

2024/FYUG/ODD/SEM/  
MATSEC-101T/281

FYUG Odd Semester Exam., 2024

MATHEMATICS  
( 1st Semester )

Course No. : MATSEC-101T

( Mathematical Skill Development with Software )

Full Marks : 50

Pass Marks : 20

Time : 2 hours

The figures in the margin indicate full marks  
for the questions

UNIT—I

1. Answer any *three* from the following :  $1 \times 3 = 3$

(a) What is an algorithm?

(b) What symbol is used to represent decision-making in a flowchart?

(c) What does the “if-then-else” statement represent?

(d) Write at least one use of arrays in programming.

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2. How do flowcharts help in problem-solving? 2

OR

3. Draw a diagram to represent a pre-test iteration. 2

4. (a) Write an algorithm to find the factorial of a given positive integer. 3

(b) Write an algorithm to check if a number is even or odd. 2

OR

5. (a) Write an algorithm to reverse a given integer number 1234. 3

(b) Draw flowchart to find the sum of first  $n$  natural numbers. 2

### UNIT—II

6. Answer any *three* from the following :  $1 \times 3 = 3$

(a) Define an even function and give an example.

(b) Draw the graph of cosine function on  $\mathbb{R}$ .

(c) What is the greatest integer function?

(d) How many functions can be defined from the set  $\{1, 2, 3\}$  to  $\{1, 4, 6\}$ ?

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7. Give an example of a periodic function and explain its key characteristic. 2

OR

8. If  $f$  is an odd function, what can you conclude about  $f(0)$ ? Justify. 2

9. Let  $f(x) = 3x + 5$  and  $g(x) = x^2$ . Find  $(f \circ g)(x)$  and  $(g \circ f)(x)$  and explain whether the composition of functions is commutative in this case. 5

OR

10. (a) Construct a bijection from  $\mathbb{N}$  to  $\mathbb{N}$ , other than the identity function. 1

(b) Give an example of a one-one function that is not onto. Also, give an example of onto function that is not one-one. 4

### UNIT—III

11. Answer any *three* from the following :  $1 \times 3 = 3$

(a) State the fundamental theorem of arithmetic.

(b) What is the well-ordering property?

(c) What is Euclidean algorithm used for?

(d) State division algorithm.

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12. Show that the integer  $53^{103} + 103^{53}$  is divisible by 39. 2

OR

13. Find the GCD of 8658 and 12321, using Euclidean algorithm. 2

14. (a) If  $a \equiv b \pmod{n}$  and  $b \equiv c \pmod{n}$ , then show that  $a \equiv c \pmod{n}$ . 2

- (b) Solve the congruence  $4x \equiv 5 \pmod{11}$  using the inverse method. 3

OR

15. (a) Show that there are infinitely many primes. 3

- (b) Find the integers  $x$  and  $y$  such that  $306x + 657y = \gcd(306, 657)$ . 2

#### UNIT—IV

16. Answer any three from the following : 1×3=3

- (a) What is a Hermitian matrix?  
(b) Define an idempotent matrix.  
(c) Give one example of an orthogonal matrix.

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- (d) Find  $A^5$  if

$$A = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

17. Express

$$A = \begin{pmatrix} 1 & 7 & 9 \\ 2 & -1 & 3 \\ 0 & 1 & 3 \end{pmatrix}$$

- as the sum of a symmetric and skew-symmetric matrices. 2

OR

18. Find the adjoint of the matrix

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 3 & 0 \\ 4 & 0 & 1 \end{pmatrix}$$

19. State and prove Jacobi's theorem. 1+4=5

OR

20. Find the inverse of the matrix

$$A = \begin{pmatrix} 2 & 3 & 1 \\ 1 & 0 & -1 \\ 3 & 1 & 2 \end{pmatrix}$$

- and verify that  $AA^{-1} = A^{-1}A = I$ . 5

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**UNIT—V**

21. Answer any *three* from the following :  $1 \times 3 = 3$

- (a) Define the order and degree of a ordinary differential equation.
- (b) Give an example of a first-order linear differential equation.
- (c) Write the differential equation of the family of parallel straight lines with slope 2.
- (d) What are general and particular solutions of a given ordinary differential equation?

22. Solve the differential equation

$$\cos y \cdot dx + (1 + e^x) \sin y \cdot dy = 0 \quad 2$$

**OR**

23. Find the differential equation of the family of curves  $y = A \cdot \sin(wx + B)$ , where  $A$  and  $B$  are constants and  $w$  is fixed. 2

24. Solve the differential equation

$$(x^2 + y^2) dx + 2xy \cdot dy = 0 \quad 5$$

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**OR**

25. Solve the linear differential equation

$$\frac{dy}{dx} + y(\tan x) = \sin x \quad 5$$

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