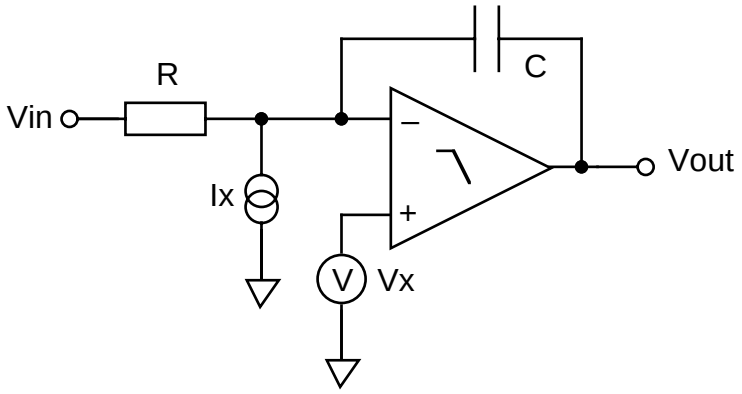
PHYSICS EXAMINATION PROBLEMS
SOLUTIONS AND HINTS FOR STUDENT SELF-STUDY

Module Code	**PHY3128**
Name of module	**Electronics for Measurement Systems**
Date of examination	**June 2003**

1. Real op-amp, single pole at ω_0:



Assume $R_o << R$ and calculate transfer function:

$$V_{out} = \frac{G\left[V_X(1+j\omega CR) + V_{in} + I_X R\right]}{(1+j\omega/\omega_0)(1+j\omega CR(1+G))}$$

2. At junction between three lines: $R = 16.7\Omega$

Impedance of the lossy line: $\mathbf{Z}_0 = \sqrt{\frac{(R+j\omega L)}{(G+j\omega C)}}$

Hint: Optimal performance requires an impedance that is independent of frequency, i.e.

$$G = 4.15\times10^{-3}\ \Omega^{-1}\ \mathrm{m}^{-1}$$

3 (i) At 150 Hz when the noise density is 7×10^{-12} W Hz^{-1} the rms noise is

$$\frac{4\times10^{9}\ \mathrm{V\ W^{-1}}\times 7\times10^{-12}\ \mathrm{W\ Hz^{-1}}}{10\ \mathrm{s}\times 2\pi\ \mathrm{Hz^{-1}\ s^{-1}}} = 0.45\ \mathrm{mV}$$

4. (a) $T = 560$ K, $V_0 = 2\times\sqrt{56\ \Omega\times P_0} = 7.63$ V \

(b) $V_{out} = \sqrt{V_0^2 - 4R_0S}$ $\qquad \Delta V_{out}/\Delta S = 14.7$ V W^{-1}