航空太空工程研究所

Electronic Circuit

Problem A.

Figure 1 shows a two-transistor amplifier circuit. Both of these transistors have $h_{fe(dc)} = 120$, and $h_{fe(ac)} = 90$.

1. Calculate the working Q-point conditions for both transistors.   (10%)

2. If the voltage signal source has its frequency range from 200 Hz to 20 KHz, calculate C_1 and C_3.   (5%)

3. Using the Ebers-Moll Model, draw the simplified a.c. circuit of Figure 1, then calculate all components in the simplified a.c. circuit.   (10%)

4. Calculate V_{out}.   (5%)

Problem B.

Figure 2 shows a transistor-FET compound single current source circuit. If the V_{GS} is kept always -2 V, answer next problem.

5. Calculate all voltages and currents in this circuit under working condition.   (15)

Problem C. (Questions please answer in briefs)

6. A measurement system operates for signal frequency between 20 KHz to 40 KHz. The system power suorce can cause a noise with frequency under 900 Hz, and another neighborhood signal source can cause high frequency noise at 100 KHz or higher. If you are to design a filter to eliminate these noises, draw a GAIN to FREQUENCY relationship for your filter. This is a problem of frequency response of filters.   (5%)

7. In an operational amplifier, what is the meaning of an offset voltage or offset applying current ?   (5%)

8. Figure 3 shows a simple transistor measurement circuit, which parameter in the hybrid parameters can be measured by this circuit diagram. Assume that the applied voltage is 6 V, and the current is measured to get 42 uA, What is the solution. Please specify with proper unit.   (5%)

Foundamental Dynamics

Problem D.

A space station circulating the earth orbit is constructed with two donut-shaped rings connected by four radial channels. An astronaut is trying to move from the inner ring aera to the outter ring through one of the radial channel as shown in the Figure. Assume that the station is spinning with an angular velocity ω. Show what is the force the astronaut feels on his way of movement. (Make whatever assumptions you would need for your answer.)   (40%)
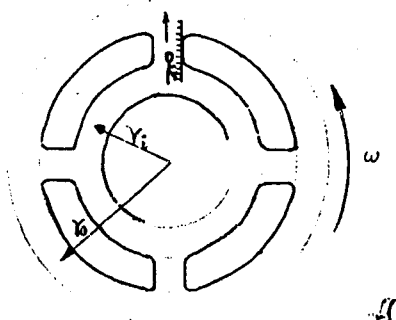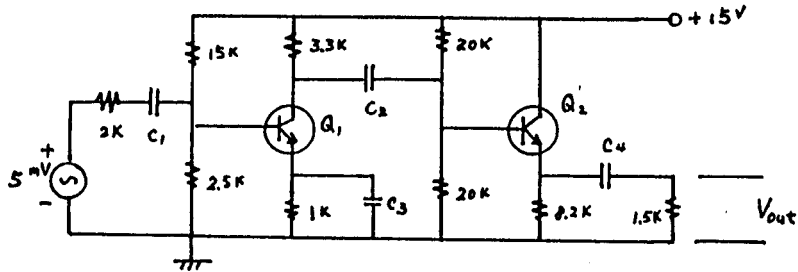
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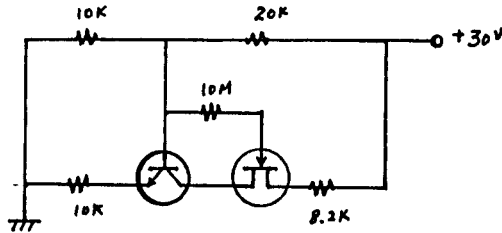Figure 1.　A two-transistor amplifier circuit.
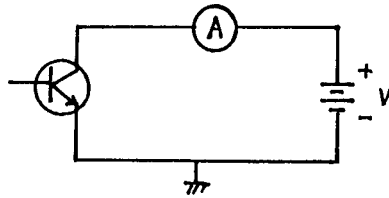

Figure 2.　A transistor-FET compound circuit.

Figure 3.　A transistor measurement circuit.