# COURSE SPECIFICATION FORM

| DEPARTMENT OF: Mathematics | | | | Academic Session: 2017-18 | |
|---|---|---|---|---|---|
| **Course Code:** | MT2220 | **Course Value:** | 0.5 | **Status:** | Optional |
| **Course Title:** | Vector Analysis and Fluids | | | **Availability:** *(state which teaching terms)* | Term 1 |
| **Prerequisites:** | MT1710 and MT1720 | | | **Recommended:** | |
| **Co-ordinator:** | | | | | |
| **Course Staff** | | | | | |
| **Aims:** | • to study the integration and differentiation of vectors and scalars defined at points in space, introducing the concepts of scalar and vector fields;<br>• to familiarize the student with the use of general orthogonal curvilinear coordinates and the evaluation of differential operators;<br>• to introduce integral theorems and demonstrate their usefulness;<br>• to show how simple partial differential equations may be solved by the technique of separation of variables;<br>• to show how the acquired concepts can be applied in the field of dynamics of inviscid fluids. | | | | | |
| **Learning Outcomes:** | On completion of the course students should be able to:<br>• identify scalar and vector fields;<br>• calculate the gradient of a scalar field and the divergence and curl of a vector field;<br>• use general orthogonal curvilinear co-ordinates and, in particular, cylindrical and spherical polar co-ordinates;<br>• use the divergence theorem and Stokes' theorem;<br>• recognize when and how variables separate in a partial differential equation;<br>• apply the equations of continuity and motion for an inviscid fluid and use Bernoulli's equation;<br>• use velocity potential and apply it to examples of irrotational flow. | | | | | |
| **Course Content:** | **Vector analysis:** scalar and vector fields. Field lines for a vector field. Gradient of a scalar field, divergence and curl of a vector field. The del-operator. Cylindrical and spherical polar coordinates. General orthogonal curvilinear coordinates. Surface and volume integrals. The divergence theorem and Stokes' theorem. Green's theorem.<br>**Partial differential equations:** Laplace's equation,, the diffusion equation and the wave equation in Cartesian coordinates. Separation of variables, used in plane polar and spherical coordinates.<br>**Dynamics of inviscid fluids:** equation of continuity. Velocity and acceleration. Equation of motion. Bernoulli's equation. Irrotational flow and velocity potential. Examples of potential flow of incompressible fluids. | | | | | |
| **Teaching & Learning Methods:** | 33 hours of lectures and examples classes.<br>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:** | Calculus ($5^{th}$ edition) – J Stewart (Brooks-Cole 2003). *Library Ref. 515 STE*<br>Vector Analysis and Cartesian Tensors – (Third Edition) D E Bourne and P C Kendall (Chapman and Hall 1992). *Library Ref. 515.34 BOU* | | | | | |
| **Formative Assessment & Feedback:** | Formative assignments in the form of 10 problem sheets. The students will receive feedback as written comments on their attempts. | | | | | |
| **Summative Assessment:** | **Exam** (%) A two-hour paper: 100%<br>**Coursework** (%) none<br>**Deadlines:** n/a | | | | | |

Updated September 2017