# UNIVERSITY OF MADRAS

## B.Sc. DEGREE PROGRAMME IN MATHEMATICS

SYLLABUS WITH EFFECT FROM 2023-2024

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">MATHEMATICAL MODELLING</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">CORE M11</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">334C5C</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td>--</td><td>5</td></tr>
<tr><td colspan="2">Pre-requisite</td><td colspan="6">12th Standard Mathematics</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Construction and Analysis of Mathematical models found in real life problems.<br>• Modelling through differential and difference equations</td></tr>
<tr><td colspan="2" rowspan="3">Course Outline</td><td colspan="6">UNIT-I: Mathematical Modelling: Simple situations requiring mathematical modelling – The Technique –Classification and some characteristics of mathematical models.<br>Chapter 1: Sections: 1.1 –1.4. Hours:15</td></tr>
<tr><td colspan="6">UNIT-II: Mathematical Modelling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models.<br>Chapter 2: Sections: 2.1 –2.4. Hours: 15</td></tr>
<tr><td colspan="6">UNIT-III: Mathematical Modelling, through system of Ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations. Epidemics: simple epidemic model, Susceptible-infected- susceptible (SIS) model, SIS model with constant number of carriers. Medicine: Model for Diabetes Mellitus. Chapter 3: Sections: 3.1, 3.2 and 3.5.1. Hours: 15</td></tr>
<tr><td colspan="6">UNIT – IV: Introduction to difference equations. Hours: 15<br>Chapter 5: Section 5.2.1 – 5.2.9</td></tr>
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|---|---|
| | **UNIT-V:** Mathematical Modelling through difference equations: Harrod Model, cob web model application to Actuarial Science<br>**Chapter 5: Sections: 5.3.1 – 5.3.4** **Hours:15** |
| **Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)** | **Total Hours: 75**<br>Questions related to the above topics, from various competitive examinations UPSC / TNPSC / others to be solved<br>(To be discussed during the Tutorial hour) |
| **Skills acquired from this course** | Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill |
| **Recommended Text** | Mathematical Modeling by J N Kapur, (1988). |
| **Reference Books** | 1. Mathematical Modeling by Bimalk. Mishra and Dipak K.Satpathi. Ane Books Pvt. Ltd(1 Januuary 2009)<br>2. Mathematical Modeling Models, Analysis and Applications, by Sandip Banerjee, CRC Press, Taylor & Francis group, 2014<br>3. Mathematical Modeling applications with Geogebra by Jonas Hall & Thomas Ligefjard, John Wiley & Sons, 2017<br>4. Mark M. Meerschaert: Mathematical Modeling, Elsevier Publ., 2007.<br>5. An introduction to mathematical Modeling, Edward A. Bender: CRC Press, 2002.<br>6. Concepts of Mathematical Modeling, Walter J. Meyer, Dover Publ., 2000. |
| **Website and e-Learning Source** | https://nptel.ac.in<br>https://www.mathhelp.com |

**** Also common for 2020 – 21 Batch as Elective**

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**Course Learning Outcome (for Mapping with POs and PSOs)**

Students will be able to

**CLO 1:** Explain simple situations requiring Mathematical Modelling and to Determine thecharacteristics of such models

**CLO 2:** Model using differential equations in-terms of linear growth and Decay models

**CLO 3:** Model using systems of ordinary differential equations of first order, to discuss aboutvarious models under the categories 'Epidemics' and 'Medicine'

**CLO 4:** Explain in detail about difference equations

**CLO 5:** Model using difference equations

| | POs | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 |
| CLO 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| CLO 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| CLO 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |
| CLO 4 | 3 | 2 | 2 | 2 | - | 1 | 2 | 3 | 2 |
| CLO 5 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 |