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 : 1×3=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.

Scanned with OKEN Scanner

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 : 1×3=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}?

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 : 1×3=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.

Scanned with OKEN Scanner

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 $a \equiv b(\text{mod}\, n)$ and $b \equiv c(\text{mod}\, n)$, then show that $a \equiv c(\text{mod}\, n)$. 2

(b) Solve the congruence $4x \equiv 5(\text{mod}\, 11)$ 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 $306x + 657y = \text{gcd}(306, 657)$. 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.

(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

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

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

Scanned with OKEN Scanner

UNIT—V

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

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

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

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

(*Continued*)

OR

25. Solve the linear differential equation

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

★ ★ ★

Scanned with OKEN Scanner