KINGSBOROUGH COMMUNITY COLLEGE
The City University of New York

CURRICULUM TRANSMITTAL COVER PAGE

Department: Math and Computer Science Date: 2/21/2018

Title Of Course Or Degree: Calculus III - MAT 2100

Change(s) Initiated: (Please check)

- ☐ Closing of Degree
- ☐ Closing of Certificate
- ☐ New Certificate Proposal
- ☐ New Degree Proposal
- ☐ New Course
- ☐ New 82 Course
- ☐ Deletion of Course
- ☐ Change in Degree or Certificate Requirements
- ☐ Change in Degree Requirements (adding concentration)
- ☐ Change in Pre/Co-Requisite
- ☐ Change in Course Designation
- ☐ Change in Course Description
- ☑ Change in Course Title, Numbers Credit and/or Hour
- ☐ Change in Academic Policy
- ☐ Pathways Submission:
  - ☐ Life and Physical Science
  - ☐ Math and Quantitative Reasoning
  - ☐ A. World Cultures and Global Issues
  - ☐ B. U.S. Experience in its Diversity
  - ☐ C. Creative Expression
  - ☐ D. Individual and Society
  - ☐ E. Scientific World

☐ Other (please describe): _____

PLEASE ATTACH MATERIAL TO ILLUSTRATE AND EXPLAIN ALL CHANGES

DEPARTMENTAL ACTION

Action by Department and/or Departmental Committee, if required:

Date Approved: 2/21/2018 Signature, Committee Chairperson: _____

I have reviewed the attached material/proposal

Signature, Department Chairperson: _____

Revised Dec. 2015 AK

KINGSBOROUGH
COMMUNITY COLLEGE
★ DREAMS BEGIN HERE ★

TO: Spring 2018 Curriculum Committee

FROM: Department of Mathematics & Computer Science

DATE: 2/21/2018

RE: Change in Number of Course Credits to Calculus III (MAT 2100)

The Department of Mathematics & Computer Science is proposing a change in number of course credits for Calculus III (MAT 2100).

FROM:

4 credits, 4 hrs

TO:

3 credits, 4 hrs. (2 lecture hrs., 2 hr. lab)

Rationale for Change: The change in number of credits reflects curricular adjustments.

KINGSBOROUGH COMMUNITY COLLEGE
THE CITY UNIVERSITY OF NEW YORK

COURSE SYLLABUS: Mathematics 2100

1. **DEPARTMENT, COURSE NUMBER, AND TITLE (SPEAK TO ACADEMIC SCHEDULING FOR NEW COURSE NUMBER ASSIGNMENT):**
   Department of Mathematics and Computer Science,
   MAT 2100 - Multivariable Calculus

2. **DOES THIS COURSE MEET A GENERAL EDUCATION/CUNY CORE CATEGORY?**
   - ☐ **Life and Physical Science**
   - ☐ **Math and Quantitative Reasoning**
   - ☐ **A. World Cultures and Global Issues**
   - ☐ **B. U.S. Experience in its Diversity**
   - ☐ **C. Creative Expression**
   - ☐ **D. Individual and Society**
   - ☐ **E. Scientific World**

   IF YES, COMPLETE AND SUBMIT WITH THIS PROPOSAL A CUNY COMMON CORE SUBMISSION FORM.

3. **DESCRIBE HOW THIS COURSE TRANSFERS (REQUIRED FOR A.S. DEGREE COURSE). IF A.A.S. DEGREE COURSE AND DOES NOT TRANSFER, JUSTIFY ROLE OF COURSE, E.G. DESCRIBE OTHER LEARNING OBJECTIVES MET: THIS COURSE TRANSFERS TO BARUCH COLLEGE:**
   MTH 3020, Brooklyn College: MAT 5.3; City College: MAT 20300, credits; Queens College: MAT 201; Staten Island College: MTH 233

4. **BULLETIN DESCRIPTION OF COURSE:** Continuation of MAT 16 with emphasis on partial differentiation, polar coordinates, multiple integration, solid geometry, vectors, parametric representation of curves and functions, and infinite series.

5. **CREDITS AND HOURS* (PLEASE CHECK ONE APPROPRIATE BOX BELOW BASED ON CREDITS):**

1-credit:	☐ 1 hour lecture ☐ 2 hours lab/field/gym
2-credits:	☐ 2 hours lecture ☐ 1 hour lecture, 2 hours lab/field ☐ 4 hours lab/field
3-credits:	☐ 3 hours lecture ☐ 3 hours lecture, 1 hour lab/field ☒ 2 hours lecture, 2 hours lab/field ☐ 1 hour lecture, 4 hours lab/field ☐ 6 hours lab/field
4-credits:	☐ 4 hours lecture ☐ 3 hours lecture, 2 hours lab/field ☐ 2 hours lecture, 4 hours lab/field ☐ 1 hour lecture, 6 hours lab/field ☐ 8 hours lab/field
More than 4-credits:	☐ Number of credits: ____ (explain mix lecture/lab below)

___ Lecture ____Lab

Explanation:_____

***Hours are hours per week in a typical 12-week semester**

6. **NUMBER OF EQUATED CREDITS IN ITEM #5:** N/A

7. **COURSE PREREQUISITES AND COREQUISITES (IF NONE PLEASE INDICATE FOR EACH)**
   - **A. PREREQUISITE(S):** MAT 16 with a grade of "C" grade or better
   - **B. COREQUISITE(S):** NONE
   - **C. PRE/COREQUISITE(S):** NONE

8. **BRIEF RATIONALE TO JUSTIFY PROPOSED COURSE TO INCLUDE:**
   - **A. ENROLLMENT SUMMARY IF PREVIOUSLY OFFERED AS AN 82 (INCLUDE COMPLETE 4-DIGIT 82 COURSE NUMBER)**
   - **B. PROJECTED ENROLLMENT:** MAT 2100 will have an enrollment of approximately 70
   - **C. SUGGESTED CLASS LIMITS:** 35
   - **D. FREQUENCY COURSE IS LIKELY TO BE OFFERED:** Fall and Spring
   - **E. ROLE OF COURSE IN DEPARTMENT'S CURRICULUM AND COLLEGE'S MISSION**

   This course has been offered during the Fall and Spring semesters (two sections). The suggested class limit is 30 students per section. The objective of this course is to deepen and widen the student's understanding of the fundamental ideas of calculus. Knowledge of parametric equations, polar coordinate system, vectors, three-dimensional analytic geometry, functions of several variables, and series is necessary for students majoring in mathematics, science, engineering, and economics.

9. **LIST COURSE(S), IF ANY, TO BE WITHDRAWN WHEN COURSE IS ADOPTED (NOTE THIS IS NOT THE SAME AS DELETING A COURSE):** NONE

10. **IF COURSE IS AN INTERNSHIP, INDEPENDENT STUDY, OR THE LIKE, PROVIDE AN EXPLANATION AS TO HOW THE STUDENT WILL EARN THE CREDITS AWARDED. THE CREDITS AWARDED SHOULD BE CONSISTENT WITH STUDENT EFFORTS REQUIRED IN A TRADITIONAL CLASSROOM SETTING:** N/A

11. **PROPOSED TEXT BOOK(S) AND/OR OTHER REQUIRED INSTRUCTIONAL MATERIAL(S):**

    Larson, Hostetler, and Edwards. Calculus, Sixth Edition. Houghton Mifflin Co., Boston, New York. ISBN 0-395-88902-2

12. **REQUIRED COURSE FOR MAJOR OR AREA OF CONCENTRATION?**
    This is a required course for Mathematics, Physics, Computer Science, and Engineering majors

IF YES, COURSE IS REQUIRED, SUBMIT A SEPARATE CURRICULUM TRANSMITTAL COVER PAGE INDICATING A "CHANGE IN DEGREE OR CERTIFICATE REQUIREMENTS" AS WELL AS A PROPOSAL THAT MUST INCLUDE A RATIONALE AND THE FOLLOWING ADDITIONAL PAGES: A "CURRENT" DEGREE WITH ALL PROPOSED DELETIONS (STRIKEOUTS) AND ADDITIONS (BOLDED TEXT) CLEARLY INDICATED, AND A "PROPOSED" DEGREE, WHICH DISPLAYS THE DEGREE AS IT WILL APPEAR IN THE CATALOG (FOR A COPY OF THE MOST UP-TO-DATE DEGREE/CERTIFICATE REQUIREMENTS CONTACT AMANDA KALIN, EXT. 4611).

NYSED GUIDELINES OF 45 CREDITS OF LIBERAL ARTS COURSE WORK FOR AN ASSOCIATE OF ARTS DEGREE (A.A.), 30 CREDITS FOR AND ASSOCIATE OF SCIENCE DEGREE (A.S.), AND 20 CREDITS FOR AN APPLIED ASSOCIATE OF SCIENCE DEGREE (A.A.S.) MUST BE ADHERED TO FOR ALL 60 CREDIT PROGRAMS.

13. IF OPEN ONLY TO SELECTED STUDENTS SPECIFY POPULATION: N/A

14. EXPLAIN WHAT STUDENTS WILL KNOW AND BE ABLE TO DO UPON COMPLETION OF COURSE:

Students will know:

a. How to investigate properties of plane and space curves using parametric equations, vectors and vector-valued functions; polar coordinates;
b. How to investigate properties of functions of several variables using partial derivatives, directional derivatives, the total differential, and the gradient;
c. How to do double integrals;
d. Infinite series and their properties.

Students will be able to study ordinary and partial differential equations with applications in mechanics, theory of electromagnetic field, quantum theory, and other parts of modern calculus-based physics and the engineering sciences.

15. METHODS OF TEACHING –E.G. LECTURES, LABORATORIES, AND OTHER ASSIGNMENTS FOR STUDENTS, INCLUDING ANY OF THE FOLLOWING: DEMONSTRATIONS, GROUP WORK, WEBSITE OR E-MAIL INTERACTIONS AND/OR ASSIGNMENTS, PRACTICE IN APPLICATION OF SKILLS, ETC.: Classroom lectures and labs. In the labs students will practice performing relevant skills described in 14.

16. **ASSIGNMENTS TO STUDENTS:** Weekly homework. The homework will call for answers to specific questions relevant to the lectures and the recitation.

17. DESCRIBE METHOD OF EVALUATING LEARNING SPECIFIED IN #15 - INCLUDE PERCENTAGE BREAKDOWN FOR GRADING. IF A DEVELOPMENTAL COURSE INCLUDE HOW THE NEXT LEVEL COURSE IS DETERMINED AS WELL AS NEXT LEVEL PLACEMENT. Classroom tests, quizzes, homework, projects, class participation, and a comprehensive final examination. Final exam -30% , 3 exams -45%, quizzes, homework and projects- 25%

18. TOPICAL COURSE OUTLINE FOR THE 12 WEEK SEMESTER (WHICH SHOULD BE SPECIFIC REGARDING TOPICS COVERED, LEARNING ACTIVITIES, AND ASSIGNMENTS):

Topical Course Outline

A lesson number preceded by an L indicates a lab

		Section(s)
Week 1		
1. Parametric Equations and Plane Curves		12.1
2. Parametric Equations and Calculus	L	12.2
3. Polar Coordinates and Polar Graphs		12.3, 12.4
Week 2		
4. Area and Arc Length in Polar Coordinates		12.5
5. Vectors in the Plane	L	13.1
6. The Dot Product of Two Vectors	L	13.2
7. Vector – Valued Functions	L	13.3
Week 3		
8. Space Coordinates and Vectors in Space		14.1
9. The Cross Product of Two Vectors in Space	L	14.2

10. Lines and Planes in Space		L14.3
Week 4		
11. Surfaces in Space		14.4
12. Review	L	
Examination #1		
13. Introduction to Functions of Several Variables		15.1
Week 5		
14. Limits and Continuity		15.2
15. Partial Derivatives	L	15.3
Week 6		
16. Differential	L	15.4
17. Chain Rules for Functions of Several Variables		15.5
Week 7		
18. Directional Derivatives and Gradients		15.6
19. Tangent Planes and Normal lines		15.7
20. Extrema of Functions of Two Variables	L	15.8
Week 8		
21. Iterated Integrals and Area in the Plane		16.1
22. Double Integrals and Volume		16.2
Week 9		
23. Change of Variables: Polar Coordinates		16.3
24. Review	L	
Examination #2		
25. Sequences	L	10.1
Week 10		
26. Series and Convergence		10.2
27. The Integral Test and p-Series	L	10.3
28. Comparisons of series	L	10.4
Week 11		
29. Alternating Series	L	10.5
30. The Ratio and Root Tests		10.6
31. Power Series	L	10.8
32. Representations of Functions by Power Series	L	10.9
Week 12		
33. Taylor and Maclaurin Series		10.10, 10.7
34. Review	L	
Examination #3		

19. SELECTED BIBLIOGRAPHY AND SOURCE MATERIALS:

A. G. Arfken, *Mathematical Methods for Physicists,* Academic Press, Inc., Orlando, 1985

B. M. L. Boas, *Mathematical Methods in the Physical Sciences*, third ed., John Wiley & Sons Inc., New York, 2006

C. W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 7 th ed. John Wiley & Sons, Inc. New York, 2001

D. E.O. Brigham, *The Fast Fourier Transform*, Prentice -Hall, Inc. Engelwood Cliffs, N. J. 1974

E. M. J. Crowe, *A History of Vector Analysis,* Dover Publ., New York, 1985

F. N. Curle and H. Davfies, *Modern Fluid Dynamics*, **vol. 1,** M Van Nostrand, London, 1968

G. K. R. Davidson A. P. Dansig, *Real Analysis with Real Applications,* Pretnice-Hall, Inc. Engelwood Cliffs, N. J. 2002

H. F. Diacu, *An Introduction to Differential Equations,* W. H. Freeman, New York, 2000

I. G. B. Folland, *Fourier Analyis and its Applications*, Wadsworth & Brooks/Cole, Pacific Grove, CA., 1992

J. H. Goldstein, *Classical Mechanics,* second ed., Addison Wesley, Reading MA, 1980

K. M. W. Hirsch, *Differential Equations, Dynamical Systems, and Linear Algebra,* Academic Press, New York, 1974

L. J. P. Keener, *Principles of Applied Mathematics. Transformation and Approximation*, Addison-Wesley Publ. Co., New York, 1988

M. A. M. Krall, *Applied Analysis,* D. Reidel Publ. Co. Boston, 1986

N. P. E. Lewis and J. W. Ward, *Vector Analysis for Engineers and Scientists*, Addison-Wesley Publ. Co. New York, 1989

O. J. Lighthill, *An Informal Introduction to Theoretical Fluid Mechanics*, Oxford University Press, Oxford, 1986

P. J. E. Marsden and A. J. Tromba, *Vector Calculus*, W. H. Freeman and Co. , New York, 1988

Q. P. C. Mathews, *Vector Calculus*, Springer-Verlag, London, 1998

R. F. W. Olver, *Asymptotics and Special Functions*, Academic Press, New York, 1974

S. M Rahman and I. Mulolani, *Applied Vector Analysis* CRC Press Taylor & Francis Group, New York 2008

T. M. Reed and B. Simon, *Methods of Modern Mathematical Physics,* Academic Press, New York, 1972

U. K. F. Riley, M. P. Hobson, and S. J. Bence, *Mathematical Methods for Physics and Engineering*, Cambridge University Press, U. K. , 1997

V. M. Schwartz, S. Green, and W. A. Rutledge, *Vector Analysis with Applications to Geometry and Physics,* Harper & Brothers, New York, 1960

W. G. Strang *Introduction to Applied Mathematics,* Wellesley-Cambridge Press, MA 1986

X. C. R. Wylie, *Advanced Engineering Mathematics,* McGraw-Hill Book Co., New York, 1975

Y. D. G. Zill and M. R. Cullen, *Advanced Engineering Mathematics,* PWS-Kent Publ. Co. , Boston, 1992

Revised 01/2018