UNIVERSITY OF THE FRASER VALLEY

ORIGINAL COURSE IMPLEMENTATION DATE: January 2006
REVISED COURSE IMPLEMENTATION DATE: January 2018
COURSE TO BE REVIEWED: (six years after UEC approval) June 2023
Course outline form version: 09/15/14

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: MATH 440	**Number of Credits:** 3 Course credit policy (105)
Course Full Title: Fourier Analysis **Course Short Title (if title exceeds 30 characters):**	
Faculty: Faculty of Science	**Department (or program if no department):** Mathematics & Statistics

Calendar Description:

The decomposition into trigonometric components of functions defined on the real line, on the circle, and on groups. Convergence criteria. Topics will be chosen from signal processing, filtering, Fast Fourier Transform, distributions, and reconstruction of musical signals.

Prerequisites (or NONE):	MATH 211, MATH 265, and one of MATH 152/ENGR 152 or MATH 221.
Corequisites (if applicable, or NONE):	NONE
Pre/corequisites (if applicable, or NONE):	NONE

Equivalent Courses (cannot be taken for additional credit)
Former course code/number:
Cross-listed with:
Equivalent course(s):
Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit
Transfer credit already exists: ☐ Yes ☒ No
Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)
Resubmit revised outline for articulation: ☐ Yes ☒ No
To find out how this course transfers, see **bctransferguide.ca**.

Total Hours: 45
Typical structure of instructional hours:

Lecture hours	
Seminars/tutorials/workshops	45
Laboratory hours	
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	
Other contact hours:	
Total	**45**

Special Topics
Will the course be offered with different topics?
☐ Yes ☒ No
If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit
Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 24

Expected frequency of course offerings (every semester, annually, every other year, etc.): Every three years

Department / Program Head or Director: Ian Affleck	**Date approved:**	November 21, 2016
Faculty Council approval	**Date approved:**	April 28, 2017
Campus-Wide Consultation (CWC)	**Date of posting:**	n/a
Dean/Associate VP: Lucy Lee	**Date approved:**	April 28, 2017
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	June 16, 2017

Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Prove properties of Fourier expansions in three settings: the circle, the line, and finite Abelian groups.
2. Compute Fourier series and Fourier transforms of representative functions and distributions.
3. Demonstrate the differences and uses of pointwise, mean-square and summability convergence.
4. Implement the Fast Fourier Transform and use it to quickly compute products of large numbers.
5. Construct a digital filter using convolutions.
6. Conduct a seminar on a topic agreed upon with the instructor.
7. Conduct independent research on a topic agreed upon with the instructor, write their results in a research paper and present these results to the class in a seminar

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods (guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion)

Facilitated discussion, student-led discussion, student presentations, individual assistance in producing a seminar, and a research project.

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☐

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials (if more space is required, download Supplemental Texts and Resource Materials form)

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	D. Kammler	A First Course in Fourier Analysis	☐	Prentice-Hall	2000
2.	T.W. Korner	Fourier Analysis	☐	Cambridge University Press	1998
3.	E.M. Stein, R Shakarchi	Fourier Analysis	☐	Princeton University Press	2003
4.	A. Vretblad	Fourier Analysis and its Applications	☐	Springer-Verlag	2003
5.			☐		

Required Additional Supplies and Materials (software, hardware, tools, specialized clothing, etc.)

Typical Evaluation Methods and Weighting

Final exam:	40%*	Assignments:	20%	Midterm exam:	20%	Practicum:	%
Quizzes/tests:	%	Lab work:	%	Field experience:	%	Shop work:	%
Project:	20%	Other:	%	Other:	%	Total:	100%

Details (if necessary):

* Students must obtain at least 40% on the final exam to pass the course.

Typical Course Content and Topics

1. Periodic functions, Fourier coefficients, differentiation and integration of Fourier series. Proofs of basic properties.
2. Pointwise convergence, summability of Fourier series.
3. Orthogonal functions, mean-square convergence, Parseval equality, Bessel inequality, Hilbert spaces.
4. Fourier transforms, Riemann-Lebesgue Lemma, convolution.
5. Applications chosen from: isoperimetric problem, Poisson summation formula, Weierstrass approximation theorem, etc.
6. Distributions: linear functionals, test functions, Fourier analysis of tempered distributions.
7. Discrete Fourier analysis, Fast Fourier Transform, Fourier analysis on groups.
8. Signal processing: filtering, noise reduction, applications to musical tones.