

Physics 326 Midterm
Sample
Open book

1. A DC Power supply is designed to convert 220 V, 50 Hz to 12 V DC with a maximum current of 1000 mA.
 - (a) Sketch the circuit diagram (without component values) of such a converter showing the following components: [4]
 - rectifier bridge
 - bleeder resistor
 - transformer
 - fuse
 - filter capacitor
 - (b) What would be the limits (maximum and/or minimum, if any) on the load resistance that should be attached to this power supply? [2]
 - (c) What filter capacitor would be necessary to limit the peak-to-peak ripple to 0.5 V? [2]
 - (e) What would be the transformer's secondary:primary winding ratio? [2]
 - (f) Show how a zener diode could be used to further reduce ripple [3]
 - (g) Estimate and justify the size of the fuse that should be used. [1]
2. (a) Design a one transistor voltage amplifier with an amplification of 10. Use NPN BJT's, $V_{CC} = 12$ V. What would be its input impedance? Set the quiescent output voltage at 8 V with collector current of 1 mA. [8]
 - (b) Estimate input and output impedances assuming both transistors' $\beta = 100$. [2]
3. (a) On the attached copy of a JFET's characteristic curves identify (by writing on the graph) and estimate the values of the following quantities: $V_{GS(off)}$, V_P , I_{DSS} . [4]
 - (b) Identify the current source region and the Ohmic region on the graph. [3]
 - (c) Draw a graph of g_m vs V_{GS} and estimate R_{DS} . [3]
 - (d) Use these characteristics to design a JFET source follower using self-bias. Estimate its voltage gain. Discuss how it could be used in conjunction with the circuit of problem 3. Estimate values for all components. [6]