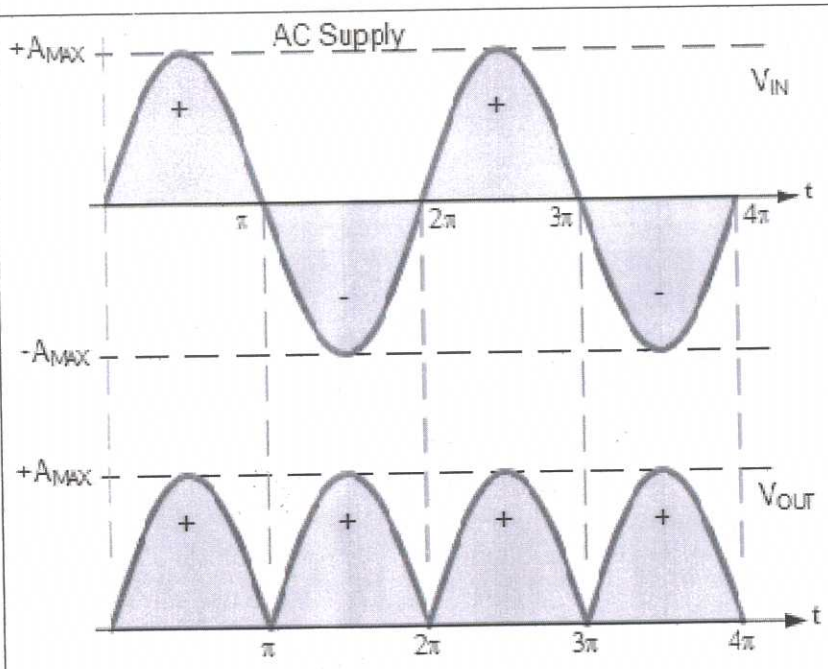
TED (15) : 2041

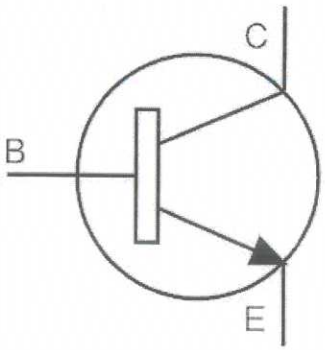
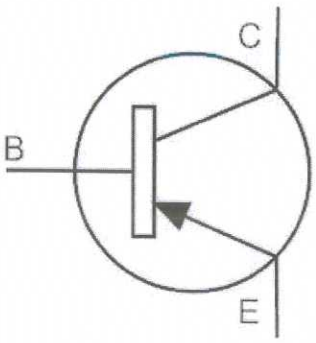
(Revision - 2015)

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY

BASIC ELECTRONICS

SCHEME OF VALUATION

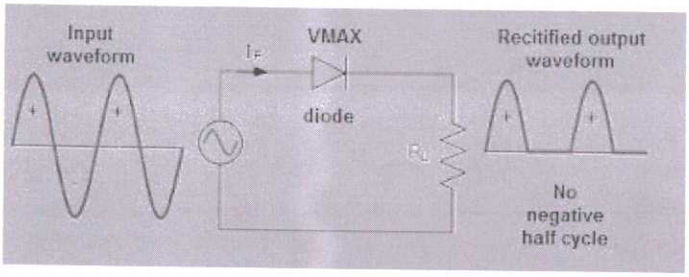
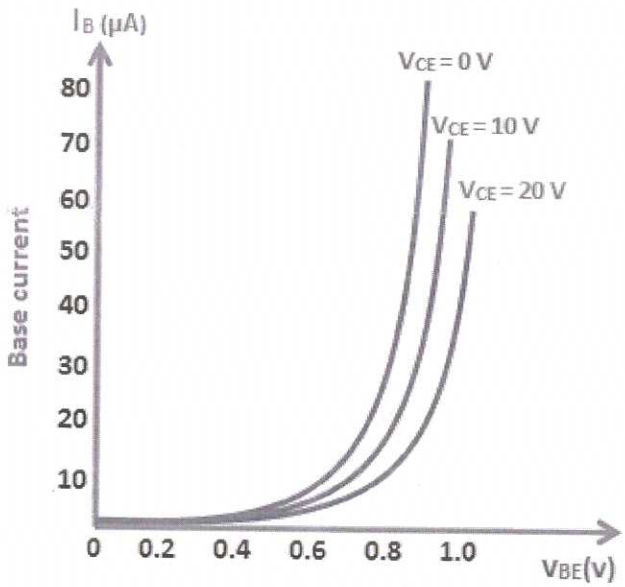
Qn No.	Scoring Indicator	Split up Score	Sub total	Total
I	**PART : A**			
1	Diode, Transistor	2		10
2	A potential difference built up across the pn junction which restricts further movement of charge carriers across the junction	2		
3	Maximum voltage across the diode in non-conducting state	2		
4	 Rectfied Output Waveform	2		

5	 **n-p-n transistor**  **p-n-p transistor**	2		
II				5*6 =30
1	1. Capacitance value 2. Tolerance 3. Voltage rating 4. Temperature coefficients 5. Dielectric constant 6. Leakage resistance	6	6	
2	The resistance value tolerance and wattage rating generally printed on one end of the resistor casing. Two methods of colour coding system 1. Four colour band system: first 3 colour band indicate the resistance value and fourth indicates the tolerance. The first band indicate first significant digit second band indicate second digit the third band indicate multiplier and fourth band represent the tolerance in percentage 2. Five colour band system: the first 3 band gives Ist ,IInd and IIIrd significant digits of resistance value the fourth band is multipliers and the fifth band indicate %tolerance	6	6	

			6	6	

Color	Digit	Multiplier	Tolerance (%)
Black	0	10^0 (1)	
Brown	1	10^1	1
Red	2	10^2	2
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	0.5
Blue	6	10^6	0.25
Violet	7	10^7	0.1
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	5
Silver		10^{-2}	10
(none)			20

3	N type semiconductor: penatvalent impurity added to pure semiconductor. The number of free electron exceeds the number of holes. So electrons are the majority charge carriers and holes are the minority charge carriers. P type semiconductor: trivalent impurity added to pure semiconductor. The number of holes is very much greater than the number of free electrons, holes are the majority charge carriers and electron are the minority charge carriers	3 3	6	
4	Zener breakdown: Breakdown occurs due to heavily doped junction and applied strong electric field,dopping level is high, breakdown occurs at lower voltage compared to avalanche breakdown. Avalanche breakdown: breakdown occurs due to avalanche multiplication between thermally generated ions, doping level is low, breakdown occurs at higher voltage	3 3	6	

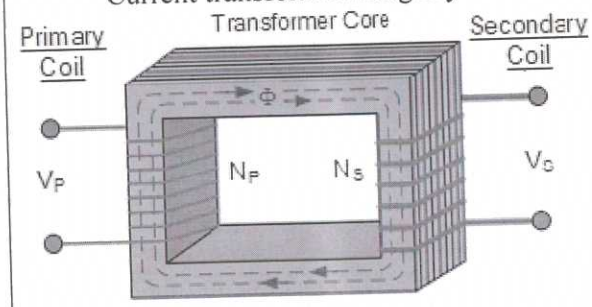
5	**Half wave rectifier** uses the same principle as PN junction diode and thus converts AC to DC. In a **half-wave rectifier** circuit, a load resistance is connected in series with the PN junction diode. Alternating current is the input of the **half wave rectifier**. ... The voltage output is measured across the load resistance.  		6	
6	In CE configuration the curve between Ib on Y axis and Vbe on X axis at constant Vce. Similar to those of a forward biased diode. As compared to CB configuration less rapidly with increase in Vbe  I/P characteristics CE configuration		6	

7	$\alpha=\Delta Ic/\Delta Ie$,$\beta=\Delta Ic/\Delta Ib$ $\gamma=\Delta Ie/\Delta Ib$ $\gamma=1+/\beta$ $\gamma=1/1-\alpha$ $\alpha=\gamma-1/\gamma$ $\beta=\gamma-1$ $\beta=\alpha/1-\alpha$ $\alpha=\beta/1+\beta$ $\gamma=1/1-\alpha=1+\beta$		6	
III a,	1. Carbon composition: used in general purpose electronic equipment 2. Carbon film: measuring computers,HF amplifiers,filters,telephone circuit 3. Metal film: professional instruments, measuring and calibrating euipments such as CRO digital multimeter etc 4. Wire wound: power electronics, load resistors, current limiting, bleeder, voltage dropping etc.	9		
b	Active components: the electronic components which are capable of amplifying or processing an electrical signal are called as active components. Have gain, perform signal processing, require bias, nonlinear operation, perform operation with or without the aid of passive components Passive components: Do not have gain or directivity, not capable of signal processing, does not require any input for operation, linear in operation, aid the active component in functioning	6	15	

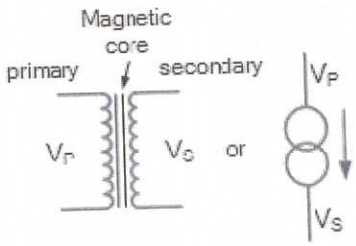
IV

a Transformer works on the principle of mutual induction. The purpose of the transformer is to transfer power from the primary where the generator is connected to the secondary where the induced secondary voltage can produce current in the load resistance. Transformer has primary winding connected to a voltage source that produce alternating current while the secondary winding is connected across the load resistor . the ac current in primary winding produce varying magnetic flux. The secondary winding cuts the varying magnetic flux which induce emf in secondary. 9

Power transformer: used in domestic power supply
AF transformer: used in audio amplifier,radio,TV receivers
LF transformer: used in IF amplifier
RF transformer: used in RF amplifiers
Current transformer: magnify current



Transformer Construction



Transformer Symbols

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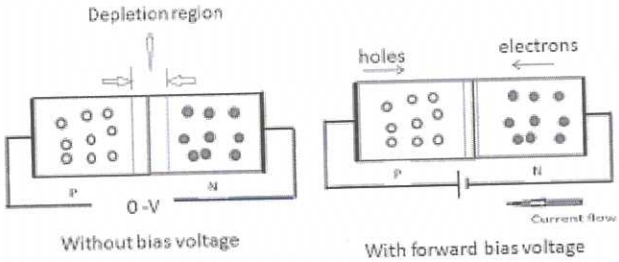
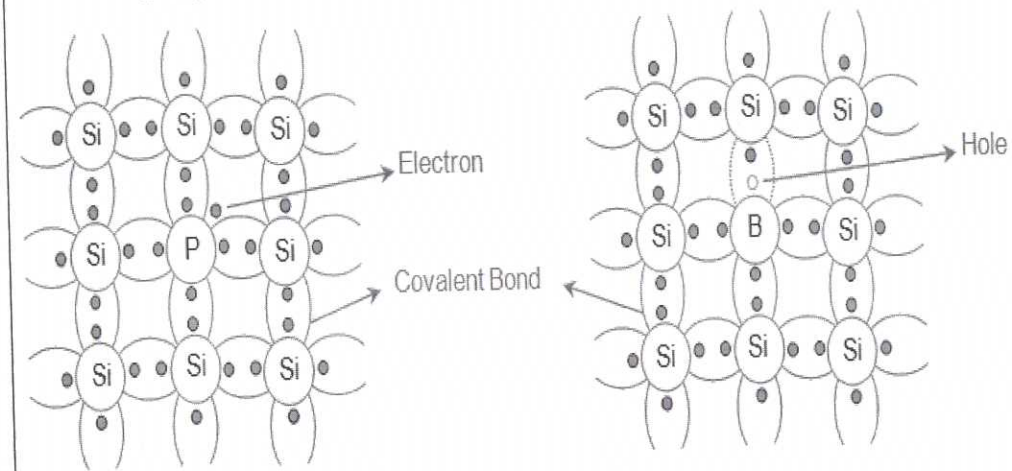
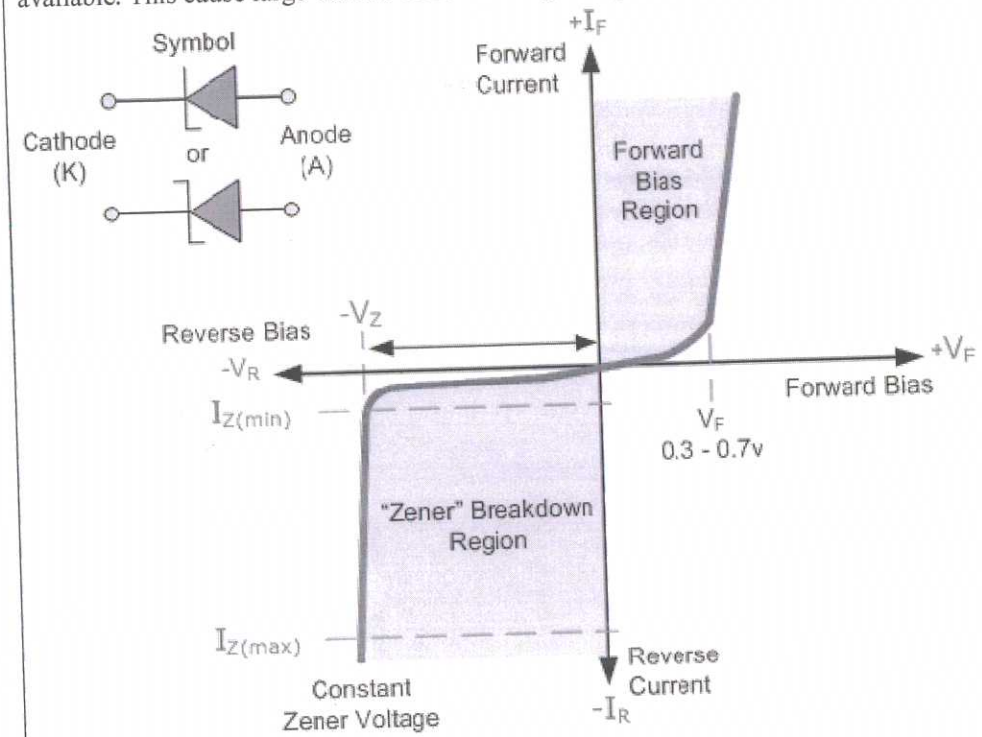
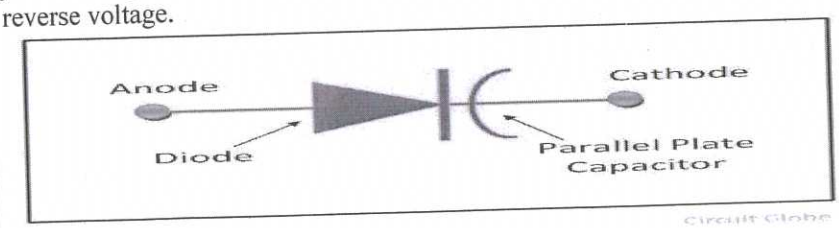
b. Ultra capacitors: is also called as super capacitor. Electrical component capable of holding hundreds of time more electric charge quantity than standard capacitor. These characteristics make ultra-capacitors useful in device that require relatively little current and low voltage. In some situation ultra-capacitor can be as rechargeable low voltage electro chemical battery. Ultra capacitors can be found in emergency, radios and flash lights 6

V a,	Operation of PN junction: forward bias, when the positive terminal of DC source is connected P type and negative terminal is connected to N type semiconductor of a PN junction. The external voltage applied to PN junction cancels the potential barrier to constitute easy flow of current through it. The junction offers low resistance to flow of current. Magnitude of current flow through the circuit depends on applied voltage. Reverse bias: when the positive terminal of a D C source connected to N type semiconductor and negative terminal connected to P type semiconductor of a PN junction. The junction potential barrier is strengthened; junction offers high resistance, practically no current flows.  	9	15	
b.	Extrinsic semiconductor: In order to increase conductity of semiconductor an impurity is added to it and this process is called doping. The resultant material after doping is called extrinsic semiconductor. When pentavalent impurity is added N type semiconductors are formed. When trivalent impurity is added P type semiconductors are formed.  Figure 1 2-D Crystal Lattice of Silicon Doped with (a) Phosphorous (b) Boron	6		

VI a.		9	
	Zener diode: properly doped crystal diode which has sharp breakdown voltage is called zener diode. A zener diode is used in reverse bias condition. When reverse bias across PN junction is increased the electric filed across junction also increased. This high electric filed causes covalent bond within the crystal to break. Thus large number of charge carriers becomes available. This cause large current to flow through the junction, this is called zener breakdown.		15

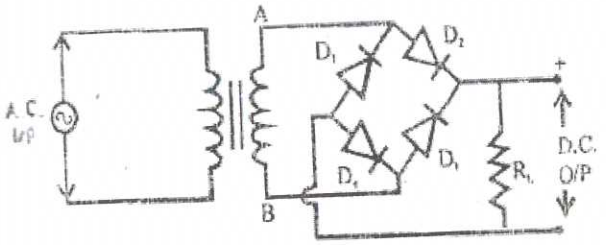


b.	Varactor diode: is a semiconductor voltage dependent variable capacitor. It is just a reverse biased diode whose mode of operation depends on its transition capacitance Ct. Reverse biased junction behave like capacitor with depletion layer as dielectric and P and N regions as capacitor plates. As reverse biased voltage is increased the depletion layer widens thereby decreasing the junction capacitance. Hence we can change the diode capacitance by simply changing the reverse voltage.	6	

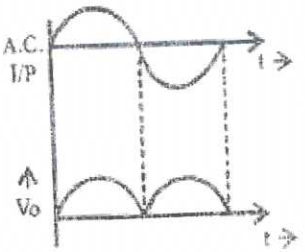


VII (a)

The circuit consists of 4 diodes D1,D2,D3,D4 connected in the form of a bridgeABCD. During positive half cycle the terminal A is positive with respect to C. the diode D1 and D2 are forward biased and acts as shorts. At the instant the diodes D3 and D4 are reverse biased and hence acts as open. The current flows and a produce a voltage difference across the resistor. During negative half cycle the terminal A is negative with respect to C, the diode D2 and D3 are forward biased and acts as shorts, D1 and D2 are reverse biased. The current flows through the resistor. Thus there is output voltage for both the half cycles. 9



a) Bridge Rectifier



b) Waveforms

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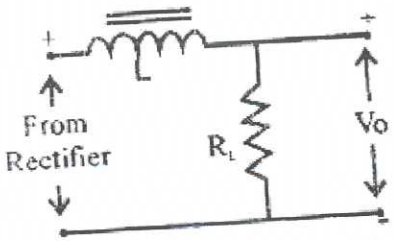
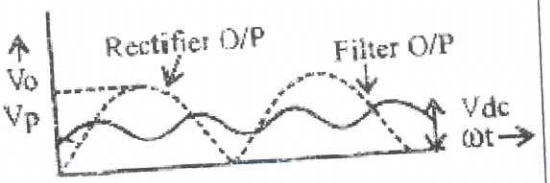
b. Inductor filter: here the inductor is connected in series with the load. The inductor inherent property to oppose the change of current. This property of the inductor is being used here to suppress the AC component from rectified output. The reactance if inductor is large for high ripple frequency and hence blocks the flow of ripples while allows the DC components to reach the load.



a) Inductor Filter



b) Waveforms

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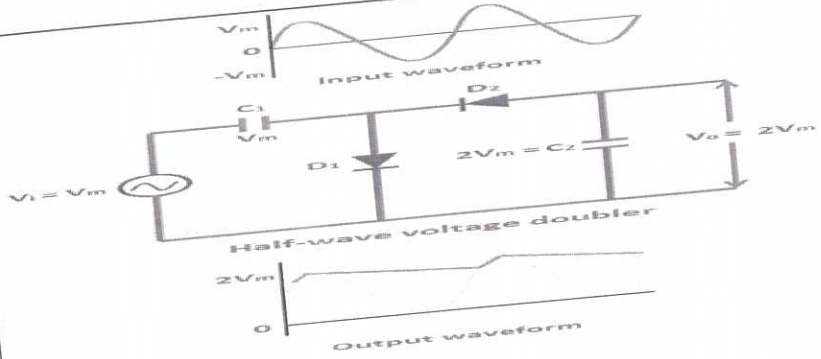
VIII a. Half-wave voltage doubler: the circuit which produces output voltage double of input AC voltage. During the positive half cycle of input voltage diode D1 is forward biased it conducts while diode D2 is reverse biased. Now the capacitor charges to peak value of secondary voltage. During the negative half cycle the diode D2 is forward biased while diode D1 is reverse biased,D2 conducts and not D1. During the next positive half cycle the D2 is open and no load is connected to across capacitor both capacitor charges to 2Vm 9 15



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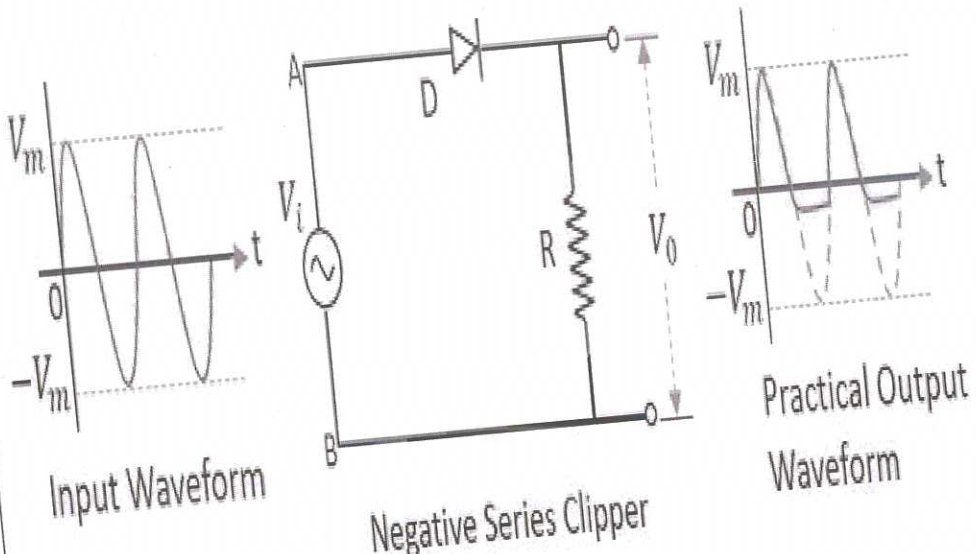
b. Negative clipper: a clipper that remove negative half cycle of input voltage. During positive half cycle of the voltage the terminal A is positive with respect to terminal Therefore the diode is forward biased and ac as a closed switch all the voltage appears across the load resistor. During negative half cycle diode is reverse biased and acts like open switch. Thus there is no voltage across the resistor.



IX

a, In CB plot characteristics the curve plotted between Ic on Y axis and Vcb on X axis at constant Ie.in the active region where collector base junction is reverse biased Ic ias almost equal to Ie. In the active region the curve is flat

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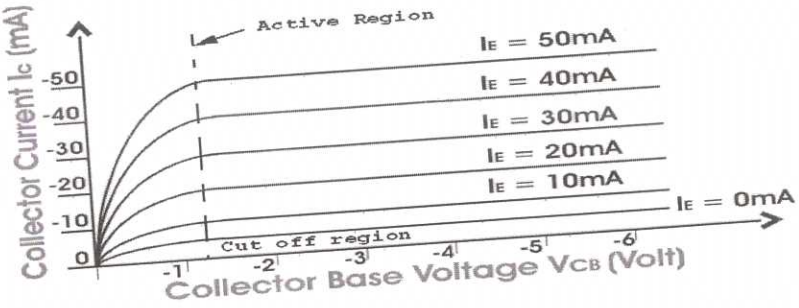
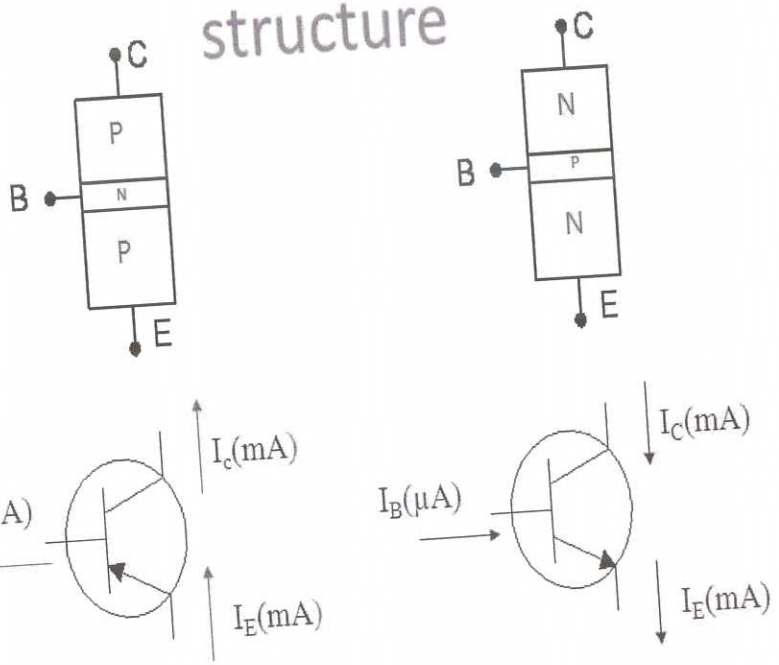


b. A semiconductor device consisting of two PN junctions formed by sandwiching either P type or N type semiconductor between a pair of opposite types is called a transistor. Basically a transistor consists of two back to back PN junctions manufactured in a single piece of semiconductor crystal. These two junctions give rise to three regions called emitter, base and collector. There are two types of transistors namely NPN transistor and PNP transistor. In NPN transistor two blocks of N type semiconductor separated by a thin layer of p type semiconductor, while in PNP two blocks of P type semiconductor are separated by a thin layer of N type semiconductor. Emitter is more heavily doped, supply majority charge carriers to base. Base forms middle portion and lightly doped. Collector is moderately doped.

6

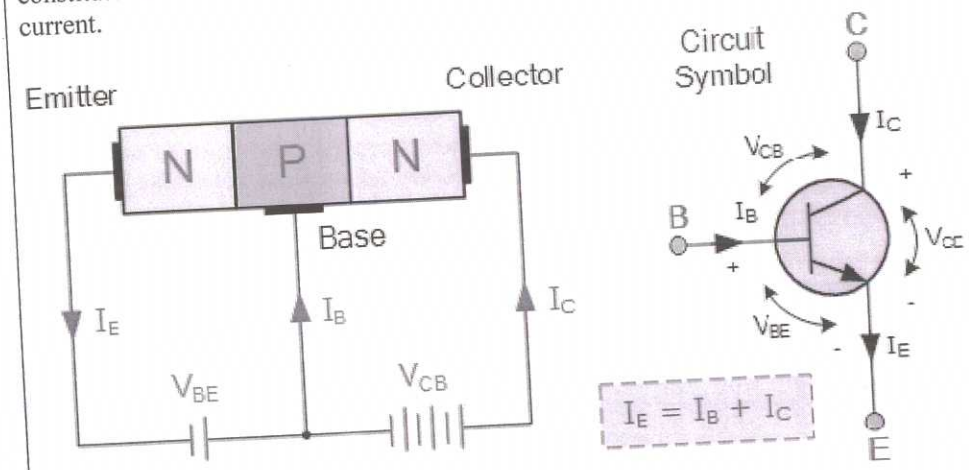
PNP and NPN transistor structure



Arrow shows the current flows

X a In NPN transistor emitter base junction is forward biased while collector base junction is revere biased. A large number of electrons in emitter are pushed towards the base . this constitute the emitter current. When these electrons enter the P type material they tend to combine with holes. Since base is lightly doped and very thin few electrons combine with holes to constitute base current, remaining electrons reaches collector this constitute collector current.
In PNP transistor emitter base junction is forward biased while collector based junction is reverse biased. A large number of holes in emitter are pushed towards base, this constitute emitter current. Since the base is lightly doped only few holes combine with electron to constitute base current. Reaming holes reaches collector region, this constitutes collector current.

9



15

b. .

In CE configuration the curve between Ic on Y-axis and Vce on X-axis at constant Ib is called output characteristics. Ic varies with Vce for Vce between 0 and 1V and then becomes almost constant and independent of Vce. This value up to which Ic change is called knee voltage. Above knee voltage Ic is almost constant. When Ib=0,Ic is not zero, but it is reverse leakage current Iceo called as the cut off region.

6