

25 Syllabus for May 2022 exam

The overall mark for the U11S02 module will be 20% coursework and 80% exam.

The exam will have 8 questions, in two sections, of which you answer 3 questions from each section. Credit will be given to the best 3 answers in each section.

You should practise the calculations covered in the notes and in the quizzes. There may be a part of some questions which are a little different, but only a small proportion.

Official tables will be available at the exam venue. Scientific calculators, such as Sharp or Casio, may be used, but programmable calculators are not permitted.

- Cross product and plane through P, Q, R in \mathbb{R}^3 . 2×2 determinants. 3×3 determinants. Cramer's Rule. Adjoint and inverse. Gauss-Jordan elimination.
- Determinants: 2×2 , 3×3 , 4×4 , evaluation by cofactor expansion (row or column), evaluation by reducing to upper triangular form, Cramer's Rule for 2 or 3 variables, adjoint and inverse of 2×2 and 3×3 matrices.
- Row space, column space, and nullspace bases.
- Linear maps: formulae (not matrices) for projection and rotation in \mathbb{R}^3 .
- Coordinate systems, change of basis formula. Orthogonal matrices and orthonormal bases.
- Matrices of linear maps in 'old' and 'new' coordinate systems. Matrices for projection, rotation.
- Least squared error estimates for linear and quadratic functions in \mathbb{R}^2 .
- Eigenvalues and eigenvectors, calculation and basis of eigenvectors in \mathbb{R}^2 . Calculating e^{At} . Solving differential equations $dX/dt = AX$, with initial conditions $X = X_0$ at $t = 0$.
- Probability. Official tables of formulae. Sample spaces and probability distributions. Uniform distribution: a fair coin, a fair die, two fair dice.
- Random variables. Binomial distribution. Mean and variance of a distribution. Sample average, variance.
- Continuous distributions: uniform, normal, student's t-distribution.

The Central Limit Theorem used to approximate distributions by a normal distribution. $B(n, p) \approx N(np, np(1 - p))$. The continuity correction should be used.

- Confidence intervals for mean of a normal distribution, estimated from sample average, (a) assuming its variance σ^2 is known, and (b) using the sample variance S^2 as an estimate for σ^2 .
- Hypothesis testing: null hypothesis, significance level, Probably the Binomial Distribution is involved, approximated by the normal distribution with continuity correction.