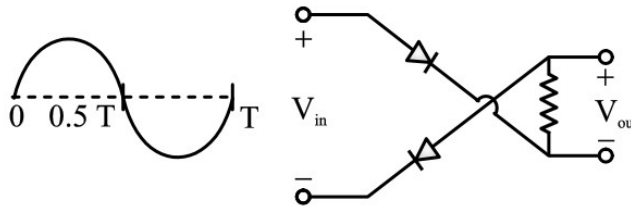


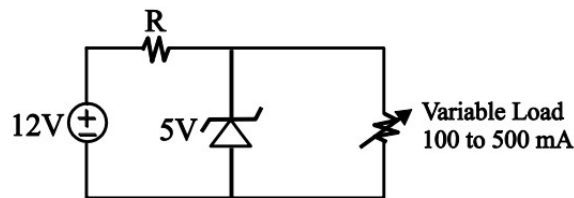
**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

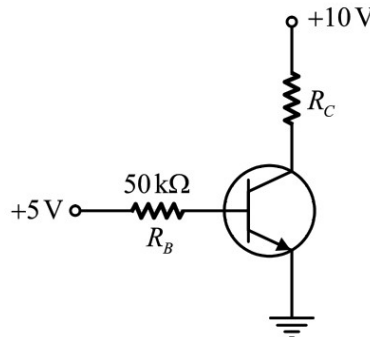
- Q.1(a) In an ideal pn junction with an ideality factor of 1 at  $T = 300\text{ K}$ , Find out the magnitude of the reverse-bias voltage required to reach 75% of its reverse saturation current (rounded off to 2 decimal places). [2]  
 $[K = 1.38 \times 10^{-23} \text{ J.K}^{-1}, h = 6.625 \times 10^{-34} \text{ J.s}, q = 1.602 \times 10^{-19} \text{ C}]$
- Q.1(b) For the circuit with ideal diodes shown in the figure, draw the shape of the output ( $V_{out}$ ) for the given sine wave input ( $v_{in}$ ). [3]



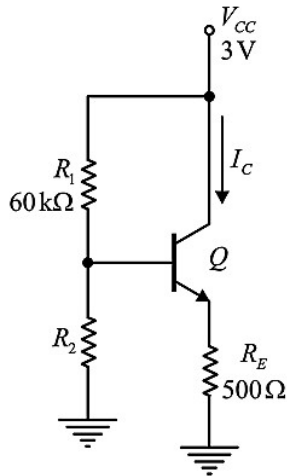
- Q.2(a) Explain the working principle of a Zener diode as a voltage regulator. [2]
- Q.2(b) Find out the value of  $R$  is in the voltage regulator shown in figure below, the load current can vary from 100 mA to 500 mA. Assuming that a Zener diode is ideal (i.e. the Zener knee current is negligibly small and Zener resistance is zero in the breakdown region). [3]



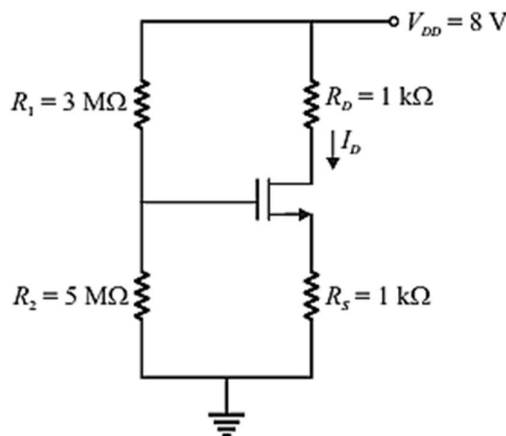
- Q.3(a) In the circuit shown, the silicon BJT has  $\beta=50$ . Assume  $V_{BE} = 0.7\text{ V}$  and  $V_{CE,sat} = 0.2\text{V}$ . [2]  
Determine the region of operation of the BJT.



- Q.3(b) In the circuit shown below, the silicon npn transistor Q has a very high value of  $\beta$ . Find [3]  
the required value of  $R_2$  to produce  $I_C = 1\text{mA}$ .



- Q.4(a) A bipolar transistor is operating in the active region with a collector current of 1 mA. [2]  
Assuming that the  $\beta$  of the transistor is 100 and the thermal voltage ( $V_T$ ) is 25mV, calculate the Transconductance ( $g_m$ ) and the input resistance ( $r_{\pi}$ ) of the transistor in the common emitter configuration.
- Q.4(b) For the circuit shown, assume that the NMOS transistor is in saturation. Its threshold voltage  $V_{th} = 1\text{V}$  and its transconductance parameter  $\mu_n C_{ox} W/L = 1\text{ mA/V}^2$ . Neglect channel length modulation and body bias effects. Under these conditions, calculate the drain current  $I_D$ . [3]



- Q.5(a) Write the working principle of logarithmic amplifier using op amp. [2]  
Q.5(b) Determine the current load  $i_L$  in the op-amp circuit given in figure below, [3]

