PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

SOLIDS AND SEMICONDUCTOR DEVICES

Illustration Type

1. In a pure semiconductor the number of conduction electrons is 6×10^{19} per cubic metre.How many holes are there in a sample of size $1cm \times 1cm \times 1mm$?

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2. Find the maximum wavelength of electromagnetic radiation which can create a hole-electron pair in germanium.The band gad in germanium os 0.65eV.

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3. A p-type semoconductor has acceptor levels $57meV$ above the valence band. Find the maximum wavelength of light which can create a hole.

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4. A semiconductor has equal electron and hole concentration of $2 \times 10^{8} m^{-3}$. On doping with a certain impurity, the hole concertraction increases to $4 \times 10^{10} m^{-3}$. (i) What type of semiconductor is obtained on doping? (ii) Calculate the new electron hole concentration of the semiconductor. (iii) How does the energy gap vary with doping?

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5. A semiconductor has an electron concentration of $0.45 \times 10^{12} m^{-3}$ and a hole concentration of $5.0 \times 10^{20} m^{-3}$. Calculate its conductivity. Given electron

mobility $= 0.135 m^2 V^{-1} s^{-1}$, hole mobility $= 0.048 m^2 V^{-1} s^{-1}$,

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6. A semiconductor is known to have an electron concentration of $5 \times 10^{12} cm^{-3}$ and a hole concentration $8 \times 10^{13} cm^{-3}$ Is the semi-conductor n-type or p-type? What is the resistivity of the sample, if the electron mobility is $23,000 cm^2 V^{-1} s^{-1}$? Take charge on electron, $e = 1.6 \times 10^{-19} C$.

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7. Determine the number density of donor atoms which have to be added to an intrinsic germanium semiconductor to produce an n-type semiconductor of conductivity $5\Omega^{-1}cm^{-1}$, given that the mobility of electron in n-type germanium is $3900cm^2V^{-1}s^{-1}$. Neglect the contribution of holes to conductivity.

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8. A battery of emf $2V$ is connected across a block of length $0.1m$ and area of cros-section $1 \times 10^{-4}m^2$. If the block is of intrinsic silocon at $300K$, find the electron and hole currents. What will be the magnitude of the total current? What will be the magnitude of the total current

if germanium is used instead of silicon?

Given that for Si at $300K$: $\mu_e = 0.135m^2V^{-1}s^{-1}$, $\mu_h = 0.048m^2V^{-1}s^{-1}$ and intristic carrier concentration $n_i = 1.5 \times 10^{16}m^{-3}$. For Ge at $300K$: $\mu_e = 0.39m^2V^{-1}s^{-1}$, $\mu_h = 0.19m^2V^{-1}s^{-1}$ and $n_i = 2.4 \times 10^{19}m^{-3}$

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9. If resistivity of pure silicon is $3000\Omega meter$, and the electron and hole mobilities are $0.12m^2V^{-1}s^{-1}$ and $0.045m^2V^{-1}s^{-1}$ respectively, determine the resistivity of a specimen of the material when 10^{19} atoms of

phosphorous are added per m^3 are also added. Given charge on electron $= 1.6x10^{-19}C$.

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10. In an intrinsic semiconductor the energy gap $E_g is 1.2eV$. Its hole mobility is much smaller than electron mobility and independent of temperature. What is the ratio between conductivity at $600K$ and $300K$? Assume that temperature dependence intrinstic concentration n_i is given by

$n_i = n_0 \exp\left(\frac{-E_g}{2k_T}\right)$, where n_0 is a constant and $k = 8.62 \times 10^{-5} eV/K$.

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11. When the voltage drop across a $p.\ n$ junction diode is increased from $0.65V$ to $0.70V$, the change in the diode current is $5mA$. What is the dynamic resistance of the diode?

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12. Figure shos the characteristic curve of a junction diode. Determie the d.c. and a.c. resistance of the diode, when it operates at $0.3V$.

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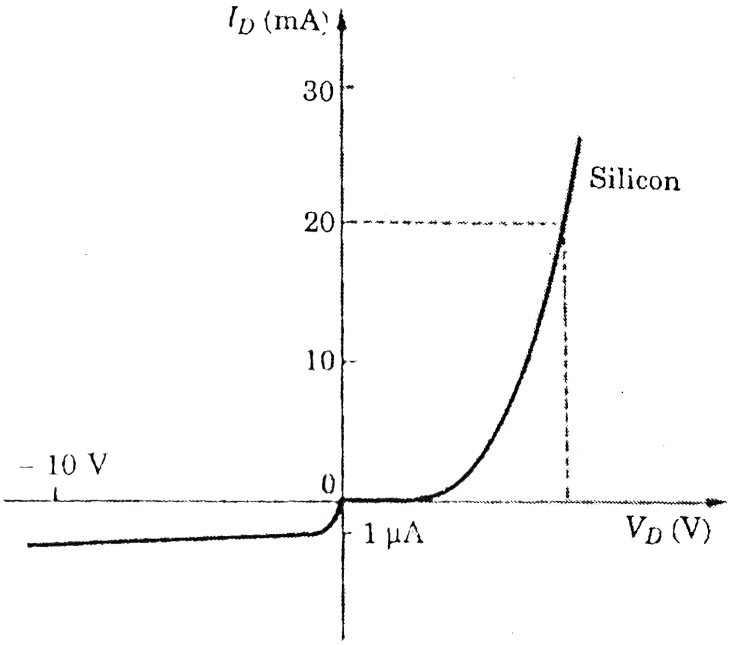
13. The volt-ampere characteristic of a silicon diode is shown in fig. Determine the resistance of the diode at (i) $I_D = 20mA$ and (ii) $V_D = -10V$.



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14. A $p-n$ junction diode when forward biased has a drop of $0.5V$ which is assumed to be independent of current. The current in excess of $10mA$ through the diode produces a large Joule heating which damages (burns) the diode. If we want to use a $1.5V$ battery to forward bias the diode, what should be the vlaue of resistor used in series with the diode so that the maximum current does not exceed $5mA$?

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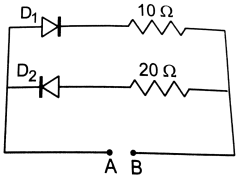
15. A 2V battery may be connected across the points A and B as shown in figure. Assume that the resistance of each diode is zero in forward bias and infinity in reverse

bias.Find the current supplied by the battery if the positive terminal of the battery is connected to (a) the point A (b)the point B.



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16. Draw the circuit to forward bias a diode. (The supply is $3V$ and $100mA$ battery). If the diode is made of silicon and knee voltage is $0.7V$, and a current of $20mA$ passes through the diode, find the wattge of the resistor and the diode.

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17. In figure what is the voltage needed to maintain $15V$ across the load resistance R_L of $2K$, assuming that the series resistance R is 200Ω and the zener requires a minimum current of $10mA$ to work satisfactorily? What is the zener rating required?

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18. A potential barrier of 0.50V exists across a p-n junction.(a) If the depletion region is 5.0×10^{-7}m wide,what is the intensity of the electric field in this region?(b) An electron with speed$5.0 \times 10^{5} ms^{-1}$ approaches the p-n junction form the n-side.With what speed will it enter the p-side?

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19. In half - wave rectification, what is the output frequency, if the

input frequency is 50 Hz ? What is the output frequency of a full - wave rectifier

for the same input frequency ?

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20. The turns ratio of a transformer used in a half wave rectifier ils $12:1$. The primary is connected to the power mains $220V, 50Hz$. Assuming the diode resistance in

forward bias to be zero, calculate the d.c. voltage across the load.

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21. In a centre trap full wave rectifier, the load resistance $R_L = 1k\Omega$. Each diode has a forward bias dynamic resistance of 10Ω. The voltage across half the secondary winding is $220 \sin 314t$. Find (i) the peak value of current (ii) the dc value of current and (iii) the rms value of current.

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22. Assume that the silicon diode in the circui shown in fig. requires a minimum current of $1mA$ to be above the knee point $(0.7V)$ of its $I-V$ characteristics. Aslo assume that the voltage across the diode is independent of current above the knee point.

(a) If $V_B = 5V$, what should be the maximum value of R so that the voltage is above the knee point?

(b) If $V_B = 5V$, what should be the value of R to estabilish the current of $5mA$ in the circuit?

(c) What is the power dissipated in the resistance R and in the diode, when a current of $5mA$ flows in the circuit at $V_B = 6V$?

(d) If $R = 1k\Omega$, what is the minimum voltage V_B required to keep the diode above the knee point?

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23. In a $p-n$ junction diode, the currect I can expressed as $I=I_0\exp\left(\frac{eV}{2k_BT}-1\right)$ where I_0 is called the reverse saturation current, V is the voltage across the diode and is positive for forward bias and negative for reverse bias, and I is the current through the diode, K_B is the Boltzmann constant $\left(8.6\times10^{-5}eV/K\right)$ and T is the absolute temperature. If for a given diode $I_o=5\times10^{-12}A$ and $T=300K$, then

(a) What will be the forward current at a formward voltage of $0.6V$?

(b) What will be the increase in the current if the voltage across the diode is increased to $0.7V$?

(c) What is the dynamic resistance ?

(d) What will be current if reverse bias voltage changes from $1V$ to $2V$?

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24. In a common emiter transistor circuit, if the collector-emitter voltages changes by $0.2V$, the collector current changes by $0.004mA$. What is the output resistance of the circuit,

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25. If a change of $100\mu A$ in the base current of an $n-p-n$ transistor in CE causes a change of $10mA$ in

the collector current, the ac current gain of the transistor is

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26. What is the change in the collector current, in a transistor of a.c. current gain 150 for a $100\mu A$ change in its base current?

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27. A transistor has a current gasin of 30. If the collector resistance is $6k\Omega$, input resistance is $1k\Omega$, calculate its voltge gain?

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28. For a transistor connected in common emitter mode, the voltage drop across the collector is $2V$ and β is 50. Find the base current is R_C is $2K$

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29. In a transistor connected in a common emitter mode it has, $R_c = 4k\Omega, R_i = 1k\Omega, I_c = 1mA$ and $I_b = 20\mu A$. Find the voltage gain.

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30. In a silicon transistor, a change of $80mA$ emitter current produces a change of $7.9mA$ in the collector current. What change in the base current is necessary to produce an equivalent change in the collector current? Find the values of α and β.

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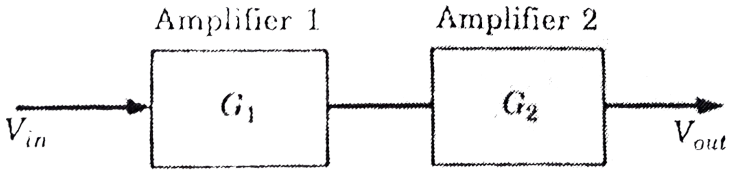
31. Two amplifiers are connected as shown in fig. Find V_0 if $G_1 = 20, G_2 = 10$ and $V_{\text{in}} = 50, V. V_Z = 10V$ for each diode.



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32. A transistor has $\alpha = 0.95$. If the emitter current is $10mA$, what is (a) the collector current, (b) the base current and (iii) gain β?

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33. The input resistance of a silicon transistor is 665Ω. Its base current is changed by $15\mu A$ which results in the change in collector current by $2mA$. This transistor is used as a common emitter amplifier with a load resistance of $5k\Omega$. What is the voltage gain of the amplifier.

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

Find the input resistance, $\beta_{a.c.}$ and transconductance of the transistor.

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

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35. In a transistor amplifier $\beta = 62, R_L = 5000\Omega$ and internal resistance of the transistor $= 500\Omega$. Calculate the voltage amplification and power amplification.

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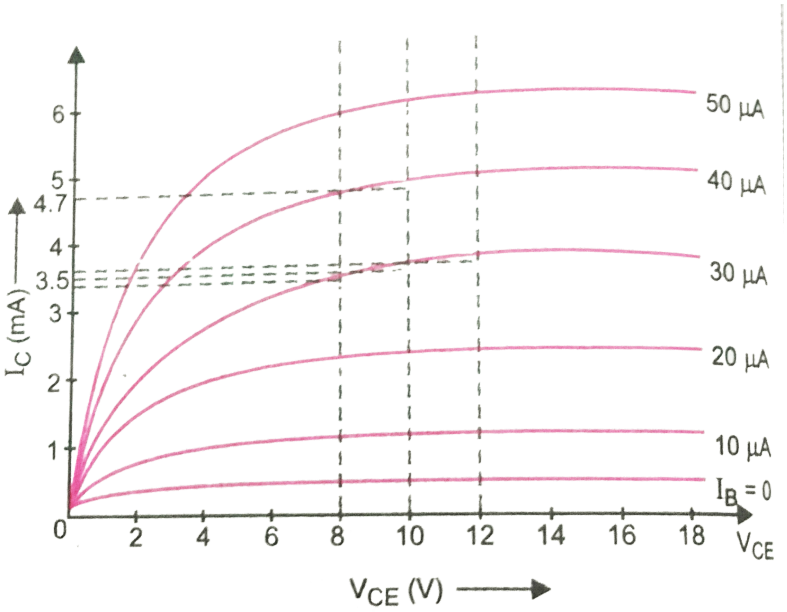
36. Output characteristics of an n-p-n transistor in CE configuration is shown in the Fig. Determine



(i) dynamic output resistance (ii) dc current gain and (iii) ac current gain at an opererating point $V_{CE} = 10V$, when $I_B = 30\mu A$.

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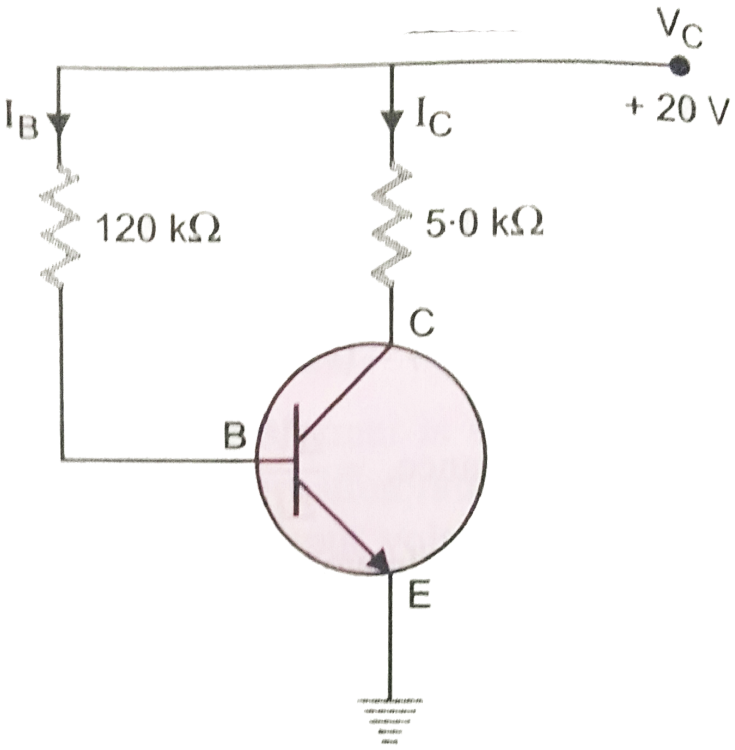
37. In the circuit Fig. the value of beta is 200. Find I_B, V_{CE}, V_{BE} and V_{BC}, when $I_C = 2.5mA$. The transistor is in active, cut off or saturation state.



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38. In the circuit shown in fig., the base current I_B is $10\mu A$ and the collector current is $5.2mA$. (a) Can this transistor circuit be used as an amplifier? (b) What happen if the resistance R_C is 500Ω and I_B, I_C and R_B remain same as above?

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39. In the circuit shown in Fig.

if we assume that when the input voltage at the base resistance is $5V$, V_{BE} is zero and V_{CE} is also zero. What is $I_{,}I$ and beta?

When the input is zero, then I is zero. What would be

the output wave form if the input wave form is as shown in Fig.

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40. An amplifier is represented by the adjoining circuit . r_i is the input resistance of the amplifier and the voltage v_i is appearing across it. This voltage is amplified by a factor of A_v and apears across the load as voltage v_0.

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41. Fig represents an amplifier circuit with an input internal resistance $r_i = 50k\Omega$. It is connected to an ac voltage source through a series resistor of $100k\Omega$. The no

load voltage gain of the transistor is 100. What is the apparent gain of the amplifier?

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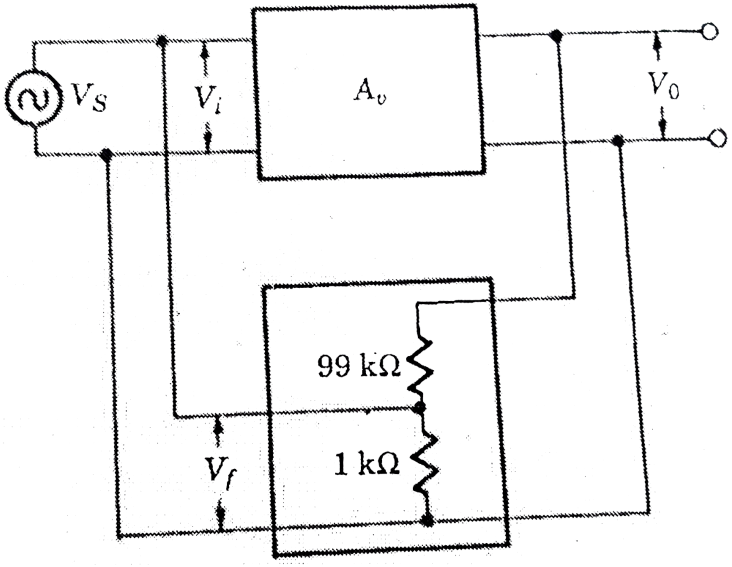
42. In the circuit, shown in fig $v_s = 0.2V, v_0 = -10V$. Find v_i and gain $A_v = v_0 / v_i$ and $A_v' = \frac{v_0}{v_s}$?



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43. Perform binary addition on the following sets numbers.

(a) 110010 and 111101 (b) 101010 and 010101 (c) 111111 and 000001

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44. Complement $(1's)$ the following binary numbers.

(a) 110010 (b) 111101 (c) 101010 (d) 111111

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45. Find the $2's$ complement of the following numbers?

(a) 111111 (b) 000000 (c) 101010 (d) 001001

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46. Perform subtraction on the following sets of numbers.

(a) 110010 and 111101 (b) 010101 and 101010 (c) 1000001 and1111111

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47. Write the output waveform of the OR gate for the inputs

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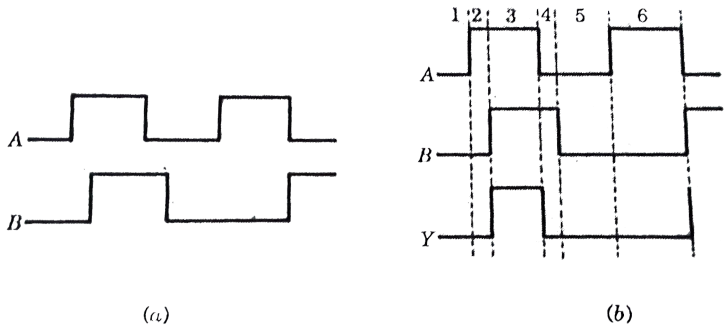
48. Two input waveforms A and B shown in fig (a) are applied to an AND gate.Write the output waveform.



(a) (b)

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49. Write the output waveform for the gates

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50. Write the Boolean equation and the truth table for the circuit shown in fig. What will be the output if both inputs are high?

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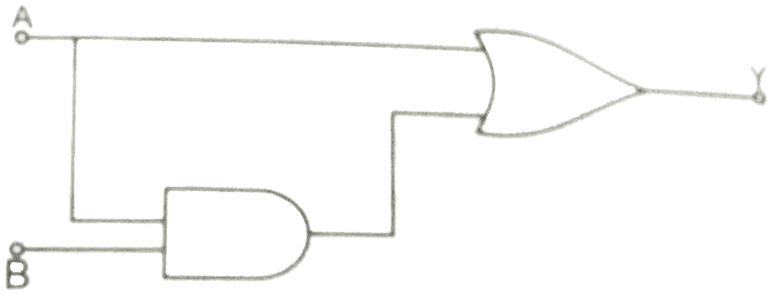
51. Express by a truth table, the output Y for all possible input A and B in the following circuit Fig.



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52. The output of an OR gate is connected to both the input of a NOR gate. Draw the logic circuit of the combination and write the truth table.

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53. The output of and AND gate is connected to both the inputsof a NAND gate. Draw the logic circuit of this combinationn of gates and write its truth table.

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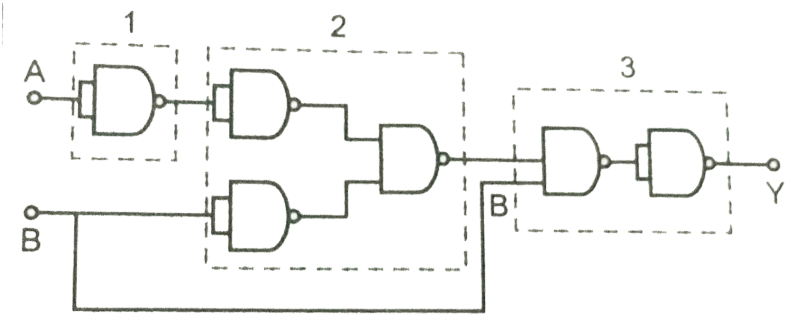
54. Identify which basic gate, OR, AND and NOT is represented by the circuits in the dotted line boxes 1, 2

and 3 Fig.



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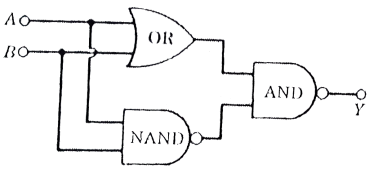
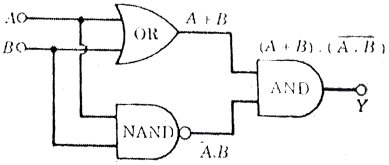
55. Write the truth table for the circuit shown in fig. Show that it represents a XOR gate.





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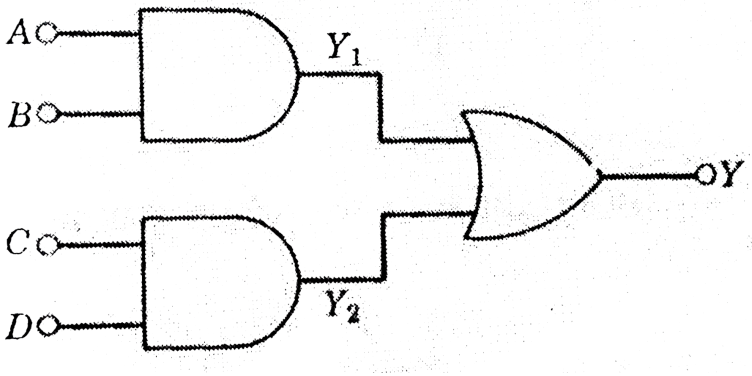
56. Write the Boolean equation and the truth table for the circuit shown in fig. Which input words does the circuit recognise?



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Problem Type

1. Mobilities of electorns and holes in a sample of intrinsic germanium at room temperature are $0.54m^2V^{-1}s^{-1}$

and $0.18 m^2 V^{-1} s^{-1}$ respectively.

If the electron and hole densities are equal to $3.6 \times 10^{19} m^{-3}$ calculate the germanium conductivity.

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2. An n-type silicon sample of width $4 \times 10^{-3} m$, thickness $25 \times 10^{-5} m$ and length $6 \times 10^{-2} m$ carries a current of $4.8 mA$ when the voltage is applied across the length of the sample. What is the current density? If the free electron density is $10^{22} m^{-3}$ then find how much time does it take for the electrons to travel the full length of the sample?

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3. In n-p-n transistor circuit, the collector current is $10mA$. If $90\,\%$ of the holes reach the collector, find emitter and base currents.

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4. In an n-p-n transistor 10^{10} electrons enter the emitter in 10^{-6}s. If 2% of the electrons are lost in the base, find the current transfer ratio and the current amplification factor.

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5. For a semiconductor of band energy gap $1.5eV$, calculate the wave-length of the emitted radiation when a conduction hand electron combines with a valence band hole. Given Planck's constat $6.6 \times 10^{-34} Js$

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6. A $10V$ Zener diode along with a series resistance R is connected across a $40V$ supply. Calculate the minimum value of the resistance, as required, if the maximum Zener current is $50mA$.

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7. A transistor is connected in common emitter configuration. The collector supply is 8V and the voltage drop across a resistor of 800Ω in the collector circuit is 0.5 V. If the current gain factor (α) is 0.96, find the base current.

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8. An n - p- n transistor is connected in common - emitter configuraration in which collector supply is 8 V and the voltage drop across the load resistance of 800Ω connected in the collector circuit is 0.8 V . If current amplification factor is 25 , determine collector - emitter voltage and base current . If the internal resistance of the

transistor is 200Ω , calculate the voltage gain and the power gain.

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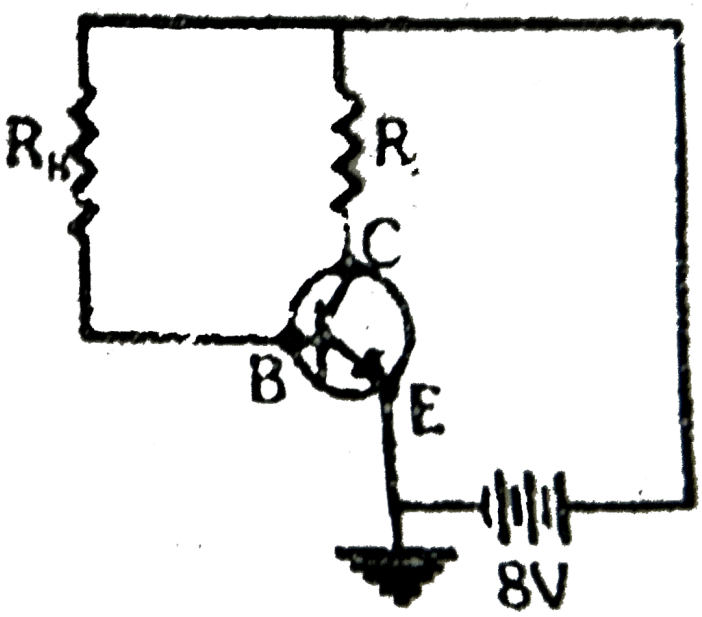
9. An n-p-n transistor in a common emitter mode is used as a simple voltage amplifier with a collector connected to load resistance R_L and to the base through a resistance R_B. The collector-emmiter voltage $V_{CE} = 4V$, the base-emitter voltage $V_{BE} = 0.6V$, current through collector is $4mA$ and the current amplification factor

$\beta = 100$ Calculate the value of R_L and R_B.



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Others

1. The energy of a photon of sodium light $(\lambda = 589nm)$ equal the band gap of a semiconducting material.(a)Find the minimum energy E requried to create a hole-electron pair.(b)Find the value of E/kTat a temperature of 300K.

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2. A doped semiconductor has impurity levels $30meV$ below the conduction band. Is the material n-type or p-type? Find the maximum wavelength of ight so that an electron of impurity level is just able to jump to into conduction band.

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3. The bank gap of an alloy semiconductor galiumarseide phosphie is $1.98eV$. Calculate the wavelength of radiation that is emitted when electrons and holes in this material combine directly. What is the colour of the emitted radiation? Take $h = 6.6 \times 10^{-34} Js$

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4. The number density of electrons and holes in intrinsic silicon at a given temperature is $4.94 \times 10^{10} cm^{-3}$. Calculate the resistivity and conductivity of the silicon. Given electron mobility $= 100 cm^2 V^{-1} s^{-1}$ and hole mobility $= 1000 cm^2 V^{-1} s^{-1}$

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5. Determine the number density of donor atoms which have to be added to an intrinsic germanium to produce an n-type semiconductor of conductity $0.06Sm^{-1}$. Given the mobility of electrons $= 0.39m^2V^{-1}s^{-1}$. Neglect the contribution of holes to the conductivity.

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6. Germanium is doped one part million with indium at room temperature. Calculate the conductivity of doped germanium. Given: concentration of Ge atoms $= 4.4 \times 10^{28}m^{-3}$, intrinsic carrier concentration

$(n_i) = 2.4 \times 10^{19} m^{-3}$, $\mu_e = 0.39 m^2 V^{-1} s^{-1}$ and $\mu_k = 0.19 m^2 V^{-1} s^{-1}$

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7. Determine the conductivity and resistivity of pure germanium at $300K$ assuming that at this temperature the concentration of germanium is $2.5 \times 10^{13} cm^{-3}$. The electron and hole mobilities are $3600 cm^2 V^{-1} s^{-1}$ and $1700 cm^2 V^{-1} s^{-1}$ respectively.

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8. The resistivity of pure germanium at a particular temperature is $0.52 \Omega m$. If the material is doped with 10^{20}

atoms m^{-3} of a trivalent impurity material, determine the new resistivity. The electron and hole mobilities are givenn to be 0.2 and $0.4 m^2 V^{-1} s^{-1}$ respectively.

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9. A sample of germanium is doped to the extent of 10^{14} donor atoms per cm^3 and 7×10^{13} acceptor atoms per cm^3. The resistivity of pure germanium at the temperature of the sample is $60 \Omega cm$. Find the total conduction current density due to an applied electric field of $2 V cm^{-1}$. The electrom and hole mobilities are given to be $3800 cm^2 V^{-1} s^{-1}$ and $1800 cm^2 V^{-1} s^{-1}$, respectivele.

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10. The energy gap in germanium is $0.75eV$. Compare the intrinsic conductivities of germanium at $300K$ and $330K$. Take $k_B = 8.6 \times 10^{-5} eVK^{-1}$

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11. In a photodiode the coductivity increases when the material is exposed to light. It is found that coductivity change only if the wavelength is less than $600nm$. What is the band gap?

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12. When the voltage drop across a $p-n$ junction diode in increased from $0.70V$ to $0.71V$ the change in the diode current is $10mA$. What is the dynamic resistance of the diode?

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13. A $P-N$ junction diode can withstand currents up to $10mA$. Under forward bias, The diode has a potential drop of $0.5V$ across it which is assumed to be independent of current. The maximum voltage of the battery used to forward bias the diode when a resistance of 200Ω is connected in series with it is

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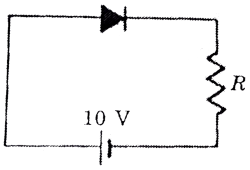
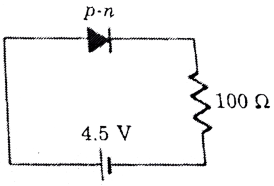
14. The silicon diode shown in fig. is rated for a maximum current of $10mA$. Calculate the minimum value of resistor R . Asume the forward voltage drop across the diode to be $0.7V$.





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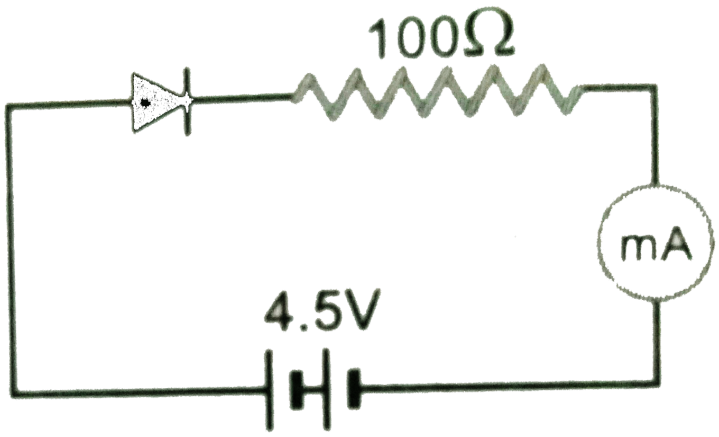
15. Figure Shows a diode connected to an external resistance and an e.m.f. Assuming that the barrier potential developed in diode is $0.5V$, obtain the value of

current in the circuit in milliampere.



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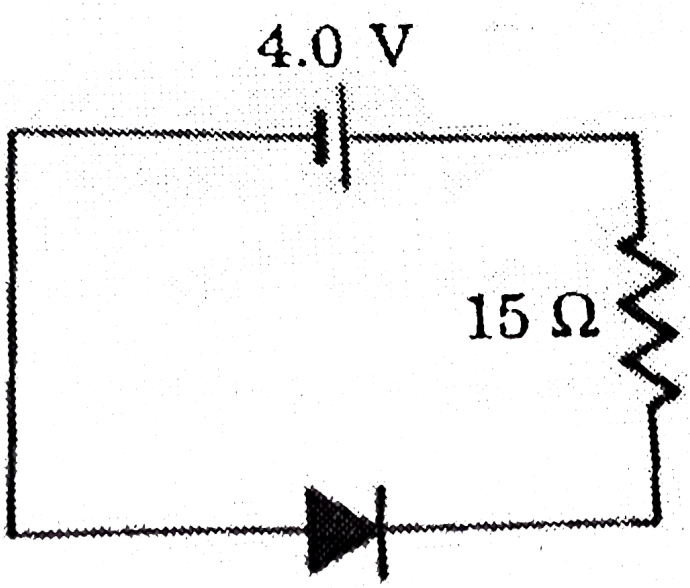
16. Find the current through the circuit and the potential difference across the diode shown in fig. The drift current

for the diode is $20\mu A$



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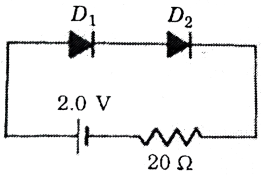
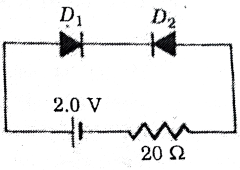
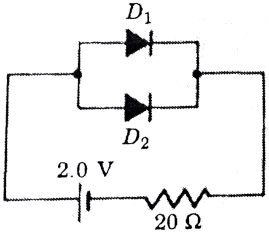
17. Determine the currents through the resistance of the circuits shown in fig.



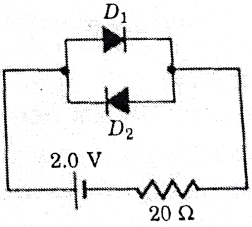
(a)



(b)



(c)



(d)

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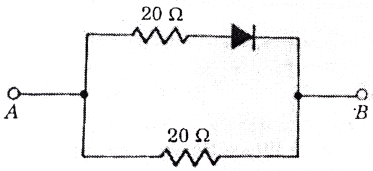
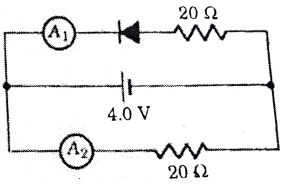
18. Find the equivalent resistnace of the circuit shown in fig between the points A and B





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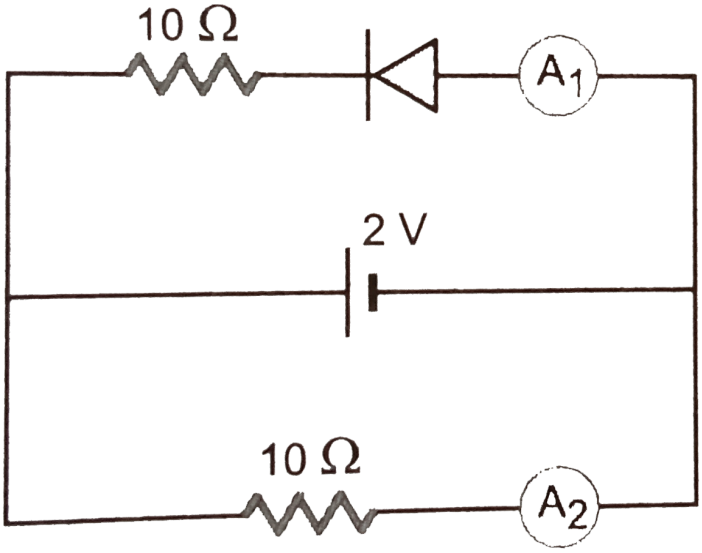
19. Assuming that the resistance of the meters are negligible, what will be the readings of the ammeters A_1 and A_2 in the circuit shown in Fig.



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20. A potential barrier of $0.60V$ exists across a p-n junction. If the depletion region is $6.0x10^{-7}m$ wide, what

is the intensity of the electric field in this region. An electron with speed $5.0x10^{5}ms^{-1}$ approaches the p-n junction from the n-side, with what speed will it enter p-side.

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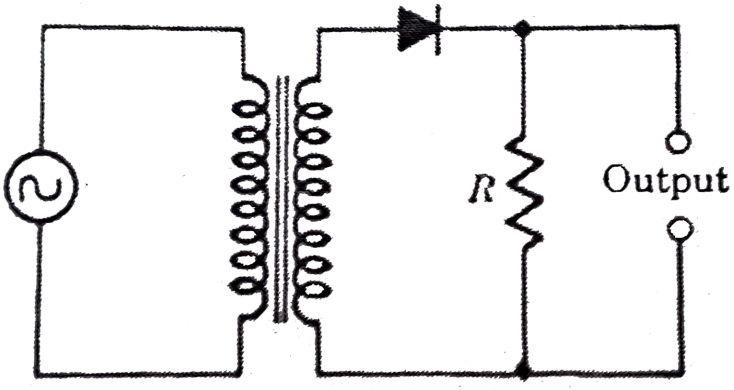
21. A sinusoidal voltage of rms value $220V$ is applied to a diode and a resistor R in the circuit shown in fig. Show that half wave rectifaction occurs. If the diode is ideal,

what is the rms voltage across?



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22. In a full wave junction diode rectifier, the input a.c. has an rms value of $10V$. The transformer used is a step up transformer having transformation ratio $1:2$. Calculate the d.c. and a.c. voltages in the rectified output.

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23. The applied input a.c. power to a half wave retifier I 100 watt. The d.c. output power obtained is 40 watt. (i) What is the rectification efficiency and (ii) What is the power efficiency?

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24. A crystal diode having internal resistance 200Ω is used as a half rectifier. If the applied voltage is $V = 50\sin\omega t$ volt and load resistance is 800Ω, find (i) maximum output current (ii) d.c. output current (iii) d.c. output power and (iv) d.c. output voltage.

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25. A transistor has a current gainn of 50. If the collector resistance is $5k\Omega$ and the input resistance is $1k\Omega$ (approx), find the voltage gain of the amplifier.

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26. When the emitter current of a transistor is changed by $1mA$, its collector current changes by $0.995mA$. Calculate its CB current gain α and CE current gain β

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27. A transistor has a base current of $0.08mA$ and the emitter current is $10mA$, . Determine (a) the collector

current (b) α and (c) β

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28. A transistor has $\alpha = 0.95$. If the emitter current is $10mA$, what is (a) the collector current, (b) the base current and (iii) gain β?

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29. The collector current for a transistor is $6.6mA$, and its current gains α is 0.95. Determine I_B and β

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30. The current gain of a transistor in common rase arrangement is 0.95. Find the voltage gain and power gain if load resistance is 200Ω

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31. For a CB amplifier the input resistance is 800Ω and the output resistance is $600k\Omega$ (a) Determine the voltage gain if the emitter current is $12mA$ and $\alpha = 0.97$ (b) What is the power gain?

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32. The power gain for common base amplifier is 800 and the voltage amplification factor is 840. The collector current when base current is 1.2 mA is

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33. The current gain of a transistor in CB configuration is 0.98. Find the change in collector current corresponding to a change of $5.0mA$ in the emitter current. What would be the change in base current?

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34. In common-emitter transistor amplifier the load resistance of the output circuit is 1000 times the load resistance of the input circuit. If $\alpha = 0.98$, then calculate the voltage gain.

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35. In a common -emitter transistor amplifier, an increase of $50\mu A$ in the base current causes an increase of $1.0mA$ in the collector current . Calculat gain β. What will be the change in emitter current? Also calculate current gain α

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36. The base current of a transistor is 0.105 mA and collector current is $2.05mA$.

Determine the value of β, I_e and α

A change of $27\mu A$ in the base current produces a change of 0.65 mA in the collector current. Find $\beta_{a.c.}$.

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37. A transistor is used in common-emitter mode in an amplifier circuit. When a signal of 30mV is added to the base-emitter voltage, the base current changes by $30\mu A$ and collector current by 3mA. The load resistance is $5kOhm$. Calculate (i) the current gain β_{ac} (ii) the input

resistance R_{BE} (iii) trans-conductance and (iv) voltage gain.

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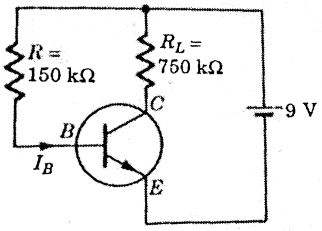
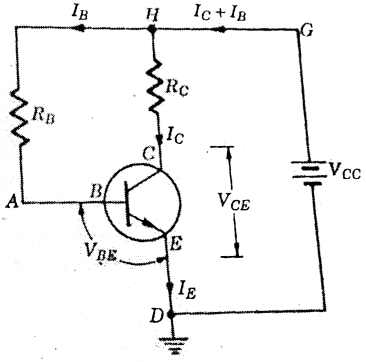
38. In a transistor circuit shown in fig, R has a resistance of $150k\Omega$, R_L has a resistance of 750Ω, and the direct current gain of the transistor is 80. Assuming ther is negligible potential difference between B and E, calculate (a) the base current rent I_B and (b) the potential difference betwen the collector and emitter.





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39. In the circuit shown in fig the base current $I_B = 5.0\mu A$, base resistor $R_B = 1.0M\Omega$ collector resistor $R_c = 1.0k\Omega$ the collector current $I_C = 5.0mA$ and the d.c. voltage in the collect circuit $V_{CC} = 6.0V$. (i) Can this circuit be used as an ampifier? (ii) What happens if the resistance R_C is 400Ω and I_B, I_C and i_C and R_B remain same as above?

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40. As shown in fig an amplifier of no load gain 400 and input resistance 100Ω is connected to external signal via

a series resistance of 300Ω. What is the apparent voltage gain?

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41. How 2-input NAND gate can be converted into a NOT gate?

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42. Write the truth table of a two input NOR gate. Explain, using a logic circuit, how a NOR gate can be converted into an AND gate.

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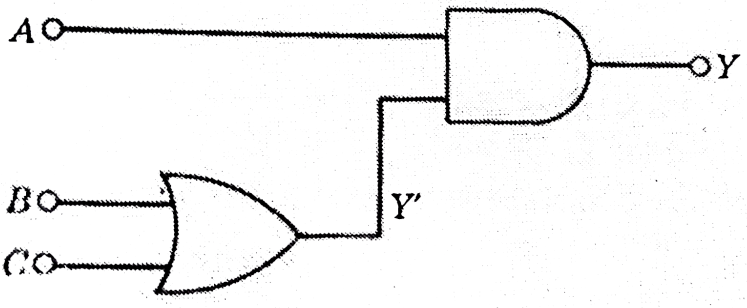
43. Write the Boolean equation and the truth table for the following circuit?



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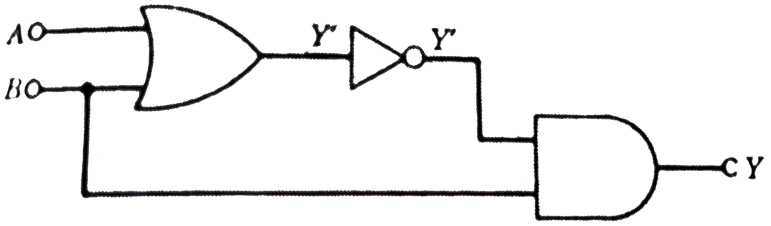
44. Write the truth table for the following circuit:



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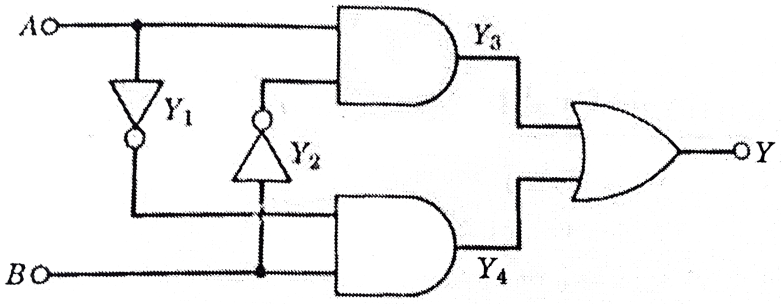
45. Write the logic table for the following circuit:



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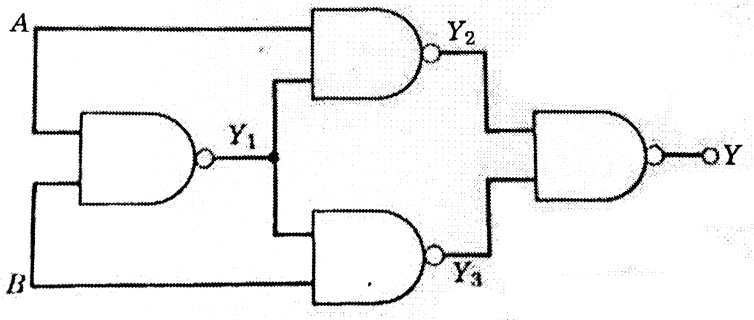
46. Write the truth table for the following circuit? Give the name of the resulting gate.



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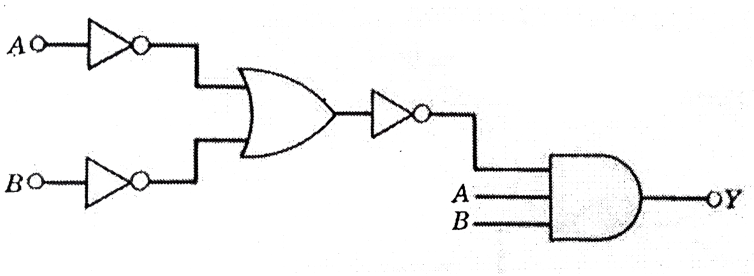
47. Find the output Y of the following circuit if the inputs are:

$A = 0, B = 0, A = 0, B = 1, A = 1, B = 0, A = 1, B = 1$



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