مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

The University of Jordan

Accreditation & Quality Assurance Center

COURSE Syllabus

Course Name: Engineering Mathematics (1)

1	Course title	**Engineering Mathematics (1)**
2	Course number	(0301202)
3	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	(0301201)
5	Program title	B.Sc.
6	Program code	
7	Awarding institution	The University of Jordan
8	Faculty	Science
9	Department	Mathematics
10	Level of course	College requirement
11	Year of study and semester (s)	all Semesters
12	Final Qualification	B.Sc. in Mathematics
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English
15	Date of production/revision	1.11.2016

16. Course Coordinator:

Office numbers, office hours, phone numbers, and email addresses should be listed.

Dr. Iryna

17. Other instructors:

Office numbers, office hours, phone numbers, and email addresses should be listed.

18. Course Description:

As stated in the approved study plan.

Ordinary differential equations, linear differential equations of second and higher order, systems of differential equations, phase plane, stability, series solutions of differential equations, orthogonal functions, Laplace transforms, linear systems of equations, matrices and determinants.

19. Course aims and outcomes:

A- Aims:

1- Model some real life problems using ODEs.
2- Solve some special types of ODEs, such as first order ODEs, Linear ODEs, Cauchy Euler ODEs.
3- Use series solutions to solve ODEs.
4- Use Laplace transforms to solve ODEs.

B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to ...

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding Skills: Student is expected to

A1) Master the basic concepts of ordinary differential equation (ODE).

A2) Select proper procedure to solve a given ODE.

A3) Find Laplace and Inverse Laplace tramsforms of given functions

A4) Master the basic concepts of linear algebra

B. Intellectual Analytical and Cognitive Skills: Student is expected to

B1) Write down an ODE that represents a given model

B2) Find several ODEs whose solution is a given function

C. Subject- Specific Skills: Student is expected to

C1) Solve a system of linear ODE's

C2) Solve a system of linear algebraic equations

C3) Use Mathematical Packages to find analytical or Numerical solution of an ODE.

D. Creativity /Transferable Key Skills/Evaluation: Student is expected to

D1) Be involved in the process of illustrating concepts, building algorithms and exploring facts.

D2) Make critical comments on obtained results

D3) Write reports, to be involved in general discussions with his class mates, and to do independent work.

20. Topic Outline and Schedule:

Topic	Week	Instructor	Achieved ILOs	Evaluation Methods	Reference
Chapter 1: First order ordinary differential equations (ODE) 1- Basic concepts: differential equation, ordinary, order, linear, non-linear, solution, homogeneous, non-honogeneous initial value problem .Examples. 1-3: First order Separable ODE, can be made separable, Examples. Problems: (2-19) odd numbers $(y' = f\left(\frac{y}{x}\right), u = \frac{y}{x})$ 1-4: First order Exact ODE, Test of Exactness, solution, can be made Exact (Integrating factor), Examples. Problems: (1-20) odd numbers 1-5: First order Linear ODE, solution (Integrating factor) can be made Linear (Bernoulli equation), Examples. Problems: (3-17) odd numbers	1-3			Exam	
Chapter 2: Second order ODE 2-1: Homogeneous, non-homogeneous, Linear independence, Basis, general solution, particular solution. Reduction of order: x-missing, y-missing, if one solution is known find another linearly independent solution, Examples Problems: (1-14) odd numbers,15,16,18,19,21. 2-2: Homogeneous Linear of constant coefficients, exponential solution, characteristic equation, three cases (two different real roots, one repeated real root, complex roots and Euler formula) Problems: (1-32) odd numbers 2-5 : Can be made equation with constant coefficients (Euler-Cauchy equation) auxiliary equation, solution, Three cases: Two distinct real roots, one repeated x^m real root, complex roots. Examples Problems: (1-15) odd numbers 2-6: Existence and uniqueness, Linear independence, Wronskian. Problems: (1-17) odd number 2-7: Non-homogeneous ODE, general solution of	4-6			***Exam***	

homogeneous + Particular solution of non-homogeneous = general solution of non-homogenous. Finding particular solution using Method of undetermined coefficients. Examples. Problems: (1-20) odd numbers 2-10: Finding Particular solution using Method of variation of parameters. Examples. Problems: (1-17) odd numbers					
Chapter 3 :Higher order Linear ODE . 3-1 : Homogeneous linear differential equation of order n, general solution, initial value problem, existence and uniqueness of solution ,linear independence, Wronskian Examples. Problems: (1-19) odd numbers 3-2: Homogeneous linear differential equation of order n of constant coefficients, exponential solution, characteristic equation of order n, cases of roots . Examples. Problems: (1-18) odd numbers 3-3 : Non-Homogeneous linear differential equation of order n, general solution of non-homogeneous = general solution of homogeneous + particular solution of non-homogeneous Finding particular solution by method of undetermined coefficients and by method of variation of parameters For Euler- Cauchy equation can be made of constant coefficients By finding auxiliary equation using solution $y = x^m$, Examples Problems: (1-14) odd numbers	7			Exam	
Chapter 4 : System of differential equations 4-1: Definition of System of differential equations, nth order ODE as a system of differential equations Examples .Problems: (11-15) odd numbers 4-2: Eigen values and eigen vectors, linear system, homogeneous , non-homogeneous systems , general solution of homogeneous system . Examples. Problems: (1-15) odd numbers 4-3 : Homogeneous systems of constant coefficients Examples Problems: (1-15) odd numbers 4-6: General solution of Non-homogeneous systems=general solution of Homogeneous system + Particular solution of non-homogeneous system .Particular solution can be found by Method of undetermined coefficients or by Method of variation of parameters. Examples. Problems: (2-16) odd numbers	8			Exam	
Chapter 5: Series solution of ODE. 5-1, 5-2: Review of basic properties of power series. Shifting of index, starting index of	9-11				

the sum, real analytic functions, existing of power series solution, regular points and singular points of a differential equation, Recurrence relation .Examples. Problems: (1-16) odd numbers; Problems: (16-23) odd numbers 5-4: Solution of ODE near regular singular points, (Frobenius Method), Indicial equation, roots , three cases. Examples. Problems: (1-17) odd numbers 5-7: Sturm – Liouville equation, Sturm – Liouville problem, real eigenvalues, eigenfunctions solution, Ortho-normal eigenfunctions. Examples .Problems: (1-19) odd numbers					
Chapter 6: Laplace Transform. 6-1: Definition of Laplace and inverse of Laplace Transform, Linearity, First shifting theorem, Existence and uniqueness of Laplace transform Examples. Problems: (1-20),(29-40),(41-54) odd numbers 6-2: Laplace Transform of derivative and of integral Solving initial value problem using Laplace transform Examples. Problems: (1-8), (10-24),(27-34) odd numbers 6-3: Unit step function ,writing branch functions as a linear combination of functions using unit step function , Second shifting theorem ,Solving initial value problems Containing branch functions. Examples. Problems: (2-34) odd numbers 6-4: Dirac δ-function: Examples. 6-5: Convolution (optional) 6-6: Differentiation and integration of Laplace transform Examples Solving ode with variable coefficients. Problems: (1-20) odd numbers 6-7: Solving System of ODE using Laplace transform. Examples. Problems: (1-20) odd numbers	12-14				
Chapter 7: Matrices, Determinants and Linear system of equations 7-1, 7-2 :Basic properties of Matrices, eigenvalues, eigenvectors Remark: part or all of these sections can be given in Chapter 4 .Examples 7-3: Linear system of algebraic equations, Coefficient matrix, Augmented matrix, Elementary row operations, row Equivalent systems, (Gauss elimination method), three cases Examples. Problems: (1-16) odd numbers 7-5: Existing and uniqueness of solution of linear	15				

system Examples. 7-7: Basic properties of Determinants, Solution of linear system using Cramer's Rule. Examples. Problems: (5-16),(18-20) odd numbers 7-8: Inverse of a matrix, Solution of linear system using inverse of a matrix, Finding inverse of a matrix using Gauss-Jordan elimination method or adjoint method. Examples. Problems: (1-12) odd numbers					

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.

- Class time will be spent on lecture as well as discussion of homework problems and some group work.
- To actively participate in class, you need to prepare by reading the textbook and doing all assigned homework before class (homework will be assigned each class period, to be discussed the following period).
- You should be prepared to discuss your homework (including presenting your solutions to the class) at each class meeting - your class participation grade will be determined by your participation in this.
- You are encouraged to work together with other students and to ask questions and seek help from the professor, both in and out of class.

22. Evaluation Methods and Course Requirements:

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

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	Exam	

23. Course Policies:

According to university regulations, attendance is mandatory. If a student is unable to attend a class, then he/she should contact the instructor. If a student misses more than 10% of the classes without excuse, then he/she will be assigned a falling grade in class.

In cases of extreme emergency or serious illness, the student will be allowed to make up the missed exams. Times and dates for make up exams will be assigned latter.

There are severe sanction for cheating, plagiarizing and any other form of dishonesty. The university regulations on cheating will be applied to any student who cheats in exams or on.

24. Required equipment:

Data Shows

25. References:

A- Required book (s), assigned reading and audio-visuals: Advanced Engineering Mathematics by E. Kreyszig, 10th Edition. B- Recommended books, materials, and media: 1) Advanced Engineering Mathematics by Dennis G. Zill and Warren S. Wright, 5th edition. 2) Advanced Engineering Mathematics by K. A. Stroud and Dexter J. Booth, 5th edition

26. Additional information:

Name of Course Coordinator: Dr. Iryna Signature: ---------- Date: 1/11/2016

Head of curriculum committee/Department: Dr. Hisham M. Hilow Signature: ----------

Head of Department: Dr. Baha Alzalg Signature: ----------

Head of curriculum committee/Faculty: Dr. Amal Al-Aboudi Signature: ----------

Dean: Dr. Sami Mahmood Signature: ----------

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Head of Department
Assistant Dean for Quality Assurance
Course File