COURSE SPECIFICATION FORM

DEPARTMENT OF: Mathematics				**Academic Session: 2017-18**	
Course Code:	MT2720	**Course Value:**	0.5	**Status:**	Optional
Course Title:	Ordinary Differential Equations and Fourier Analysis			**Availability:** *(state which teaching terms)*	Term 2
Prerequisites:	MT1710, MT1720 and MT1820			**Recommended:**	
Co-ordinator:					
Course Staff					
Aims:	This course aims to introduce the concepts of eigenvalues and eigenfunctions in the familiar situation of the trigonometric differential equation and to show how these yield Fourier series expansions for a general function. These Fourier series can be generalized to (a) generate more general eigenfunction expansions for a given function and (b) develop the Fourier transform, which is used in a variety of applications; its properties are investigated. The final step is to introduce a technique for solving differential equations where the coefficients are no longer constant.				
Learning Outcomes:	On completion of the course, students should be able to: • locate eigenvalues both analytically and graphically; • determine the Fourier series for a periodic function, including odd and even functions, and recognize the function represented by a given Fourier series; • understand the role of eigenfunctions in building up a general function; • orthogonalize a set of polynomials over a specified interval; • manipulate the Dirac delta-function; • manipulate and apply the Fourier transform; • complete a solution-in series in straightforward cases.				
Course Content:	**Introduction to Sturm-Liouville theory:** eigenvalues and eigenfunctions; self-adjoint operators, orthogonal functions and their properties, orthogonalization, completeness of eigenfunctions. Laguerre polynomials, Legendre polynomials. **Fourier series:** Fourier-Euler formulae and statement of Fourier Theorem on $[-\pi,\pi]$, Fourier sine and cosine formulae, extension to general analysis. **The Fourier transform:** Fourier transform of derivatives, statement of Inversion Theorem, Dirac delta-function, Convolution Theorem, Parseval Theorem. **Ordinary differential equations:** The Cauchy-Euler equation. Solution in series for a second-order linear differential equation, for two out of the four cases that can arise.				
Teaching & Learning Methods:	33 hours of lectures and examples classes. 117 hours of private study, including work on problem sheets and examination preparation. This may include discussions with the course leader if the student wishes.				
Key Bibliography:	Elementary Differential Equations and Boundary Value Problems – W E Boyce & R C di Prima (Wiley). *Library Ref. 515.41 BOY*				
Formative Assessment & Feedback:	Formative assignments in the form of 8 problem sheets. The students will receive feedback as written comments on their attempts.				
Summative Assessment:	**Exam** (%) A two-hour paper: 100% **Coursework** (%) None				

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