COURSE NAME:	FOURIER SERIES AND INTEGRAL TRANSFORMS
COURSECODE:	(MATH 2421)
LEVEL:	II
NUMBER OF CREDITS:	3
SEMESTER:	II
PREREQUISITES:	(MATH1141, MATH1142 & MATH1151) or (MATH1185) or (M10A & M10B)

RATIONALE:

For students to be accomplished in the application of mathematical methods to real-world problems, it is necessary to expose them to case-studies which show best practice in modeling, and for them to accumulate experience in the construction and analysis of mathematical models. This will be beneficial in enabling students to transfer their acquired mathematical skills in their chosen careers.

COURSE DESCRIPTION:

The course introduces mathematical techniques commonly used in mathematical modeling, and demonstrates their application to problems in physics and engineering. The course requires students to actively apply these techniques in similar problems.

CONTENT:

Fourier series - Laplace transforms - Fourier transforms - Special functions.

LEARNING OBJECTIVES:

By the end of the course, students will be able to:

- write the Fourier series expansion of a given function and check for the existence of Fourier series for a given function;
- expand a given function in terms of its Fourier series, for the cases of even and odd functions;
- expand a given function in a half range: even and odd periodic expansions of a given function;
- write the Laplace transform of a function and its properties;
- find the Laplace transform of a function;
- solve a given differential equation with the help of the properties and transform of the coefficient function;
- write the Fourier transform of a function and its properties;

- find the Fourier transform of the function;
- solve the given differential equation with the help of the properties and the Fourier transform of the coefficient function;
- write the beta and gamma functions, their relations and expose to applications.

SYLLABUS

Fourier Series:

- Introduction, Fourier series expansion of a function and determination of Fourier coefficients, Continuous and discontinuous functions and its expansion in Fourier series , Existence of Fourier series of a function; Examples: Expressing the given function in terms of Fourier series; Fourier series – even and odd functions; Fourier series in an arbitrary interval; Even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

Laplace Transforms:

- Introduction, Definition and properties of Laplace transforms; Laplace transform of some standard functions; Finding the transform of a given function – examples; Definition of inverse transform and properties; examples, convolution theorem, Applications of Laplace transforms in solving differential equations;

Fourier Transforms:

- Fourier integral theorem, Fourier sine and cosine integrals; Fourier transform and properties; Fourier sine and cosine transforms – properties; Inverse transforms – Finite Fourier transforms; Applications in solving differential equations;

Special functions:

- Gamma functions and properties; Beta function and properties; Relations between beta and gamma functions

Tutorials

TEACHING METHODOLOGY

This course will be delivered through a combination of informative lectures, participative tutorials. The total estimated 39 contact hours are broken down as follows: 29 hours of lectures, 10 hours of tutorials. The course material will be posted on the webpage

http://ourvle.mona.uwi.edu/. Practice problems and assignments will also be disseminated to students via this webpage, as well as assignment solutions after the due date.

ASSESSMENT

The course assessment will be broken into two components; a coursework component worth 40% and a final theory exam will be two hours in length and worth 60%.

The Coursework element will consist of two distinctive parts.

1. Two course work exams that should take place during weeks 5 and 9. Each of these exams will be worth 10% each of the student's final grade and of one hour duration.

2. Five take home assignments (problem papers). One will be given every fortnight. These assignments will accounts for 20% of the student's final grade. Each being worth of 4% of the student's final grade.

REFERENCE MATERIAL:

Books:

1. PINKUS, Allan & Samy Zafrany. *Fourier Series and Integral Transforms*. Cambridge University Press, 1997. ISBN-10: 9780521597715 [prescribed]

2. ANDREWS, Larry C. & Bhimsen K. Shivamoggi. *Integral Transforms for Engineering.* MacMillan, 1999. ISBN# 0-8194-3232-6 [highly recommended]

3. CARSLAW, H.S. *Introduction to the theory of Fourier's series and integrals*, BiblioBazaar, 2008. ISBN-10: 0559202873 [recommended]

These are the standard books for the topics of the mathematical methods mentioned above. These books very well written for undergraduate level and comprehensively cover all the content of the course with physical interpretation with plenty of applications of the models.

Online Resources:

1. http://www.math.technion.ac.il/~mcwikel/fourier/index.html - This link gives the material on Fourier series and integral transforms with some exercise and examples.