Bago University
Department of Physics
First Semester Examination, March 2019

Fourth Year (BSc)
(Physics Specialization)

Phys 4101
Electronics
Time Allowed: (3) Hours

Answer any Six questions.

1 (a) What do you understand by the terms: (i) class A amplifier, (ii) class B amplifier and (iii) class C amplifier? Draw the circuit diagram of a tuned class C amplifier.

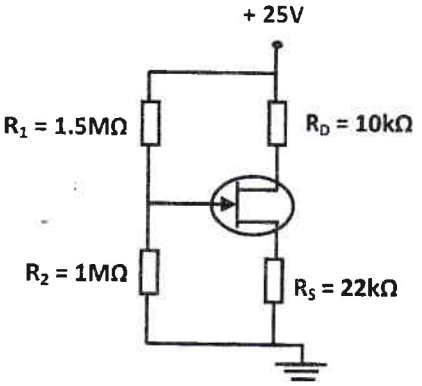
(b) What are the maximum peak value of collector current and output voltage of the class A amplifier expressed below? Also find the large signal voltage gain and power gain of the amplifier. The component values of the amplifier are:
$R_1 = 12\ k\Omega$, $R_2 = 3.3\ k\Omega$, $R_C = 1.2\ k\Omega$, $R_E = 330\ \Omega$, $R_L = 12\ k\Omega$, $V_{CC} = +9V$, $\beta = 150$, $\beta_{dc} = 200$. Assume that $r_e' = 7\ \Omega$.

2 (a) (i) What is the class B push-pull amplifier?
(ii) What is the resonant frequency of a tank circuit with L = 10mH and C = 0.001μF?

(b) A class C amplifier is driven by a 200kHz signal. The transistor is on for 1μs, and the amplifier is operating over 100 percent of its load line. If $I_{C(sat)} = 100mA$ and $V_{CE(sat)} = 0.2V$. V_{CC} equal to 24V and the R_C is 100Ω. What is the average power dissipation and determine the efficiency?

3 (a) Derive the ac voltage gain of common source amplifier with voltage divider bias.

(b) What is the drain voltage in following figure? Draw also the dc load line and Q-point for following figure.



4 (a) Drawing the equivalent circuit, find the voltage gain of a source follower FET amplifier with voltage divider bias.

(b) Draw the circuit diagram of a common source FET amplifier with voltage divider bias using the following components.
$R_1 = 20\ M\Omega$, $R_2 = 10\ M\Omega$, $R_D = 1\ k\Omega$, $R_S = 2\ k\Omega$ and $g_m = 2000\ \mu S$.
What will be the voltage gain of the circuit? Also express the voltage gain in decibel. If 2 mV signal is applied to the amplifier, what will be the output voltage?

5 (a) List the capacitances that affect low-frequency gain of a bipolar amplifier. Also list the capacitances that affect high-frequency gain.

(b) The component values of bipolar transistor amplifier are given below. Find the critical frequency and phase shift due to (i) input coupling capacitor C1 and (ii) output coupling capacitor C2.
$R_S = 1\ k\Omega$, $C_1 = 0.1\ \mu F$, $R_1 = 60\ k\Omega$, $R_2 = 20\ k\Omega$, $V_{CC} = 10\ V$, $R_C = 2\ k\Omega$,
$R_E = 1\ k\Omega$, $C_2 = 0.1\ \mu F$, $C_3 = 10\ \mu F$, $R_L = 10\ k\Omega$, $\beta = 100$, $r_e' = 13.9\ \Omega$.

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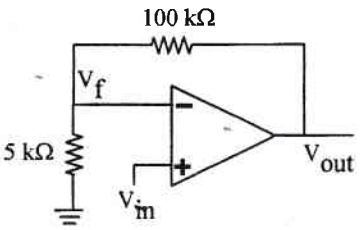
6 (a) What are the effect of coupling capacitors and bypass capacitor at lower frequencies?

(b) For an output RC circuit in a certain amplifier, $R_C = 10k\Omega$, $C_2 = 0.1\mu F$ and $R_L = 10k\Omega$.
(i) Determine the critical frequency.
(ii) If the midrange voltage gain of the amplifier is 50, what is the gain at the critical frequency?

7 (a) Compare a practical op-amp to the ideal op-amp.
Define the differential input impedance of an op-amp.

(b) Determine the voltage gain of the amplifier in dB. If $V_{in} = 0.5V$, what will be the value of V_f?
The open-loop voltage gain is 100000. If the CMRR of the op-amp is 80 dB, what will be the common-mode gain of this op-amp?



8 (a) Derive output impedance of the noninverting amplifier with circuit diagram.

(b) (i) Determine the input and output impedances of the amplifier in Figure. The op-amp sheet gives $Z_{in} = 2M\Omega$, $Z_{out} = 75\Omega$ and $A_{01} = 200000$. (ii) Find the closed-loop voltage gain.