

# COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electronics and Communications Engineering

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Course Title: Advanced Engineering Mathematics

Course No.: EC738

Problem Set #2

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## Eigenvalue Problems (Analytical)

1. Using polynomial method, find the eigenvalues and eigenvectors for:
  - a)  $A = \begin{bmatrix} 1 & 4 \\ -5 & -5 \end{bmatrix}$
  - b)  $A = \begin{bmatrix} 3 & -1 & 7 \\ -1 & -1 & 1 \\ 7 & 1 & 3 \end{bmatrix}$
  - c) In problem 1b, prove that the sum of eigenvalues equals the trace of the matrix (the trace of a matrix is the sum of the diagonal components)
2. For the mass-spring system given in lecture, find natural frequencies and eigenvectors if the mass is 20Kg,  $k=100\text{N/m}$ . Sketch the displacement of each mass as a function of time

## Eigenvalue Problems (Numerical: Finite Difference/Polynomial Method)

3. For the problem in lecture 3 (Schrodinger Equation for a 1D infinite potential well, use four internal nodes:
  - a. Write down the new matrix equation
  - b. Use the polynomial method to approximate the 4 eigenvalues
  - c. Show the % error w.r.t. analytical solution, and compare with errors for 2-node & 3-node solutions given in lecture.