King Fahd University of Petroleum and Minerals
Department of Mathematics & Statistics

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The Course Code and Name: Math 106, Applied Calculus.

The Course Credit Hours: 3-0-3 (Three lecture sessions per week.)

Instructors: Dr. Dhaker Kroumi and Dr. Muhmmad Imran Qureshi.

The Course Description: Limits and Continuity. The derivative. Rules for differentiation. Derivative of logarithmic, exponential, and trigonometric functions. Differentials. Growth and decay models. Definite and indefinite integrals. Techniques of integration. Integrals involving logarithmic, exponential, and trigonometric functions. Integration by tables. Area under a curve and between curves. Functions of several variables. Partial derivatives and their applications to optimization.
The Course Prerequisite: One-year preparatory mathematics or its equivalent.

Learning Outcomes: After completion of the course, the student should be able to:
- Differentiate functions using the appropriate techniques from the following: power rule, product rule, quotient rule, chain rule;
- Differentiate exponential functions, trigonometric functions and logarithmic functions;
- Find the relative minima and/or maxima, absolute minimum and/or maximum and the inflection point(s) using differentiation;
- Solve problems about optimization and exponential growth and decay using the concept of differentiation of a function of one variable.
- Integrate some algebraic and trigonometric functions (and understand the relationship between the derivative and the integral of a function);
- Use the Fundamental Theorem of Calculus to evaluate the integral of a function;
- Calculate the area between two curves;
- Classify extreme values of a function of two variables and apply them to optimization problems;
- Apply the techniques of differentiation and integration to various applications in business and economics.

Textbook: Haeussler, Ernest F., Richard S. Paul, and Richard J. Wood. Introductory Mathematical Analysis for Business, Economics, and the Life and Social Sciences (13th edition). Upper Saddle River, NJ: Pearson Prentice Hall, 2011.

Table 1: Tentative Classes Pacing Schedule (Subject to Change)

Week	Dates	Sections	Topics	Suggested Problems
1	Aug. 29-Sep. 02	10.1-10.3	Limits - Limits (Continued) - Continuity	PROBLEMS 10.1: 4, 8, 17, 23, 36, 42, 44 PROBLEMS 10.2: 2, 13, 15, 21, 29, 41, 47, 52, 58 PROBLEMS 10.3: 6, 11, 22, 30, 36
2	Sep. 05-09	11.1-11.3	The Derivative - Rules for Differentiation - The Derivative as a Rate of Change	PROBLEMS 11.1: 12, 15, 18, 20, 25, 27 PROBLEMS 11.2: 22, 33, 60, 72, 78, 85 PROBLEMS 11.3: 8, 10, 12, 16, 21, 27, 40, 41
3	Sep. 12-16	11.4, 11.5	The Product Rule and the Quotient Rule - The Chain Rule	PROBLEMS 11.4: 9, 15, 28, 37, 57, 66 PROBLEMS 11.5: 6, 13, 30, 41, 71, 73
4	Sep. 19-23	12.1, 12.2	Derivatives of Logarithmic Functions - Derivatives of Exponential Functions	PROBLEMS 12.1: 16, 18, 20, 24, 28, 30, 32, 50 PROBLEMS 12.2: 10, 14, 16, 22, 28, 30, 38,39
			National Day Holidays: Thursday, Sep. 23, 2021	
5	Sep. 26-30	12.4, 12.5*	Implicit Differentiation - Logarithmic Differentiation	PROBLEMS 12.4: 10, 14, 20, 22, 30, 34 PROBLEMS 12.5: 7, 10, 14, 18, 20, 27
6	Oct. 03-07	12.7, 13.1	Higher-Order Derivatives - Relative Extrema	PROBLEMS 12.7: 2, 8, 14, 30, 33, 35 PROBLEMS 13.1: 16, 18, 30, 38, 48, 52
7	Oct. 10-14	13.2, 13.3	Absolute Extrema on a Closed Interval - Concavity	PROBLEMS 13.2: 2, 6, 10, 12 PROBLEMS 13.3: 12, 28, 40, 42, 60, 68
			Major Exam 1: Oct. 11, 2021, Material: Sections 10.1-12.7 Student Break: Oct. 17, 2021	
8	Oct. 18-21	13.4, 13.5	The Second-Derivative Test – Asymptotes	PROBLEMS 13.4: 5, 6, 8, 10, 12 PROBLEMS 13.5: 14, 20, 22, 34, 35, 45
9	Oct. 24-28	13.6, 14.1	Applied Maxima and Minima - Differentials	PROBLEMS 13.6: 4, 15, 18, 22, 26 PROBLEMS 14.1: 12, 14, 20, 22, 29
10	Oct. 31-Nov. 04	14.2, 14.3	The Indefinite Integral - Integration with Initial Conditions	PROBLEMS 14.2: 8, 10, 18, 27, 30, 45 PROBLEMS 14.3: 5, 7, 11, 14, 15
11	Nov. 07-11	14.4, 14.5	More Integration Formulas - Techniques of Integration	PROBLEMS 14.4: 9, 12, 15, 33, 35, 52 PROBLEMS 14.5: 6, 12, 23, 30, 40, 44, 53,63

Major Exam-II: Nov. 15, Material: Sections 13.1-14.5
12	Nov. 14-18	14.7, 14.9	The Fundamental Theorem of Integral Calculus - Area between Curves	PROBLEMS 14.7: 16, 36, 42, 44, 48 PROBLEMS 14.9: 1, 3, 5, 20, 33, 37, 46, 58
13	Nov. 21-25	15.1, 15.2	Integration by Parts - Integration by Partial Fractions	PROBLEMS 15.1: 6, 8, 12, 18, 20, 24, 32 PROBLEMS 15.2: 1, 5, 6, 7, 8, 17, 31
Midterm Break: Sunday-Thursday, Nov. 28- Dec. 02
14	Dec. 05-09	15.3, 17.1	Integration by Tables - Partial Derivatives	PROBLEMS 15.3: 3, 7, 9, 14, 20, 36, 44, 54 PROBLEMS 17.1: 2, 8, 18, 20, 24, 30, 35
15,16	Dec. 12-16,	17.4, 17.6	Higher-Order Partial Derivatives - Maxima and Minima for Functions of Two Variables	PROBLEMS 17.4: 6, 8, 12, 18, 20, 21, 23 PROBLEMS 17.6: 4, 9, 17, 19, 22, 26, 29
	Dec. 19-20		Revision	
Normal Thursday Class: Monday, Dec. 20, 2021 **Final Exam:** To Be Held During Dec. 22- Jan. 03; Material: Comprehensive *Expressing the percentage rate of change in revenue in terms of the percentage rate of change in price using the elasticity of demand is beyond the scope of the course, since Section 12.3 is not included.

Table 2: The Course Grading Policy

Quizzes	10% (30 points)	• The questions of all assessments are based on the examples and exercises of the Textbook. • The average (out of 30) of the class work grade should be in the interval [21, 22.5], that is, [70%, 75%].
Homework	5% (15 points)	
Major Exam-I	25% (75 Points)	
Major Exam-II	25% (75 points)	
Final Exam (comprehensive)	35% (105 points)	

Cheating in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in an "**F**" grade in the course along with reporting the incident to the higher university administration.

Missing a Quiz, or an Exam:

- **Assessments, Quizzes, and Major Exams:** No make-up test will be given under any circumstances. If a student misses one of these tests for a legitimate reason (such as medical emergencies), he must present an official excuse from the Student Affairs to the designated instructor no later than a week before the date of the Final Exam. In this case the student grade for this test will be the average of all other tests grades he received in the course during the term, except for the Final Exam grade

received in the course during the term, except for the Final Exam grade. If no such official excuse is forwarded to the instructor on time, the student receives ZERO grade.

- **Final Exam:** If a student misses the Final Exam for a legitimate reason (such as medical emergencies), he will be given a make-up Final Exam.

Attendance: Students are expected to attend all classes.

- If a student misses a class, he is responsible for any announcement made in that class.
- A student, who has a valid excuse for an absence, must present an officially authorized document to his instructor no later than a week before the date of the Final Exam; no excuses shall be accepted after that date.
- A DN grade will be awarded to any student who accumulates
    - o 9 unexcused absences in classes.
    - o 12 excused and unexcused absences in classes.

Usage of Calculators: Calculators are not allowed in all exams.

Academic Integrity: All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin on the webpage of the Registrar.

Tips on How to Enhance Your Problem-Solving Skills:

- Make sure you understand the concepts and techniques of each section.

- Take notes during classes and study your notes, textbook, and, if available, lecture slides before your next class.

- Review the lecture to consolidate your learning and locate any missed points.

- Try always to solve the problems on your own first before reading the solution or asking for help.

- If you find it difficult to solve a certain type of problems, you should try more problems of that type.

- Try to make good use of the office hours of your instructor.

- Solve old exams as part of your preparation for the Midterm and Final Exams.

- Last, but not least, consult your instructor whenever you feel you need help understanding a concept or solving a problem.