COURSE SPECIFICATION FORM

<table>
<tr><td colspan="4">DEPARTMENT OF: Mathematics</td><td colspan="2">Academic Session: 2017-18</td></tr>
<tr><td>Course Code:</td><td>MT1810</td><td>Course Value:</td><td>0.5</td><td>Status:
(ie:Core, or Optional)</td><td>Mandatory for all programmes</td></tr>
<tr><td>Course Title:</td><td colspan="3">Number Systems</td><td>Availability:
(state which teaching terms)</td><td>Term 1</td></tr>
<tr><td>Prerequisites:</td><td colspan="3">A-level Mathematics or equivalent</td><td>Recommended:</td><td></td></tr>
<tr><td>Co-ordinator:</td><td colspan="5"></td></tr>
<tr><td>Course Staff</td><td colspan="5"></td></tr>
<tr><td>Aims:</td><td colspan="5">This course aims to introduce fundamental algebraic structures used in subsequent courses and the notion of formal proofs, and to illustrate these concepts with examples.</td></tr>
<tr><td>Learning Outcomes:</td><td colspan="5">On completion of the course, students should be able to:
• apply Euclid's algorithm to find the greatest common divisor of two integers;
• use mathematical induction in a careful and logical way to prove simple results;
• perform arithmetic operations on complex numbers, using $x+iy$ and $re^{i\theta}$ forms, locate points on the Argand diagram, and extract roots of complex numbers;
• prove De Morgan's laws and the distributive laws of set theory, and use the principle of inclusion/exclusion in simple cases;
• determine whether a given mapping is bijective and if so find its inverse;
• establish whether a given relation on a set is an equivalence relation and find the corresponding equivalence classes;
• compile truth tables to determine whether two statements are logically equivalent;
• define a ring, integral domain and field, establish some of their simple properties.</td></tr>
<tr><td>Course Content:</td><td colspan="5">The integers: division with quotient and remainder, binary numbers, the Euclidean algorithm, greatest common divisors, $\gcd(m,n) = sm + tn,$ primes, statement of the fundamental theorem of arithmetic, the principle of mathematical induction.
Complex numbers: Cartesian addition and multiplication, the complex conjugate, rules of manipulation (the field axioms), inversion, the Argand diagram, modulus and argument, extraction of nth roots (quadratic equations and roots of unity (cyclic groups)), $e^{i\theta} = \cos\theta + i\sin\theta,$ e^z and $\log z$.
Sets: intersection, union, complement, Venn diagrams, De Morgan's laws.
Mappings: composition, associative law, injections, surjections, bijections and inverses. Equivalence relations and partitions. Propositional logic, truth tables.
Rings and fields: the ring Z_n of integers modulo n, the field Z_p. The ring $F[x]$ of polynomials over a field, analogy with Z (division law, monic polynomials, gcds), zeros, remainder and factor theorems, a polynomial of degree n over F has at most n zeros. The ring of 2×2 matrices over a field.</td></tr>
<tr><td>Teaching & Learning Methods:</td><td colspan="5">33 hours of lectures and examples classes, 11 hours of problem workshops, 106 hours of private study, including work on problem sheets and examination preparation. This may include discussions with the course leader if the student wishes.</td></tr>
<tr><td>Key Bibliography:</td><td colspan="5">A Concise Introduction to Pure Mathematics – M Liebeck (Chapman and Hall/CRC Mathematics 2000) Library Ref. 510 LIE
Discrete Mathematics (2^{nd} edition)– N L Biggs (Oxford UP 2002). Library Ref. 510 BIG</td></tr>
<tr><td>Formative Assessment & Feedback:</td><td colspan="5">Formative assignments in the form of 11 problem sheets. The students will receive feedback as written comments on their attempts.</td></tr>
<tr><td>Summative Assessment</td><td colspan="5">Exam (%) A two-hour paper: 80%
Coursework (20%) Attempting problem sheets 10%; one 45 minute test in January: 10%.</td></tr>
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Updated September 2017

The information contained in this course outline is correct at the time of publication, but may be subject to change as part of the Department's policy of continuous improvement and development. Every effort will be made to notify you of any such changes.