LAGUARDIA COMMUNITY COLLEGE
CITY UNIVERSITY OF NEW YORK
DEPARTMENT OF MATHEMATICS, ENGINEERING AND COMPUTER SCIENCE

MAT 202 - CALCULUS II
PRE-REQUISITES: MAT 201 (CALCULUS I)

CATALOG DESCRIPTION: This is the second course in the calculus sequence designed to provide students with an appreciation of the usefulness and power of calculus. Emphasis will be placed on the applications of integrals to various desciplines. Among the topics studied are Techniques of integration (e.g. by parts, by partial fractions); Areas between curves; Volumes of revolution; Applications of integrals to Physics; Sequences and Series; Taylor series representation of analytic functions; Parametric Calculus and Polar coordinates.

ENTRY LEVEL SKILLS: The student should know the concepts of derivative, indefinite integral, and definite integral, and have good computational skills to calculate derivatives and simple integrals involving polynomials, trigonometric and inverse trigonometric functions, exponential and logarithmic functions. Furthermore, the student should be able to use calculus to graph elementary functions.

TEXT: *Calculus: Early Transcendentals* (Eighth Edition) by James Stewart, Published by Brooks/Cole Cengage Learning (2016), ISBN: 9781285741550

INSTRUCTIONAL OBJECTIVES: During this course, the instructor expects to:

1. Enable students to compute definite and indefinite integrals using u-substitutions, trigonometric substitutions, integration by parts, partial fraction decomposition, and using tables.
2. Enable students to evaluate certain types of trigonometric integrals, including integrals involving powers of sine and cosine functions, or powers of tangent and secant functions.
3. Introduce improper integrals and enable students to evaluate improper integrals.
4. Introduce and illustrate various methods for approximating definite integrals, including the Midpoint Rule, Trapezoidal Rule, and Simpson's Rule.
5. Enable students to set up and compute integrals representing the area between given curves, as well as volume of solids of revolution, using both cross-sections and/or cylindrical shells method.
6. Enable students to compute arc lengths of curves.
7. Enable students to compute work and hydrostatic force and calculate centroid of regular or irregular thin geometric plates, using definite integrals.
8. Introduce the meaning of limit of a sequence and sum of an infinite series, and various convergence tests used to determine the convergence or divergence of numerical sequences and infinite series, including the Divergence Test, Comparison Test, Integral Test, Alternating Series Test, Ratio Test and Root Test.
9. Enable students to determine convergence or divergence of numerical sequences and series by applying appropriate convergence tests.

10. Enable students to compute power series representations of analytic functions, both using geometric series and the Taylor or Maclaurin series expansion of a function and compute the radii of convergence of these power series representations.
11. Introduce parametric curves and basic calculus of parametric curves, including tangent lines to parametric curves, area of regions enclosed by parametric curves and arc lengths of parametric curves.
12. Introduce polar coordinates and basic calculus in polar coordinates, including tangent lines to polar curves, area of regions enclosed by polar curves and arc lengths of polar curves.

PERFORMANCE OBJECTIVES: At the conclusion of this course, students will be able to:

1. Compute definite and indefinite integrals using u-substitutions, trigonometric substitutions, integration by parts, partial fraction decomposition, and using tables.
2. Compute certain types of trigonometric integrals, including integrals involving powers of sine and cosine functions, or powers of tangent and secant functions.
3. Identify and compute improper integrals, and explain, in English sentences, why a given integral is or is not improper.
4. Write and compute approximations for definite integrals using the Midpoint Rule, Trapezoidal Rule, and Simpson's Rule.
5. Write, set up and evaluate definite integrals representing the area between given curves, as well as volume of solids of revolution, by illustrating the region or shape whose area/volume is being sought, and drawing a typical rectangle, cross-section, or cylindrical shell.
6. Write, set up and compute definite integrals representing arc lengths of curves.
7. Write, set up and compute definite integrals representing work, hydrostatic force and coordinates of the centroid of regular or irregular thin geometric plates.
8. Explain, in English sentences, the meaning of limit of a sequence and sum of an infinite series and write down statements of various convergence or divergence tests including the Divergence Test, Comparison Test, Integral Test, Alternating Series Test, Ratio Test and Root Test, and produce examples for each test.
9. Analyze numerical sequences and series for convergence or divergence and determine their convergence or divergence.
10. Write power series representations of analytic functions, both using geometric series and the Taylor or Maclaurin series expansion of a function and compute the radii of convergence of these power series representations.
11. Draw curves defined by parametric equations and compute tangent lines to parametric curves, area of regions enclosed by parametric curves and arc lengths of parametric curves.
12. Draw curves defined in polar coordinates, compute area of regions enclosed by polar curves and compute arc lengths of polar curves.

GRADING: Your grade will be based on your performance on the quizzes, class worksheets, tests, and a final exam that the instructor will give. Class worksheets are problems that the instructor will give students to solve in class, in order to assess students' learning during that particular class. Quizzes could be based on homework assignments. The instructor may also count solutions to homework assignments as a factor in the grade. In any case, you are encouraged to work out solutions to unassigned problems (in addition to the assigned problems) to acquire more practice, which is essential for success in mathematics. You are urged to meet with the instructor frequently

during the semester to discuss your progress. The table below shows how your grade will be calculated:

- **Homework and/or Class worksheets** (9 is recommended): 9%
- **Quizzes** (8 is recommended): 16%
- **Tests** (3 is recommended): 45%
- **Final Exam** 30%

COURSE SYLLABUS AND OPTIONS: The instructor may choose one of the two options described below to introduce course topics. The difference between the two options is just the order according to which topics are introduced in the course:

OPTION I: This option closely follows the textbook, and topics are introduced in the same order that they appear in the textbook.

OPTION II: This option allows for an earlier introduction of Sequences and Series and will give students more time to practice and absorb these topics, before the Final Exam.

GENERAL POLICIES:

ATTENDANCE: Attendance is mandatory. A student who misses more than 15 minutes of a class will be marked as late by the instructor. Three lateness will be considered an absence. *More than 6 hours of unexcused absences may result in a WU or F grade.*

ACADEMIC INTEGRITY: In certain instances, at the discretion of the instructor, a student may be asked to demonstrate his/her ability of conceptually understanding the work he/she submitted. In such instances, depending on the course modality, the instructor may ask any student for a written, in-person, or oral (live video session) clarification or explanation of solutions to any assignment, including homework, quizzes, tests, final exam, etc.

Solutions submitted by students for any assignment in this course, including homework, quizzes, tests, final exam, etc., must be based on the covered material. Solutions that are based on material that was not or will not be covered in this course, or will be covered but has not been covered yet, will not be accepted and will receive no credit.

EXAMS: This course will have three Tests and one Cumulative Final Exam. Regardless of the teaching modality (in-person, hybrid, online), the Final Exam will be administered on paper in a classroom on the LaGuardia Community College campus.

COURSE SYLLABUS (Option I)			
Lecture	**Topics**	**Sect.**	**Section Homework Assignment**
1	Integration by substitution (Review) Integration by Parts	5.5 7.1	p. 418: 2,7,8,10,12,14,18,20,21,22,23,25,30,31,32,39,40, 42 to 45,4857,59,60,67,70,71,77 p. 476: 2,4,7 to 11,13,16,18,19 to 22,24,30,32 to 35,37,38
2	Trigonometric Integrals and Substitutions	7.2 7.3	p. 484: 1,2,4,5,6,8,11 to 14,16 to 24,28,29,30,34,37,41,49 p. 491: 2,4 to 10,14,16,21 to 26,28,30
3	Integration by Partial Fractions	7.4	p. 501: 3,4,6,8,10,12,18 to 21,26,28,36,40,44,47,48,50
4	Integration Using Tables	7.6	p. 512: 2,3,6,7,10,12,13,16,17,18,20,21,22,24,25 to 29,31
5	Approximate Integration	7.7	p. 524: 1,2,5,6,7,9,14,16,17,20,21,29,35,39
6	Improper Integrals	7.8	p. 534: 1,2,5,7,8,9,14,15,17 to 25,30,32,33,36 to 40,58
7	**TEST 1**		
8	Areas Between Curves	6.1	p. 434: 1 to 8,10,11,12,14,16 to 21,24,25,27,28,29 p. 477: 57,58 p. 485: 57,58
9	Volumes by Cross-Sections Volumes by Cylindrical Shells	6.2 6.3	p. 446: 3,4,6,8,11 to 18,23 to 26,39,42 p. 453: 1,2,5 to 8,12,13,14,17 to 20,30,31,32,37 to 43 and p. 477: 61 to 64 p. 485: 61 to 64
10	Work Arc Length	6.4 8.1	p. 458: 1 to 5,7 to 10,13,16,18 to 24,26 p. 548: 1,2,9 to 15,17 to 20,33 to 40
11	Applications to Physics and Engineering	8.3	p. 565: 1 to 6,8,9,11,13,14,22,23 to 28,30,31,33,34
12	Sequences	11.1	p. 704: 1,2,6,8,9,12,14,16,18,20,21,26 to 32,37,38,40 to 42, 44 to 51,56,72,74,76 to 79
13	Series	11.2	p. 715: 1 to 8,15,18,19,22,25,26,27,30 to 39,41,42,45 to 48, 50,67,68
14	The Integral Test Comparison Tests	11.3 11.4	p. 725: 2,5 to 10,12,14,18,20 to 28,30,32 p. 731: 1 to 6,8 to 12, 13,15,18,22,24 to 32
15	**TEST 2**		
16	Alternating Series Absolute Convergence, The Ratio and Root Tests	11.5 11.6	p. 736: 1,4,5,8,9,13 to 18,20,26,29,30,32,34,35 p. 742: 1 to 6,9,11 to 14,18,19,20,24,26,27,29,30,31,33,35, 36,38,39,40,43,44
17	Power Series	11.8	p. 751: 1,2,4,7 to 10,12,13,14,17,18,19,22 to 26,28 to 31
18	Representations of Functions as Power Series	11.9	p. 757: 1,2,4,5,7,8,9,12,14,15 to 18,20,25 to 28,39
19	Taylor and Maclaurin Series	11.10	p. 771: 1 to 5,8 to 12,14,15,16,20,23,25,26,31,34,38 to 42
20	Curves Defined by Parametric Equations	10.1	p. 645: 2,3,4,6,7,8,12,14,15,16,18,20,24,26,27,28
21	Calculus with Parametric Curves	10.2	p. 655: 2,5,6,8,13,14,15,18,25,28 to 34,41 to 44,52
22	Polar Coordinates	10.3	p. 666: 2,4,6,7,10,12,14,15,16,18,20,23 to 26,28,32,34,44, 47,50,54,57,58,60,63,64
23	Areas and Lengths in Polar Coordinates	10.4	p. 672: 3 to 8,11,12,18,20,22,24,25,28,29,30,33,35,36,38, 42,47,48
24	**TEST 3**		
25	**Final Exam**		

COURSE SYLLABUS (Option II)			
Lecture	**Topics**	**Sect.**	**Section Homework Assignment**
1	Integration by substitution (Review) Integration by Parts	5.5 7.1	p. 418: 2,7,8,10,12,14,18,20,21,22,23,25,30,31,32,39,40, 42 to 45,4857,59,60,67,70,71,77 p. 476: 2,4,7 to 11,13,16,18,19 to 22,24,30,32 to 35,37,38
2	Trigonometric Integrals and Substitutions	7.2 7.3	p. 484: 1,2,4,5,6,8,11 to 14,16 to 24,28,29,30,34,37,41,49 p. 491: 2,4 to 10,14,16,21 to 26,28,30
3	Integration by Partial Fractions	7.4	p. 501: 3,4,6,8,10,12,18 to 21,26,28,36,40,44,47,48,50
4	Integration Using Tables	7.6	p. 512: 2,3,6,7,10,12,13,16,17,18,20,21,22,24,25 to 29,31
5	Improper Integrals	7.8	p. 534: 1,2,5,7,8,9,14,15,17 to 25,30,32,33,36 to 40,58
6	Areas Between Curves	6.1	p. 434: 1 to 8,10,11,12,14,16 to 21,24,25,27,28,29 p. 477: 57,58 p. 485: 57,58
7	**TEST 1**		
8	Volumes by Cross-Sections Volumes by Cylindrical Shells	6.2 6.3	p. 446: 3,4,6,8,11 to 18,23 to 26,39,42 p. 453: 1,2,5 to 8,12,13,14,17 to 20,30,31,32,37 to 43 and p. 477: 61 to 64 p. 485: 61 to 64
9	Arc Length Work	8.1 6.4	p. 548: 1,2,9 to 15,17 to 20,33 to 40 p. 458: 1 to 5,7 to 10,13,16,18 to 24,26
10	Sequences	11.1	p. 704: 1,2,6,8,9,12,14,16,18,20,21,26 to 32,37,38,40 to 42, 44 to 51,56,72,74,76 to 79
11	Series	11.2	p. 715: 1 to 8,15,18,19,22,25,26,27,30 to 39,41,42,45 to 48, 50,67,68
12	The Integral Test Comparison Tests	11.3 11.4	p. 725: 2,5 to 10,12,14,18,20 to 28,30,32 p. 731: 1 to 6,8 to 12, 13,15,18,22,24 to 32
13	Alternating Series Absolute Convergence, The Ratio and Root Tests	11.5 11.6	p. 736: 1,4,5,8,9,13 to 18,20,26,29,30,32,34,35 p. 742: 1 to 6,9,11 to 14,18,19,20,24,26,27,29,30,31,33,35, 36,38,39,40,43,44
14	Power Series	11.8	p. 751: 1,2,4,7 to 10,12,13,14,17,18,19,22 to 26,28 to 31
15	**TEST 2**		
16	Representations of Functions as Power Series	11.9	p. 757: 1,2,4,5,7,8,9,12,14,15 to 18,20,25 to 28,39
17	Taylor and Maclaurin Series	11.10	p. 771: 1 to 5,8 to 12,14,15,16,20,23,25,26,31,34,38 to 42
18	Curves Defined by Parametric Equations	10.1	p. 645: 2,3,4,6,7,8,12,14,15,16,18,20,24,26,27,28
19	Calculus with Parametric Curves	10.2	p. 655: 2,5,6,8,13,14,15,18,25,28 to 34,41 to 44,52
20	Polar Coordinates	10.3	p. 666: 2,4,6,7,10,12,14,15,16,18,20,23 to 26,28,32,34,44, 47,50,54,57,58,60,63,64
21	Areas and Lengths in Polar Coordinates	10.4	p. 672: 3 to 8,11,12,18,20,22,24,25,28,29,30,33,35,36,38, 42,47,48
22	Approximate Integration	7.7	p. 524: 1,2,5,6,7,9,14,16,17,20,21,29,35,39
23	Applications to Physics and Engineering	8.3	p. 565: 1 to 6,8,9,11,13,14,22,23 to 28,30,31,33,34
24	**TEST 3**		
25	**Final Exam**		