

國立虎尾科技大學 107 學年度第二學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班

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科目：工程數學

注意事項：

- (1) 本試題共有 5 題，任選○題作答，每題 20 分，合計一百分。
- (2) 請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
- (3) **禁止 使用計算機**

1. Given

$$y'' + 2y' + 2y = r(t) \quad \begin{cases} r(t) = 10 \sin 2t & \text{if } 0 < t < \pi \\ r(t) = 0 & \text{if } t > \pi \end{cases} \quad \begin{cases} y(0) = 1 \\ y'(0) = -5 \end{cases}$$

- (1) Solve the initial value problem above using Laplace Transfer method.
- (2) What mechanical system can apply above differential equation?

2. At point P in O_{xi} coordinate axes the stress tensor is

$$\sigma_{ij} = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 0 & 2 \\ 1 & 2 & 0 \end{bmatrix}$$

Find values of principal stresses (i.e, eigen values) and the directions associated with them (i.e., principal axes)

3. (1) Please find Fourier Series of $f(t)$ below

$$f(t) = \begin{cases} -1 & \text{if } -2 < t \leq 0 \\ 1 & \text{if } 0 < t \leq 2 \end{cases} \quad T=4$$

(2) Please find Fourier Transfer of $f(x)$, "a" is any constant.

$$f(x) = e^{-a|x|}$$

4. Please solve differential equation below

(1) $(2x - 4y + 5)y' + x - 2y + 4 = 0$

(2) $xy' + 2y = 4e^{x^2}$

5. Find reverse Matrix of A (i.e., A^{-1})

$$A = \begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$$

- (1) Using Gauss-Jordan Elimination (2) using Determinants (i.e., Det A)