



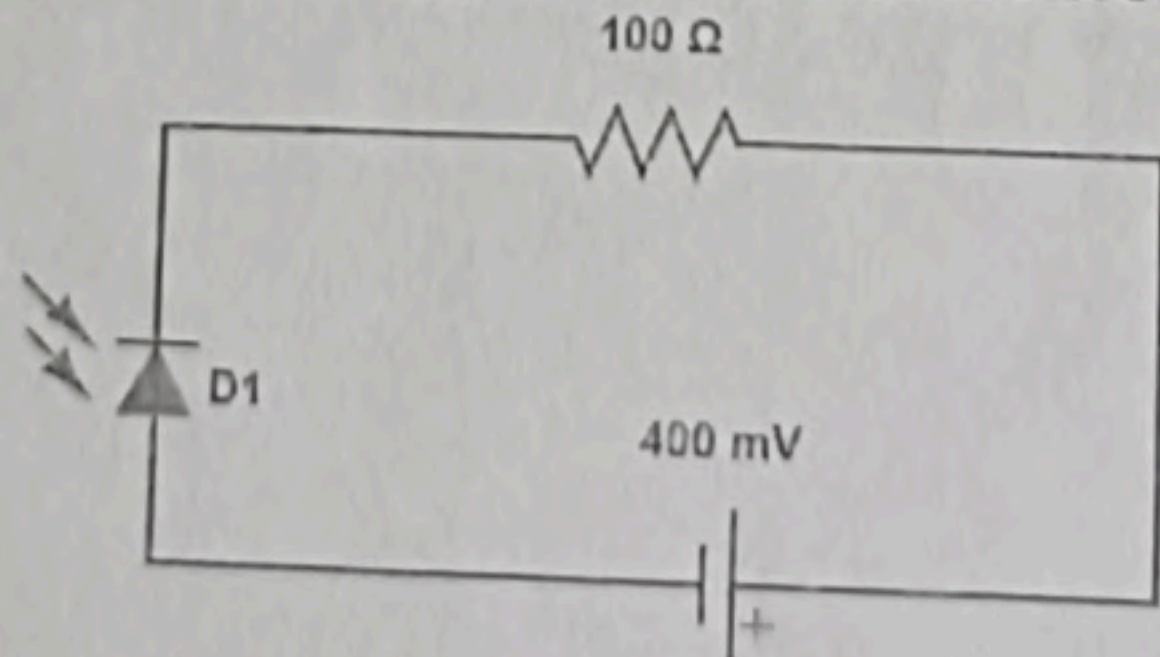
Continuous Assessment Test (CAT) – II OCTOBER 2025

Programme	:	B.Tech (VLSI Design and Technology)	Semester	:	Fall Semester 2025-26
Course Code & Course Title	:	BEVD201L & Physics of Semiconductor Devices	Class Number	:	CH2025260100502
Faculty	:	Dr. Biswajit Jena	Slot	:	E1+TE1
Duration	:	90 minutes	Max. Mark	:	50

General Instructions: Write only your registration number on the question paper in the box provided and do not write other information

- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	CO	BT Level
1		For a solar cell, photocurrent $I_L=30$ mA, diode saturation current $I_S=5.0 \times 10^{-12}$ A, ideality $\eta=1$, $T=300$ K. (a) Compute the open-circuit voltage V_{oc} . (b) Estimate the short-circuit current I_{sc} .	[5]	3	L3
2	a	A semiconductor device is exposed to light at different intensities: 0 lux, 100 lux, 200 lux, and 500 lux. How does the device's behavior change with varying light intensities? Illustrate and discuss its current-voltage characteristics for each light intensity level. [3+4 marks]	[7]	3	L2
	b	A photo diode is connected as shown in figure 1. When the device is illuminated with light intensity of 100 lumens/cm², a current of 1.8mA flows in the circuit. Calculate the resistance offered by the photodiode. If the illumination is doubled, what happens to the resistance value?[8 marks]  Figure. 1	[8]	3	L3
3		In a CE transistor circuit $V_{CC}=30$ V, $V_{BB}=6$ V, $R_C=1$ k Ω , $R_B=1$ M Ω , $\beta_{dc}=100$ and $I_{CBO}=0.1$ μ A at 25° C. Compute I_B and I_C at (i) 25° C (ii) 55° C. [5+5 Marks]	[10]	4	L4

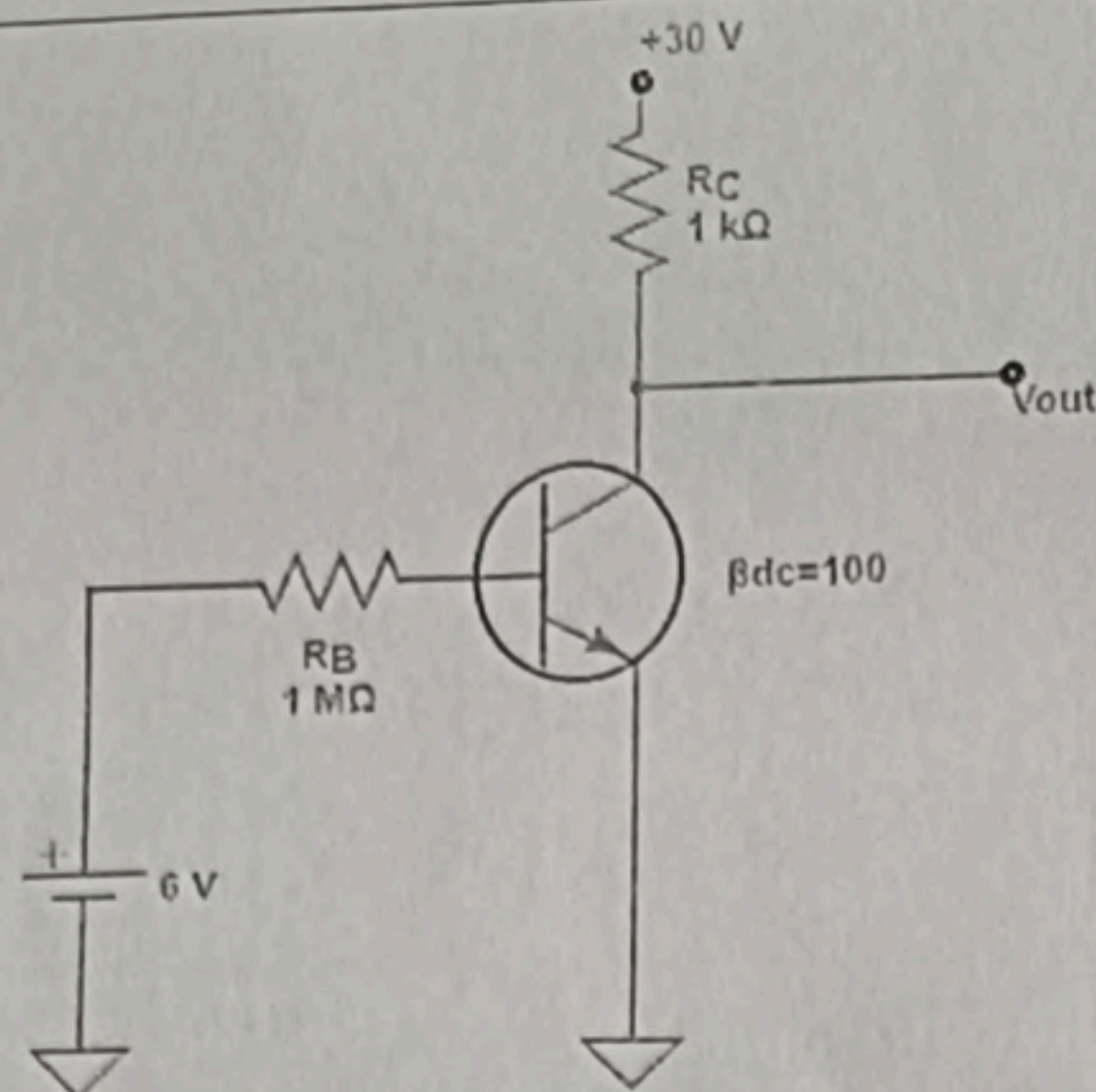


Figure. 2

When the output characteristics of a CE transistor are observed, it is found that the collector current slightly increases with V_{CE} , even when the base current is kept constant. Suppose at $V_{CE}=5\text{ V}$, the current is 5 mA , and the extrapolated characteristics meet the voltage axis at -100 V . If the applied V_{CE} is doubled, how would the collector current and the effective output resistance change? If the physical emitter area is increased, what qualitative effect will this have on the slope of the output characteristics, and why? [5+5 Marks]

A MOS capacitor is built on a p-type silicon substrate with an oxide thickness of 25 nm , oxide permittivity $\epsilon_{ox}=3.9\epsilon_0$, and capacitor area of $50\text{ }\mu\text{m}\times 50\text{ }\mu\text{m}$. The substrate doping concentration is $N_A=1\times 10^{16}\text{ cm}^{-3}$, intrinsic carrier concentration is $n_i=1.5\times 10^{10}\text{ cm}^{-3}$, and the thermal voltage at 300 K is 26 mV . The permittivity of silicon is given as $\epsilon_{si}=11.7\epsilon_0$ with $\epsilon_0=8.85\times 10^{-14}\text{ F/cm}$. Calculate the oxide capacitance per unit area and the total oxide capacitance, find the Fermi potential ϕ_F and the surface potential $2\phi_F$, and sketch the $C-V$ characteristics indicating accumulation, depletion, and inversion regions. [4+3+3 Marks]

Charge of electron, $e = 1.602 \times 10^{-19}\text{ C}$

Mass of electron, $m_e = 9.109 \times 10^{-31}\text{ kg}$

Boltzmann constant, $k = 1.381 \times 10^{-23}\text{ J/K}$

*****All the best *****