



PHYSICS

BOOKS - NN GHOSH PHYSICS (HINGLISH)

DIODE, TRIODE & TRANSISTER

Examples

1. In a diode valve the space-charge limited current at 100 V is 100 mA. What is the space-

charge current at 150 V ?



Watch Video Solution

2. In a diode valve the saturation current at 750 K is 100 mA. What is the saturation current at 800 K ? Work function of metal is 1.6 eV.



Watch Video Solution

3. The equation of the working part of the characteristic of a diode can be written as $I = 0.75 \times 10^{-3}V - 2 \times 10^{-3}A$. Calculate the load current, voltage and power dissipated at the plate when a load of resistance 1000Ω and $100V$ from a source are applied.



Watch Video Solution

4. In the normal operating region, the characteristics of a certain triode may be

written as

$$I_p = 10^{-5}(160V_S + 2.22V_p)$$

Determine analytically the values of μ , r_p and g_m .



[Watch Video Solution](#)

5. The current conducted by the p-n junction of a semiconductor diode is $100\mu A$ at a voltage of $-1V$. Calculate the current at a voltage of $+0.2V$.



[Watch Video Solution](#)

6. Calculate the electrical resistivity and conductivity of a silicon crystal if every 10 million silicon atoms is replaced by an atom of indium. Given that intrinsic carrier density of silicon $= 1.5 \times 10^{16} m^{-3}$, atomic weight of silicon $= 28.09$, density of silicon $= 2330 kg m^{-3}$, mobility of electrons $(\mu_n) = 0.135$, that of holes $(\mu_p) = 0.018$, By how many times is the conductivity increased ?



Watch Video Solution

Exercises

1. A diode has Child's constant $K = 0.2$ (current in mA and voltage in volts). Calculate the voltage across the tube, across a load of resistance 10000Ω and source the voltage when the tube produces a current of 12.8 mA through the load.



[Watch Video Solution](#)

2. In a certain triode, the output is 5 mA with an anode potential of 200 V and grid potential $-3V$. When the potential is increased to 260 V, the current rises $10.7mA$. A change in grid voltage to $-4V$ restores the current to the original value. Find the constant of the valve



[Watch Video Solution](#)

3. A triode valve of anode slope resistance $20k\Omega$ is used with an anode load resistance of $50k\Omega$. If an alternating signal of 0.5 V (rms

value) is applied to the grid, find the output if the amplification factor of the valve is 15.



[Watch Video Solution](#)

4. The voltage of a triode amplifier with a resistive load of $5k\Omega$ is 10 while with a resistive load of $12k\Omega$. It is 15. Calculate the amplification factor and plate resistance of the triode.



[Watch Video Solution](#)

5. The plate resistance of a triode is $7.7k\Omega$, and the transconductance is 2.6 millimho. If only the plate voltage is increased by 50 V, what is the increase in the plate current ? What change in grid voltage will now bring the plate current to its former value ?



[Watch Video Solution](#)

6. Determine the conductivity of pure germanium at $27^\circ C$. The concentration of the carriers at this temperature is $2.2 \times 10^{19} m^{-3}$.

The mobility of electrons = 0.36 and that of holes = 0.17



[Watch Video Solution](#)

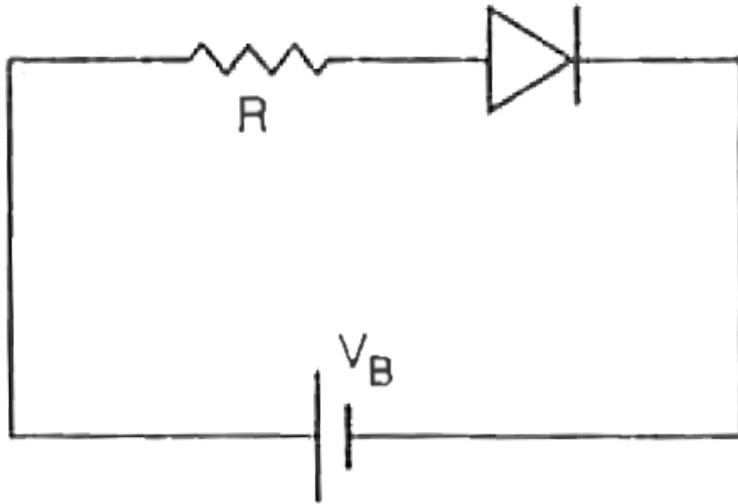
7. In a p-n junction diode the reverse saturation current is $10\mu A$. What will be the forward current for a voltage of 0.2 V ?



[Watch Video Solution](#)

8. Assume that the silicon diode in the given circuit requires a minimum current of 1 mA to be above the (knee-point voltage = 0.7 V) of its $I - V$ characteristics. Assuming that the voltage across the diode is independent of current above the knee-point, find the maximum value of R so that the voltage is above the knee-point if $V_B = 5A$. Also find the value of R to establish a current of 5 mA in the

circuit for the since voltage.



[Watch Video Solution](#)

9. The base current of a transistor is $105\mu A$ and the collector current is 2.05 mA . Determine the value of β , I_C and α . If a

change of $27\mu A$ in the base current produces a change of 0.65 mA in the collector, find β_{ac} .



[Watch Video Solution](#)

10. In a silicon transistor, a change of 7.89 mA in the emitter current produces a change of 7.89 mA in the collector current. What change in the base current will bring the same change in the collector current ?



[View Text Solution](#)

11. In a silicon transistor the base current is changed by $20\mu A$. This results in a change of 0.02 V in the base to emitter voltage and a change of 2 mA in the collector current

(a) Find the input resistance r_b , β_{ac} and transconductance g_m of the transistor

(b) The transistor is used as an amplifier with a load resistance of $5k\Omega$. What is the voltage gain of the amplifier ?



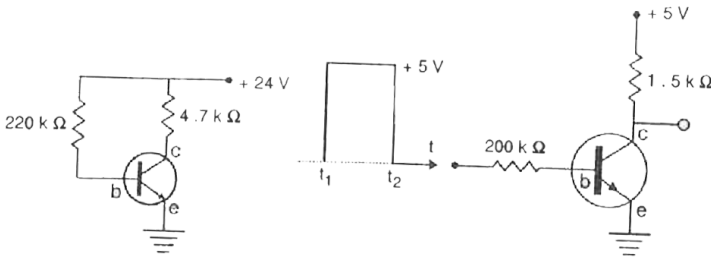
[Watch Video Solution](#)

12. In triode valve, for a grid voltage $V_g = -1.2V$, the plate current I_p (in mA) and the plate voltage are given by the relation $I_p = -50 + 0.1V_p$, when the grid voltage is changed to $-3.2V$ and the plate voltage is kept at 150 V, plate current of 5 mA is observed. Calculate the valve constant and the voltage amplification for $20k\Omega$ load in the plate circuit.



[View Text Solution](#)

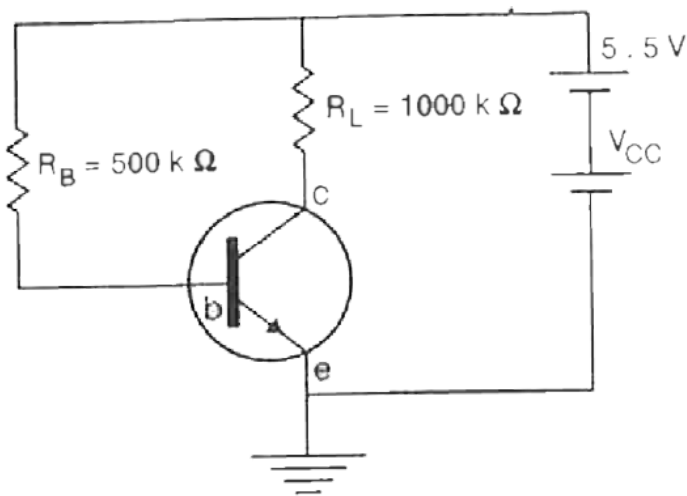
13. In the accompanying circuit (Fig. 5.9) the value of β is 100. Find I_B , V_{CE} , V_{CE} and V_{BC} , when $I_C = 1.5\text{mA}$. Is the transistor in active, cut-off or saturation state ?



Watch Video Solution

14. In the accompanying circuit Fig. 5.10, if it is assumed that when that input voltage at the base resistance is 5 V, V_{BE} is zero and V_{CE} is

also zero, what are I_B , I_C and β ? When the input is zero, I_B is zero. What will be the output waveform if the input waveform is as shown in the figure ? What is the practical use of this current ?



[View Text Solution](#)

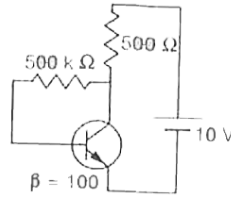
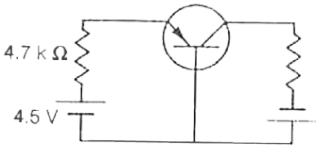
15. In the given circuit Fig. 5.11, the base current is $10\mu A$ and the collector current is 52 mA. Can this transistor be used as an amplifier ?



[View Text Solution](#)

16. In the given circuit (Fig. 5.12) calculate the value of the collector current if its $I_{CD} = 10\mu A$ and $\alpha = 0.97$. Assume a voltage drop between base and emitter of 0.15 V

[Hint : $I_C = \alpha I_C + I_{CO}$]



[Watch Video Solution](#)

17. Calculate the emitter current and collector voltage of the circuit given in Fig. 5.13



[View Text Solution](#)

18. A transistor connected in common emitter configuration has $V_{CC} = 8V$, $V_L = 0.5V$ and $R_L = 800\Omega$. If its $\alpha = 0.96$ determine (i) collector emitter voltage, (ii) its base current.



Watch Video Solution

19. In a transistor collector load is $4k\Omega$ whereas the zero signal current is 1 mA. (a) What is the operating point if $V_{CC} = 10V$? (b) What will be the operating point if

$$R_L = 5k\Omega ?$$

[Hint : Operating point is zero signal
collectorm current and V_{CO}]



[Watch Video Solution](#)