Indian Institute of Technology, Kharagpur

Mid-Autumn Semester Examination–2011

Program: B.Tech/Dual Degree — Time: 2 hours

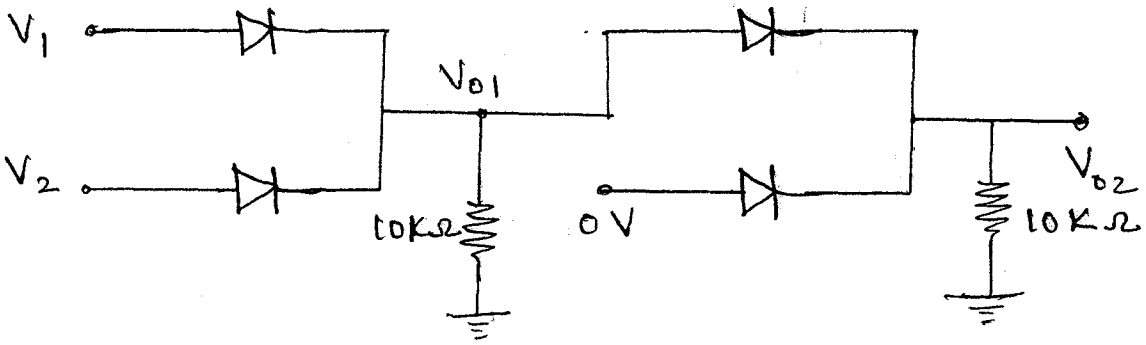
Subject: **EC 21101 Basic Electronics** — Total Marks: 30

Answer all the questions. Total no.of pages: 2.

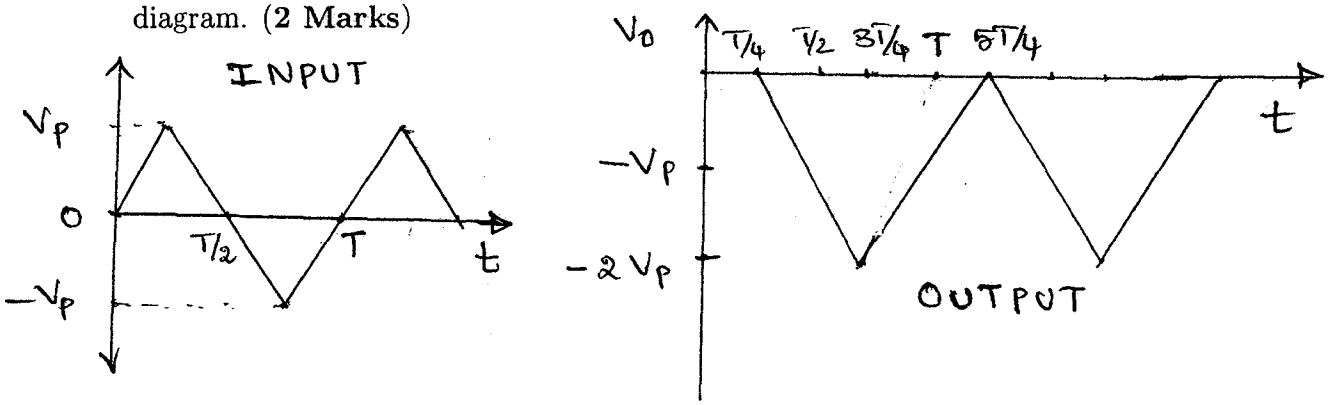
1. (a) Derive ripple factor for a half-wave rectifier.(**2 Marks**)

   (b) Draw the circuit diagram of a passive band-stop filter, derive its voltage transfer function and also plot its frequency response. (**3 Marks**)

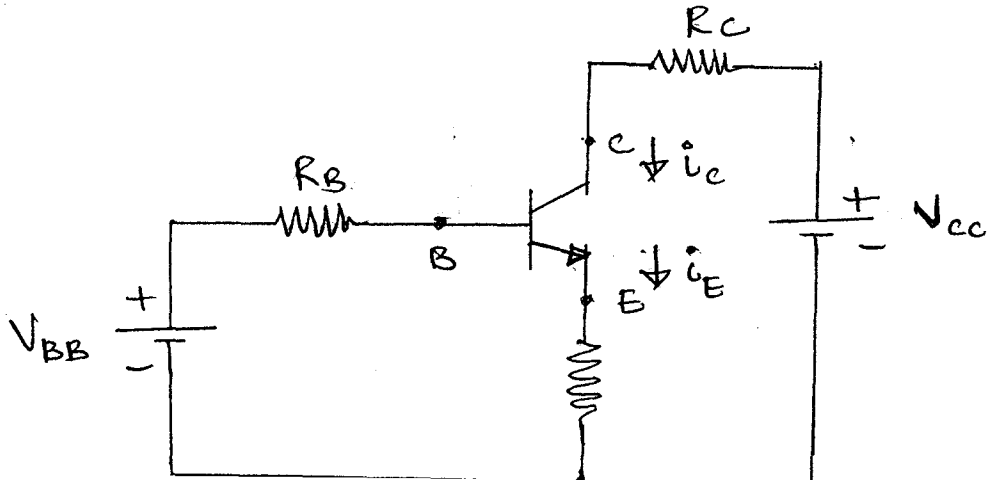
2. (a) For the circuit shown below, find V_{o_1} and V_{o_2} when (i) $V_1 = V_2 = 0V$, (ii)$V_1 = 5V$ and $V_2 = 0V$, (iii)$V_1 = V_2 = 5V$. Assume that $V_\gamma = 0.6V$. (**3 Marks**)



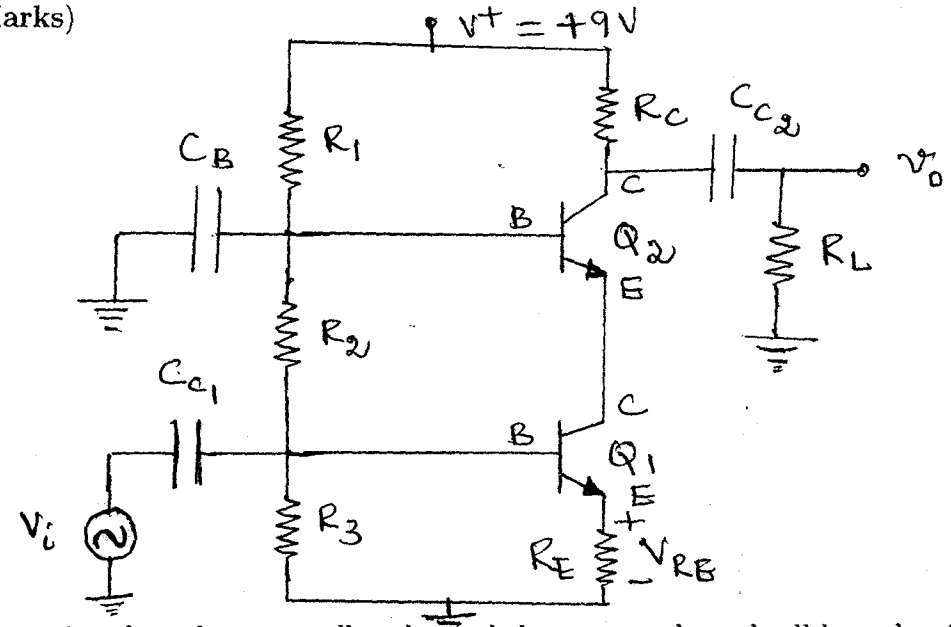
   (b) The input and output waveforms are shown in Fig. for a circuit. Draw that circuit diagram. (**2 Marks**)



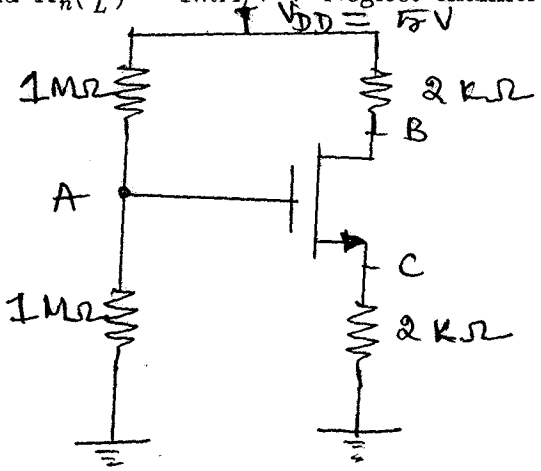
3. The transistor shown below is a silicon device with a base current of 40 μA and $I_{CBO} = 0$. If $V_{BB} = 6V$, $R_E = 1k\Omega$, and $\beta = 80$, find (i)I_{EQ} and (ii) R_B (iii) If $V_{CC} = 15V$ and $R_C = 3k\Omega$, find V_{CEQ}. (**5 Marks**)



4. Design circuit shown in Fig., called a cascade circuit, to meet the following specifications: $V_{CE1} = V_{CE2} = 2.5V$, $V_{RE} = 0.7V$, $I_{C1} \cong I_{C2} = 1mA$, and $I_{R1} \cong I_{R2} \cong I_{R3} = 0.1mA$. (**5 Marks**)



5. Determine the voltages at all nodes and the current through all branches in Fig. below. Assuming $V_T = 1V$ and $K_n'(\frac{W}{L}) = 1mA/V^2$. Neglect channel length modulation. (**5 Marks**)



6. Design the biasing of the NMOS cascade circuit to meet specific requirements. For the circuit shown below, the transistor parameters are: $V_{TN_1} = V_{TN_2} = 1.2V$, $K_{n_1} = K_{n_2} = 0.8mA/V^2$, and $\lambda_1 = \lambda_2 = 0$. Let $R_1 + R_2 + R_3 = 300k\Omega$ and $R_S = 10k\Omega$. Design the circuit such that $I_{DQ} = 0.4mA$ and $V_{DSQ_1} = V_{DSQ_2} = 2.5V$. (**5 Marks**)