

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

MATH-106 Applied Calculus T-221

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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)

**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:

1. Compute derivative of various functions using appropriate technique.
2. Use concepts of relative minima and/or maxima, absolute minimum and/or maximum and inflection points.
3. Solve problems in optimization and exponential growth and decay.
4. Evaluate integral of some algebraic and trigonometric functions and use the Fundamental Theorem of Calculus.
5. Compute area between curves.
6. Calculate partial derivatives of a function of several variables and classify extreme values of a function of two variables and apply them to optimization problems.
7. Use basic concepts of calculus 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: The Course Grading Policy**

|                                       |                        |  |
|---------------------------------------|------------------------|--|
| <b>Quizzes</b>                        | 10% (40 points)        | <ul style="list-style-type: none"><li>• The questions of all assessments are based on the examples and exercises of the Textbook.</li><li>• The average (out of 40) of the class work grade should be in the interval [28, 30], that is, [70%, 75%].</li></ul> |
| <b>Homework</b>                       | 5% (20 points)         |  |
| <b>Major Exam-I</b>                   | 25% (100 Points) (MCQ) |  |
| <b>Major Exam-II</b>                  | 25% (100 points) (MCQ) |  |
| <b>Final Exam<br/>(comprehensive)</b> | 35% (140 points) (MCQ) |  |

Table 2: Tentative Classes Pacing Schedule (Subject to Change)

| Week   | Dates            | Sections             | Topics  | Suggested Problems   |
|--|------------------|----------------------|---|--|
| 1  | Aug. 28-Sep. 01  | 10.1-10.3            | Limits - Limits (Continued) - Continuity  | <b>PROBLEMS 10.1:</b> 4, 8, 17, 23, 36, 42, 44<br><b>PROBLEMS 10.2:</b> 2, 13, 15, 21, 29, 41, 47, 52, 58<br><b>PROBLEMS 10.3:</b> 6, 11, 22, 30, 36 |
| 2  | Sep. 04-08       | 11.1-11.3            | The Derivative - Rules for Differentiation - The Derivative as a Rate of Change | <b>PROBLEMS 11.1:</b> 12, 15, 18, 20, 25, 27<br><b>PROBLEMS 11.2:</b> 22, 33, 60, 72, 78, 85<br><b>PROBLEMS 11.3:</b> 8, 10, 12, 16, 21, 27, 40, 41  |
| 3  | Sep. 11-15       | 11.4, 11.5           | The Product Rule and the Quotient Rule - The Chain Rule                         | <b>PROBLEMS 11.4:</b> 9, 15, 28, 37, 57, 66<br><b>PROBLEMS 11.5:</b> 6, 13, 30, 41, 71, 73   |
| 4  | Sep. 18-21       | 12.1, 12.2, Handouts | Derivatives of Logarithmic, Exponential and Trigonometric functions             | <b>PROBLEMS 12.1:</b> 16, 18, 20, 24, 28, 30, 32, 50<br><br><b>PROBLEMS 12.2:</b> 10, 14, 16, 22, 28, 30, 38,39                                      |
| <b>National Day Holidays: Thursday, Sep. 22, 2022</b>      |                  |                      |   |  |
| 5  | Sep. 25-29       | 12.4, 12.5*          | Implicit Differentiation - Logarithmic Differentiation                          | <b>PROBLEMS 12.4:</b> 10, 14, 20, 22, 30, 34<br><b>PROBLEMS 12.5:</b> 7, 10, 14, 18, 20, 27  |
| <b>Major Exam I: Oct. 02, Material: Sections 10.1-12.5</b> |                  |                      |   |  |
| 6  | Oct. 02-06       | 12.7, 13.1           | Higher-Order Derivatives - Relative Extrema                                     | <b>PROBLEMS 12.7:</b> 2, 8, 14, 30, 33, 35<br><b>PROBLEMS 13.1:</b> 16, 18, 30, 38, 48, 52   |
| 7  | Oct. 09-13       | 13.2, 13.3           | Absolute Extrema on a Closed Interval - Concavity                               | <b>PROBLEMS 13.2:</b> 2, 6, 10, 12<br><b>PROBLEMS 13.3:</b> 12, 28, 40, 42, 60, 68   |
| 8  | Oct. 16-20       | 13.4, 13.5           | The Second-Derivative Test – Asymptotes   | <b>PROBLEMS 13.4:</b> 5, 6, 8, 10, 12<br><b>PROBLEMS 13.5:</b> 14, 20, 22, 34, 35, 45  |
| 9  | Oct. 23-27       | 13.6, 14.1           | Applied Maxima and Minima - Differentials                                       | <b>PROBLEMS 13.6:</b> 4, 15, 18, 22, 26<br><b>PROBLEMS 14.1:</b> 12, 14, 20, 22, 29  |
| 10   | Oct. 30- Nov. 03 | 14.2, 14.3           | The Indefinite Integral - Integration with Initial Conditions                   | <b>PROBLEMS 14.2:</b> 8, 10, 18, 27, 30, 45<br><b>PROBLEMS 14.3:</b> 5, 7, 11, 14, 15  |
| <b>Major Exam-II: Nov. 06, Sections 12.7-14.3</b>          |                  |                      |   |  |
| 11   | Nov. 06-10       | 14.4, 14.5           | More Integration Formulas - Techniques of Integration                           | <b>PROBLEMS 14.4:</b> 9, 12, 15, 33, 35, 52<br><b>PROBLEMS 14.5:</b> 6, 12, 23, 30, 40, 44, 53,63  |

|  |                            |                   |   |   |
|--|----------------------------|-------------------|---|---|
| 12   | Nov. 13-17                 | 14.7,<br>14.9     | The Fundamental Theorem of Integral Calculus - Area between Curves                                  | <b>PROBLEMS 14.7:</b> 16, 36, 42, 44, 48<br><b>PROBLEMS 14.9:</b> 1, 3, 5, 20, 33, 37, 46, 58       |
| 13   | Nov. 20-24                 | 15.1,<br>15.2     | Integration by Parts - Integration by Partial Fractions   | <b>PROBLEMS 15.1:</b> 6, 8, 12, 18, 20, 24, 32<br><b>PROBLEMS 15.2:</b> 1, 5, 6, 7, 8, 17, 31       |
| <b>Midterm Break: Sunday-Thursday, Nov. 27- Dec. 01</b>  |                            |                   |   |   |
| 14   | Dec. 04-08                 | 15.3,<br>17.1     | Integration by Tables - Partial Derivatives   | <b>PROBLEMS 15.3:</b> 3, 7, 9, 14, 20, 36, 44, 54<br><b>PROBLEMS 17.1:</b> 2, 8, 18, 20, 24, 30, 35 |
| 15,16  | Dec. 11-15,<br><br>Dec. 18 | 17.4,<br><br>17.6 | Higher-Order Partial Derivatives - Maxima and Minima for Functions of Two Variables<br><br>Revision | <b>PROBLEMS 17.4:</b> 6, 8, 12, 18, 20, 21, 23<br><b>PROBLEMS 17.6:</b> 4, 9, 17, 19, 22, 26, 29    |
| <b>Normal Thursday Class: Monday, Dec. 18, 2022</b>  |                            |                   |   |   |
| <b>Final Exam: To Be Held During Dec. 21- Jan. 03; Material: Comprehensive</b><br><i>*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.</i> |                            |                   |   |   |

**Grading:** The letter grades are based on curved grading (a grading curve), which will depend on the average of all students taking the course.

**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.

**Exam Hall policy:** No student will be allowed to take the exam if not having his/her KFUPM ID card or National/Iqama ID card. Students are not allowed to carry mobile phones and smart watches to the exam halls. Students must take the exam in the place assigned to them.

**Missing an Exam:** In case, a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he must bring an official excuse from Students Affairs. Otherwise, he will get zero in the missed 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 after getting two warnings from the instructor, in case a student accumulates
  - 9 unexcused absences in classes.
  - 15 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.