

**PO Attainment**

Faculty Name: Dr. Manish Pant

Class-Sem: MSC-4

Academic Year: 2022-23

Course Name: Mathematical Modelling

Course Code: MMA-401

Program Name: MSC Mathematics

**CO-PO MAPPING:**

| Course | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1    | 1   | 1   |     |     | 2   | 1   |     |     | 1   |      |      |      |
| CO2    | 2   |     | 1   | 3   |     |     | 2   | 2   |     |      |      |      |
| CO3    |     | 3   | 1   |     |     | 1   | 1   |     |     |      | 2    |      |
| CO4    |     |     |     | 2   | 2   |     |     | 1   | 2   | 1    |      |      |
| CO5    | 3   |     | 3   |     | 3   |     |     |     |     |      | 2    | 1    |
| CO6    |     | 1   |     | 1   |     | 3   | 1   | 2   | 1   | 1    |      | 1    |

**CO ATTAINMENT:**

| Dr. Manish Pant | Att. Level |
|-----------------|------------|
| CO1             | 3.00       |
| CO2             | 3.00       |
| CO3             | 3.00       |
| CO4             | 2.09       |
| CO5             | 2.20       |
| CO6             | 2.71       |

**PO ATTAINMENT :**

|                       | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Overall PO Attainment | 2.6 | 2.9 | 2.5 | 2.6 | 2.4 | 2.8 | 2.9 | 2.7 | 2.5 | 2.4  | 2.6  | 2.5  |

Faculty Signature



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| Q.No  | Questions  | Marks (70) | CO  | BL |
|-------|--|------------|-----|----|
| 1-I   | Write the condition of exact differential equation   | 01         | CO1 | L2 |
| 1-II  | Translate the explicit function  | 01         | CO2 | L1 |
| 1-III | Solve  | 01         | CO2 | L2 |
| 1-IV  | $(x - y)^2 \frac{dy}{dx} = a^2$  | 01         | CO3 | L3 |
| 1-V   | Write the solution of linear differential equations.   | 01         | CO2 | L1 |
| 1-VI  | What are assumptions of prey-predator model?   | 01         | CO1 | L1 |
| 1-VII | What is population growth model?   | 01         | CO1 | L1 |
| 2-I   | Mathematical model   | 01         | CO1 | L1 |
| 2-II  | Boundary value problem   | 01         | CO1 | L1 |
| 2-III | Advantage of mathematical model  | 01         | CO1 | L1 |
| 2-IV  | Order and degree of differential equation  | 01         | CO1 | L2 |
| 2-V   | Orthogonal trajectory  | 01         | CO1 | L1 |
| 2-VI  | Singular solution of differential equation   | 01         | CO1 | L3 |
| 2-VII | Schematic model  | 01         | CO1 | L1 |
| 3-I   | a) Explain the interest compounded model.<br>OR<br>b) Explain the limitation of mathematical model.  | 7          | CO2 | L2 |
| 3-II  | a) Find the orthogonal trajectory of the family of the curve<br>OR<br>b) Describe Fick's law of diffusion.   | 7          | CO3 | L2 |
| 4-I   | a) Solve<br>OR<br>b) How the real world problems are solved by using mathematical modelling.   | 7          | CO3 | L5 |
| 4-II  | a) Construct a MM for change of price of commodity<br>OR<br>b) Solve linear differential equation  | 7          | CO4 | L3 |
| 5-I   | a) Derive compartment model.<br>OR<br>b) Detail out the classification of MM? Give two examples of each type of model  | 7          | CO5 | L4 |
| 5-II  | a) Write a python program to demonstrate the use of break, continue and pass statements with the help of for loop.<br>OR<br>b) Write a python program to implement list as stack.                  | 7          | CO6 | L6 |
| 6-I   | a) What is the need of mathematical modelling? Give at least ten situations requiring mathematical modelling<br>OR<br>b) Write a function in python to illustrate different dictionary operations. | 7          | CO5 | L4 |
| 6-II  | a) Explain mean, median, mode, bias, variance and outliers with suitable example?<br>OR<br>b) Explain Machine learning and how does it work?   | 7          | CO6 | L6 |

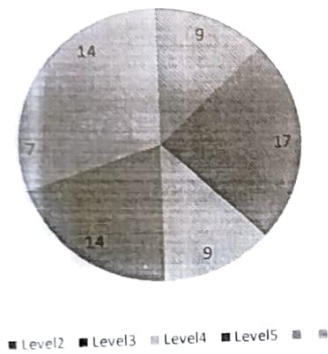
BL – Bloom's Taxonomy Levels

(1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

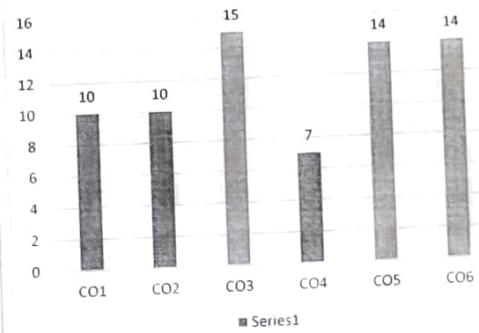
CO – Course Outcomes PO – Program Outcomes; PI Code – Performance Indicator Code

| Level        | Marks     | CO           | Marks     |
|--------------|-----------|--------------|-----------|
| Level1       | 9         | CO1          | 10        |
| Level2       | 17        | CO2          | 10        |
| Level3       | 9         | CO3          | 15        |
| Level4       | 14        | CO4          | 7         |
| Level5       | 7         | CO5          | 14        |
| Level6       | 14        | CO6          | 14        |
| <b>Total</b> | <b>70</b> | <b>Total</b> | <b>70</b> |

Bloom's Level wise Marks Distribution



Course Outcome wise Marks Distribution



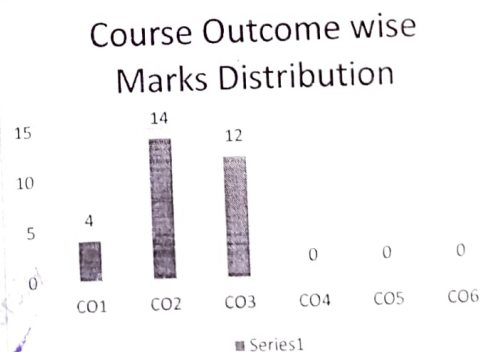
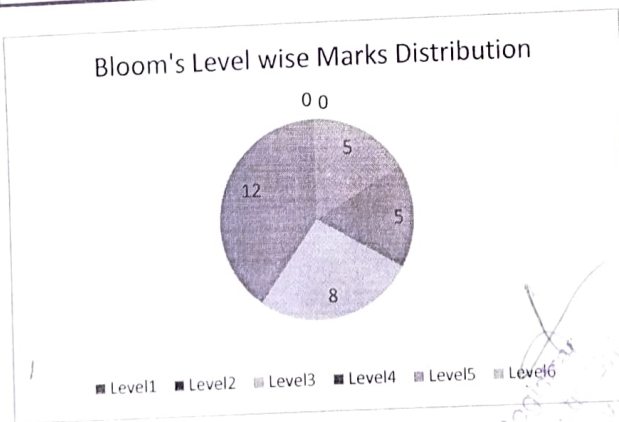
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| Q.No  | Questions  | Marks (30) | CO  | BL |
|-------|--|------------|-----|----|
| 1-I   | Verbal model   | 01         | CO1 | L1 |
| 1-II  | Mathematical model   | 01         | CO1 | L1 |
| 1-III | Schematic model  | 01         | CO2 | L2 |
| 1-IV  | Advantage of mathematical model  | 01         | CO1 | L2 |
| 1-V   | Differential equation  | 01         | CO2 | L2 |
| 2-I   | Solve  | 01         | CO2 | L1 |
| 2-II  | Define the boundary value problem  | 01         | CO2 | L2 |
| 2-III | Translate the explicit function  | 01         | CO2 | L2 |
| 2-IV  | Write the condition of exact differential equation   | 01         | CO2 | L1 |
| 2-V   | Describe the classification of mathematical model  |            |     |    |
| 3     | a) Explain compartment model.<br>b) Explain the limitation of model.<br>c) Solve   | 08         | CO2 | L3 |
| 4-A   | a) Explain the population growth problem.<br>OR<br>b) Write a python program to find the factorial of a number using recursion.                                | 06         | CO3 | L4 |
| 4-B   | a) Explain the prey-predator model<br>OR<br>b) Write a python program to demonstrate the use of break, continue and pass statements with the help of for loop. | 06         | CO3 | L4 |

| Level        | Marks     | CO           | Marks     |
|--------------|-----------|--------------|-----------|
| Level1       | 5         | CO1          | 4         |
| Level2       | 5         | CO2          | 14        |
| Level3       | 8         | CO3          | 12        |
| Level4       | 12        | CO4          | 0         |
| Level5       | 0         | CO5          | 0         |
| Level6       | 0         | CO6          | 0         |
| <b>Total</b> | <b>30</b> | <b>Total</b> | <b>30</b> |



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| Q.No  | Questions  | Marks (30) | CO  | BL  |
|-------|--|------------|-----|-----|
| 1-I   | What is mathematical model   | 01         | CO4 | 1.1 |
| 1-II  | Write the condition of exact differential equation   | 01         | CO4 | 1.1 |
| 1-III | Define the boundary value problem  | 01         | CO4 | 1.2 |
| 1-IV  | What is the advantage of mathematical model?   | 01         | CO4 | 1.1 |
| 1-V   | Define the differential equation.  | 01         | CO4 | 1.1 |
| 2-I   | What is mathematical model   | 01         | CO5 | 1.2 |
| 2-II  | Write the condition of exact differential equation   | 01         | CO5 | 1.2 |
| 2-III | Define the boundary value problem  | 01         | CO5 | 1.2 |
| 2-IV  | What is the advantage of mathematical model?   | 01         | CO5 | 1.2 |
| 2-V   | Define the differential equation.  | 01         | CO5 | 1.2 |
| 3     | a) Solve the linear differential equation<br>OR<br>b) Explain the limitation of model.<br><br>OR<br>b) Solve | 08         | CO5 | 1.3 |
| 4-A   | a) Explain the non-linear population growth problem.<br>OR<br>b) Explain Decision Tree Algorithm.            | 06         | CO6 | 1.4 |
| 4-B   | a) Explain the compartment model.<br>OR<br>b) Explain MAE, MSE and RMSE.                                     | 06         | CO6 | 1.5 |

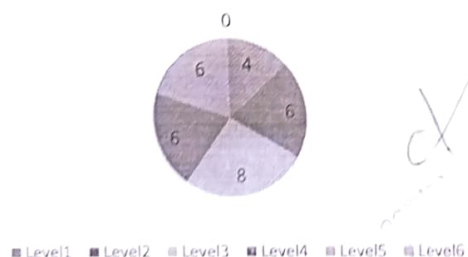
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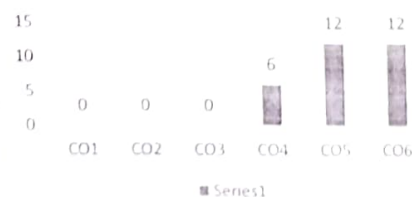
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|        |    |       |    |
|--------|----|-------|----|
| Level1 | 4  | CO1   | 0  |
| Level2 | 6  | CO2   | 0  |
| Level3 | 8  | CO3   | 0  |
| Level4 | 6  | CO4   | 6  |
| Level5 | 6  | CO5   | 12 |
| Level6 | 0  | CO6   | 12 |
| Total  | 30 | Total | 30 |

Bloom's Level wise Marks Distribution



Course Outcome wise Marks Distribution



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| Q.No | Questions   | Marks (10) | CO  | BL |
|------|---|------------|-----|----|
| 1    | How the real world problems are solved by using mathematical modelling. | 05         | CO4 | L2 |
| 2    | Construct a MM for change of price of commodity                         | 05         | CO5 | L1 |
|      |   |            |     |    |
|      |   |            |     |    |
|      |   |            |     |    |

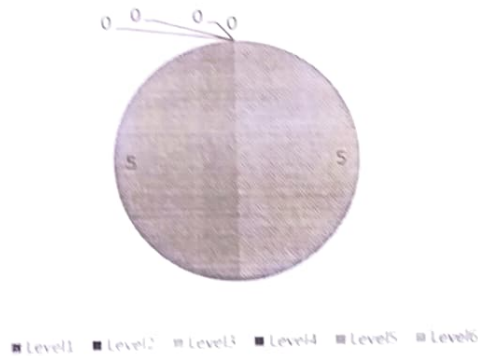
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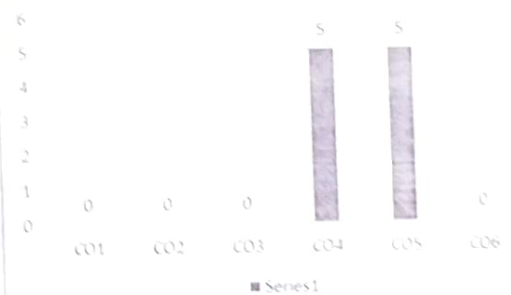
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| Level        | Marks     | CO           | Marks     |
|--------------|-----------|--------------|-----------|
| Level1       | 5         | CO1          | 0         |
| Level2       | 5         | CO2          | 0         |
| Level3       | 0         | CO3          | 0         |
| Level4       | 0         | CO4          | 5         |
| Level5       | 0         | CO5          | 5         |
| Level6       | 0         | CO6          | 0         |
| <b>Total</b> | <b>10</b> | <b>Total</b> | <b>10</b> |

Bloom's Level wise Marks Distribution



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| Q.No | Questions  | Marks (10) | CO  | BL |
|------|--|------------|-----|----|
| 1    | Derive compartment model.  | 05         | CO4 | L1 |
| 2    | Detail out the classification of MM? Give two examples of each type of model | 05         | CO5 | L2 |
|      |  |            |     |    |
|      |  |            |     |    |
|      |  |            |     |    |
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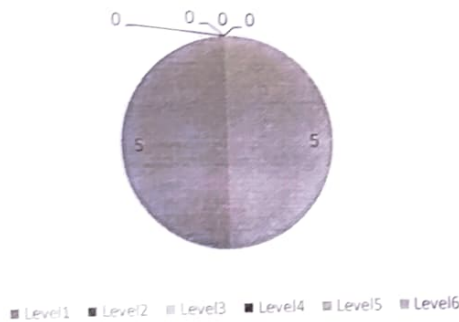
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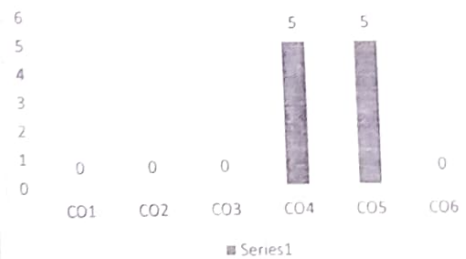
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| Level        | Marks     | CO           | Marks     |
|--------------|-----------|--------------|-----------|
| Level1       | 5         | CO1          | 0         |
| Level2       | 5         | CO2          | 0         |
| Level3       | 0         | CO3          | 0         |
| Level4       | 0         | CO4          | 5         |
| Level5       | 0         | CO5          | 5         |
| Level6       | 0         | CO6          | 0         |
| <b>Total</b> | <b>10</b> | <b>Total</b> | <b>10</b> |

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