



Department of Mathematics

College of Education

University of Salahaddin

Subject: Ordinary differential equations

Course Book – (Year, 2)

Lecturer's name, Qumri Hayder Hamko

Academic Year: 2020/2021

Course Book

1. Course name	Ordinary differential equations
2. Lecturer in charge	Qumri Hayder Hamko
3. Department/ College	Mathematic/Education
4. Contact	e-mail: qumrihamko@su.edu.krd Tel:(07504549076)
5. Time (in hours) per week (12 Hours ,Three groups A B &C)	Theory: 3 Practical:(conclusion) 1
6. Office hours	Sunday(8:30-12:30),Monday(8:30-12:30) , Wednesday (8:30-12:30)
7. Course code	
8. Teacher's academic profile	Date of first Employment: 18-5-1985 in Department of Mathematics, College of Education, Salahaddin University-Howler, Erbil. B.Sc. of Mathematics at college of Education from university of Salahaddin, Erbil- Iraq at July 1984. M.Sc. in Applied Mathematics at college of Education from university of Salahaddin, Erbil- Iraq at September 1994. Employment: 1997-2004 (مقرر القسم) Decision of department of Mathematics, College of Education, Salahaddin University. 2004-2008 Head of Mathematics Department, College of Education-Soran, Salahaddin University. 2008-2010 (مقرر القسم) Decision of department of Mathematics, College of Education, Salahaddin University. 2015-2020 A study aPhd. In pure Mathematics(TOPOLOGY) at college of Education from university of Salahaddin ,Erbil- Iraq.
9. Keywords	
10. Course overview:	Topics covered include solutions of ordinary differential equations ,initial and boundary value problem, including existence and uniqueness theorems, qualitative, and analytical methods of equations of first ,second and higher order, Cauchy-Euler equations, solutions by infinite series, systems of equations, and the Laplace transformation.
11. Course objective:	Students should be able to <ul style="list-style-type: none"> •Identify and classify various types of differential equation. •Calculate general and particular solutions of first order linear differential equations by qualitative, and analytical methods, which include separation of variables, homogeneous equations, exact equations, integrating factor, and Bernoulli methods). <ul style="list-style-type: none"> • Determine whether unique solutions in existence and uniqueness theorems. •Create and solve Riccattis equation that problems. •Calculate general and particular solutions of second order linear differential equations by various methods, which include reduction of order, undetermined coefficients, variation of parameters, and solutions by series. <ul style="list-style-type: none"> •Define and use Laplace transforms to solve differential equations. •Solve systems of first order linear equations using differential operator, Laplace transform, and solutions of linear systems.

- Apply solutions of first order initial value problems.
- Power series solutions.
- classify differential equations by order, linearity, and homogeneity.
- solve first order linear differential equations.
- solve linear equations with constant coefficients.
- use separation of variables to solve differential equations.
- solve exact differential equations.
- use variation of parameters to solve differential equations.
- use the method of undetermined coefficients to solve differential equations.
- determine whether a system of functions is linearly independent using the Wronskian.

12. Student's obligation

- 1- Attendance.
- 2- Quiz.
- 3- Test about some questions in the conclusion .
- 4-There examinations' will be given, each %40.
- 5- Final examination,%60 .

13. Forms of teaching

The essence of the teaching program is prepared on papers. Elaborations and explanations of the details are done on black and white board and obligatory .For the student to a achieve a level excellence in this subject; the following points should be given at most consideration:

- Class attendance on regular basis for the purpose of learning and doing class work.
- Active participation in class discussions.
- Reviewing the lecture notes and topics on weekly basis, noting the ambiguous points, if any, and requesting clarification during instructor office hours.
- Giving adequate and sufficient priority of papers, pencils, eraser for writing lecture and daily tests.

14. Assessment scheme

Homework and assignments, Quizzes and attendance, Discussion and Conclusion, presentation.10 %.

Midterm examines 30 % .

Final examine 60 %

Average 100 %

15. Student learning outcome:

1. Find general solutions to first-order, second-order, and higher-order homogeneous and non homogeneous differential equations by manual and technology-based methods.
2. Identify and apply initial and boundary values to find particular solutions to first-order, second-order, and higher order homogeneous and non-homogeneous differential equations by manual and technology-based methods, and analyze and interpret the results.
3. Select and apply appropriate methods to solve differential equations; these methods will include, but are not limited to, undetermined coefficients, variation of parameters, Laplace and inverse Laplace transforms.
4. Select and apply series techniques to solve differential equations.

16. Course Reading List and References:

- C.Ray Wylie, Differential Equations.
- Tyn Myint-U Ordinary Differential Equations.
- W.E.Boyce, Elementary Differential Equations.
- D. Arnold, second edition, Differential Equations
- طرق حل المعادلات التفاضلية الاعتيادية د.خالد أحمد السامرائي

Differential Equations, Second Edition, by J. Polking, A. Boggess and D. Arnold. Prentice Hall, 2006.

Elementary Differential Equations, 9th edition (7th or 8th ed ok), W. E. Boyce and R.C. Dippima, John Wiley and Sons.

The course materials of the course consists of the above books, articles from internet, and lectures notes, make sure read all the materials and prepare well before going for the exams.

17. The Topics:

First semester

Week 1-6 : Introduction to Differential Equations

- Definitions and terminology
- classify differential equations by order, degree, linearity, and homogeneity.

- Initial-value problems

First-Order Differential Equations.

- Separation of variables.
- Solutions by substitutions.
- Homogenous Differential Equations.
- Non-homogeneous Differential Equations.
- Exact Differential Equations.
- Non-Exact Differential Equations.(Integrating Factor)

Week 7-8: Linear first order Ordinary Differential Equations.

Lecturer's name

Qumri Hayder Hamko
(4hrs) 4/10/2020

(2A+2B +2C)

(12 Hours)

<p>(Linear ,Bernoulli's , Riccattis ,Simultaneous).</p> <p>Week 9-10: Existence and uniqueness theorem of first order ordinary differential equations.</p> <p>Week 11-12: The reduction of higher order ordinary differential equations in to first order. Ordinary differential equations in first order and higher degree.</p> <p>Week 13-14:Higher order ordinary differential equations .</p> <p>A. Linearly dependent and Linearly independent solutions .wronskian method.</p> <p>B. Fundamental Solutions of Homogeneous Equations</p> <p>C. Reduction of Order</p> <p>D. Homogeneous Linear Equations with Constant Coefficients</p> <p>E. Non homogeneous Differential Equations.</p> <p>Second semester</p> <p>Week 1-4: How to find a particular solution of non-homogeneous ordinary differential equations with constant Coefficients.(the variation of parameters method, short method or operator methods, undetermined coefficients).</p> <p>Week 5-7: Linear higher order differential equations with variable Coefficients. Cauchy- Euler Equations</p> <p>Week 8-10: The Laplace Transformation.</p> <p>A. Definition and Properties of the Laplace Transform.</p> <p>B. Inverse Laplace Transform.</p> <p>C. Transforms of Derivatives.</p> <p>D. Solving Initial Value Problems Using Laplace Transforms.</p> <p>Week 11-14: The power series solution.</p> <p>A. Power Series Solutions About an Ordinary Point.</p> <p>B. Solutions About Singular Points.</p>	
<p>18. Practical Topics (If there is any)</p>	
<p>19. Examinations:</p> <p>1: Q1/ Solve the following differential equations:</p> <p>1) $y''+4y'+4y = \frac{e^{-2x}}{x^2}$. 2) $\frac{dy}{dx} = e^{3x-2y}$.</p> <p>3) $(2y - x - 5)dy - (3x + y + 1)dx = 0$. 4) $(2D^2 + 2D + 3)y = x(x + \cos x)$</p> <p>Q2/prove or disprove:</p> <p>1) Every homogenous differential equation is to be separable differential equation by using the relation $\frac{y}{x} = \vartheta$.</p> <p>2) Every Separable differential equation is to be homogenous differential equation.</p>	

Q3/ Choose the correct answer: (with out solving)

(1) which of the following will be an integrating factor for the (LFODE.)

$$Xy' + (X+2)y = X^3 ?$$

a) $e^{x/2} + e^{2x}$

b) $e^{(x/2)+2x}$

c) $x^2 e^x$

d) $x^2 + e^x$

(2) Find the general solution of the differential equation $X^2 y' = y^2$

a) $y = cx$

b) $y = 1/(1/x+c)$

c) $y = c e^{1/x}$

d) $y = c_1 \sin(x) + c_2 \cos(x)$.

(3) Which of the following equation is a third order and non-linear ordinary differential equation?

a) $dy/dx = y + 1$

b) $y''' + y'' + y' + y = 1$

c) $y''' + x^3 y = 0$

d) $y''' + y y' = 1$.

Q4/Match the differential equation with the solution (Choose the correct answer):

A. $y' = -2Y$

a. $Y = \sin(x) + C$

B. $y' = (3/x) Y$

b. $Y = C e^{-2x}$

C. $y' = \cos(x)$

c. $Y = C x^3$

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

ئەم کۆرسبووکە دەبیت لە لایەن ھاوئێکی ئەکادیمیەو سەیر بکرت و ناوەرۆکی بابەتەکانی کۆرسەکە پەسەند بکات و جەند
ووشەیک بنوسیت لەسەر شیاوی ناوەرۆکی کۆرسەکە و واژووی لەسەر بکات.
ھاوئێ ئەو کەسەیکە زانیاری ھەبیت لەسەر کۆرسەکە و دەبیت پلەیی زانستی لە مامۆستا کەمتر نەبیت.