College of the Redwoods

CURRICULUM PROPOSAL

1. Course ID and Number: **MATH 50B**

2. Course Title: **Integral Calculus**

3. Check one of the following:

   ☐ New Course *(If the course constitutes a new learning experience for CR students, the course is new)*
   Required - Justification for Need (Provide a brief description of the background and rationale for the course. This might include a description of a degree or certificate for which the course is required or the relationship of this course to other courses in the same or other disciplines. To see examples of such descriptions, consult pages 10-11 of **The Course Outline of Record: A Curriculum Reference Guide**.

   ☒ Updated/Revised Course
   If curriculum has been offered under a different discipline and/or name, identify the former course:
   Should another course be inactivated? No ☒ Yes ☐ Inactivation date:
   Title of course to be inactivated:
   (If yes, attach a completed *Course Inactivation Form* found on the **Curriculum Website**.)

4. If this is an update/revision of an existing course, provide explanation of and justification for changes to this course. Be sure to explain the reasons for any changes to class size, unit value, and prerequisites/corequisites. **Course Outline needs updated wording in order to match C-ID standards more clearly and explicitly, especially course learning outcomes and skills list.**

5. List the faculty with which you consulted in the development and/or revision of this course outline:
   Faculty Member Name(s) and Discipline(s): David Arnold, Michael Butler, Mike Haley, Steven Jackson, Tami Matsumoto, Todd Olsen, Richard Ries, Bruce Wagner, Jon Pace, Kevin Yokoyama (all Mathematics)

6. If any of the features listed below have been modified in the new proposal, indicate the "old" (current) information and "new" (proposed) changes. If a feature is not changing, leave both the "old" and "new" fields blank.

	FEATURES	OLD	NEW
☐	Course Title		
☐	TOPS/CIPS Code		
☐	Catalog Description (Please include complete text of old and new catalog descriptions.)		
☐	Grading Standard	**Select**	**Select**
☐	Total Units		
☐	Lecture Units		
☐	Lab Units		
☐	Prerequisites		
☐	Corequisites		
☐	Recommended Preparation		
☐	Maximum Class Size		
☐	Repeatability—Maximum Enrollments	**Select**	**Select**
☒	Other		**Updated:**

			Course Learning Outcomes **Skills** **to better match the C-ID descriptor**

1. DATE: **4/15/14**

2. DIVISION**: Math, Science, and Engineering**

3. **[CB01]** COURSE ID AND NUMBER: **MATH 50B**

4. **[CB02]** COURSE TITLE: **Integral Calculus**
   (Course title appears in Catalog and schedule of classes.)

5. SHORT TITLE: **Integral Calculus**
   (Short title appears on student transcripts and is limited to 30 characters, including spaces.)

6. **[CB03]** LOCAL ID (TOPS): **170100** **Taxonomy of Program Codes**

7. NATIONAL ID (CIP): **27.0101** **Classification of Instructional Program Codes**

8. DISCIPLINE(S): **Mathematics** **Select from Minimum Qualifications for Faculty**
   Course may fit more than one discipline; identify all that apply:

9. FIRST TERM NEW OR REVISED COURSE MAY BE OFFERED: **Fall 2014**

10. COURSE UNITS *(Note: 1 lecture unit requires 18 hours in-class/36 hours out-of-class; 1 lab unit requires 54 in-class hours)*

TOTAL UNITS:	**4** **[CB07]** min. units	**4** **[CB06]** max. units	LECTURE UNITS:	**4**	LAB UNITS:	**0**
TOTAL HOURS:	**72** min. units	**72** max. units	LECTURE HOURS:	**72**	LAB HOURS:	**0**

11. MAXIMUM CLASS SIZE: **40**

12. WILL THIS COURSE HAVE AN INSTRUCTIONAL MATERIALS FEE? No ☒ Yes ☐ Fee: $
    If yes, attach a completed **Instructional Materials Fee Request Form** found on the **Curriculum Website.**

GRADING STANDARD

Letter Grade Only ☒ Pass/No Pass Only ☐ Grade-Pass/No Pass Option ☐

[CB12] Is this course a repeatable lab course? No ☒ Yes ☐ If yes, how many total enrollments? **Select**

Is this course to be offered as part of the Honors Program? No ☒ Yes ☐
If yes, explain how honors sections of the course are different from standard sections.

CATALOG DESCRIPTION -- *The **catalog description** should clearly describe for students the scope of the course, its level, and what kinds of student goals the course is designed to fulfill. The catalog description should begin with a sentence fragment.*

The second in the series of three calculus courses. Integral Calculus develops a set of advanced symbolic and numerical integration techniques, building on skills developed in the first course in the series, Differential Calculus. The course includes applications of integration, sequences and series, and the use of the Taylor polynomial to approximate functions. Students are introduced to parametric and polar equations.

Special Notes or Advisories (e.g. Field Trips Required, Prior Admission to Special Program Required, etc.): **A graphing calculator is required.**

PREREQUISITE COURSE(S)

No ☐ Yes ☒ Course(s): **MATH 50A**
Rationale for Prerequisite: **Sequential course**
Describe representative skills without which the student would be highly unlikely to succeed. **Students must be well-grounded in the art and theory of differentiation in order to be successful in this course. Students must be able to**

differentiate a variety of mathematical functions by hand, including functions involving trigonometric, logarithmic, exponential, and power functions.

COREQUISITE COURSE(S)

No ☒ Yes ☐ Course(s):

Rationale for Corequisite:

RECOMMENDED PREPARATION

No ☒ Yes ☐ Course(s):

Rationale for Recommended Preparation:

COURSE LEARNING OUTCOMES –*This section answers the question "what will students be able to do as a result of taking this course?" State some of the objectives in terms of specific, measurable student actions (e.g. discuss, identify, describe, analyze, construct, compare, compose, display, report, select, etc.). For a more complete list of outcome verbs please see Public Folders>Curriculum>Help Folder>SLO Language Chart.* ***Each outcome should be numbered.***

1. Evaluate definite and indefinite integrals using a variety of integration formulas and techniques including the evaluation of improper integrals.
2. Apply integration to areas and volumes, and other applications such as work or length of a curve.
3. Apply convergence tests to sequences and series and represent functions as power series.
4. Graph, differentiate and integrate functions in polar and parametric form.

COURSE CONTENT–*This section describes what the course is "about"-i.e. what it covers and what knowledge students will acquire*

Concepts: *What terms and ideas will students need to understand and be conversant with as they demonstrate course outcomes?* ***Each concept should be numbered.***

1. The use of the graphing calculator and/or mathematical software as a fundamental problem-solving tool.
2. The presentation of mathematical solutions in a logical coherent structure, including the use of fundamental writing skills, grammar, and punctuation.
3. Limits and their role in the major theorems in calculus.
4. Continuity and its role in the major theorems in calculus.
5. Differentiation and its role in the major theorems in calculus.
6. Integration and its role in the major theorems in calculus.
7. Sequences and series and their role in the major theorems in calculus.
8. Differential equations and their role in the major theorems in calculus.
9. The Fundamental Theorem of Calculus and its role in the major theorems in calculus.
10. Mathematical modeling and its role in the major theorems in calculus.

Issues: *What primary tensions or problems inherent in the subject matter of the course will students engage?* ***Each issue should be numbered.***

1. The appropriate use of technology in the problem-solving process.
2. The connection between mathematics and the real world.
3. The role of the student in becoming a successful learner.
4. The recognition that the problem-solving skills learned in this class are applicable in future mathematics classes and classes in related fields, such as physics, engineering, etc.

Themes: *What motifs, if any, are threaded throughout the course?* ***Each theme should be numbered.***

1. Problem solving.
2. Writing.
3. Technology.
4. Communication.

Skills: *What abilities must students have in order to demonstrate course outcomes? (E.g. write clearly, use a scientific calculator, read college-level texts, create a field notebook, safely use power tools, etc).* ***Each skill should be numbered.***

1. Integration

- **Use techniques in numerical integration, including the trapezoidal method and Simpson's rule, to estimate the value of a definite integral.**
- **Calculate integrals using techniques including:**
  - **o integration by parts,**

o trigonometric integrals,
o trigonometric substitution,
o partial fraction decomposition,
o improper integrals.

- **Use integration to find:**
  o area between curves,
  o volume of solids and volume of a solid of revolution.
- **Use integration to solve real-world applications.**
- **Demonstrate the fundamental relationship between the derivative and the integral.**

2. Sequences and series

- **Introduction to sequences and series.**
- **Determine convergence of sequences.**
- **Compute the limit of a sequence, using limit laws and theorems.**
- **Find the sum of a series as a limiting value of a sequence of partial sums.**
- **Determine convergence of infinite series, by using tests, including:**
  o integral test,
  o comparison test,
  o limit comparison test,
  o alternating series test,
  o ratio test,
  o root test.
- **Determine whether a series converges absolutely or conditionally.**
- **Find the radius of convergence and interval of convergence of a power series.**
- **Represent functions as power series.**
- **Create new power series, by using:**
  o multiplication and division,
  o differentiation,
  o integration.
- **Use Taylor Polynomials to approximate functions, and calculate the remainder term.**

3. Parametric and polar equations

- **Sketch the graphs of equations in polar or parametric form:**
  o by hand,
  o using graphing technology.
- **Convert a variety of equations in Cartesian form into polar form, and vice-versa.**
- **Construct a set of parametric equations that produce a given geometric locus or path.**
- **Calculus with parametric curves**
- **Polar curves and calculus in polar coordinates**

4. Applications such as:

- **work,**
- **arc length,**
- **area of a surface of revolution,**
- **moments and centers of mass,**
- **separable differential equations,**
- **growth and decay.**

REPRESENTATIVE LEARNING ACTIVITIES –*This section provides examples of things students may do to engage the course content (e.g., listening to lectures, participating in discussions and/or group activities, attending a field trip). These activities should relate directly to the Course Learning Outcomes.* ***Each activity should be numbered.***

1. Listening to lectures.
2. Participating in group activities and/or assignments.
3. Participating in class assignments and/or discussions.

4. **Completing homework assignments.**
5. **Using the graphing calculator and/or mathematical software to complete activities designed to foster a deeper level of understanding of the concepts and skills developed in this class.**

ASSESSMENT TASKS –*This section describes assessments instructors may use to allow students opportunities to provide evidence of achieving the Course Learning Outcomes.* ***Each assessment should be numbered.***

Representative Assessment Tasks (*These are examples of assessments instructors could use.)*:

1. Take-home examinations and/or quizzes allow the instructor to include questions and/or exercises that require the use of the graphing calculator and/or mathematical software to supplement the analysis. Extra time allows the students to develop their writing and presentation skills.
2. **Writing assignments designed to develop communication of mathematical concepts.**
3. **Group and/or individual projects and presentations.**

Required Assessments for All Sections *(These are assessments that are required of all instructors of all sections at all campuses/sites. Not all courses will have required assessments. Do not list here assessments that are listed as representative assessments above.)*:

1. Homework assignments.
2. **In class examinations/quizzes (two options):**

- **Option 1) At least two one-hour, closed book, in class midterm examinations, plus a comprehensive, closed book, in-class final examination.**
- **(Option 2) At least one one-hour, closed book, in class midterm examination, plus the equivalent of a one-hour midterm examination in the form of in-class, closed-book quizzes; plus a comprehensive, closed-book, in-class final examination.**

EXAMPLES OF APPROPRIATE TEXTS OR OTHER READINGS –*This section lists example texts, not required texts.*

Author, Title, and Date Fields are required

Author **Stewart** Title ***Calculus, Early Transcendentals, Seventh Edition*** Date **2012**

Author Title _____ Date

Author Title _____ Date

Author Title _____ Date

Other Appropriate Readings:

COURSE TYPES

1. Is the course part of a Chancellor's Office approved **CR Associate Degree**? ☐ No ☒ Yes

   If yes, specify all program codes that apply. *(Codes can be found in Outlook/Public Folders/All Public Folders/ Curriculum/Degree and Certificate Programs/choose appropriate catalog year)*:

   ☒ Required course for degree(s) **MATH.LA.AA, AAT.MATH**
   ☒ Restricted elective for degree (s) **SCI.LA.AA, SCIEX.LA.AA**

   Restricted electives *are courses specifically listed (i.e. by name and number) as optional courses from which students may choose to complete a specific number of units required for an approved degree.*

2. Is the course part of a Chancellor's Office approved **CR Certificate of Achievement**? ☒ No ☐ Yes
   If yes, specify all program codes that apply. (*Codes can be found in Outlook/Public Folders/All Public Folders/ Curriculum/Degree and Certificate Programs/choose appropriate catalog year*):

   ☐ Required course for certificate(s)
   ☐ Restricted elective for certificate(s)

   Restricted electives *are courses specifically listed (i.e. by name and number) as optional courses from which students may choose to complete a specific number of units required for an approved certificate.*

3. **[CB24]** Is the course Stand Alone? ☒ No ☐ Yes
   (If "No" is checked for **BOTH** #1 & #2 above, the course is stand alone.)

4. **[CB08]** Basic Skills: **NBS Not Basic Skills**

5. **[CB10]** Work Experience: **NWE Not Coop Work Experience**

6. Course eligible Career Technical Education funding (applies to vocational and tech-prep courses only): No ☒ Yes ☐

7. **[CB23]** Course eligible Economic Workforce Development funding : No ☒ Yes ☐
(If TOPS code has an asterisk it is indicative that the course is vocational.)

8. **[CB11]** Purpose**: Y Credit Course** Course Classification Status

9. Accounting Method: **W Weekly Census**

10. **[CB13]** Disability Status**: N Not a Special Class**

11. **[CB09]** Course SAM Priority Code: **E Not Occupational** Definitions of SAM Priority Codes

COURSE TRANSFERABILITY

1. **[CB05]** Current Transferability Status: **A Transferable to both UC and CSU**

2. **[CB21]** Course Prior to Transfer Level: **Y Not Applicable** Definitions of Course Prior to Transfer Levels

CURRENT TRANSFERABILITY STATUS (Check at least one box below):

This course is currently transferable to:

☐ Neither CSU nor UC

☐ CSU as general elective credit

☒ CSU as a specific course equivalent (see below)

If the course transfers as a specific course equivalent give course number(s)/ title(s) of one or more currently-active, equivalent *lower division* courses from CSU.

1. Course **Math 110 - Calculus II**, Campus **Humboldt State University** 2. Course , Campus

☐ UC as general elective credit

☒ UC as specific course equivalent

If the course transfers as a specific course equivalent give course number(s)/ title(s) of one or more currently-active, equivalent *lower division* courses from UC.

1. Course **Math 21B and part of Math 21C - Calculus**, Campus **UC Davis (quarter system)** 2. Course **Math 19B - Calculus for Science, Engineering, and Mathematics**, Campus **UC Santa Cruz**

PROPOSED CSU TRANSFERABILITY (Check at least one of the boxes below):

☒ No Proposal

☐ Remove as General Education

☐ Propose as General Elective Credit

☐ Propose as a Specific Course Equivalent (see below)

If specific course equivalent credit is proposed, give course number(s)/ title(s) of one or more currently-active, equivalent *lower division* courses from CSU.

1. Course , Campus 2. Course , Campus

PROPOSED UC TRANSFERABILITY (Check one of the boxes below):

☒ No Proposal

☐ Remove as General Education

☐ Propose as General Elective Credit OR Specific Course Equivalent (fill in information below)

If "General Elective Credit OR Specific Course Equivalent" box above is checked, give course number(s)/ title(s) of one or more currently-active, equivalent *lower division* courses from UC.

1. Course , Campus 2. Course , Campus

CURRENTLY APPROVED GENERAL EDUCATION Check at least one box below):

☐ **Not currently approved**

CR ☐ CR GE Category:

CSU ☐ CSU GE Category:

IGETC ☐ IGETC Category:

PROPOSED CR GENERAL EDUCATION (Check at least one box below):

☒ **No Proposal**
☐ **Remove as General Education**
☐ **Review to maintain CR GE Status**
☐ **New GE Proposal**

_____Approved as CR GE by Curriculum Committee: _____ (DATE)
_____Not Approved

CR GE Outcomes
GE learning outcomes in Effective Communication, Critical Thinking, and Global Awareness must be addressed in all general education courses.

- Effective Communications: *Explain how the proposed GE course fulfills at least one of the CR GE outcomes in this category.*
- Critical Thinking: *Explain how the proposed GE course fulfills at least one of the CR GE outcomes in this category.*
- Global Awareness: *Explain how the proposed GE course fulfills at least one of the CR GE outcomes in this category.*

GE Criteria for Breadth and Generality
GE courses should be broad and general in scope. Typically such courses are introductory-- not advanced or specialized—and the content encompasses a broad spectrum of knowledge within a given field of study.

Explain how the proposed GE course fulfills GE criteria for breadth and generality.

CR GE Area Designation
Course Learning Outcomes and Course Content should provide evidence of appropriate GE Area Designation.
Additional rationale for GE Area Designation (optional):

☐ Natural Science
☐ Social Science
☐ Humanities
☐ Language and Rationality
  ☐ Writing
  ☐ Oral Communications
  ☐ Analytical Thinking

PROPOSED CSU GENERAL EDUCATION BREADTH (CSU GE) (Check at least one box below):

☒ **No proposal**

A. Communications and Critical Thinking
☐ A1 – Oral Communication
☐ A2 – Written Communication
☐ A3 – Critical Thinking

B. Science and Math
☐ B1 – Physical Science
☐ B2 – Life Science
☐ B3 – Laboratory Activity
☐ B4 – Mathematics/Quantitative Reasoning

C. Arts, Literature, Philosophy, and Foreign Language
☐ C1 – Arts (Art, Dance, Music, Theater)
☐ C2 – Humanities (Literature, Philosophy, Foreign Language)

D. Social, Political, and Economic Institutions
☐ D0 – Sociology and Criminology
☐ D1 – Anthropology and Archeology
☐ D2 – Economics
☐ D3 – Ethnic Studies
☐ D5 – Geography
☐ D6 – History
☐ D7 – Interdisciplinary Social or Behavioral Science
☐ D8 – Political Science, Government and Legal Institutions
☐ D9 – Psychology

E. Lifelong Understanding and Self-Development
☐ E1 – Lifelong Understanding
☐ E2 – Self-Development

Rationale for inclusion in this General Education category: Same as above ☐

Proposed Intersegmental General Education Transfer Curriculum (IGETC) (Check at least one box below):

☒ **No proposal**
☐ 1A – English Composition
☐ 1B – Critical Thinking-English Composition
☐ 1C – Oral Communication (CSU requirement only)
☐ 2A – Math

- ☐ 3A – Arts
- ☐ 3B – Humanities
- ☐ 4A – Anthropology and Archaeology
- ☐ 4B – Economics
- ☐ 4E – Geography
- ☐ 4F – History
- ☐ 4G – Interdisciplinary, Social & Behavioral Sciences
- ☐ 4H – Political Science, Government & Legal Institutions
- ☐ 4I – Psychology
- ☐ 4J – Sociology & Criminology
- ☐ 5A – Physical Science
- ☐ 5B – Biological Science
- ☐ 6A – Languages Other Than English

Rationale for inclusion in this General Education category: Same as Above ☐

Submitted By: **Michael Butler** Tel. Ext. **4234** Date: **4/15/14**

Division Chair/Director**: Tracey Thomas** Review Date: **04/17/14**

CURRICULUM COMMITTEE USE ONLY

Approved by Curriculum Committee: No ☐ **Yes** ☒ **Date: 04.25.14**

Academic Senate Approval Date: 05.02.14 **Board of Trustees Approval Date: 06.03.14**
