國立臺灣科技大學

114學年度碩士班招生

試題

系所組別：0310機械工程系碩士班甲組

科　　目：工程數學

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1、(15%) Solve $x^2y'' - 3xy' + 3y = 2x^4e^x$

2、(15%) Solve $(x + 2y)dx + 2xdy = 0$, y(1)=0

3、(20%) Find the Laplace (or Inverse Laplace) transform of the following equation:

(1) (10%) $\mathcal{L}^{-1}\left\{\frac{6s+3}{s^2+4}\right\}$

(2) (10%) $\mathcal{L}\{e^{2t} * \sin(t)\}$

4、(20%)

(1) (10%) Compute the directional derivative of the field $f(x,y,z)=x^3+y^2z$ in the direction of the vector $2\bar{i}+\bar{k}$ at the point P: (1, 1, 1).

(2) (10%) Evaluate the following integral from A:(0, 1, 2) to B:(1, 1, 7).

$$I=\int_C \left(3x^2dx+2yzdy+y^2dz\right)$$

5、(10%) Evaluate

$$\int_{-\infty}^{\infty} \frac{x^2}{\left(x^2+a^2\right)\left(x^2+b^2\right)}dx$$

where a and b are positive constants.

6、(20%) Solve the following partial differential equation

$$\frac{\partial\theta}{\partial t}=\frac{\partial^2\theta}{\partial x^2}+2$$

Boundary conditions： $\theta(l,t)=0$, $\frac{\partial\theta(0,t)}{\partial x}=0$,

Initial conditions： $\theta(x,0)=0$

Starting from separation of variables according to the following steps

(1) (10%) assume separation of variables $\theta(x,t)=\varphi(x,t)+\phi(x)$ and solve $\phi(x)$.

(2) (10%) solve $\varphi(x)$ using a further separation of variable and determine the full answer of $\theta(x,t)$.