

Fourth Semester Examination, April - 2005

BASIC ELECTRONICS

Full Marks : 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five questions from the rest.

The figures in the right-hand margin indicate marks for the questions.

1. Answer the following : 2×10

- (a) If the depletion width of a p-n junction with doping levels of $N_A = 10^{16}/\text{cm}^3$ and $N_D = 10^{18}/\text{cm}^3$ is x_d , what distance does the depletion region penetrate into the n-side of the junction ?

0.5 pd

P.T.O.

- (b) What is the value of the current I in the following circuit (Fig. 1) assuming $V_Z = 5.6V$ and $V_D = 0.7V$.

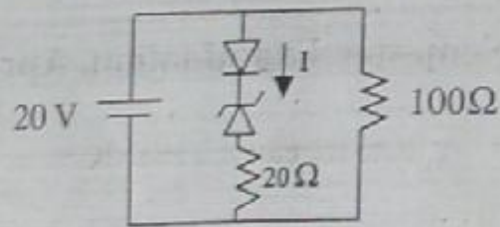


Figure 1

- (c) If $292_{10} = 1204_b$, determine the value of b . 6
 (d) Convert the decimal number 359 to its octal equivalent. 547
 (e) Find the node voltage V_2 and I_C for the following circuit (Fig. 2). Take β to be very high.

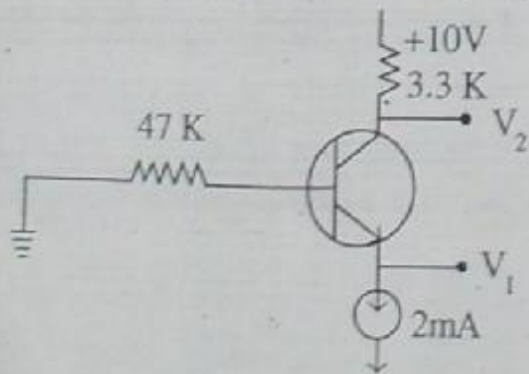


Figure 2

- (f) An enhancement type NMOS transistor with $V_T = 2V$ has its source terminal grounded and its gate is given 3V. In what region of operation the device operate for $V_D = 0.5V$ and $V_D = 1V$?
 (g) Draw and scale the output waveform of the following circuit (Fig. 3) if a sinewave of 10V p-p is applied to the following circuit.

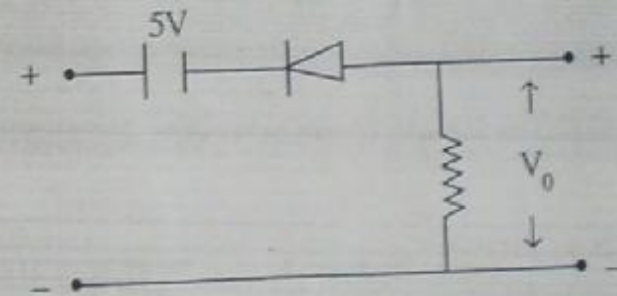


Figure 3

- (h) A 10V forward voltage is applied to a silicon diode in series with a load of $10K\Omega$. Draw the dc load line and find its slope.
 (i) If each inverter in the following figure (Fig. 4) has a propagation delay of 10ns, determine the waveshape of the output waveform V_O . What is its frequency ?

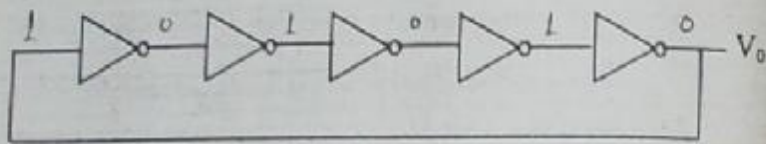


Figure 4

(j) Apply DeMorgan's law to the following expression :

$$\overline{AB(C+\bar{D})}$$

2. A germanium diode displays a forward voltage of 0.25V at 10mA current at room temperature(300°K). Estimate the reverse saturation current(I_s) assuming unity ideality factor. Calculate the bias voltage needed for diode currents of 1mA and 100mA. Also estimate the values of I_s and diode forward current at 0.25V at 30°C above room temperature. 10
3. A bridge rectifier uses a diode with forward resistance of 5Ω each. Transformer secondary resistance is 5Ω and the secondary voltage is 30V(rms). Determine the dc output voltage for $I_{dc} = 200\text{mA}$ and the rms value of the output ripple voltage. 10

4. For both the circuits shown below (Fig. 5a, 5b), calculate I_B, I_C and V_{CE} . Take $V_{cc}=12\text{V}$, $V_{BE}=5\text{V}$, $R_B=86\text{K}$, $R_C=1\text{K}$, $R_E=1\text{K}$, $R_F=80\text{K}$, $V_{BE}=0.7\text{V}$ and $\beta=120$.

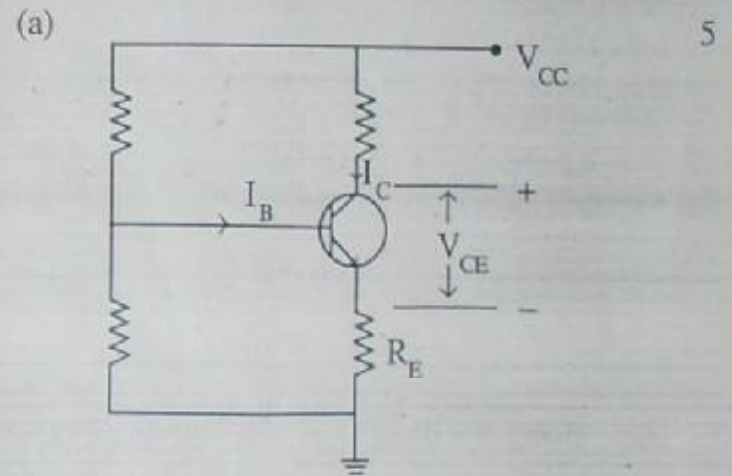


Figure 5a

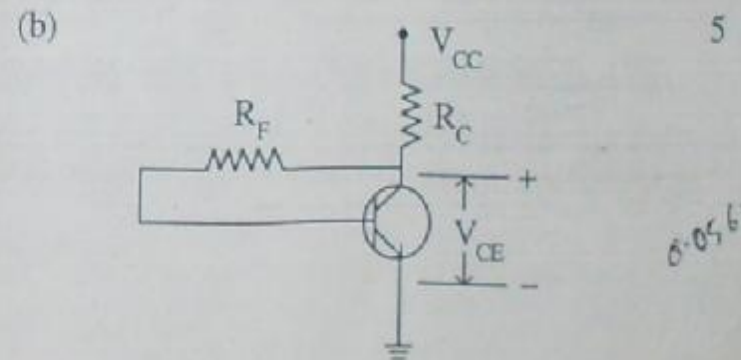


Figure 5b

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6. Derive the transfer characteristics in terms of R , I_s (I_s being the reverse saturation current of the transistor) and V_T . Assume $n = 1$. (For the circuit shown in Fig. 6). 10

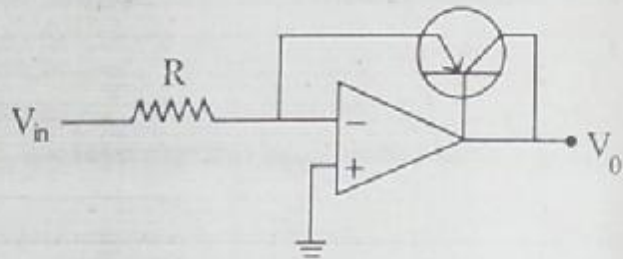


Figure 6

7. (a) Bring out the essential differences between an analog communication system and a digital communication system. 5
- (b) What type of time base is used in a CRO? Explain with a neat sketch. 5