

Vidya Vikas Mandal's  
Shree Damodar College of Commerce & Economics, Margao-Goa  
FY BCA, Semester-I, Semester End Assessment, November 2023  
Elementary Mathematics MAT 111 (OA-38, NEP-2020)

Duration: 2hrs

Max Marks: 80

Instructions:

- 1) All Questions are Compulsory
- 2) Start each question on fresh page.
- 3) Figures to the right indicate maximum marks.

Q1. Answer the Following.

(4 x 4 = 16 Marks)

i) Describe Argand plane of complex numbers with the help of diagram.

Define the following terms with the help of an example:

- ii) a) Order of a differential equation
- b) Dot product of two vectors

iii) Write the truth table of NOT, OR, AND and biconditional statements.

State whether the following statements are true or false. Justify your answer

- iv) a) Inverse of  $4x-2$  is  $4x+2$
- b)  $f:A \rightarrow B$  where  $A=\{1,2,3\}$  and  $B=\{1,2,3\}$   
if  $f=\{(1,1), (1,2), (1,3)\}$

Q2. Answer ANY FOUR of the Following.

(4 x 4 = 16 Marks)

i) Express  $4+4i$  in polar form.ii) Show that  $(p \rightarrow q) \leftrightarrow (\sim p \vee q)$  is a tautology.If  $A = \{1,2,3, 4,6,8\}$   $B = \{1,3,5,7,9\}$  and  $X = \{1,2,3,\dots,10\}$  find:

- a)  $A \cup B$
- iii) b)  $A \cap B$
- c)  $A - B$
- d)  $A'$

Find :

- iv) a)  $\lim_{x \rightarrow 0} \frac{3^x - 1}{x}$
- b)  $\lim_{x \rightarrow 2} \frac{x^6 - 64}{x^{10} - 1024}$

$$c) \lim_{x \rightarrow 0} \frac{\sin 2x}{3x}$$

List the elements of the following sets:

- a)  $\{x/x \in \mathbb{N}, 5 < x < 10\}$   
 v) b)  $\{\frac{1}{x} / x \in \mathbb{Z}, x > 0\}$   
 c)  $\{2n/ n \in \mathbb{N}, n < 5\}$   
 d)  $\{x^2/ x \in \mathbb{W}\}$

- vi) Every continuous function is differentiable. State whether true or false and justify using an example.

**Q3. Answer ANY TWO of the Following.**

**(2 x 8 = 16 Marks)**

Find:

- i) a) Domain and range of  $h(x) = 3x + 7$   
 b)  $f(3), g(5), f[g(x)], g[f(x)], f[f(x)], g[g(x)]$   
 if  $f(x) = 2x$  and  $g(x) = x + 5$   
 ii) Compute curl and divergence of  $xz^3\hat{i} - 2x^2yz\hat{j} + 2yz^4\hat{k}$  at the point  $(1, -1, 1)$

Show that:

- iii) a)  $R = \{(x, y) / x - y \text{ is divisible by } 5; x \in \mathbb{Z}, y \in \mathbb{Z}\}$  is an equivalence relation.  
 b)  $f(x) = 4x + 5; f: \mathbb{R} \rightarrow \mathbb{R}$  is bijective.

**Q4.A Answer ANY ONE of the Following.**

**(1 x 8 = 8 Marks)**

Solve the following differential equations

- i) a)  $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$   
 b)  $\frac{dy}{dx} = \sqrt{4 - y^2}; -2 < y < 2$

Determine whether:

- B) a)  $y = \cos x + c$  is a solution of  $\frac{dy}{dx} + \sin x = 0$   
 b)  $y = e^x + 1$  is a solution of  $\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$

**Q4.B Locate the maximum and minimum of  $f(x) = (x-1)(x-2)^2$**

**8 Marks**

(2 x 8 = 16 Marks)

**Q5. Attempt the Following.**

Deduce the differential equations representing family of curves by eliminating arbitrary constant  $a$ .

i)

a)  $y^2 = 4ax$

b)  $x^2 + y^2 = 2ay$

Test for continuity of the following function at  $x = 2$  and  $x = 4$ . In case the function is discontinuous at any point then state whether the discontinuity is removable. If it is removable then redefine the function suitably so as to make it continuous.

ii)  $f(x) = \begin{cases} x^2 - 4 & 0 \leq x \leq 2 \\ 3x + 3 & 2 < x < 4 \\ x^2 - 1 & 4 < x \leq 6 \\ 10 & x = 4 \end{cases}$

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