Programme	B. Sc. Mathematics Honours			
Course Code	MAT3MN202			
Course Title	**DIFFERENTIAL EQUATIONS AND FOURIER SERIES**			
Type of Course	**Minor**			
Semester	III			
Academic Level	200-299			
Course Details	Credit	Lecture/Tutorial per week	Practicum per week	Total Hours
	4	4	-	60
Pre-requisites	Basic Calculus and familiarity with Real Numbers			
Course Summary	In Module I students are introduced to various types of differential equations, including linear, separable, exact equations, and Bernoulli's equation. Module II delves deeper into linear equations, both homogeneous and nonhomogeneous. Module III introduces Fourier series, including trigonometric series, Fourier cosine and sine series, and half-range expansions. Module IV transitions into algebra of complex numbers, , and functions of complex variables, including analytic functions and the Cauchy-Riemann equations, which are fundamental in complex analysis.			

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply various methods, such as separation of variables, linear, and exact equations, integrating factors, and substitution, to solve differential equations, including those with constant coefficients and Cauchy-Euler equations.	Ap	C	Internal Exam/ Assignment/ Seminar/ Viva / End Sem Exam
CO2	Analyse and solve partial differential equations, including separable ones, and comprehend Fourier series and their applications in solving differential equations and understanding periodic function	An	C	Internal Exam/ Assignment/ Seminar/ Viva / End Sem Exam
CO3	Apply complex number theory, including arithmetic operations, polar forms, powers, roots, sets in the complex plane, functions of a complex variable, and Cauchy-Riemann equations, to analyze and solve real-world problems in various fields.	Ap	C	Internal Exam/ Assignment/ Seminar/ Viva / End Sem Exam

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Text Book	Advanced Engineering Mathematics (6/e) : Dennis G Zill, Jones & Bartlett Learning, LLC (2018) ISBN: 978-1-284-10590-2			
Module	**Unit**	**Content**	**Hrs 60**	**External Marks (70)**
I	**Foundations of Differential Equations**			**17**
	1	Introduction to Differential Equations Section 1.1: Definitions and Terminology Introduction, A Definition, Classification by Type, Notation, Classification by Order, Classification by Linearity, Solution.	**10**	
	2	Section 2.2: Separable Equations Introduction, A Definition, Method of Solution.		
	3	Section 2.3: Linear Equations Introduction, A Definition, Standard Form, Method of Solution, An Initial Value Problem.		
	4	Section 2.4: Exact Equations Introduction, Differential of a Function of Two Variables (Definition 2.4.1 and Theorem 2.4.1 only), Method of Solution.		
	5	Section 2.4: Exact Equations, Integrating Factors		
	6	Section 2.5: Solutions by Substitutions Bernoulli's Equation		
II	**Linear Differential Equations**			**18**
	7	Section 3.1: Theory of Linear Equations 3.1.2 Homogenous Equations, Linear Dependence and Independence, Solutions of Differential Equations.	**11**	
	8	Section 3.1: Theory of Linear Equations 3.1.3 Nonhomogeneous Equations, Complementary Function		
	9	Section 3.3: Homogeneous Linear Equations with Constant Coefficients Introduction, Auxiliary Equation.		
	10	Section 3.4: Undetermined Coefficients Introduction, Method of Undetermined Coefficients (Topics up to and including Example 4)		

	11	Section 3.6: Cauchy-Euler Equations Cauchy-Euler Equation (Second Order Only), Method of Solution.		
III	**Fourier Series**			**18**
	12	Section 12.2: Fourier Series Trigonometric Series (Definition 12.2.1 onwards), Convergence of a Fourier Series, Periodic Extension	**13**	
	13	Section 12.3: Fourier Cosine and Sine Series Introduction, Even and Odd Functions, Properties, Cosine and Sine Series (Definition 12.3.1 onwards).		
	14	Section 12.3: Fourier Cosine and Sine Series Half-Range Expansions.		
	15	Section 13.1: Separable Partial Differential Equations Introduction, Linear Partial Differential Equation, Solution of a PDE, Separation of Variables.		
	16	Section 13.1: Separable Partial Differential Equations Classification of Equations.		
IV	**Introduction to Complex Analysis**			**17**
	17	Section 17.1: Complex Numbers Introduction, A Definition, Terminology, Arithmetic Operations, Conjugate, Geometric Interpretation	**14**	
	18	Section 17.2: Powers and Roots Introduction, Polar Form, Multiplication and Division, Integer Powers of z.		
	19	Section 17.2: Powers and Roots DeMoivre's Formula, Roots.		
	20	Section 17.3: Sets in the Complex Plane Introduction, Terminology.		
	21	Section 17.4: Functions of a Complex Variable Introduction, Functions of a Complex Variable, Limits and Continuity, Derivative, Analytic Functions.		
	22	Section 17.5: Cauchy- Riemann Equations Introduction, A Necessary Condition for Analyticity, Harmonic Functions, Harmonic Conjugate Functions.		
	Module V (Open Ended)		**12**	
		Initial Value Problems		
		Differential Equations as Mathematical Models		
		Method of Variation of Parameters in solving DE		

V		Solving DE with the Runge-Kutte Method		
		Interpolation, Extrapolation		
		Classical PDEs and Boundary Value Problems		
		Heat Equation		
		Wave Equation		
		Fourier Transform		
References				
	1	Advanced Engineering Mathematics, Erwin Kreyszig, 8th Edition, Wiley Student Edition.		
	2	Mathematics For Engineers and Scientist, Alan Jeffrey, Sixth Edition		
	3	Complex Analysis A First Course with Applications (3/e), Dennis Zill & Patric Shanahan Jones and Bartlett, Learning (2015) ISBN 1-4496-9461-6		

Note: Proofs of all the results are also exempted for the end semester exam.

Mapping of COs with PSOs and POs :

	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	3	1	3	2	3	3	3	1	2
CO 2	3	1	3	2	3	3	3	1	2
CO 3	3	2	3	2	3	3	3	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/ Seminar
- Internal Exam
- Viva
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Seminar	Viva	End Semester Examinations
CO 1	✔	✔	✔	✔	✔
CO 2	✔	✔	✔	✔	✔
CO 3	✔	✔	✔	✔	✔