※ 考生請注意:本試題 □可 ☑不可 使用計算機

1. **Linearization of damped pendulum** (25%)

   Solve the following differential equation

   $\theta'' + c\theta' + k\sin\theta = 0$ 　　　where $k > 0$ & $c > 0$

2. **Laplace Transforms and Fourier Analysis**

   (a) Please state the reason why an engineer needs to learn and understand Laplace and Fourier transformation, Fourier series and Integrals. (15%)

   (b) For a full-wave rectification of *Sin wt*, find its Laplace transform and Fourier Series representation. (10%)

3. **Linear Algebra**

   (a) Find the inverse of the matrix [A] (10%)

   (b) Find the eigenvalues and eigenvectors of the matrix [B] (15%)

   where:

   $$[A] = \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix} \qquad [B] = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$$

4. **Probability and Mathematical Statistics**

   (a) Please explain "***Normal or Gauss Distribution***" by using descriptive and quantitative statements. (15%)

   (b) Compute the probability of obtaining at least two "*six*" in rolling a fair die 4 times. (10%)