MATHEMATICS (Elective/Honours)(d) Let $f(x) x $, show that $h^{L_0} \frac{f(h) - f(0)}{h}$ (Algebra-I and Calculus-I) (GHS-11)(d) Let $f(x) x $, show that $h^{L_0} \frac{f(h) - f(0)}{h}$ (GHS-11)(e) Examine the continuity of the function f given as in Q. No. $1(d)$ on R.Marks : 75 Time : 3 hours2. (a) Which of the following statements are true?The figures in the margin indicate full marks for the questions(i) A $P(A)$ (ii) $A P(A)$ (iii) $\{A\} P(A)$ (iv) $\{A\} P(A)$ Answer five questions, taking one from each unit UNIT-I(ii) $\{A\} P(A)$ (iv) $\{A\} P(A)$ (i	1/EH–29 (i) (Syl	labus–2019)		(2)	
MATHEMATICS (Elective/Honours) (Algebra-I and Calculus-I) (GHS-11) Marks : 75 Time : 3 hours The figures in the margin indicate full marks for the questions Answer five questions, taking one from each unit UNIT-I 1. (a) Find the domain of the function $f(x) = \frac{1}{\sqrt{ x x }} = \frac{1}{x}$ (b) If $f(x) = \frac{x}{x-1}$, show that $\frac{f(x) = \frac{f(x)}{1} = \frac{f(y)}{1} = \frac{x}{xy}}{1} = \frac{x}{3}$ (c) If $f(x) = \frac{x}{x-1}$, show that $\frac{f(x) = \frac{f(y)}{1} = \frac{x}{xy}}{1} = \frac{x}{3}$ (d) If R is a relation on \mathbb{Z} (0) and xRy if and only if xy 0, prove that R is an equivalence relation. 3 3 3 3 3 3 3 3			(c)	where $[x]$ denotes the greatest integer	3
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(3)

3.

4.

	If A and B are two sets and A A B B, then prove that A B. 2 f:Q Q is defined by $f(x) = 3x = 4$.
07	Show that <i>f</i> is invertible and find f^{-1} . 3
	Unit—II
(a)	Define, with example, the following terms : 2×3=6 (<i>i</i>) Symmetric matrix
	(ii) Skew-symmetric matrix(iii) Diagonal matrix
(b)	Reduce the matrix <i>A</i> to the normal form and find its rank, where
	$1 0 2 1 \\ 0 1 2 1$
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	2 2 8 0 6
(c)	Let A and B are Hermitian matrices, show that AB BA is Hermitian. 3
(a)	Examine if the following system of equations are consistent :
	x y 2z 4
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	-
	If consistent, solve the system. 3+4=7

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	(b)	Using elementary operation find the inverse of the matrix A , where
		1 0 2
		$\begin{array}{cccc} A & 2 & 1 & 0 \\ & 3 & 2 & 1 \end{array} $
		3 2 1 6
	(c)	Show that the matrix
		2 2 4
		A 1 3 4
		1 2 3
		is idempotent. 2
		Unit—III
5.	(a)	State the intermediate value theorem. Prove that the equation $x^4 x^3 3 0$
		has a real root between 1 and 2. 2+1=3
	(b)	Evaluate $\frac{dy}{dx}$ of any <i>two</i> of the following :
		dx $3\times 2=6$
		where
		(i) $x^y y^x = 1$
		(ii) $x \sqrt{1 u}$, $y \sqrt{1 u}$
		(iii) $y \tan \sqrt[1]{\frac{1}{1} \cos \frac{1}{1}}$
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(5)

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3

(c) Find the points on the curve

 $y 2x^3 15x^2 34x 20$ where the tangents are parallel to y 2x 0.

- (d) From the first principle obtain the derivative of $\frac{1}{\sqrt{x}}$.
- 6. (a) If the area of a circle increases at a uniform rate, prove that the rate of increase of the perimeter varies inversely as the radius.
 - (b) Evaluate : $2\frac{1}{2} \times 2=5$

(i) Lt
$$\frac{1}{x^{0}}$$
 $\frac{1}{x^{2}}$ $\frac{1}{\sin^{2} x}$
(ii) Lt $\frac{e^{x} \sin x}{\log(1 x)}$

(c) If $y \tan^{-1} x$, show that (i) $(1 \quad x^2)y_1 \quad 1$ (ii) $(1 \quad x^2)y_n \quad 1 \quad 2nxy_n \quad n(n \quad 1)y_{n-1} \quad 0$ Find also $(y_n)_0$. $1^{\frac{1}{2}+3\frac{1}{2}+2=7}$

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(6)

UNIT—IV

- 7. (a) Evaluate any two of the following : $3 \times 2=6$ (i) $\frac{d}{5 + 4\cos}$ (ii) $\frac{dx}{x(x - 1)^2}$ (iii) $\sqrt{2ax - x^2} dx$
 - (b) Show that

$$\int_{0}^{\overline{2}}\sin^{6}\cos^{3}d = \frac{2}{63}$$
 3

(c) Find by method of summation

$$\int_{0}^{1} x^{3} dx \qquad 3$$

(d) Evaluate, if possible,

$$\frac{dx}{1 \cos x} \qquad \qquad 3$$

8. (*a*) Show that

$$\int_{0}^{1} x \log \sin x \, dx \quad \frac{2}{2} \log \frac{1}{2} \qquad 4$$

(b) Evaluate :

^{*n*}_{*n*}Lt
$$\frac{1^2}{n^3 \ 1^3} \ \frac{2^2}{n^3 \ 2^3} \ \cdots \ \frac{n^2}{2n^3}$$

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(c) If
$$u_n = \int_0^{\frac{1}{2}} x^n \sin x \, dx$$
, $n = 0$, prove that
$$u_n = n(n = 1)u_n = 2$$

(d) Evaluate :
$$\int_{0}^{1} x^{3} \sqrt{1 - 3x^{4}} dx$$

Unit—V

9. (a) All the circles which touch the Y-axis at the origin is given by the equation $x^2 y^2 2cx$. Obtain the differential equation of the family.

(b) Solve any four of the following :
$$3 \times 4=12$$

(i) $(3y \ 2x \ 4) dx \ (4x \ 6y \ 5) dy$
(ii) $x^2 dy \ (xy \ 2y^2) dx \ 0$
(iii) $3e^x \tan y dx \ (1 \ e^x) \sec^2 y dy \ 0$
(iv) $x dy \ y dx \ \cos \frac{1}{x} dx$
(v) $x(x^2 \ y^2 \ 4) dx \ y(x^2 \ y^2 \ 9) dy \ 0$
(vi) $(1 \ y^2) dx \ (\tan^1 y \ x) dy$

(8)

- **10.** (a) Solve any two of the following : $2\frac{1}{2} \times 2=5$ (i) $p(p^2 xy) p^2(x y)$ (ii) $y 2px p^2$ (iii) $p^2 py x 0$ (p stands for $\frac{dy}{dx}$
 - (b) Find the orthogonal trajectories of the family of confocal conics

$$\frac{x^2}{a^2} \quad \frac{y^2}{b^2} \quad 1$$

is a parameter.

(c) Reduce the equation $(px \ y)(x \ py) \ 2p$ to Clairaut's form by the substitution $x^2 \ u, \ y^2 \ v.$ 2

(d) Solve any two of the following : $2 \times 2 = 4$

$$(i) \quad \frac{d^2 y}{dx^2} \quad 8 \quad \frac{dy}{dx} \quad 25y \quad 0$$
$$(ii) \quad \frac{d^2 y}{dx^2} \quad 2 \quad \frac{dy}{dx} \quad y \quad 0$$
$$(iii) \quad \frac{d^2 y}{dx^2} \quad 6 \quad \frac{dy}{dx} \quad 25y \quad 0$$

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