

Planning and Quality Assurance Affairs

Form (A)

Course Specifications

General Information

Course name	Mathematical Physics
Course number	PHYS3315
Faculty	
Department	
Course type	Major Needs
Course level	3
Credit hours (theoretical)	3
Credit hours (practical)	0
Course Prerequisites	

Course Objectives

- 1 - study the Series Solutions of ODEs. Special Functions
- 2 - Study the Laplace Transforms
- 3 - Study the Fourier Analysis
- 4 - solution of Partial Differential Equations (PDEs) and mathematical modeling

## Course Contents

- 1 - Power Series Method
- 2 - Legendre's Equation. Legendre Polynomials  $P_n(x)$
- 3 - Extended Power Series Method: Frobenius Method
- 4 - Bessel's Equation. Bessel Functions  $J_\nu(x)$
- 5 - Bessel Functions of the  $Y_\nu(x)$ . General Solution
- 6 - Laplace Transform. Linearity. First Shifting Theorem (s-Shifting)
- 7 - Transforms of Derivatives and Integrals. ODEs
- 8 - Unit Step Function (Heaviside Function).
- 9 - Second Shifting Theorem (t-Shifting)
- 10 - Short Impulses. Dirac's Delta Function. Partial Fractions
- 11 - Convolution. Integral Equations
- 12 - Table of Laplace Transforms
- 13 - Fourier Series
- 14 - Arbitrary Period. Even and Odd Functions. Half-Range Expansions
- 15 - Forced Oscillations
- 16 - Approximation by Trigonometric Polynomials
- 17 - Sturm–Liouville Problems. Orthogonal Functions
- 18 - Orthogonal Series. Generalized Fourier Series
- 19 - Basic Concepts of PDEs
- 20 - Modeling: Vibrating String, Wave Equation
- 21 - Heat Equation: Solution by Fourier Series.
- 22 - Steady Two-Dimensional Heat Problems. Dirichlet Problem
- 23 - Heat Equation: Modeling Very Long Bars.
- 24 - Solution by Fourier Integrals and Transforms
- 25 - Modeling: Membrane, Two-Dimensional Wave Equation
- 26 - Rectangular Membrane. Double Fourier Series

## Teaching and Learning Methods

- 1 - The course is given as lecture and discussion, where several problems on the material are solve at the end of each unit. In addition some assignments are given to the students as a homework.
- 2 - ADVANCED ENGINEERING MATHEMATICS
- 3 - ERWIN KREYSZIG
- 4 - 10th ed