| QF04/0408-4.0E | Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Department of Basic Sciences |
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|---|---|---|---|---|---|
| **Study plan No.** | **2024/2025** | | **University Specialization** | **Bachelor of Mathematics** | |
| **Course No.** | **0420804** | | **Course name** | **Ordinary Differential Equations 1** | |
| **Credit Hours** | **3** | | **Prerequisite/ Co-requisite** | **Calculus (2)** | |
| **Course type** | ☐ MANDATORY UNIVERSITY REQUIREMENT | ☐ UNIVERSITY ELECTIVE REQUIREMENTS | ☐ FACULTY MANDATORY REQUIREMENT ☐ Support course family requirements | ✓ **Mandatory requirements** | ☐ Elective requirements |
| **Teaching style** | ☐ Full online learning | | ☐ Blended learning | ✓ **Traditional learning** | |
| **Teaching model** | ☐ 1 Synchronous: 1 asynchronous | | ☐ 1 face to face : 1 asynchronous | ✓ **2 Traditional** | |

## Faculty member and study divisions' information (to be filled in each semester by the subject instructor)

| Name | Academic rank | Office No. | Phone No. | E-mail | |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| **Division number** | **Time** | **Place** | **Number of students** | **Teaching style** | **Approved model** |
| | | | | Traditional | |
| | | | | | |
| | | | | | |

## Brief description

Differential equations of first-order, Methods for solving linear differential equations of higher order, Methods for solving Cauchy – Euler equations, Laplace transformations.

## Learning resources

| | | | | |
|---|---|---|---|---|
| Course book information (Title, author, date of issue, publisher ... etc) | A First Course in Differential Equations with Modeling Applications, Zill, Dennis G. 10th edition,2013 | | | |
| Supportive learning resources (Books, databases, periodicals, software, applications, others) | 1. Elementary Differential Equation and Boundary Value Problems, William Boyce & Richard C. Diprima, 10th edition, 2013.<br>2. Introduction to theory of Ordinary Differential Equations, V. hamrmaiah, 2013.<br>3. Ordinary Differential Equation, Purna Chandra, 2012.<br>4- A First Course in Differential Equations with Applications". By W.R. Derrick and S.I. Grossman, 3ed Edition, 1987 | | | |
| Supporting websites | 1. http://eqworld.ipmnet.ru/en/solutions/ode.htm<br>2. http://www.sosmath.com/diffeq/diffeq.html | | | |
| The physical environment for teaching | ✓ Class room | ☐ labs | ☐ Virtual educational platform | ☐ Others |
| Necessary equipment and software | | | | |

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|---|---|
| Supporting people with special needs | |
| For technical support | |

## Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

| No. | Course learning outcomes | The associated program learning output code |
|---|---|---|
| | **Knowledge** | |
| **K1** | Define the basic concepts of the ordinary differential equations | **MK 2** |
| **K2** | Classify the types of first order ordinary differential equations | **MK 1** |
| **K3** | Recognize the higher order linear differential equations with constant coefficients. | **MK 1** |
| **K4** | Recognize the nonhomogeneous linear ordinary differential equations. | **MK 1** |
| | **Skills** | |
| **S1** | Use different techniques to solve first order ordinary differential equations. | **MS 4** |
| **S2** | Apply method for solving higher-order homogeneous linear ordinary differential equations with constant coefficients. | **MS 4** |
| **S3** | Apply methods for solving nonhomogeneous linear ordinary differential equations. | **MS 5** |
| | **Competences** | |
| **C1** | Work professionally with different types of ordinary differential equations | **MC 2** |
| **C2** | Develop the individual's ability to communicate and interact with other mathematical courses. | **MC 1** |

## Mechanisms for direct evaluation of learning outcomes

| Type of assessment / learning style | Fully electronic learning | Blended learning | Traditional Learning (Theory Learning) | Traditional Learning (Practical Learning) |
|---|---|---|---|---|
| First/Second exam | 30% | 30% | **30%** | 30% |
| Participation / practical applications | . | . | **20%** | 30% |
| Asynchronous interactive activities | 30% | 30% | **0%** | . |
| Final exam | 40% | 40% | **50%** | 40% |

## Schedule of simultaneous / face-to-face encounters and their topics

| Week | Subject | learning style | Reference |
|---|---|---|---|
| **1** | Basic definitions.<br>Solution, general solution, examples.<br>Particular solution and initial value problem. | Lecture | 2 – 11 |
| **2** | Existence and Uniqueness Theorem. | Lecture | 17 – 36 |

| | | | |
|---|---|---|---|
| | Directional fields. Separable ODE | | |
| **3** | Differential eqns .of the form $y' = f(y + ax + b)$<br>Homogeneous functions and homogeneous differential eqns of the first order. | Lecture | 37 - 59 |
| **4** | Differential equations of the form $y' = f(\frac{a_1x + b_1y + c_1}{a_2x + b_2y + c_1})$<br>Definition of exact equations. Necessary and sufficient condition for exactness. | Lecture | 37 - 59 |
| **5** | Non-exact differential equations and integrating factors. | Lecture | 37 - 59 |
| **6** | Linear ODE of the first order. Discontinuous forcing terms. | Lecture | 37 - 59 |
| **7** | Bernoulli's equation. Riccati's equation. | Lecture | 37 - 59 |
| **8** | Higher order equations (some special cases).<br>Reduction of order of higher order differential equations.<br>**Midterm Exam 30%** | Lecture | 93 – 108 |
| **9** | The Basic Theory of Linear differential equations of n-th order. Linear dependence and independence of functions. The Wronskian. | Lecture | 93 – 108 |
| **10** | Homogeneous Linear differential equations with constant coefficients.<br>Distinct and repeated real roots of Characteristic equations. | Lecture | 109 – 141 |
| **11** | Complex roots of the characteristic equation of the homogenous differential equations.<br>Method of undetermined coefficients.<br>Finding the particular solution for higher order nonhomogeneous linear differential equations | Lecture | 109 – 141 |
| **12** | Method of variation of parameters for finding the particular solution for higher order nonhomogeneous linear differential equations. | Lecture | 141 – 146 |
| **13** | Ordinary Differential Equations with variable coefficients<br>Cauchy-Euler Differential Equations | Lecture | 147 – 153 |
| **14** | Laplace Transform and inverse Laplace transform. | Lecture | 239 - 300 |
| **15** | Using Laplace transform to solve initial-value problems. | Lecture | 300 - 310 |
| **16** | **Final Exam 50%** | | |