

D.Voc. Industrial Electronics
Subject: Mathematics II
Subject Code: ZDSC-104
Semester: 2nd (Regular)
Batch: 2018-21
Theory (External): 70 Marks
Time: 03 hours

Instructions to the Students

1. This Question paper consists of two Sections. All sections are compulsory.
2. **Section A** comprises 10 questions of objective type in nature. All questions are compulsory. Each question carries 2 marks.
3. **Section B** comprises 8 essay type questions out of which students need to do any 5. Each question carries 10 marks.
4. Read the questions carefully and write the answers in the answer sheets provided.
5. Do not write anything on the question paper.
6. Wherever necessary, the diagram drawn should be neat and properly labelled.

Roll Number

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SECTION -A (OBJECTIVE TYPE QUESTIONS)**(10x2=20 Marks)**

1. If $A = \{1, 2\}$, $B = \{3, 4\}$. Then find number of relations from A to B.
2. Let $f: N \rightarrow R$ defined by $f(x) = 4x + 3$. Then find inverse of f.
3. Evaluate $\lim_{x \rightarrow 0} \frac{\sin ax}{\cos bx}$
4. Find conjugate of $\frac{(1+i)^2}{3-i}$
5. What is the probability drawing two red cards from a pack of 52 cards with replacement.
6. If A and B are two points with position vectors $\vec{2a}$ and $\vec{3b}$ respectively, then find \vec{AB} .
7. Find the minor of -2 and -4 in the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 1 & -2 & 2 \\ 3 & 2 & 4 \end{bmatrix}$.
8. Find the radius and centre of the circle $x^2 + y^2 - x + 2y - 3 = 0$.
9. Find the foci of the hyperbola $25x^2 - 9y^2 = 225$.
10. Evaluate the integral: $\int \left(\frac{2x}{a} + \frac{a}{3x} + x^a + a^{4x} \right) dx$.

SECTION -B (ESSAY TYPE QUESTIONS)

(5x10=50 Marks)

1. (a) Let m be an arbitrary but fixed positive integer show that the relation congruence modulo m on the set Z of all integers defined by $a \equiv b \pmod{m}$ is an equivalence relation.

(b) Let $f : R \rightarrow R$ defined by $f(x) = x^2 + 2$ and $g : R \rightarrow R$ defined by $g(x) = \frac{x}{x-1}$, find $f \circ g$ and $g \circ f$. Find domain of f and range of g .

2. (a) Differentiate $(x^2 - 5x + 8)(x^2 + 7x + 9)$ in two ways (i) by using product rule (ii) by logarithmic differentiation .

(b) Discuss the continuity of the function f defined by

$$f(x) = \begin{cases} 3x - 1 & \text{if } x > 1 \\ 2x + 2 & \text{if } x \leq 1. \end{cases}$$

3. (a) From the sum of n terms of the series $8 + 88 + 888 + 8888 + \dots$

(b) Evaluate the following integrals (i) $\int \frac{dx}{x^2 - 6x + 13}$ (ii) $\frac{x^3 - x^2 + x + 1}{x - 1}$

4. (a) Find the modulus and principle argument of the complex number $\frac{1+2i}{1-3i}$ and express in amplitude form.

(b) By using properties of determinants, show that

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(a+b+c)$$

5. (a) Prove that If $\vec{a} = \vec{i} + 2\vec{j} - 3\vec{k}$ and $\vec{b} = 3\vec{i} - \vec{j} + 2\vec{k}$, then show that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are orthogonal.

- (b) Find the work done in moving an object along the vectors $2\vec{i} + 4\vec{j} - \vec{k}$ if the force applied is $\vec{i} + \vec{j} + 5\vec{k}$.
6. (a) Solve the system of equation by Cramer's rule
 $x + y + z = 6$, $y + 3z = 11$, $x - 2y + z = 0$.
- (b) A committee of 3 persons is to be selected from 4 men and 5 women. What is the probability that in committee
- (i) At least one man is selected
(ii) at most one women is selected
(iii) one man and 2 women selected
7. (a) Find the equation of circle of radius 5 with centre on x axis and passing through the point (2,3).
- (b) Find the equation of ellipse with vertices (0, ± 10) and foci (0, ± 8).
8. (a) Show that the equation $y = x^2 - 2x + 3$ represents a parabola. Find the vertex, focus, directrix latus rectum and axis. Also draw rough sketch.

-----End of the Paper-----