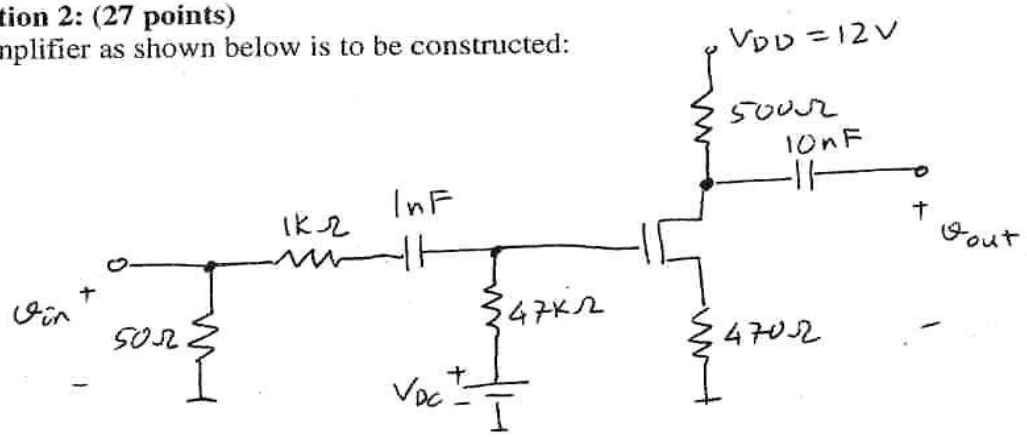
EE411/EEE511 Midterm II
25th December 2002 18.00

Question 1: (16 points)
There is a mathing contest. The winner will be the person who used the minimum number of components to match a 1 Ohm-resistor into 10 Ohms at the frequency of 15.91 MHz. The allowed component types are inductors and capacitors. Do the match, state the component values and draw the circuit.
Note: The matching circuit must reject low frequency components.

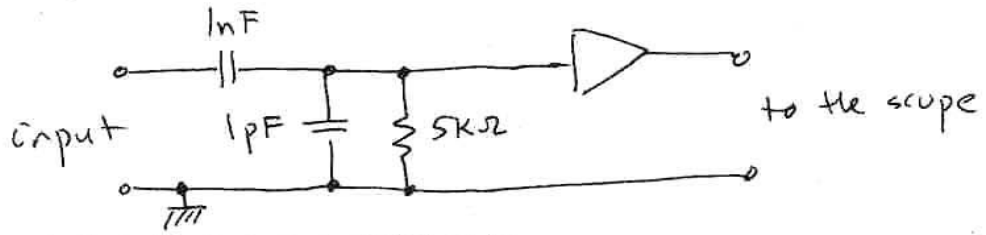
Question 2: (27 points)
An amplifier as shown below is to be constructed:



$G_m = 8 \times 10^{-3}$ millisiemens C_{gs}=1pF C_{gd}=0.5pF

The 3dB-bandwidth of the amplifier is not known. The engineer responsible from the design tries to measure the bandwidth of the the amplifier by driving it using a 50 Ohm source and by measuring the output using a FET probe connected to an oscilloscope (The equivalent circuit of the FET probe is given below).

a) (11 points) Estimate the midband gain and the bandwidth of the amplifier without the FET probe.
b) (11 points) Estimate the midband gain and the bandwidth of the amplifier with the FET probe connected.
c) (5 points) Comment on the results.



The equivalent circuit of a typical FET probe.

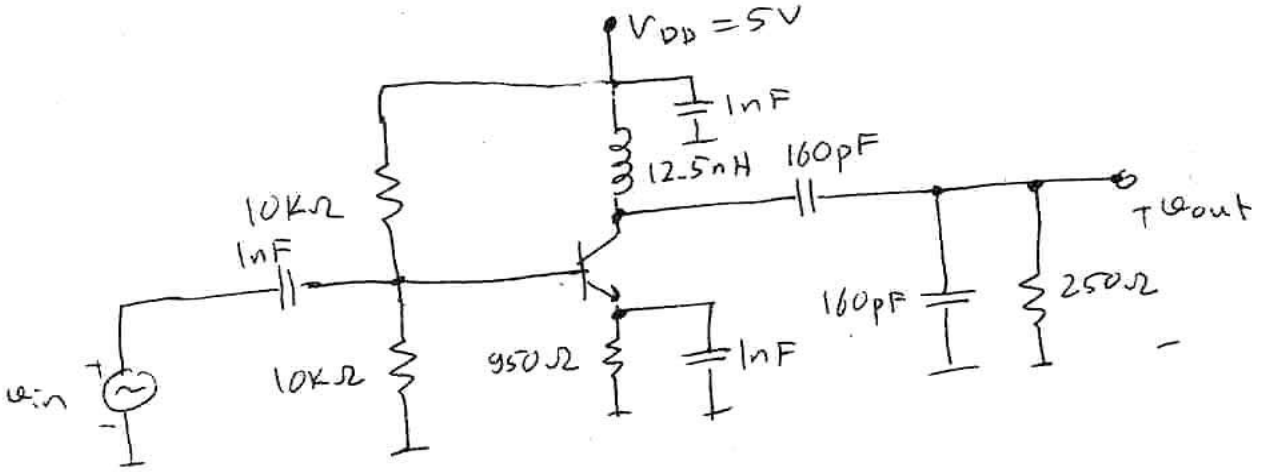
Question 3: (30 points)

Given the circuit below:

a) (10 points) Calculate the resonance frequency of the output tank

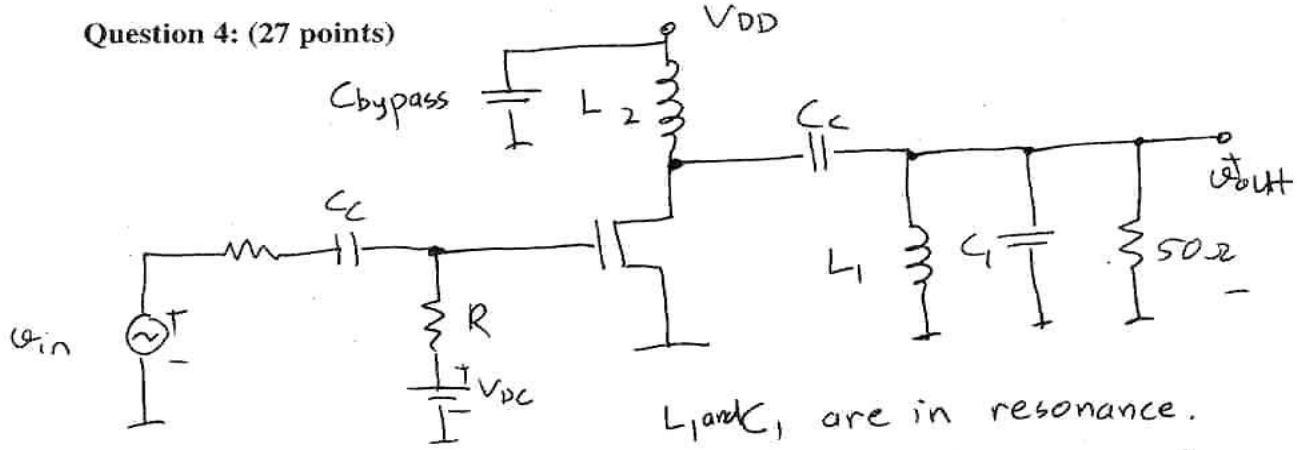
b) (10 points) Calculate the Q of the output tank

c) (10 points) If $v_{in}= 10^{-3}\cos 10^{9}t$, what is the rms voltage at the output?



The transistor is an ideal BJT with V_{BE}=0.6 Volts.

Question 4: (27 points)



There is an RF power amplifier which was designed to operate either in class-A or class-B modes depending on the application. The delivered power is 1 Watts.

a) (9 points) What must be the power supply voltage V_{DD} so that the amplifer operates at maximum efficiency at both class-A and class-B modes?

b) (9 points) In class-A operation, find the power supply current, transistor dissipation and the peak transistor current.

c) (9 points) In class-B operation, find the power supply current, transistor dissipation and the peak transistor current.