p-type side to the n-type side.

26. Which of the following statements is not true ? **(1997, 1M)**

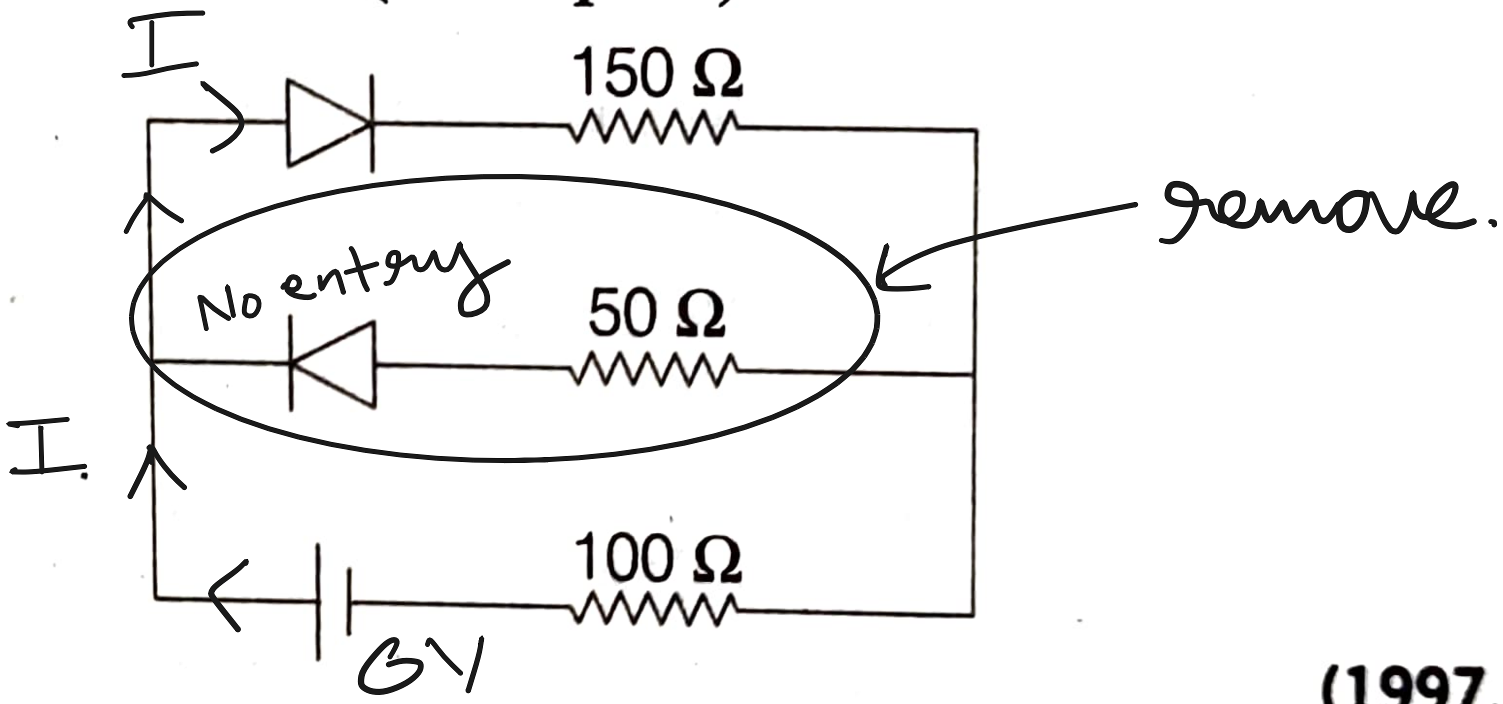
(a) The resistance of intrinsic semiconductors decreases with increase of temperature.

(b) Doping pure Si with trivalent impurities give p-type semiconductors.

(c) The majority carriers in n-type semiconductors are holes.

(d) A p-n junction can act as a semiconductor diode.

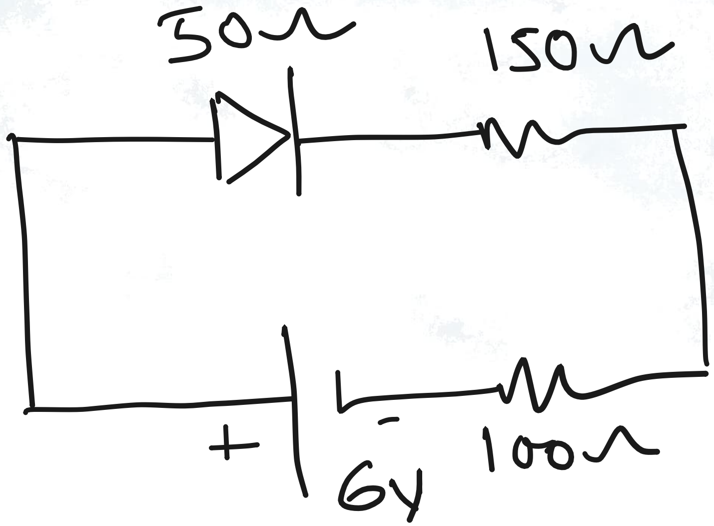
27. The circuit shown in the figure contains two diodes each with a forward resistance of 50 Ω and with infinite backward resistance. If the battery voltage is 6 V, the current through the 100 Ω resistance (in ampere) is



(1997, 1M)

(a) zero (b) 0.02 (c) 0.03 (d) 0.036

<u>Note</u> remove reverse bias diode from ckt.



$$I = \frac{6}{300\Omega} = 0.02$$

28. The dominant mechanisms for motion of charge carriers in forward and reverse biased silicon *p-n* junctions are (1997C, 1M)

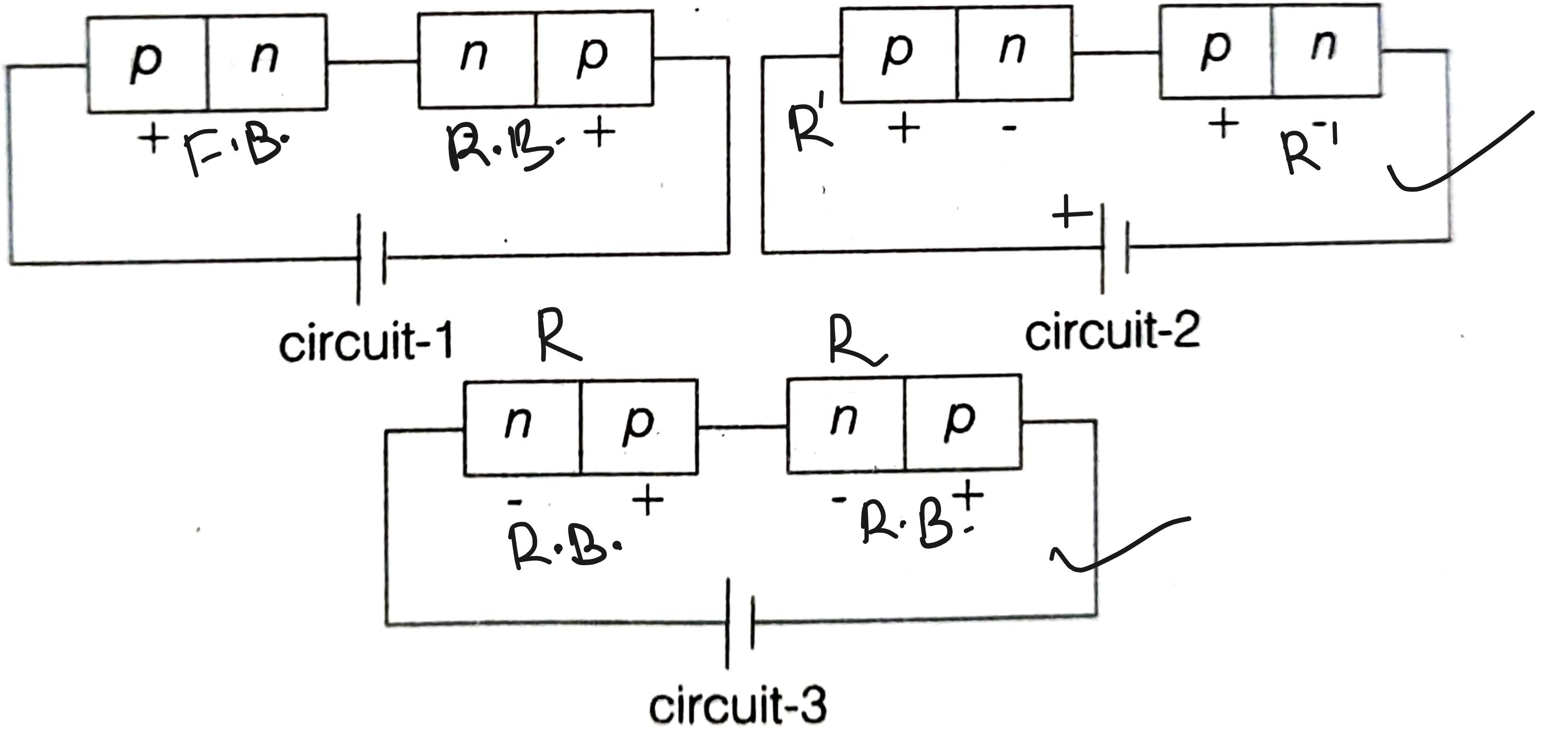
(a) drift in forward bias, diffusion in reverse bias.

(b) diffusion in forward bias, drift in reverse bias.

(c) diffusion in both forward and reverse bias.

(d) drift in both forward and reverse bias.

30. Two identical *p-n* junctions may be connected in series with a battery in three ways. The potential drops across the two *p-n* junctions are equal in **(1989, 2M)**



5. Given below in the left column are different modes of communication using the kinds of waves given in the right column.

A.	Optical fibre communication	P.	Ultrasound
B.	Radar	Q.	Infrared light
C.	Sonar	R.	Microwaves
D.	Mobile phones	S.	Radio waves

From the options given below, find the most appropriate match between entries in the left and the right column.

(Main 2019, 10 April I)

(a) A-Q, B-S, C-R, D-P (b) A-S, B-Q, C-R, D-P
(c) A-Q, B-S, C-P, D-R (d) A-R, B-P, C-S, D-Q

2. In an amplitude modulator circuit, the carrier wave is given by $C(t) = 4\sin(20000\,\pi t)$ while modulating signal is given by, $m(t) = 2\sin(2000\,\pi t)$. The values of modulation index and lower side band frequency are

(Main 2019, 12 April II)

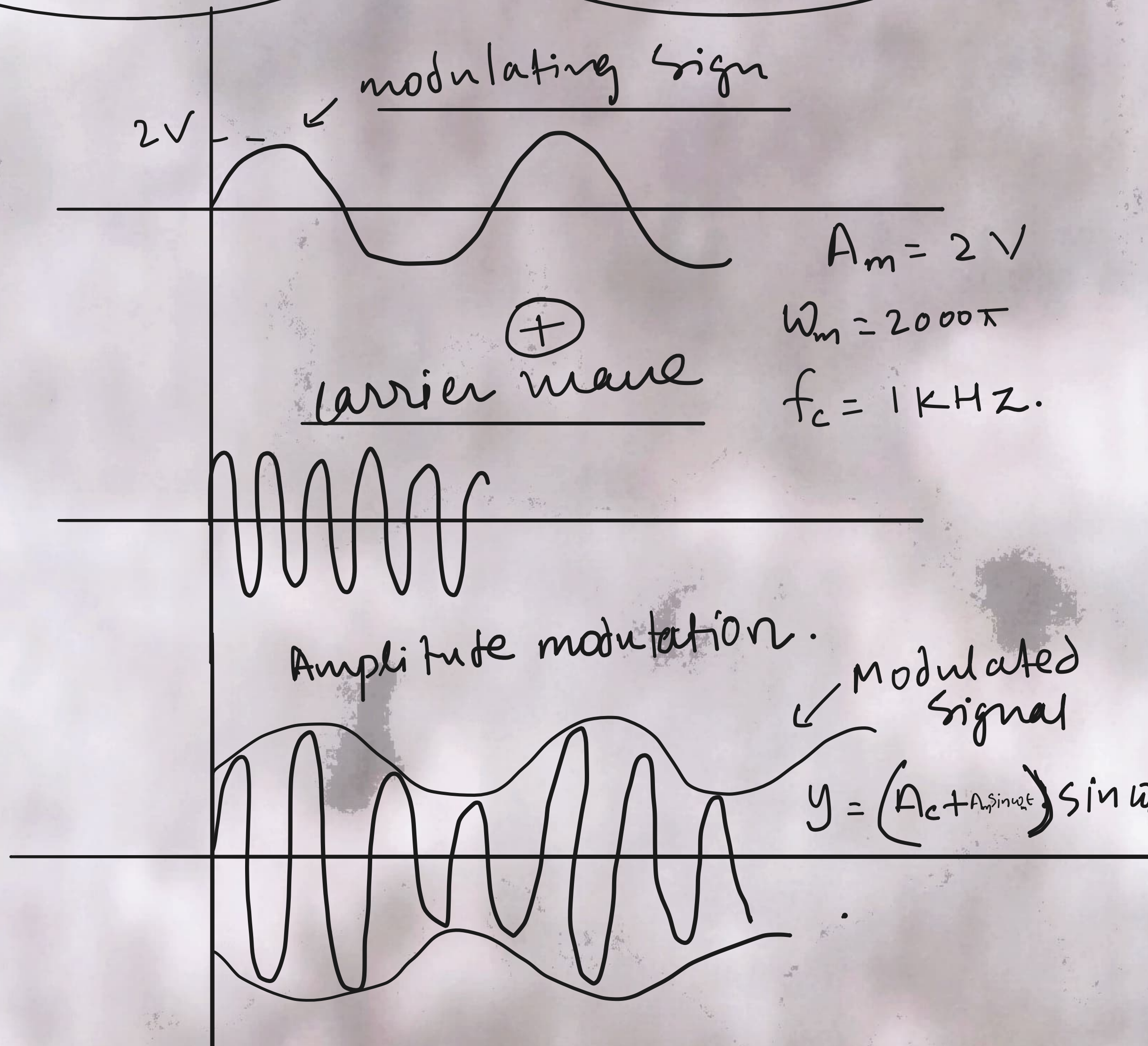
(a) 0.5 and 10 kHz
(b) 0.4 and 10 kHz
(c) 0.3 and 9 kHz
(d) 0.5 and 9 kHz

$A_c = 4$ volts, $\omega_c = 20000\pi$

$2\pi f_c = 20000\pi$

$m = \frac{A_m}{A_c} = \frac{2}{4} = 0.5$

$f_c = 10KHz$



$A_m = 2V$

$W_m = 2000\pi$

$f_c = 1KHz.$

$y = (A_c + A_m \sin\omega_m t)\sin\omega_c t$

$f_{L.S.B.} = f_c - f_m = 10KHz - 1KHz$

$= 9KHz$

$f_{U.S.D.} = f_c + f_m = 10KHz + 1KHz$

$= 11KHz$

f_m

↓

7. A message signal of frequency 100 MHz and peak voltage 100 V is used to execute amplitude modulation on a carrier wave of frequency 300 GHz and peak voltage 400 V. The modulation index and difference between the two side band frequencies are **(Main 2019, 10 April I)**

(a) $0.25 ; 1 \times 10^8$ Hz
(b) $4 ; 1 \times 10^8$ Hz
(c) $0.25 ; 2 \times 10^8$ Hz
(d) $4 ; 2 \times 10^8$ Hz

range of Freq $f_c + f_m$ to $f_c - f_m$

$$f_c + f_m - (f_c - f_m)$$

$$f_{U.S.B.} - f_{L.S.B.} = 2f_m$$

$$m = \frac{100}{400} = \frac{V_m}{V_c} = 0.25$$

8. The physical sizes of the transmitter and receiver antenna in a communication system are **(Main 2019, 9 April II)**

(a) proportional to carrier frequency

(b) inversely proportional to modulation frequency

(c) independent of both carrier and modulation frequency

(d) inversely proportional to carrier frequency

↓ Size of anteena $\propto \lambda \propto \frac{1}{\text{freq} \uparrow}$

NEET

Note minimum size of Anteena req to catch signal $= \frac{\lambda}{4}$

10. A signal $A\cos\omega t$ is transmitted using $v_0 \sin\omega_0 t$ as carrier wave. The correct amplitude modulated (AM) signal is

(Main 2019, 9 April I)

(a) $(v_0 \sin\omega_0 t + A\cos\omega t$

(b) $(v_0 + A)\cos\omega t \sin\omega_0 t$

(c) $v_0 \sin[\omega_0(1 + 0.01A\sin\omega t)t]$

(d) $v_0 \sin\omega_0 t + \frac{A}{2}\sin(\omega_0 - \omega)t + \frac{A}{2}\sin(\omega_0 + \omega)t$

V.IMP.

Note In A.M. Modulated wave is given

(imp) by = $y = (V_0 + A\cos\omega t)\sin\omega_0 t$

↑ Amplitude of carrier wave

↑ modulating signal

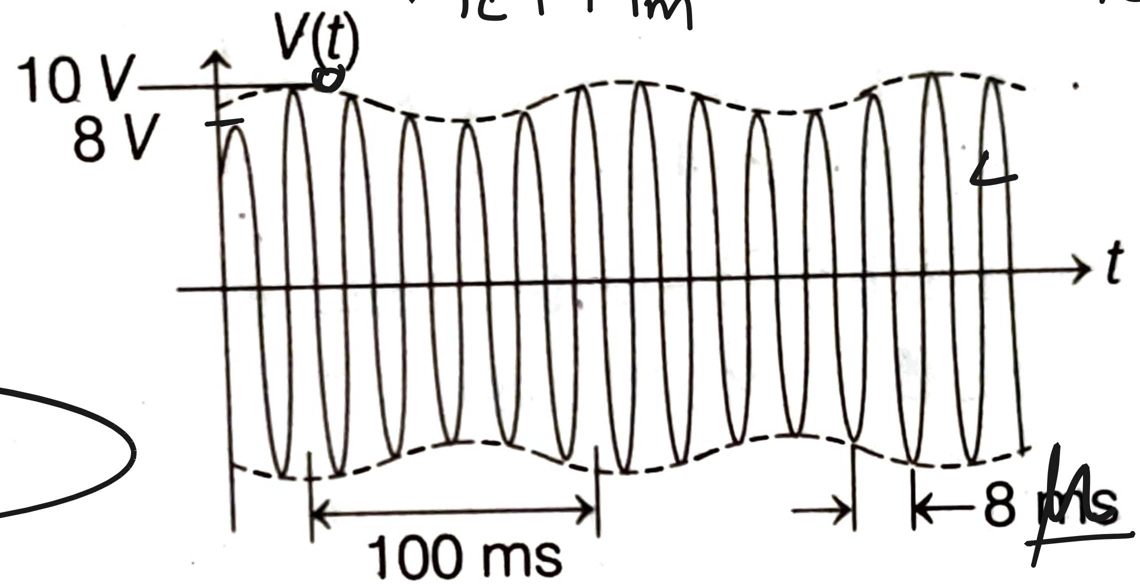
$y = \underline{V_0 \sin\omega_0 t} + \underline{A\cos\omega t \sin\omega_0 t}$

$2\sin C\cos D = \sin(C+D) + \sin(C-D)$

$y = V_0 \sin\omega_0 t + \frac{A}{2}\{\sin(\omega_0 - \omega)t + \sin(\omega_0 t + \omega t)\}$

20. An amplitude modulated signal is plotted below

(Main 2019, 11 Jan II)



Which one of the following best describes the above signal?

(a) $[1 + 9\sin(2\pi \times 10^4 t)]\sin(2.5\pi \times 10^5 t)$ V

(b) $[9 + \sin(2\pi \times 10^4 t)]\sin(2.5\pi \times 10^5 t)$ V

(c) $[9 + \sin(4\pi \times 10^4 t)]\sin(5\pi \times 10^5 t)$ V

(d) $[9 + \sin(2.5\pi \times 10^5 t)]\sin(2\pi \times 10^4 t)$ V

$$y = \{A_c + A_m \sin(\omega_m t)\} \sin(\omega_c t)$$

$\omega_m =$

21. An amplitude modulates signal is given by

$$v(t) = 10[1 + 0.3\cos(2.2 \times 10^4 t)]\ \sin(5.5 \times 10^5 t).$$

Here, t is in seconds. The sideband frequencies (in kHz) are $\left(\text{Take, } \pi = \frac{22}{7}\right)$

(Main 2019, 11 Jan I)

(a) 892.5 and 857.5
(b) 89.25 and 85.75
(c) 178.5 and 171.5
(d) 1785 and 1715

16. To double the covering range of a TV transmission tower, its height should be multiplied by **(Main 2019, 12 Jan II)**

(a) $\sqrt{2}$ (b) 4 (c) 2 (d) $\frac{1}{\sqrt{2}}$

23.

17. In a Frank-Hertz experiment, an electron of energy 5.6 eV passes through mercury vapour and emerges with an energy 0.7 eV. The minimum wavelength of photons emitted by mercury atoms is close to **(Main 2019, 12 Jan II)**

(a) 250 nm
(b) 2020 nm
(c) 1700 nm
(d) 220 nm