

## B.Tech. Degree III Semester Regular/Supplementary Examination in Marine Engineering November 2023

### 19-208-0301 ENGINEERING MATHEMATICS-III (2019 Scheme)

Time: 3 Hours

Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

- CO1: Transform a region to another region using conformal mapping and calculate residues.  
 CO2: Understand different sampling distributions for statistical analysis of data and fit a best curve to the data.  
 CO3: Solve algebraic and transcendental equations and differential equations by numerical methods.  
 CO4: Solve difference equations and apply it to engineering problems.  
 CO5: Perform numerical differentiation and integration.

Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 – Analyze,  
 L5 – Evaluate, L6 – Create

PI – Programme Indicators

(Answer **ALL** questions)

(5 × 15 = 75)

- |  | Marks | BL | CO | PI |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
|--|-------|----|----|----|----|----|----|---|----|----|----|----|----|----|--|--|--|--|
| I. (a) State the necessary and sufficient condition for a function to be analytic and verify that $f(z) = z^2$ is analytic.  | 7     | L1 | 1  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| (b) Find the analytic function whose real part is $y = e^x \cos y$ .   | 8     | L2 | 1  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| <b>OR</b>  |       |    |    |    |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| II. (a) State Cauchy's theorem and evaluate $\int_C \frac{z^2 - z + 1}{z - 1} dz$ , where C is the circle $ z  = 1$ .  | 8     | L2 | 1  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| (b) Expand the function in Laurent's series<br>$f(z) = \frac{1}{(z-1)(z+3)}$ for $1 <  z  < 3$ .   | 7     | L2 | 1  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| <b>OR</b>  |       |    |    |    |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| III. (a) Define the following terms:<br>(i) Population<br>(ii) Sample<br>(iii) Statistic<br>(iv) Parameter   | 6     | L1 | 2  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| (b) A population follows the normal distribution with mean 2 and variance 9. Find the probability that the mean of a sample of size 16 taken from this population will be greater than 2.5.  | 9     | L3 | 2  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| <b>OR</b>  |       |    |    |    |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| IV. (a) What are the normal equations to fit a straight line by least square method and fit a straight line $y = ax + b$ to the following data?  | 6     | L2 | 2  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |
| <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>x</td> <td>10</td> <td>12</td> <td>14</td> <td>18</td> <td>20</td> <td>22</td> </tr> <tr> <td>y</td> <td>14</td> <td>19</td> <td>21</td> <td>24</td> <td>27</td> <td>30</td> </tr> </table> | x     | 10 | 12 | 14 | 18 | 20 | 22 | y | 14 | 19 | 21 | 24 | 27 | 30 |  |  |  |  |
| x  | 10    | 12 | 14 | 18 | 20 | 22 |    |   |    |    |    |    |    |    |  |  |  |  |
| y  | 14    | 19 | 21 | 24 | 27 | 30 |    |   |    |    |    |    |    |    |  |  |  |  |
| (b) In a partially destroyed record only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$ , $\bar{y}$ and the coefficient of correlation between x and y.                       | 9     | L2 | 2  | 1  |    |    |    |   |    |    |    |    |    |    |  |  |  |  |

(P.T.O.)

- |              |  | Marks        | BL     | CO     | PI     |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|--------------|--|--------------|--------|--------|--------|--------|--------|----|----|------|--------|--------|--------|--------|--------|--------|--------|--|--|--|--|
| V.           | (a) Find a real root of the equation $\sin x - xe^x = 0$ correct to four decimal places by bisection method.   | 8            | L2     | 3      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (b) Find by Newton's iterative method the real root of $x \tan x + 1 = 0$ which is near $x = \pi$ .  | 7            | L2     | 3      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| <b>OR</b>    |  |              |        |        |        |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| VI.          | (a) Use Taylors method to find $y(0.2)$ correct to 3 decimal places where $\frac{dy}{dx} = 2y + 3e^x$ and $y(0) = 0$ .   | 7            | L2     | 3      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (b) Solve $\frac{dy}{dx} = (x + y)$ , $y(0) = 1$ correct to 3 decimal places at $x = 0.3$ , using modified Euler's method.   | 8            | L2     | 3      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| VII.         | (a) Find a difference equation satisfied by $y = (A + Bx)2^x$ .  | 8            | L2     | 4      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (b) Express $f(x) = x^2 - x - 5$ in factorial notation. Hence find $\Delta^2 f(x)$ .   | 7            | L2     | 4      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| <b>OR</b>    |  |              |        |        |        |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| VIII.        | (a) Solve the difference equation $(\Delta^2 - 3\Delta + 2)y_n = 0$ .  | 5            | L2     | 4      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (b) Solve the equation $y_{n+2} + 5y_{n+1} + 6y_n = n + 2^n$ .   | 5            | L2     | 4      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (c) Solve $y_{n+2} + y_{n+1} + y_n = n^2 + 3$ .  | 5            | L2     | 4      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| IX.          | (a) From the following data, evaluate $\cos 12^\circ$ and $\cos 48^\circ$ using Newton's interpolation formula.  | 7            | L2     | 5      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>x(in degree)</th> <th>10</th> <th>20</th> <th>30</th> <th>40</th> <th>50</th> <th>60</th> <th>70</th> </tr> </thead> <tbody> <tr> <td>cosx</td> <td>0.9848</td> <td>0.9397</td> <td>0.8660</td> <td>0.7660</td> <td>0.6428</td> <td>0.5000</td> <td>0.3420</td> </tr> </tbody> </table> | x(in degree) | 10     | 20     | 30     | 40     | 50     | 60 | 70 | cosx | 0.9848 | 0.9397 | 0.8660 | 0.7660 | 0.6428 | 0.5000 | 0.3420 |  |  |  |  |
| x(in degree) | 10   | 20           | 30     | 40     | 50     | 60     | 70     |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| cosx         | 0.9848   | 0.9397       | 0.8660 | 0.7660 | 0.6428 | 0.5000 | 0.3420 |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (b) Using Legrange's formula express the function $\frac{3x^2 + x + 1}{(x-1)(x-2)(x-3)}$ as a sum of partial fractions.  | 8            | L3     | 5      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| <b>OR</b>    |  |              |        |        |        |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| X.           | (a) Evaluate $\frac{dy}{dx}$ at $x = 4$ from the following:  | 7            | L2     | 5      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | <table border="1" style="margin-left: 20px;"> <tbody> <tr> <td>x</td> <td>1</td> <td>2</td> <td>4</td> <td>8</td> <td>10</td> </tr> <tr> <td>y</td> <td>0</td> <td>1</td> <td>5</td> <td>21</td> <td>27</td> </tr> </tbody> </table>   | x            | 1      | 2      | 4      | 8      | 10     | y  | 0  | 1    | 5      | 21     | 27     |        |        |        |        |  |  |  |  |
| x            | 1  | 2            | 4      | 8      | 10     |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
| y            | 0  | 1            | 5      | 21     | 27     |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (b) Evaluate $\int_0^{\frac{\pi}{2}} e^{\sin x} dx$ by   | 8            | L2     | 5      | 1      |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (i) Trapezoidal rule   |              |        |        |        |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |
|              | (ii) Simpson's 3/8 <sup>th</sup> rule  |              |        |        |        |        |        |    |    |      |        |        |        |        |        |        |        |  |  |  |  |

Bloom's Taxonomy Levels  
L1-10%, L2-80%, L3-10%,