COURSE NAME: **ENGINEERING MATHEMATICS II**

COURSE CODE: **MATH 2230**

LEVEL: II

SEMESTER: I

NUMBER OF CREDITS: 3

PREREQUISITES: MATH1180

RATIONALE:
This course aims to give students a substantial knowledge of: Power series and power series solutions to linear differential equations with variable coefficients, Euler's differential equation, Laplace transform and the method Laplace transform employed to solve linear differential equations with constant coefficients, Fourier series expansions and method of separation of variables for partial differential equations, line integrals and surface integrals. It is a compulsory course for student taking a major in the faculty of Engineering and is useful for students taking a Physics major.

COURSE DESCRIPTION:
This course provides students with the tools necessary to solve the variety of mathematical problems obtained when modelling many physical problems in Engineering, Physics and other areas of applied mathematics. The course exposes students to the various techniques used when solving a variety of differential equations, both ordinary and partial, as well as necessary elements of vector calculus. The following topics will be covered: Power series solutions to initial value problems, Laplace transform, Fourier series, the method of separation of variables, and vector calculus.

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

- Solve differential equations with variable coefficients using a power series solution, Euler's method or the method of Frobenious.
- Recall the properties of a power series.
- Determine the Laplace transform of a function by ether the definition of the Laplace transform of a function, or by recollection and the properties of Laplace transform.
- Using the convolution integral find the convolution of two or more functions.
- State and use the properties of the convolution of functions.
- Use the method of Laplace transform to solve linear differential equations with constant coefficient.
- Determine the Fourier series expansion of a function.
- Recall and use the properties of an odd or even function.
- Determine the Fourier sine and cosine series expansion of a function.
- Solve simple Strum-Liuville boundary value problems.
- Classify partial differential equations as either parabolic, elliptic or hyperbolic.

- Solve the heat, Laplace and wave equations using the method of separation of variables.
- Determine the gradient, divergence, Laplacian and the curl of a scalar or vector function.
- Evaluate line and surface integrals.
- Recall and use Stoke's divergence theorem.

CONTENT:

Ordinary differential equations: Power Series Solution, Legendre's Equation, Bessel's Equation.

Laplace Transform: Convolution Theorem, Application to Simple Initial Value Problems and Integral Equations, Periodic Functions.

Fourier Series: Fourier series expansion, Odd and Even Functions, Fourier Sine and Cosine Series

Partial Differential Equations: Wave, Diffusion, Laplace equations.

Vector Calculus: Scalar and Vector Fields, Line Integrals, Surface Integrals and Stoke's Divergence Theorem.

TEACHING METHODOLOGY:

This course will be delivered by a combination of theoretical classes and practices (tutorials) . The lecture mode will be largely interactive. The total estimated 39 contact hours are broken down as follows: 26 hours of lectures and 13 hours of tutorials. The course material (notes, practice problems and assignments) will be posted on ourvle http://ourvle.mona.uwi.edu/

ASSESSMENT: The course assessment has two components:

Final exam: 2-hour written paper	75%
Two Midterm Exams (10% each)	25%

REFERENCE MATERIAL:

Books:

Prescribed

Kreyszig, Erwin. *Advanced Engineering Mathematics*, 9th edition, Wiley, 2006. ISBN: 0-471-48885-2.

Recommended

Braun, Martin. Differential Equation and Their Applications, Springer, 2006.

ISBN: 978-1-4684-9229-3.

Highly Recommended

Kreyszig, Erwin. *Advanced Engineering Mathematics* (Undergraduate Texts in Mathematics), 9th edition, Wiley, 2006. ISBN: 0-471-48885-2.

These books are pedagogically sound, comprehensively address all element of the syllabus, and provide useful case studies and examples.

Online Resources:

1. http://tutorial.math.lamar.edu

Paul's Online Math Notes

This is an online mathematics notes and tutorial by Dr. Paul Dawkins for lectures at Lamar University. Online notes and tutorials on algebra, calculus, and differential equations. Also, PDFs, some reduced to fit onto one printed page, offering a review of algebra and trigonometry, a primer of complex numbers, listing common math errors, suggesting how to study math; cheat sheets for algebra and trigonometry; a list of common derivatives and integrals; and a table of Laplace transforms.