Form: Course Syllabus	**Form Number**	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
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	Number of Pages	10

1.	**Course Title**	**Ordinary Differential Equation II**
2.	**Course Number**	0331421
3.	**Credit Hours (Theory, Practical)**	3
	Contact Hours (Theory, Practical)	3
4.	**Prerequisites/ Corequisites**	0301221
5.	**Program Title**	B.Sc. in Mathematics
6.	**Program Code**	
7.	**School/ Center**	Science
8.	**Department**	Mathematics
9.	**Course Level**	Elective specialization requirement
10.	**Year of Study and Semester (s)**	all semesters
11.	**Other Department(s) Involved in Teaching the Course**	
12.	**Main Learning Language**	English
13.	**Learning Types**	☐ Face to face learning ■ Blended ☐ Fully online
14.	**Online Platforms(s)**	■ Moodle ■ Microsoft Teams
15.	**Issuing Date**	
16.	**Revision Date**	20/11/2024

17. Course Coordinator:

Name: Nabil Shawagfeh Contact hours:

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18. Other Instructors:

Name:
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Contact hours:
Name:
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19. Course Description:

Linear ordinary differential equations; existence and uniqueness theorems; infinite series solutions (Frobenious method); Bessel functions and Legendre Polynomials; Strum-Liouville theory; Green's functions; linear systems with constant coefficients; non-linear differential equations and stability.

20. Program Student Outcomes (SO's):

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Identify, formulate, and solve broadly-defined technical or scientific problems by applying knowledge of Mathematics and Science and/or technical topics to areas relevant to the discipline.
2. Formulate and design a model, process, procedure or program to meet desired needs.
5. Reflect the impact of technical and/or scientific solutions in economic, environmental, and societal contexts.
7. Utilize research methods, critical and creative thinking skills to assess and analyze information) to solve problems properly, then draw valid reasoning and logical conclusions leading to true consequences.

21. Course Intended Learning Outcomes (CLO's):

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Write a mathematical proof of the existence and uniqueness theorem.
2. Use Frobenious method to find series solutions for some types of second order ODEs about regular singular points for the three cases (The difference between the two exponents is not an integer, zero, or an integer)
3. Study Green's functions and apply them for solving ODEs.
4. Find the solutions for some types of linear systems with constant coefficients.
5. Discuss the stability of linear systems with constant coefficients.

Course CLOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1		√	√	√		
2		√	√		√	
3	√	√	√	√	√	
4	√	√			√	
5	√	√	√	√	√	

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)	SO (8)
1 Write a mathematical proof of the existence and uniqueness theorem.	*						*	
2- Use Frobenious method to find series solutions for some types of second order ODEs about regular singular points for the three cases (The difference	*	*			*			

between the two exponents is not an integer, zero, or an integer)								
3 Study Green's functions and apply them for solving ODEs	*	*			*			
4- Find the solutions for some types of linear systems with constant coefficients.	*	*			*			
5- Discuss the stability of linear systems with constant coefficients.	*	*					*	

23. Topic Outline and Schedule:

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
1	1.1	Review of ODE	1	BL	Moodle	S	Exam	Text Book
	1.2	Review of ODE	1	BL	Moodle	S	Exam	Text Book
	1.3	Review of ODE	1	BL	Moodle	AS	Exam	Text Book
2	2.1	Convergence of sequence of functions	1	BL	Moodle	S	Exam	Text Book
	2.2	Lipschitz Condition	1	BL	Moodle	S	Exam	Text Book
	2.3	Hypothesis of the Existence and Uniqueness Theorem	1	BL	Moodle	AS	Exam	Text Book

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
3	3.1	Proof of the Existence and Uniqueness Theorem	1	BL	Moodle	S	Exam	Text Book
	3.2	Proof of the Existence and Uniqueness Theorem	1	BL	Moodle	S	Exam	Text Book
	3.3	Remarks and Examples	1	BL	Moodle	AS	Exam	Text Book
4	4.1	Remarks and Examples	1	BL	Moodle	S	Exam	Text Book
	4.2	Review of Power Series Solutions	2	BL	Moodle	S	Exam	Text Book
	4.3	Review of Regular(Irregular) Singular Points	2	BL	Moodle	AS	Exam	Text Book
5	5.1	Review of Frobenius Method	2	BL	Moodle	S	Exam	Text Book
	5.2	The difference of the indicial roots is not integer	2	BL	Moodle	S	Exam	Text Book
	5.3	The difference of the indicial roots is integer	2	BL	Moodle	AS	Exam	Text Book
6	6.1	The indicial roots are equal	2	BL	Moodle	S	Exam	Text Book
	6.2	Bessel Functions	2	BL	Moodle	S	Exam	Text Book
	6.3	DEs Solvable in Terms of Bessel Functions	2	BL	Moodle	AS	Exam	Text Book

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
7	7.1	Properties and examples of Bessel Functions	2	BL	Moodle	S	Exam	Text Book
	7.2	Legendre Polynomials	2	BL	Moodle	S	Exam	Text Book
	7.3	Solution of Legendre's equation	2	BL	Moodle	AS	Exam	Text Book
8	8.1	Two-point boundary value problem	2	BL	Moodle	S	Exam	Text Book
	8.2	Special types of boundary conditions	2	BL	Moodle	S	Exam	Text Book
	8.3	Regular Sturm–Liouville boundary value problems	3	BL	Moodle	AS	Exam	Text Book
9	9.1	Eigen values and eigen functions of Sturm–Liouville problems	3	BL	Moodle	S	Exam	Text Book
	9.2	Some properties of regular Sturm–Liouville problems	3	BL	Moodle	S	Exam	Text Book
	9.3	Periodic Sturm–Liouville problems	3	BL	Moodle	AS	Exam	Text Book
10	10.1	Properties of Periodic Sturm–Liouville problems	3	BL	Moodle	S	Exam	Text Book
	10.2	Green's function for a regular Sturm–Liouville problem	3	BL	Moodle	S	Exam	Text Book
	10.3	Properties of Green's	3	BL	Moodle	AS	Exam	Text

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
		Functions						Book
11	11.1	Basic theory of systems of first-order linear equations	4	BL	Moodle	S	Exam	Text Book
	11.2	Homogeneous linear system with constant coefficients	4	BL	Moodle	S	Exam	Text Book
	11.3	Complex eigenvalues	4	BL	Moodle	AS	Exam	Text Book
12	12.1	Complex eigenvalues	4	BL	Moodle	S	Exam	Text Book
	12.2	Repeated eigenvalues	4	BL	Moodle	S	Exam	Text Book
	12.3	Mid Term		BL	Moodle	AS	Exam	Text Book
13	13.1	Repeated eigenvalues	4	BL	Moodle	S	Exam	Text Book
	13.2	Nonhomogeneous Linear systems (undetermined coefficients)	4	BL	Moodle	S	Exam	Text Book
	13.3	Nonhomogeneous Linear systems (variation of parameters)	4	BL	Moodle	AS	Exam	Text Book
14	14.1	Phase plane and phase portrait	5	BL	Moodle	S	Exam	Text Book
	14.2	Real Unequal Eigenvalues of the Same	5	BL	Moodle	S	Exam	Text Book

Week	Lecture	Topic	CLO/s Linked to the Topic	Learning Types Face to Face (FF) Blended (BL) Fully Online (FO)	Platform Used	Synchronous (S) Asynchronous (A)	Evaluation Methods	Learning Resources
		Sign						
	14.3	Real Eigenvalues of Opposite Sign.	5	BL	Moodle	AS	Exam	Text Book
15	15.1	Equal Eigenvalues	5	BL	Moodle	S	Exam	Text Book
	15.2	Complex Eigenvalues.	5	BL	Moodle	S	Exam	Text Book
	15.3	Revision	5	BL	Moodle	AS	Exam	Text Book

24. Evaluation Methods:

Opportunities to demonstrate achievement of the CLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
First Exam	30		1,2,5,7	6th week	
Mid Term	30		1,2,5	12th week	
Final Exam	40		1,2,5,7	16th week	

25. Course Requirements:

Each student must have

- computer

- Account on Microsoft Teams

26. Course Policies:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled times. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of the lectures without an excuse (of sickness or due to other insurmountable difficulty), then the student shall be barred from sitting for the final examination. Also he/she will get a failing grade in this course.
3. Medical certificates for excuses of exam absences should be introduced to the University Physician for authorization. These authorized certificates should also be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
4. Test papers shall be returned to students after correction, where the student mark is considered final after a lapse of one week following their return.
5. Cheating is prohibited, where University cheating regulations will be applied on any student who cheats in exams or on home works.

27. References:

A- Required book (s), assigned reading and audio-visuals:

1. Elementary Differential Equations and Boundary Value Problems, W. Boyce & R. DiPrima.

2. Introduction to Ordinary Differential Equations, A. L. Rabenstein.

B- Recommended books, materials, and media:

1. Ordinary Differential Equations, E. Rainville & P. Bedient.

2. Special Functions for Scientists and Engineers, W. Bell.

28. Additional information:

Name of the Instructor or the Course Coordinator: **Prof. Nabil Shawagfeh**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ Department: **Prof. Manal Ghanem**	Signature: ……	Date: ……
Name of the Head of Department: **Prof. Baha Alzalg**	Signature: ……	Date: ……
Name of the Head of Quality Assurance Committee/ School of Science: **Prof. Emad A. Abuosba**	Signature: ……	Date: ……
Name of the Dean or the Director: **Prof. Mahmoud I. Jaghoub**	Signature: ……	Date: ……