Department of Chemistry

College of Science

University of Salahaddin

Subject: Differential Equations

Course Book – 2nd years

Lecturer's name: MSc. Muzhda Amjad abdulraheem

Academic Year: 2023-2024

Course Book

1. Course name	**Differential Equation**
2. Lecturer in charge	**MSc. Muzhda Amjad abdulraheem**
3. Department/ College	**Chemistry / Science**
4. Contact	**E-mail :** muzhda.abdulraheem@su.edu.krd
5. Time (in hours) per week	**6 hours**
6. Office hours	**2**
7. Course code	
8. Teacher's academic profile	My name is **Muzhda Amjad Abdullraheem**, I born in Erbil, Iraq in **1981**.I graduated from mathematical Department / college of science in Salahaddin University-Erbil in **2003-2004**, in Erbil,Iraq.I got Master of science in differential equation in **2010**.I am working as a lecturer in mathematical department/college of science/Salahaddin University-Erbil.
9. Keywords	**Calculus,Derivative, integral**

10. Course overview:

The overall goal of the field of Differential Equation is understanding the differential equations with its solution by some methods and application of it in chemistry fields .

11. Course objective:

To give the students an operational understanding of geometric insight into the concepts of differential Equations and applying these concepts to problem solving.

12. Student's obligation

Students should actively participate in lectures and must be involved in solving exercises, as well as encouragement to express an opinion and proposals and providing reports and seminars.

13. Forms of teaching

All lectures are shown by data show with power point file, where it’s exist for students and must using whiteboard in all lectures to give student more explanations to the subjects.

14. Assessment scheme

Midterm exam1: 15 marks, Midterm exam2: 15 marks.
There will be weekly tutorials, which give the students 10 .
Final exam: 60 marks. The examination schedule will be announced by the exam board of the department of mathematics.

15. Student learning outcome:

A student passing the course shall be able to account for the Differential Equations problems, principles and techniques that are used to establish properties.

16. Course Reading List and References:

- Dennis G. Zill, **A First Course of Diff. Eq.** , 2004 .
- George B. Thomas, **Thomas' Calculus**, 11th Edition, 2005.

17. The Topics:	**Lecturer's name**
• Introduction • Differential equation • Order, degree and solution • First order methods • Separable • Homogenous • Linear • Exact • Integrating Factor • Bernoulli • Second Order Equations • Linear Second Order • Homogenous Case • Non - Homogenous Case • Chemistry Applications	
18. Practical Topics (If there is any)	

19. Examinations:

Q.1) Solve $\frac{dy}{dx} - 3y = e^x y^3$ where $y(0) = 1$

Solution:

$$\frac{dy}{dx} - 3y = e^x y^3$$

$$P(x) = -3\,, \qquad f(x) = e^x\,, \qquad n = 3$$

$$I(x) = e^{\int (1-n)P(x)dx}$$

$$I(x) = e^{\int (1-3)(-3)dx} = e^{\int -6dx} = e^{6x}$$

$$\Rightarrow \quad I(x) = e^{6x}$$

$$I(x)y^{1-n} = \int (1-n)I(x)f(x)dx$$

$$e^{6x}y^{1-3} = \int (1-3)e^{6x}e^x dx$$

$$e^{6x}y^{-2} = -2\int e^{7x}dx$$

$$e^{6x}y^{-2} = \frac{-2}{7}e^{7x} + C$$

$$y^{-2} = \frac{-2e^{7x}}{7e^{6x}} + \frac{C}{e^{6x}}$$

$$y^2 = \frac{1}{(\frac{-2}{7}e^x + \frac{C}{e^{6x}})}$$

$$y(0) = 1 \quad \Rightarrow (1)^2 = \frac{1}{(\frac{-2}{7}e^0 + \frac{C}{e^0})}$$

$$\Rightarrow\ 1 = \frac{1}{(\frac{-2}{7} + C)}$$

$$\Rightarrow 1 = (\frac{-2}{7} + C)$$

$$\Rightarrow C = \frac{9}{7}$$

$$\Rightarrow \qquad y = \sqrt{\frac{1}{(\frac{-2}{7}e^x + \frac{9}{7e^{6x}})}}$$

Q.2) Solve $(2y^2x^3 + e^x)dx - (\sin(y) - yx^4)dy = 0$

Solution:

$$\frac{d(2y^2x^3+e^x)}{dy} = 4yx^3 \qquad = \qquad \frac{d(-\sin(y)+yx^4)}{dx} = 4yx^3$$

⇒ The eq. is exact, and there exist a function $F(x, y)$ such that

$$\int dF = \int (2y^2x^3 + e^x)dx$$

$$\Rightarrow \qquad F(x, y) = \frac{1}{2}y^2x^4 + e^x + K(y)$$

$$\frac{dF}{dy} = yx^4 + \frac{dK}{dy} \ \ldots\ldots\ldots\ldots\ldots (*)$$

Comparison between (*) and Q we get

$$\frac{dK}{dy} = -\sin(y)$$

$$K(y) = Cos(y) + C$$

$$\Rightarrow \qquad F(x, y) = \frac{1}{2}y^2x^4 + e^x + Cos(y) + C$$

20. Extra notes:

21. Peer review

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