Department	General Study	**Major**								
Course Name	Mathematics 2	**Course Code**	MATH 302							
Prerequisites	MAT 301	**Credit Hours CRH**	4		CTH		6			
			L	3	P	2	T	1		

Course Description:

This course covers sequences and series, especially focusing on power series and Taylor's formula. Give students an understanding of Fourier series and Fourier transform, and provide students with practice in their application and interpretation in a range of situations. Help understanding how single-variable calculus generalizes to higher dimensions and Learn Green's theorem. Treatment of numerical methods including numerical solution of equations, interpolation method, approximation of functions, numerical integration, and differentiation, ..

General Objective:

The primary objective of the course is to develop the basic understanding of the mathematics that underlies modern science.

Detailed Objectives:

Trainee will be able to:

1-	Evaluate limits of sequences, know basic limits and determine the limits of some simple recursively defined sequences.
2-	Apply series tests (Divergence Test, Comparison and Limit Comparison Tests, Ratio Test, Alternating Series Test, …) to determine whether a particular series converges or diverges.
3-	Determine the radius and interval of convergence for a power series and describe when they can be differentiated and integrated term-by-term.
4-	Represent functions as Taylor series and Maclaurin series.
5-	Approximate functions using Taylor polynomials and partial sums of infinite series.
6-	Compute the coefficients of Fourier series for a periodic function.
7-	Find the sum of a Fourier series of a continuous or regular numerical function at a given point.
8-	Approximate functions using trigonometric polynomials (in particular the Fourier polynomial) and partial sums of infinite series.
9-	Calculate Fourier transforms for a variety of simple functions.
10-	Apply Fourier analysis to solve various engineering problems.
11-	Evaluate double and triple integrals, and learn their use to compute volume, surface area, etc.
12-	Use Green's Theorem in the Plane.
13-	Analyze and Solve problems using Numerical Methods.

Detailed of Theoretical Contents		
Hours	**Contents**	**Assessment Tools**
16	**Infinite Sequences and Series:** **1. Sequences of real Numbers:** • Definition and Examples: - Arithmetic Sequences. - Geometric Sequences. -Alternating Sequences	Quiz:1 Exam:1 Final Exam

<table>
<tr><th colspan="4">Detailed of Theoretical Contents</th></tr>
<tr><th>Hours</th><th colspan="2">Contents</th><th>Assessment Tools</th></tr>
<tr><td></td><td colspan="2">• Bounded and Monotone Sequences.
• Convergent and Divergent Sequences.
2. Infinite Series:
• Definition and Examples:
- Geometric Series.
- Harmonic and P-series.
- Alternating Series.
• Tests of Convergence for Series: Divergence Test, Comparison and Limit Comparison Tests, Ratio Test, Alternating Series Test, …
• Absolute and Conditional Convergence.</td><td></td></tr>
<tr><td></td><td rowspan="3">Textbook</td><td>1</td><td>Andrei D. Polyanin, Alexander V. Manzhirov."Handbook of mathematics for engineers and scientists".First Edition. New York. Chapman and Hall/CRC , 2007, 1017 pages. ISBN: 978-1-58488-502-3.</td><td></td></tr>
<tr><td></td><td>2</td><td>James Stewart. “Calculus “. Eighth Edition. Boston. Early transcendentals, 2016, 1397 pages. ISBN: 978-1-292-14665-2.</td><td></td></tr>
<tr><td></td><td>3</td><td>Anthony Croft, Robert Davison, Martin Hargreaves, James Flint. “Engineering Mathematics. A Foundation for Electronic, Electrical, Communications and Systems Engineers “. Fifth Edition. New York. Pearson Education, 2017, 1017 pages. ISBN: 978-1-285-74155-0.</td><td></td></tr>
<tr><td>14</td><td colspan="2">Power Series and Taylor Series:
1. Power Series:
• Definition and Examples.
• Radius and Interval of Convergence.
• Operations on Power Series (Addition and subtraction, Multiplication and division, Differentiation and integration).
• Functions Given by Power Series (f(x)=1/(1-x), …)
2. Taylor and Maclaurin Series.
• Definition
• List of Maclaurin series of some common function
-Exponential function.
-Natural logarithm.
-Geometric series.
-Binomial series.
-Trigonometric functions.
• Differentiation and integration of Maclaurin and Taylor Series.</td><td>Quiz:2
Exam:1
Final Exam</td></tr>
<tr><td></td><td>Textbook</td><td>1</td><td>Andrei D. Polyanin, Alexander V. Manzhirov."Handbook of mathematics for engineers and scientists".First Edition. New York. Chapman and Hall/CRC , 2007, 1017 pages. ISBN: 978-1-58488-502-3.</td><td></td></tr>
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Hours	**Contents**			**Assessment Tools**
		2	Anthony Croft, Robert Davison, Martin Hargreaves, James Flint. " Engineering Mathematics. A Foundation for Electronic, Electrical, Communications and Systems Engineers ". Fifth Edition. New York. Pearson Education, 2017, 1543 pages. ISBN: 978-1-285-74155-0.	
		3	James Stewart. "Calculus ". Eighth Edition. Boston. Early transcendentals, 2016, 1397 pages. ISBN: 978-1-292-14665-2.	
20	**Fourier Analysis: Fourier Series and Fourier Transforms:** **1. Fourier Series:** • Periodic Functions (of any period p=2L). • Even and Odd Functions: Integrating Odd and Even Functions Over Symmetric Domains. • Fourier Series: - Fourier Coefficients. - Half Range Fourier Series: Even Function and Half Range Cosine Series, Odd Function and Half Range Sine Series. - Convergence of Fourier Series. **2. Fourier Transforms:** • Fourier Integral. • Fourier Cosine and Sine Transform. • Fourier Transform. • Discrete and Fast Fourier Transforms (Optional). • Tables of Transforms			Quiz:3 Exam:2 Final Exam
	Textbook	1	Andrei D. Polyanin, Alexander V. Manzhirov."Handbook of mathematics for engineers and scientists".First Edition. New York. Chapman and Hall/CRC , 2007, 1017 pages. ISBN: 978-1-58488-502-3.	
		2	Erwin Kreyszig . Herbert Kreyszig. Edward J. Norminton. "Advanced engineering mathematics". Tenth Edition. New York. Wiley , 2011, 1283 pages. ISBN: 978-0-470-45836-5.	
		3	B. V. Ramana. "Higher Engineering Mathematics". Sixth Edition. New York. Tata McGraw Hill, 2010,679 pages. ISBN: 978-0070634190.	
16	**Multiple Integrals:** **1. Double Integrals:** • Double Integrals over Rectangles. • Double Integrals in Polar Coordinates. • Green's Theorem in the Plane. • Applications of Double Integrals. **2. Triple Integrals:** • Triple Integrals in Cylindrical Coordinates.			Quiz:4 Exam:2 Final Exam

<table>
<tr><th colspan="5">Detailed of Theoretical Contents</th></tr>
<tr><th>Hours</th><th colspan="3">Contents</th><th>Assessment Tools</th></tr>
<tr><td rowspan="5"></td><td colspan="3">• Triple Integrals in Spherical Coordinates.
• Applications of Triple Integrals.</td><td></td></tr>
<tr><td rowspan="3">Textbook</td><td>1</td><td>James Stewart. “Calculus “. Eighth Edition. Boston. Early transcendentals, 2016, 1397 pages. ISBN: 978-1-292-14665-2.</td><td></td></tr>
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<tr><td>3</td><td>John Bird. "Higher Engineering Mathematics". Eighth Edition. New York. Routledge, 2017, 924 pages. ISBN: 978-1-315-26502-5.</td><td></td></tr>
<tr><td rowspan="5">12</td><td colspan="3">Introduction to Numerical Analysis:
• Solution of equations in one variable: Bisection method, Newton-Raphson Method.
• Interpolation : Lagrange Interpolation, Newton’s Divide-Difference Interpolation.
• Approximation Method: Curve fitting using Discrete Least-Square.
• Numerical Differentiation: Numerical Methods for 1st and 2nd derivatives of a function based on Taylor series.
• Numerical Integration: Rectangular and Trapezoidal Method.
• Some Application on MATLAB and MAPLE.</td><td>Quiz:5
Final Exam</td></tr>
<tr><td rowspan="4">Textbook</td><td>1</td><td>Steven C. Chapra.” Applied Numerical Methods with MATLAB for Engineers and Scientists”. Fourth edition. New York. McGraw-Hill Education, 2018, 714 pages. ISBN 978-0-07-339796-2.</td><td></td></tr>
<tr><td>2</td><td>Richard L. Burden, J. Douglas Faires, Annette M. Burden. "Numerical Analysis". Tenth Edition. Boston. Cengage Learning,2015, 896 pages. ISBN: 9781305253667</td><td></td></tr>
<tr><td>3</td><td>Amos Gilat, Vish Subramaniam. “Numerical Methods for Engineers and Scientists An Introduction with Applications using MATLAB “. Third Edition. New Jersey. John Wiley & Sons, Inc, 2014, 577 pages. ISBN 978-1-118-55493-7.</td><td></td></tr>
<tr><td>4</td><td>Erwin Kreyszig . Herbert Kreyszig. Edward J. Norminton. "Advanced engineering mathematics". Tenth Edition. New York. Wiley , 2011, 1283 pages. ISBN: 978-0-470-45836-5.</td><td></td></tr>
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