Department of Mathematics
Calculus I | Course outline

Course code and name: 0301101, Calculus I
Credit hours: 3
Prerequisite: The required prerequisite is a good preparation in matrix linear algebra and multivariate calculus.
Teaching Language: English

Instructor Name	Dr. Baha Alzalg
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Office hours	To be determined
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Course Website:	https://sites.ju.edu.jo/sites/Alzalg/Pages/Calculus-I.aspx
Department phone	06/5355000-22100

Course Description

Functions: domain, operations on functions, graphs of functions; trigonometric functions; limits: meaning of a limit, computational techniques, limits at infinity, infinite limits; continuity; limits and continuity of trigonometric functions; the derivative: techniques of differentiation, derivatives of trigonometric functions; the chain rule; implicit differentiation; differentials; Roll's Theorem; the mean value theorem; the extended mean value theorem; L'Hopital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function; graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps); antiderivatives; the indefinite integral; the definite integral; the fundamental theorem of calculus ; area under a curve; area between two curves; transcendental functions: inverse functions, logarithmic and exponential functions and their derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions; some techniques of integration.

Learning Objectives

Upon completion of this course, the student should be able to

1. Know the basic theories of calculus and the accompanying mathematical techniques and procedures required and become well-trained on them.

2. Solve several practical applications of calculus and to solve several applied problems using differentiation and integration in a clear, logical manner.

3. Develop ability to reason logically, then transfer mathematical concepts from one situation to another rather than memorizing mechanical procedures.

Intended Learning Outcomes (ILOs):

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

A. Knowledge and Understanding Skills: Student is expected to

A1) Calculate the limit for various types of functions.
A2) Determine whether a given function is continuous at a certain point.
A3) Differentiate and integrate various types of functions.
A4) Sketch the graph of polynomials, trigonometric and rational functions.
A5) Use correctly some famous Theorems in calculus such as: Intermediate Value Theorem, Mean Value Theorem, and Fundamental Theorem of Calculus.

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

B1) Students should be able to use mathematical symbols as well as calculus I concepts (limits, continuity, derivatives, applications of the derivative, antiderivative, the definite and indefinite integral, and the Fundamental Theorem of Calculus) to analyze, graph, and solve real world problems.

C. Subject- Specific Skills: Student is expected to

C1) Calculate limits and determine continuity for functions.
C2) Perform differentiation and integration correctly.
C3) Sketch the graph of polynomial and rational polynomial functions, as well as some transcendental functions.

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

D1) Use mathematical symbols and mathematical structures to model and solve real world problems.
D2) Choose the correct use of quantifiable measurements of real world situations.

ILOs: Learning and Evaluation Methods

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	**Exam**	**A1**

Course Contents

Content	Reference	Week	ILO/s	Evaluation Methods
1.　Functions and models §1.1: Four ways to represent a function 　　Ex: 2,4,7–10, 31-55,72–78 §1.2: Mathematical models: A catalog of essential functions 　　Ex: 1-5,6,8,9 §1.3: New functions from old functions 　　Ex:1, 3, 5-7, 9-24, 27, 33-36, 39, 43-47, 49, 50, 51, 61 §1.5: Exponential functions 　　Ex: 1,3,11–21,33 §1.6: Inverse functions and logarithms 　　Ex: 3–18,21-31,35–41,47–57,63–72,75		1-3		A1
2.　Limits and derivatives §2.2 The limit of a function 　　Ex: 7,8,15–17,29-33,38 §2.3 Calculating limits using the limit laws 　　Ex: 1, 2, 7, 9-32, 37, 39, 41–46, 48, 49, 51, 52 § 2.5: Continuity 　　Ex: 4, 18, 20, 23, 33, 35–39, 43, 45-47, 51-54, 57, 58, 65, 67 § 2.6: Limits at infinity; Horizontal asymptotes 　　Ex: 3,7,15–38,41–46,48,52-56 §2.7: Derivatives and rate of change 　　Ex: 27,29,31,33-38,53,54 §2.8: The derivative as a function 　　Ex: 1,3,23,29,37-40		4-5		A1
3.　Differentiation rules §3.1: Derivatives of polynomials and exponential functions 　　Ex: 3–36, 44, 46, 52-55, 57, 68, 70, 74, 75, 77 §3.2: The product and quotient rules 　　Ex: 3-9, 11-13, 16-25, 27, 33, 39, 43, 48, 49, 52, 54 §3.3: Derivatives of trigonometric functions 　　Ex: 1–16, 21–24, 30, 39–49, 52 §3.4: The chain rule 　　Ex: 7–17, 23-45, 50, 51, 53, 56, 59, 61, 63, 65, 66, 69, 95-97 §3.5: Implicit differentiation 　　Ex: 55–21, 24, 26, 37, 49-60, 75-78 §3.6: Derivatives of logarithmic functions 　　Ex: 2-23, 26, 27, 29, 33, 41-52, 53, 55		5-8		A1

§3.10: Linear approximations and differentials Ex: 2, 3, 6–11, 13, 15, 17, 19, 20, 23–31 §3.11: Hyperbolic Functions Ex: 7–21, 23, 31, 33, 35, 40, 41, 43, 45, 47, 54				
4. Applications of differentiation §4.1: Maximum and minimum values Ex: 9, 11, 13, 29–45, 47–62, 65–68 §4.2: The mean value theore Ex: 2, 5, 7, 9, 11, 15, 17, 19, 23, 25 §4.3: How derivatives affect the shape of a graph Ex:5–7, 9, 11, 13, 15-17, 19, 25, 31, 37-53 §4.4: Indefinite forms and L'Hopital's rule Ex: 1–66, 74, 89, 90 §4.5: Summary of curve sketching Ex: 5, 9, 13, 17, 19, 24, 25, 29, 30, 37, 43, 45, 54, 66-69		9-12		A1
5. Integrals §5.2: The definite integral Ex: 34–42,47–50 §5.3: The fundamental theorem of calculus Ex: 2, 7–44, 55–62 §5.4: Indefinite integrals and the net change theorem Ex: 2,5–18,21–46,49,50 §5.5: The substitution rule Ex: 7–48, 53–74, 74, 78, 79, 85, 86		13-15		A1

Learning Methodology

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

- The instructor will spend most of the class time on presenting the new material as well as on discussing homework problems.
- Group work in this class is encouraged.
- To actively participate in class, you need to prepare by reading the textbook and to do all assigned problems before class. (Problems will be assigned each class period, then to be discussed the following period).
- You should be prepared to discuss your homework at each class meeting.
- You are encouraged to work together with other students and to ask questions and seek help from your professor, both in and out of class.
- Students are also encouraged to use graphing calculators extensively and to use computer software supplements.

Students may consult the webpage of the book for further practicing and more examples: http://www.stewartcalculus.com/media/10_home.php

Evaluation

Evaluation	Point %	Date
Exam I	20 %	Week 5
Exam II	30 %	Week 10
Final Exam	50 %	

Main Reference/s:

James Stewart (2012) Calculus (Early Transcendentals), 7th Edition, Thomson, Metric international version, Canada.

References:

(1) G. Thomas (2005) Calculus, 11th edition, Addison Wesley (Person Education).
(2) R. Smith and R. Minton (2007) Calculus, 3rd edition, McGraw Hill.
(3) Howard Anton, Irl Bivens and Stephen Davis (2005) Calculus, 8th edition, John Wiley and sons Inc., New York.

Intended Grading Scale (Optional)

0 - 39	**F**
40 - 49	**D-**
50 - 54	**D**
55 - 59	**D+**
60 - 64	**C-**
65 - 69	**C**
70 - 73	**C+**
74 - 76	**B-**
77 - 80	**B**
81 - 84	**B+**
85 - 89	**A-**
90 -100	**A**

Notes:

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 time. 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 lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.
3.   Medical certificates shall be given to the University Physician to be authorized by him. They should 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. His/her mark is considered final after a lapse of one week following their return.
5.   Solutions for the exams questions and marks will be announced at the course webpage.
6.   Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on homeworks.