

Physics 6770, Optical Measurement Techniques and Instrumentation
Self assessment test 1

Determine whether the course content is too advanced for you. This self assessment test contains three parts, an algebra part, an elementary optics part and the electricity part. If you can't answer more than 12 of these 15 questions correctly, you should reconsider whether you meet the prerequisites of PHYS6770.

- 1.) When $x^2 - 15x = 54$, what is x ?
- 2.) From the equations (i) $4z - 3y + x - 20 = 6$, (ii) $2y - z - x = 1$ and (iii) $-20x + 11z - 5y + 13 = 0$, determine the values of x, y and z .
- 3.) Simplify the expression:
$$\frac{1}{\sqrt{2}} (1, 1) \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}^2 \frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$
- 4.) The observable $f(t) = [At^2/\sin(\omega t)] + B \ln(t/t_0)$ is given as a function of time t . What is the derivative $df(t)/dt$?
- 5.) Given is a set of integers $\{1, 4, 5, 2, 8, 34, 23, 7, 0, -4, 52, 56, 22, 28\}$. What is the average and the median of these numbers?
- 6.) What is the index of refraction?
- 7.) What is a wave number?
- 8.) Given an ideal lens with focal length f and an object at a distance s_o from the lens, for which s_o will the image of the object be minified, have the same size, be magnified and for which s_o will an image not exist?
- 9.) What is the energy of a photon with wavelength λ in vacuum?
- 10.) What is the relationship between the reflection coefficient R and the transmission coefficient T of a transparent, non-absorbing object?
- 11.) What is electric current?
- 12.) What is voltage?
- 13.) What is Ohm's law?
- 14.) What are Kirchhoff's rules for voltage loops and current nodes at low frequencies?
- 15.) What is the AC current in a capacitor with capacitance $C = 100\mu\text{F}$ connected to an AC voltage $V = 110\text{V}$ with frequency $f = 60\text{Hz}$?