19

(b) Express $3x^3-2x^2+7x-6$ in factorial polynomials and get their successive forward differences tanking $h=1$.

17. If α,β,γ are the roots of the equation $x^3-px^2+qx-r=0$ find the value of

(a) $\Sigma\alpha^2$ (b) $\Sigma\alpha^3$

(c) $\Sigma\alpha^2\beta$ (d) $\Sigma\alpha^2\beta^2$