COURSE SPECIFICATION FORM

DEPARTMENT OF: Mathematics				**Academic Session: 2017-18**	
Course Code:	MT2940	**Course Value:**	0.5	**Status:** *(ie:Core, or Optional)*	Mandatory for G100 and G103, optional for others
Course Title:	Real Analysis			**Availability:** *(state which teaching terms)*	Term 1
Prerequisites:	MT1940			**Recommended:**	
Co-ordinator:					
Course Staff					
Aims:	• To explain the rigorous definition of limit of a function of a positive integer variable; • To discuss convergence of series, including power series; • To discuss the concepts of continuity and differentiability of functions of a real variable *x*; • To show how the Riemann integral is constructed.				
Learning Outcomes:	On completion of the course, students should be able to: • quote the Weierstrass definition of a limit and verify it in simple cases; • use standard tests to investigate the convergence of commonly occurring series; • specify the power series of standard functions; • understand the Intermediate Value Theorem and the Mean Value Theorems; • understand the constructive approach of the Riemann integral.				
Course Content:	**Sequences and series:** Sequences which tend to a limit (such as $n^{\frac{1}{n}}$, $(1+\frac{1}{n})^n$). Absolute convergence of series; use of comparison and ratio tests for absolute convergence; absolute convergence implies convergence. Conditional convergence, alternating series test, rearrangement of $\sum \frac{(-1)^{n-1}}{n}$. **Differentiation:** Formal definition of ' $f(x) \to \alpha$ as $x \to a$ ' with connection to continuity. The intermediate value theorem. Differentiability at a point – definition and geometric interpretation, with examples. Differentiability implies continuity. Derivative of a sum, product, quotient, and the chain rule (with application to inverse functions). Differentiability on an open interval; Rolle's theorem, Mean Value Theorem, Cauchy's Mean Value Theorem, with applications including l'Hôpital's rule. Taylor's theorem with (one) remainder. **Power series:** Existence of radius of convergence, and use of ratio test to find it. Power series can be differentiated term-by-term within the circle of convergence. Formal definition and properties of exp, sin, cos, etc., and (using the inverse function) of log, $\sin^{-1}$ etc. Periodicity of sin and cos. **Riemann integral:** Upper and lower sums, leading to definition and properties of Riemann integral. Fundamental theorem of calculus. Integral test for convergence of series.				
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:	Numbers and Functions (steps into analysis) – R P Burn (Cambridge 2000). *Library Ref. 515.23 BUR* Yet Another Introduction to Analysis – Victor Bryant (Cambridge 1990). *Library Ref. 515 BRY*				
Formative Assessment & Feedback:	Formative assignments in the form of weekly 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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