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ASPN CLASSES

(Questions based on Model Paper for 2021 – 22)

MATHEMATICS PASSING MARKS

Class: PUC-II **FIVE MARKS QUESTIONS** **Max Marks : 40 +**

CHAPTER: 1 RELATIONS AND FUNCTIONS

PART – 1

1. Show that the function f: R → R given by $f(x) = 4x + 3$ is invertible. Write the inverse of f. **[M-14] [J-15] [M-15] [J-17] [M-18] [J-18] [M-19] [J-19]**
2. Show that the function f :R → [4, ∞) defined by $f(x) = x^2 + 4$ is invertible. Write the inverse of f. **[J-16]**
3. Show that the function f: N→Y defined by $f(x) = x^2$ where Y is range of f is invertible. Write the inverse of f. **[J-14]**
4. Show that the function f:R_+ → [-5, ∞) defined by $f(x) = 9x^2 + 6x - 5$ is invertible. Write the inverse of f.
5. Show that the function f: N→ S given by $f(x) = 4x^2 + 12x + 15$ where S is range off is invertible. Write its inverse of f. **[M-16] [M-17]**
6. Show that the function f: R - $\{{}^{-4}/_{3}\}$ → R be defined by $f(x) = \frac{4x}{3x+4}$ is invertible. Write the inverse of f.
7. If $(x) = \frac{4x+3}{6x-4}$, $x \neq \frac{2}{3}$ show that $fof(x) = x$, for all $x \neq {}^{2}/_{3}$. What is the inverse of f?
8. Show that f: [-1, 1] → R, given by $f(x) = \frac{x}{x+2}$ is one-one. Find the inverse of the function f:[-1,1] → Range f.

PART-2

1) Verify whether the function $f: N \to N$ defined by $f(x) = x^2$ is one-one , onto and bijective.
2) Check the injectivity and surjectivity of the function $f: R \to R$ defined by $f(x) = 3 - 4x$. Is it a bijective function?
3) Verify whether the function $f: R \to R$ defined by $f(x) = x^2$ is one-one , onto and bijective.
4) Verify whether the function $f: Z \to Z$ defined by $f(x) = x^3$ is one-one , onto and bijective.
5) Verify whether the function $f: R \to R$ defined by $f(x) = x^4$ is one-one , onto and bijective.
6) If $f: R \to R$ defined by $f(x) = 1 + x^2$, then show that f is neither one-one nor onto.
7) Verify whether the function $f: R \to R$ defined by $f(x) = 3x$ is one-one , onto and bijective.
8) Show that function $f: N \to N$ defined by $f(1) = f(2) = 1$ & $f(x) = x - 1$ for every $x > 2$, is onto but not one - one.
9) Show that function $f: R_* \to R_*$ defined as $f(x) = \frac{1}{x}$ is both one-one and onto, where R_* is the set of all non-zero real numbers
10) Let $A = R - \{3\}$ and $B = R - \{1\}$ consider the function $f: A \to B$ defined by $f(x) = \frac{x-2}{x-3}$. is f is one-one and onto function?
11) Consider the identity function $I_N: N \to N$ defined as $I_N(x) = x, \forall\, x \in N$. Show that I_N is onto but $I_N + I_N: N \to N$ defined as $(I_N + I_N)(x) = I_N(x) + I_N(x) = x + x = 2x$ is not onto.
12) Show that the function $f: \to R \to R$ defined by $f(x) = |x|$ is neither one-one nor onto.
13) Let $f: R \to R$ be a function defined by $f(x) = [x]$, $[x]$ is a greatest integer function then show that f is neither one-one nor onto.
14) Show that the signum function $f: R \to R$ given by $f(x) = \begin{cases} 1 \; if \; x > 0 \\ 0 \; if \; x = 0 \\ -1 \; if \; x < 0 \end{cases}$ is neither one-one nor onto.

CHAPTER: 3 MATRICES

1. If A = $\begin{bmatrix}1 & 2\\2 & 1\end{bmatrix}$ B = $\begin{bmatrix}2 & 0\\1 & 3\end{bmatrix}$ and C = $\begin{bmatrix}1 & 1\\2 & 3\end{bmatrix}$ calculate AC, BC & (A+B)C Verify that (A+B)C = AC + BC

2. If A = $\begin{bmatrix}-2\\4\\5\end{bmatrix}$ & B = $\begin{bmatrix}1 & 3 & -6\end{bmatrix}$ verify that $(\mathrm{AB})'$= $\mathrm{B}'\mathrm{A}'$. **[M-16]**

3. If A = $\begin{bmatrix}1\\-4\\3\end{bmatrix}$ & B = $\begin{bmatrix}-1 & 2 & 1\end{bmatrix}$ verify that $(AB)'$ = $B'A'$. **[J-18]**

4. If A = $\begin{bmatrix}0 & 6 & 7\\-6 & 0 & 8\\7 & -8 & 0\end{bmatrix}$ B = $\begin{bmatrix}0 & 1 & 1\\1 & 0 & 2\\1 & 2 & 0\end{bmatrix}$ and C = $\begin{bmatrix}2\\-2\\3\end{bmatrix}$ Calculate AC, BC &(A+B)C. Verify that AC+BC=(A+B)C. **[J-19] [J-16] [J-17] [M-18]**

5. If A = $\begin{bmatrix}1 & 2 & -3\\5 & 0 & 2\\1 & -1 & 1\end{bmatrix}$ B = $\begin{bmatrix}3 & -1 & 2\\4 & 2 & 5\\2 & 0 & 3\end{bmatrix}$ & C = $\begin{bmatrix}4 & 1 & 2\\0 & 3 & 2\\1 & -2 & 3\end{bmatrix}$ then compute (A+B)& (B-C). Also verify A+(B-C) = (A+B)-C. **[J-15]**

6. If A = $\begin{bmatrix}1 & 1 & -1\\2 & 0 & 3\\3 & -1 & 2\end{bmatrix}$ B = $\begin{bmatrix}1 & 2\\0 & 2\\-1 & 4\end{bmatrix}$ = $\begin{bmatrix}1 & 2 & 3 & -4\\2 & 0 & -2 & 1\end{bmatrix}$ Show that A(BC) = (AB)C.

7. If A = $\begin{bmatrix}1 & 2 & 3\\3 & -2 & 1\\4 & 2 & 1\end{bmatrix}$ then show that $\mathrm{A}^3 - 23\mathrm{A} - 40\mathrm{I} = 0$. **[J-14] [M-15] [M-19]**

8. If A = $\begin{bmatrix}1 & 0 & 2\\0 & 2 & 1\\2 & 0 & 3\end{bmatrix}$ Prove that $A^3 - 6A^2 + 7A + 2I = 0$. **[M-17]**

9. If A = $\begin{bmatrix}0 & -tan^{\alpha}/_2\\tan\,^{\alpha}/_2 & 0\end{bmatrix}$ &I is the itentity matrix of order 2. Show that I+ A = (I-A) $\begin{bmatrix}cos \propto & -sin \propto\\sin \propto & cos \propto\end{bmatrix}$.

CHAPTER: 4 DETERMINANTS

1. Solve the system of equations
   $2x - 3y + 5z = 11$, $3x + 2y - 4z = -5$,$x + y - 2z = -3$. **[M-16]**
2. Solve the system of equations by matrix method
   $3x - 2y + 3z = 8$, $2x + y - z = 1$ and $4x - 3y + 2z = 4$. **[J-16][M-19] [J-19]**
3. Solve the system of equations by matrix method
   $x - y + 2z = 7$, $3x + 4y - 5z = -5$ and $2x - y + 3z = 12$.**[J-14] [M-18]**
4. The sumof three numbers is 6. If we multiply third number by 3 and add second number to it we get 11. By adding first and third numbers we get double of the second number represent it algebraically & find the numbers using matrix method. **[J-17]**
5. The cost of 4kg onion, 3kg, wheat & 2kg rice is Rs 60. The cost of 2 kg onion 4 kg wheat 6 kg rice is Rs 90. The cost of 6 kg onion 2 kg wheat & 3 kg rice is Rs 70. Find cost of each item per kg by matrix method. **[J-18]**
6. Solve the following system of equations by matrix method
   $x - y + z = 4,2x + y - 3z = 0 \& x + y + z = 2$. **[M-14]**
7. Solve the following system of equations by matrix method
   $2x + 3y + 3z = 5, x - 2y + z = -4 \& 3x - y - 2z = 3$. **[J-15] [M-15]**
8. Use product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equations
   $x - y + 2z = 1,2y - 3z = 1$, $3x - 2y + 4z = 2$. **[M-17]**
9. Solve the system of the following equations
   $\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4,\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1$, $\frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2$

CHAPTER: 5 DIFFERENTIABILITY

1. If$y = (sin^{-1}x)^2$ then show that $(1 - x^2)^2 \frac{d^2y}{dx^2}$ - $x\frac{dy}{dx} = 2$. **[M-16]**
2. If $y = (cos^{-1}x)$, Find $\frac{d^2y}{dx^2}$ in terms of y alone.
3. If $y = sin^{-1}x$show that $(1 - x^2)\frac{d^2y}{dx^2}$ -$x\frac{dy}{dx} = 0$. **[M-19]**
4. If $y = (tan^{-1}x)^2$ then show that $(x^2 + 1)^2 \frac{d^2y}{dx^2} + 2x(x^2 + 1)\frac{dy}{dx} = 2$. **[J-15] [M-18] [M-17]**
5. If $y = 3\cos(logx) + 4\sin(logx)$ show that $x^2y_2 + xy_1 + y = 0$. **[J-14] [J-16] [J-19] [J-17]**
6. If $y = 5\cos(logx) + 7\sin(logx)$ show that $x^2y_2 + xy_1 + y = 0$.

7. If $y = 3e^{2x} + 2e^{3x}$ prove that $\frac{d^2y}{dx^2}$ - $5\frac{dy}{dx} + 6y = 0$. **[M-14]**

8. If $y = Ae^{mx} + Be^{nx}$ prove that $\frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + mny = 0$. **[M-15] [J-18]**

9. If $y = e^{a\cos^{-1}x}$ show that $(1-x^2)\frac{d^2y}{dx^2} - x\frac{dy}{dx} - a^2y = 0$.

10. If $x = a(cost + t\ sint)$&$y = a(sint - tcost)$ find $\frac{d^2y}{dx^2}$

CHAPTER: 11 THREE DIMENTIONAL GEOMETRY

1. Derive the equation of the line through a given point and parallel to a given vector $\vec{b}$. **[J-14] [M-15] [M-19]**
2. Derive the equation of the line passing through two given points both in vector & Cartesian form. **[J-17] [M-18] [J-18]**
3. Derive the shortest distance between two skew lines.
4. Derive the equation of the plane in normal form (both vector & Cartesian form). **[M-14]**
5. Derive the equation of a plane perpendicular to a given vector & passing through a given point both in vector & Cartesian form. **[J-15] [J-16] [M-16] [M-17] [J-19]**

CHAPTER: 13 PROBABILITY

PART – 1

1. If a fair coin is tossed 10 times find the probability of
   i) exactly six heads
   ii) at least six heads
   iii) at most six heads **[J-14][J-16][J-17] [M-18]**
2. A die is thrown 6 times if getting an odd number is a success, what is the probability if
   i) 5 successes
   ii) at least 5 successes
   iii) at most 5 successes **[J-19][M-15]**
3. A person buys a lottery ticket in 50 lotteries in each of which his chance of winning a prize, is $\frac{1}{100}$what is the probability that he will win a prize atleast once and exactly once. **[M-14] [J-18]**
4. The probability that a student is not a swimmer is $\frac{1}{5}$. Find the probability that out of 5 students,
   i) at least four are swimmers &
   ii) at most three are swimmers. **[M-16]**

5. The probability that a bulb produced by a factory will fuse after 150 days of use is 0.05. Find the probability that out of 5 such bulbs
   i) none
   ii) not more than one
   iii) more than one will fuse after 150 days of use **[M-17]**
6. Five cards are drawn successively with replacement from a well-shuffled deck of 52 cards. What is the probability that
   i) all the five cards are spates?
   ii) only 3 cards are spates
   iii) none is a spate **[J-15] [M-19]**

PART - 2

1) If A and B are independent events then prove that
   a) A and B' b) A' and B c) A' and B' are also independent
2) A die is thrown, if E be an event, the number appearing is a multiple of 3 and F be an event the number appearing is even, Then state whether E and F are independent or not.
3) A fair coin and unbiased die are tossed. Let 'A' be an event 'head appears on the coin' and B be an event 3 on the die. Check whether A and B are independent or not.
4) 3 coins are tossed simultaneously consider an event E "3 heads or 3 tails". F be an event 'atleast 2 heads' and G be an event 'atmost 2 heads'. Of the pairs (E,F), (E,G) (F,G) which are independent? Which are dependent?
5) A box of oranges inspected by examining 3 randomly selected oranges drawn without replacement. If all the 3 oranges are good the box is approved for sale. Otherwise it is rejected. Find the probability that a box containing 15 oranges out of which 12 are good and 3 are bad ones will be approved for sale?
6) One card is drawn at random from a well shuffled deck of 52 cards. In which of the following cases , events E and F are independent.
   1) E : the card drawn is a spade and F: the card drawn is an ace
   2) E : the card drawn is black and F : the card drawn is a king
   3) E : the card drawn is a king or queen and F : the card drawn is a queen or jack
7) Probability of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem then find the probability that
   a) the problem is solved b) exactly one of them solves the problem

CHAPTER: 12 LINEAR PROGRAMMING

(6 Marks Questions)

Type – I

1. Solve the following programming problem graphically, Maximise $z = 4x + y$
   subject to the constraints: $x + y \leq 5$
   $3x + y \leq 90$
   $x \geq 0 y \geq 0$
2. Solve the following programming problem graphically, Minimise $z = 200x + 500y$
   subject to the constraints: $x + 2y \geq 10$
   $3x + 4y \leq 24$
   $x \geq 0 y \geq 0$
3. Solve the following programming problem graphically, Minimise $z = -3x + 4y$
   subject to $x + 2y \leq 8$
   $3x + 2y \leq 12$
   $x \geq 0 y \geq 0$ **[J-17]**
4. Solve the following programming problem graphically, Maximise $z = 5x + 3y$
   subject to $3x + 5y \leq 15$
   $5x + 2y \leq 10$
   $x \geq 0 y \geq 0$
5. Solve the following programming problem graphically, Maximise $z = 3x + 2y$
   subject to $x + 2y \leq 10$
   $3x + y \leq 15$
   $x, y \geq 0$

Type - II

6. Solve the following problem graphically minimize & maximize $z = 3x + 9y$
   subject to $x + 3y \leq 60$
   $x + y \geq 10$
   $x \leq y$
   $x, y \geq 0$ **[J-16] [M-18]**
7. Solve the following problem graphically minimize & maximize $z = 5x + 10y$
   subject to $x + 2y \leq 120$
   $x + y \geq 60$
   $x - 2y \geq 0$
   $x, y \geq 0$ **[M-16] [M-19]**
8. Solve the following problem graphically minimize & maximize $z = x + 2y$
   subject to $x + 2y \geq 100$
   $2x - y \leq 0$
   $2x + y \leq 200$
   $x, y \geq 0$ **[J-14] [M-14]**

9. Solve the following problem graphically minimize & maximize $z = 600 + 400y$
subject to $x + 2y \leq 12$
$2x + y \leq 12$
$4x + 5y \geq 20$ **[M-17]**
$x, y \geq 0$

Type - III

10. A manufacturing company makes two modelsA and B of a product. Each piece of Model A requires 9 labour hours for fabricating nd 1 labour hour for finishing. Each piece of Model B requires 12 labour hours for fabricating and 3 labour hours for finishing. For fabricating and finishing, the maximum labour hours available are 180 and 30 respectively. The company makes a profit of Rs 8000 on each piece of model A and Rs 12000 on each piece of Model B. How many pieces of Model A and Model B should be manufactured per week to realise a maximum profit? What is the maximum profit per week? **[M-15]**

11. One kind of cake requires 200g of flour and 25g of fat, and another kind of cake requires 100g of flour and 50g of fat. Find the maximum number of cakes which can be made from 5kg of flour and 1 kg of fat assuming that there is no shortage of the other ingredients used in making the cakes. **[J-15]**

12. Reshma wishes to mix two types of food P and Q in such a way that the vitamincontents of the mixture contain at least 8 units of vitamin A and 11 units ofvitamin B. Food P costs Rs 60/kg and Food Q costs Rs 80/kg. Food P contains3 units/kg of Vitamin A and 5 units / kg of Vitamin B while food Q contains4 units/kg of Vitamin A and 2 units/kg of vitamin B. Determine the minimum costof the mixture.

13. A dietician wishes to mix two types of foods in such a way that vitamin contents of the mixture contain atleast 8 units of vitamin A and 10 units of vitamin C. Food 'I' contains 2 units/kg of vitamin A and 1 unit/kg of vitamin C. Food 'II' contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs Rs 50 per kg to purchase Food 'I' and Rs 70 per kg to purchase Food 'II'. Formulate this problem as a linear programming problem to minimise the cost of such a mixture.

CHAPTER:5 CONTINUITY

FOUR MARKS QUESTIONS:

(1) Find the value of 'k' if $f(x) = \begin{cases} \frac{k\cos x}{\pi - 2x}, & if\ x \neq \frac{\pi}{2} \\ 3, & if\ x = \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$ **ANS:** $K = 6$ **[M-14; J-14; M-17;J-19]**

(2) Find the values of 'a' and 'b' such that the function defined by $f(x) = \begin{cases} 5, & if\ x \leq 2 \\ ax + b, & if\ 2 < x < 10 \\ 21, & if\ x \geq 10 \end{cases}$ is continuous function **ANS:** $a = 2, b = 1$ **[JULY-2015]**

(3) Find the value of 'k' if $f(x) = \begin{cases} kx + 1, & if\ x \leq 5 \\ 3x - 5, & if\ x > 5 \end{cases}$ is continuous at $x = 5$ **ANS:** $K = \frac{9}{5}$ **[M-15;M-19]**

(4) For what value of 'λ' is the function defined by $f(x) = \begin{cases} \lambda(x^2 - 2x), & if\ x \leq 0 \\ 4x + 1, & if\ x > 0 \end{cases}$ **[J-17]**
Continuous at $x = 0$? what about continuity at $x = 1$?

(5) Find the relationship between 'a' and 'b'so that the function 'f' defined by $f(x) = \begin{cases} ax + 1, & if\ x \leq 3 \\ bx + 3, & if\ x > 3 \end{cases}$ is continuous at $x = 3$ **ANS:** $a = b + \frac{2}{3}$ **[M-2018]**

(6) Find the value of 'k' if $f(x) = \begin{cases} kx^2, & if\ x \leq 2 \\ 3, & if\ x > 2 \end{cases}$ is continuous at $x = 2$ **[J-16;J-18]**

(7) Find the value of 'k' if $f(x) = \begin{cases} kx + 1, & if\ x \leq \pi \\ \cos x, & if\ x > \pi \end{cases}$ is continuous at $x = \pi$ **ANS:** $k = -\frac{2}{\pi}$

(8) Find the value of 'k' if $f(x) = \begin{cases} \frac{1 - \cos 2x}{1 - \cos x}, & if\ x \neq 0 \\ k, & if\ x = 0 \end{cases}$ is continuous at $x = 0$ **ANS:** $k = 4$ **[M-16]**

(9) Find the value of 'k' if $f(x) = \begin{cases} \frac{\sin 2x}{x}, & if\ x \neq 0 \\ k, & if\ x = 0 \end{cases}$ is continuous at $x = 0$ **ANS:** $k = 2$

CHAPTER: 4 DETERMINANTS

(4 Marks Questions) (PART – 1)

1) If $A = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ satisfying the equation $A^2 - 4A + I = O$ where $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $and\ O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ then find A^{-1}.

2) If $A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$ satisfying the equation $A^2 - 5A + 7I = O$ then find the inverse of A using this equation where $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $and\ O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$.

3) If $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ satisfying the equation $A^2 - 5A - 2I = O$ then find the inverse of A using this equation where $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $and\ O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$.

PART – 2

[C] FOUR MARKS QUESTIONS:

1. P.T $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix} = a^3$

2. P.T $\begin{vmatrix} b+c & q+r & y+z \\ c+a & r+p & z+x \\ ab & p+q & x+y \end{vmatrix} = 2\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$

3. P.T $\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix} = 4abc$ [MARCH-2014]

4. P.T $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right) = abc+bc+ca+ab$ [M-19]

5. P.T $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = (a-b)(b-c)(c-a)$ [J-17]

6. P.T $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$ [MARCH-2016]

7. P.T $\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$ [M-17]

8. P.T $\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x)^2$

9. P.T $\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2(3y+k)$

10. P.T $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$ [J-16]

11. P.T $\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix} = 2(x+y+z)^3$ [J-14; M-18; J-18]

12. P.T $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1-x^3)^2$ [JUNE-2019]

13. P.T $\begin{vmatrix} 1+a^2-b^2 & 2ab & -2b \\ 2ab & 1-a^2+b^2 & 2a \\ 2b & -2a & 1-a^2-b^2 \end{vmatrix} = (1+a^2+b^2)^3$

14. P.T $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$ [MARCH-2015; JULY-2015]

15. If x, y, z are different and $\Delta = \begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$ then prove that $1+xyz=0$