Almansoura university
Faculty of Engineering
Dept. of Electronics & Electrical Commu.

Electronics 1
Final-Term Exam
Time allowed: 3 Hours

Answer the following questions; assuming any missing data.

1) a- Discuss the applications of the Darlington pair.
   b- Write an expression for the input impedance of the common collector amplifier as a function of the impedances connected to the emitter terminal.

2) For the emitter follower (Common collector) in Fig. 1, the signal source is directly coupled to the transistor base. Find the dc emitter current. Assume $\beta = 100$. Neglecting r_o, find R_{in}, the voltage gain v_o/v_{sig}, the current gain i_o/i_i and the output resistance R_{out}.

3) The amplifier shown in Fig. 2 has $R_{sig} = R_L = 1$ kΩ, $R_C = 1$ kΩ, $R_B = 47$ kΩ, $\beta = 100$, $C\mu = 0.8$ pF, and $f_T = 600$ MHz.

   (a) Find the dc collector current of the transistor.
   (b) Find g_m and r_π.
   (c) Neglecting r_o, find the midband voltage gain from base to collector (neglect the effect of R_B).
   (d) Use the gain obtained in (c) and the Miller theorem to find the component of R_{in} that arises as a result of R_B. Hence find R_{in}.
   (e) Find the overall gain at midband.
   (f) Find C_{in}.
   (g) Find f_H.

4) Use the circuit of Fig. 3 to design a common gate amplifier. Find R_{in}, R_{out}, A_{vo}, A_v, G_v, and Gi for $R_L = 15$ kΩ and $R_{sig} = 50$ Ω. What will the overall voltage gain become for $R_{sig} = 50$ Ω? 10 kΩ? 100 kΩ?

5) The circuit shown in Fig. 4 consists of two stages:
   Stage 1: CE amplifier with $V_{cc} = 12$ V, $R_c = 1.0$ kΩ and $r_e = 5$Ω.
   Stage 2: Darlington emitter follower amplifier with voltage divider bias, given $R_1 = 10$ kΩ, $R_2 = 22$ kΩ, $R_E = 22$ Ω, $R_L = 8$ Ω, $V_{cc} = 12$ V and $\beta_1 = \beta_2 = 100$.

   a) Determine the voltage gain of the common-emitter amplifier.
   b) Determine the voltage gain of the Darlington emitter-follower.
   c) Determine the overall voltage gain.
   d) If the circuit is without the Darlington pair, find the gain and compare with that obtained in C.

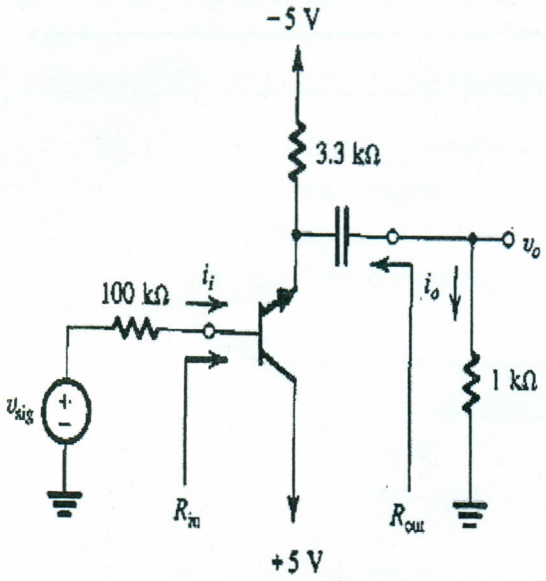

Fig. 1

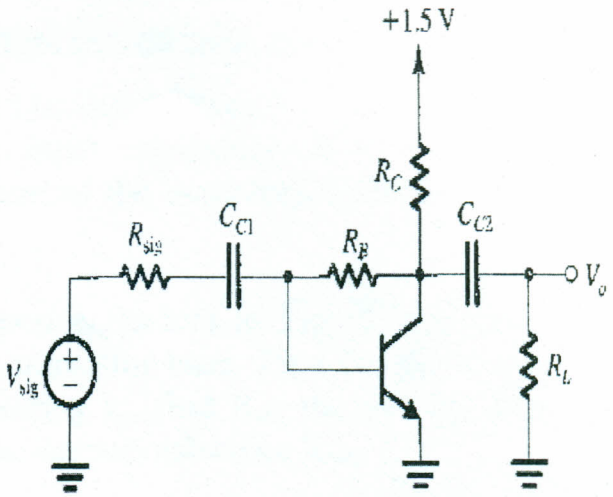

Fig. 2

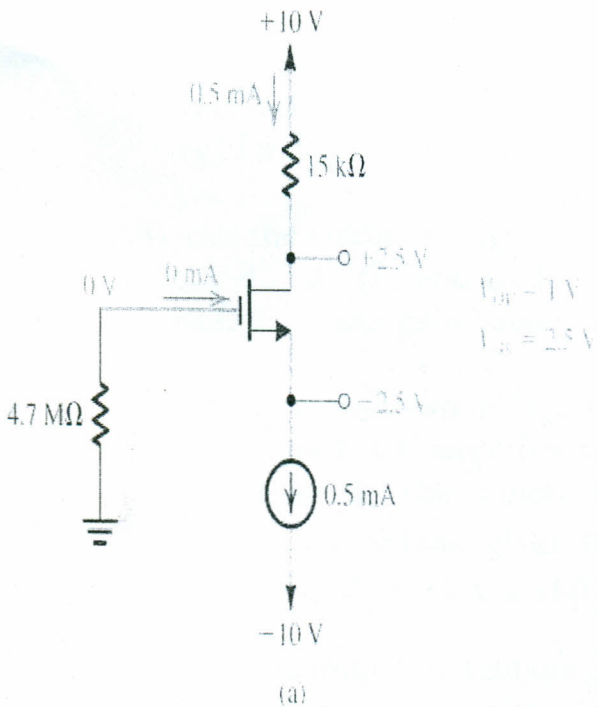

Fig. 3

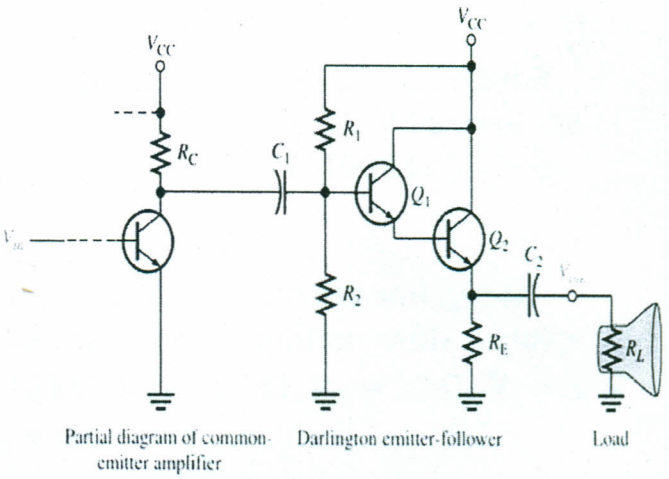

Fig. 4