

國立嘉義大學九十四學年度
光電暨固態電子研究所碩士班招生考試試題

科目：工程數學

1. Find the total mass of the area cut from the upper half of the sphere $x^2 + y^2 + z^2 = 1$ by the cylinder $x^2 + y^2 - y = 0$, with the mass per unit area be equal to $|x|$. (20%)
2. Given a vector $\vec{A}(t) = A_r(t)\hat{r} + A_\theta(t)\hat{\theta}$, where \hat{r} and $\hat{\theta}$ represent unit vectors along r direction and θ direction, respectively. Find the components of $d\vec{A}/dt$ along \hat{r} and $\hat{\theta}$. (20%)
3. If $f(x)$ is complex, we usually want the average of the square of the absolute value of $f(x)$. Show that if a complex $f(x) = \sum_{-\infty}^{\infty} c_n \exp \frac{in\pi x}{L}$, then the average of $|f(x)|^2$ is $\sum_{-\infty}^{\infty} |c_n|^2$. (20%)
4. Suppose that the rate at which you work on a hot day is inversely proportional to the excess temperature above 75° . One day the temperature was rising steadily, and you started studying at 2 p.m. You covered 20 pages the first hour and 10 pages the second hour. At what time was the temperature 75° ? (20%)
5. If **A** and **B** are 2 by 2 matrices which do not necessarily commute, show that **AB** and **BA** have the same eigenvalues. (20%)