November 23, 2015 Lecturer Dmitri Zaitsev Michaelmas Term 2015

**Course 2E01 2015 (SF Engineers & MSISS & MEMS)**

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Due: at the end of the tutorial

## Exercise 1

Find the orthogonal projection of the vector $\mathbf{v}$ onto the plane spanned by the orthogonal basis (with respect to the standard dot product)

$$\{(1,-2,0),(-2,-1,1)\},$$

where

(i) $\mathbf{v} = (1,0,-1)$;

(ii) $\mathbf{v} = (1,1,-1)$.

## Exercise 2

Use the Gram-Schmidt process to transform the given basis into orthogonal one:

(i) $\mathbf{u}_1 = (-1,0)$, $\mathbf{u}_2 = (1,2)$;

(ii) $\mathbf{u}_1 = (1,0,1)$, $\mathbf{u}_2 = (0,0,1)$, $\mathbf{u}_3 = (0,2,1)$;

## Exercise 3

Find the characteristic polynomials of the following matrices:

(ii) $\begin{pmatrix} 0 & 2 \\ -1 & 0 \end{pmatrix}$;

(iii) $\begin{pmatrix} 1 & 2 & -1 \\ 0 & 3 & -2 \\ 0 & 0 & -3 \end{pmatrix}$;

(iv) $\begin{pmatrix} 0 & -2 & 1 \\ 1 & 0 & 2 \\ 0 & -2 & 1 \end{pmatrix}$.