What do you need to know for JEGs bit of EEE225

There is no formula sheet

This is a list of items typical of what I expect you to know - not everything is on the list. The common factor linking all the items on this list is that they are all basic relationships without which one cannot proceed. Many of them should have been imprinted on your memory in first year (or equivalent of first year for direct entrants).

- Small signal BJT equivalent circuit containing r_{be}, $g_m v_{be}$ (or βi_b) and r_{ce}

- BJT relationships: $h_{fe} = \beta = \frac{\Delta I_C}{\Delta I_B} = \frac{i_c}{i_b}$, $h_{FE} = \frac{I_C}{I_B}$, $g_m = \frac{eI_C}{kT}$, $r_{be} = \frac{\beta}{g_m} = \frac{v_{be}}{i_b}$, $g_m v_{be} = \beta i_b$
- Circuit shapes: differential pairs, Darlington pairs, current mirrors, common emitter, emitter follower and common base circuits and how to use equivalent circuits to evaluate performance parameters

- Op-amp relationships: $v_O = A_V\left(v^+ - v^-\right)$. The ideal inverting and non-inverting gains, $G_{inverting} = -R_2/R_1$ and $G_{non\text{-}inverting} = (R_1 + R_2)/R_1$, I also expect you either to know or to be able to work out. Neither take longer than about 20 seconds to work out.

- The idea and application of Gain-Bandwidth product.

- The idea and application of slew rate.

- That a first order system is described by

  $$\frac{v_O}{v_I} = k\frac{1}{1 + j\frac{\omega}{\omega_0}}$$ for a low-pass

  $$\frac{v_O}{v_I} = k\frac{j\frac{\omega}{\omega_0}}{1 + j\frac{\omega}{\omega_0}}$$ for a high pass and

  $$\frac{v_O}{v_I} = k\frac{1 + j\frac{\omega}{\omega_1}}{1 + j\frac{\omega}{\omega_0}}$$ for a pole-zero or lead-lag circuit.

  For these three relationships, $\omega_0 = 1/\tau = -3$dB or corner frequency

- I will tell you the expressions for thermal noise and shot noise if you need them. I expect you to remember how to combine noise sources in circuits, the definitions of signal to noise ratio and noise factor, the development of the noise factor definition to include added noise, and equivalent circuit representations of noise generators in amplifiers. I also expect you to remember how to work out noise temperature and how to apply kT/C to evaluate the total noise voltage across a capacitor.