# 2018

## M.Sc. 1st Semester Examination

### APPLIED MATHEMATICS WITH OCEANOLOGY
### AND
### COMPUTER PROGRAMMING

PAPER—MTM-197

**(Practical)**

*Full Marks* : 25

*Time* : 2 Hours

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*Illustrate the answers wherever necessary.*

## Lab 1 : *Computational Methods : Using MATLAB*

Select *one* question from each group on lottery basis.

### Group-A　　　　　　　1×6

1. Write a script program in MATLAB to create two vectors $x$ and $y$ having a regular spacing of $h$ starting at $a$ and ending at $b$ by two different methods.

**2.** Write a script program in MATLAB such that for a given 4×4 matrix *A* carry out the following instructions :

(a) create a vector *V* consisting of the elements in the second column of *A*,

(b) create a vector *W* consisting of the elements in the third row of *A*,

(c) create a 2×3 array *D* consisting of all elements in the first two rows and the last three columns of *A*.

**3.** Write a script program in MATLAB such that for a given 4×4 matrix *A* carry out the following instructions :

(a) find the maximum and minimum values in each column,

(b) find the maximum and minimum values in each row.

**4.** Write a script program in MATLAB such that for a given 4×4 matrix *A* carry out the following instructions :

(a) sort each column and store the result in matrix *B*,

(b) sort each row and store the result in matrix *C*,

(c) add each row and store the result in an array D.

5. Write a script program in MATLAB to solve the following set of equations :

$$3x + 2y - 9z = -65$$
$$-9x - 5y + 2z = 16$$
$$6x + 7y + 3z = 5$$

(a) use the lest division method,

(b) use the matrix inverse method, and

(c) compare the results obtained in two methods.

6. Write a script program in MATLAB to find two solutions of the following set of equations :

$$x + 3y + 2z = 2$$
$$x + y + z = 4$$

7. Write a script program in MATLAB to solve the following set of equations :

$$x - y = 2$$
$$x + 5y = 18$$
$$4x - 6y = 20$$

8. Given a diagonalizable matrix A, let the list $(\lambda_1, \lambda_2, ..., \lambda_n)$ be the eigen-values. Write a MATLAB function program that will

compute the sum $\displaystyle\sum_{i=1}^{n} \lambda_i$ and the product $\displaystyle\prod_{i=1}^{n} \lambda_i$ .

9. Write a script program in MATLAB for a given square matrix $A$, find an invertible matrix $P$ and a diagonal matrix $D$ such that $PDP^{-1} = A$. Also, compare $A^{10}$ and $PD^{10}P^{-1}$.

10. Write a script program in MATLAB for which use poly and roots function to compute the characteristics polynomial and characteristic roots of a random $4 \times 4$ matrix.

11. Write a script program in MATLAB to obtain the roots of $x^3 + 13x^2 + 52x + 6 = 0$. Use the poly function to confirm your answer.

### Group–B
$1 \times 8$

1. Write a script program in MATLAB, use a while loop to determine how many terms in the series $3k^3$, $k = 1, 2, 3, ...,$ are required for the sum of these terms to exceed 2000. What is the sum of these terms ?

*(Continued)*

2. Write a script program in MATLAB to find either minimum or maximum or sum according to your response for the function $y = x \sin x$ in the range $-\pi/2 \le x \le \pi/2$ with spacing 0.1 using switch statement.

3. Write a script program in MATLAB to display all prime numbers between two specified numbers.

4. Write a script program in MATLAB to find all palindrome numbers between two specified numbers.

5. Write a function program in MATLAB to find all armstrong numbers between two specified numbers.

6. Write a script program in MATLAB to generate a Pascal triangle.

7. Write a MATLAB function to find the value of $\int_a^b f(x)dx$ by Trapezoidal Rule.

8. Write a MATLAB function to find the value of $\int_a^b f(x)dx$ by Simpson's 1/3 Rule.

9. Write a program in MATLAB to convert decimal-to-binary and vice versa.

10. Write a MATLAB function program to find a real root of the equation $x^2 - \sin 2x - 1 = 0$ by Bisection method.

11. Write a MATLAB function program to find a real root of the equation $x^2 - \sin 2x - 1 = 0$ by Newton-Raphson's method.

## Group–C                                                      1×6

1. In MATLAB represent the graphs of the functions $\sin x$, $\sin 2x$ and $\sin 3x$, varying in the range $(0, 2\pi)$ for $x$, all on the same axes with mentions title, axes and different line specification.

2. In MATLAB represent the graphs of the functions $\cos x$, $\cos 2x$ and $\cos 3x$, varying in the range $(0, 2\pi)$ for $x$, all on the same axes. The first function, $\cos x$, with a black line, the second, $\cos 2x$, using blue star and the third $\cos 3x$ with red circles.

*(Continued)*

**3.** In MATLAB represent the graphs of the cycloid whose parametric equations are $x = t - 2\sin t$, $y = 1 - 2\cos t$, for t varying between $-3\pi$ and $3\pi$.

**4.** In MATLAB represent on the same figure of the function

$y = \left| e^{-\frac{x}{2}} \sin 5x \right|$ represented in normal scale, logarithmic

scale and semi-logarithmic scales.

**5.** In MATLAB represent the graph of the curve whose equation in polar coordinates is as follows : $r = \sin 2t \cos 2t$ for $t$ between 0 and $2\pi$.

**6.** In MATLAB represent the mesh graph for the surface of equation : $z = xe^{\left(-x^2 - y^2\right)}$, $-2 < x.y < 2$. Also represent the mesh with its contour.

**7.** Suppose that George, Sam, Betty, Charlie and Suzie contributed $15, $5, $10, $5 and $15 respectively to a colleague's going-away present. Create a pie chart in MATLAB of their contributions. What percentage of the cost was paid by Sam ?

8. In MATLAB plot the function $f(x) = 1/\sqrt{x}$ over the range $0.1 \leq x \leq 10.0$ using function fplot. Be sure to label your plot properly.

9. In MATLAB create a contour plot the real part of $z$ versus $x$ and $y$ of the function $x = e^{x+iy}$ for the interval $-1 \leq x \leq 1$ and $-2\pi \leq y \leq 2\pi$.

10. In MATLAB draw the surface of parametric coordinates : $x = 4\cos r \sec t,\ y = 2\sin r\sec t,\ z = \tan t,\ -2\pi < r < 2\pi,\ -\pi < t < \pi$.

11. In MATLAB on the same axes represent the graphs of the functions $y = \sin x^2$ and $y = log\sqrt{x}$. The text of each equation is properly positioned within the graph.

*Note book and viva — 5 marks*

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