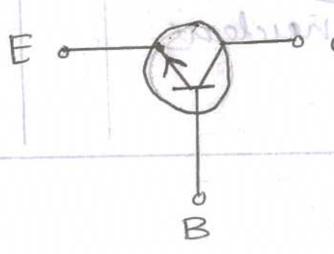
SCHEME OF VALUATION

Revision: 15 Course code: (15) 2041

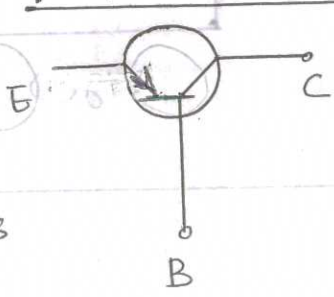
Course Title: BASIC ELECTRONICS

Qst: No	Scoring indicators	Split up score	Sub Total	Total
	PART-A			
I 1.	Power supply Impidence mating Isolate two circuits electrically	2		
2.	Value of inductance Current rating Tolerance Temperature coefficient Stability d.c. resistance Q-factor Frequency range	2		
3.	Diffusion current in semiconductor is the current which flows as a result of a gradient of carrier concentration (Due to the difference of carrier concentration from one region to another).	2		
4.	Shunt Capacitor Filter Series inductor Filter Chock Input L.C. Filter π-Filter	2		
5.	NPN Transistor PNP Transistor	2	5x2 =10	10

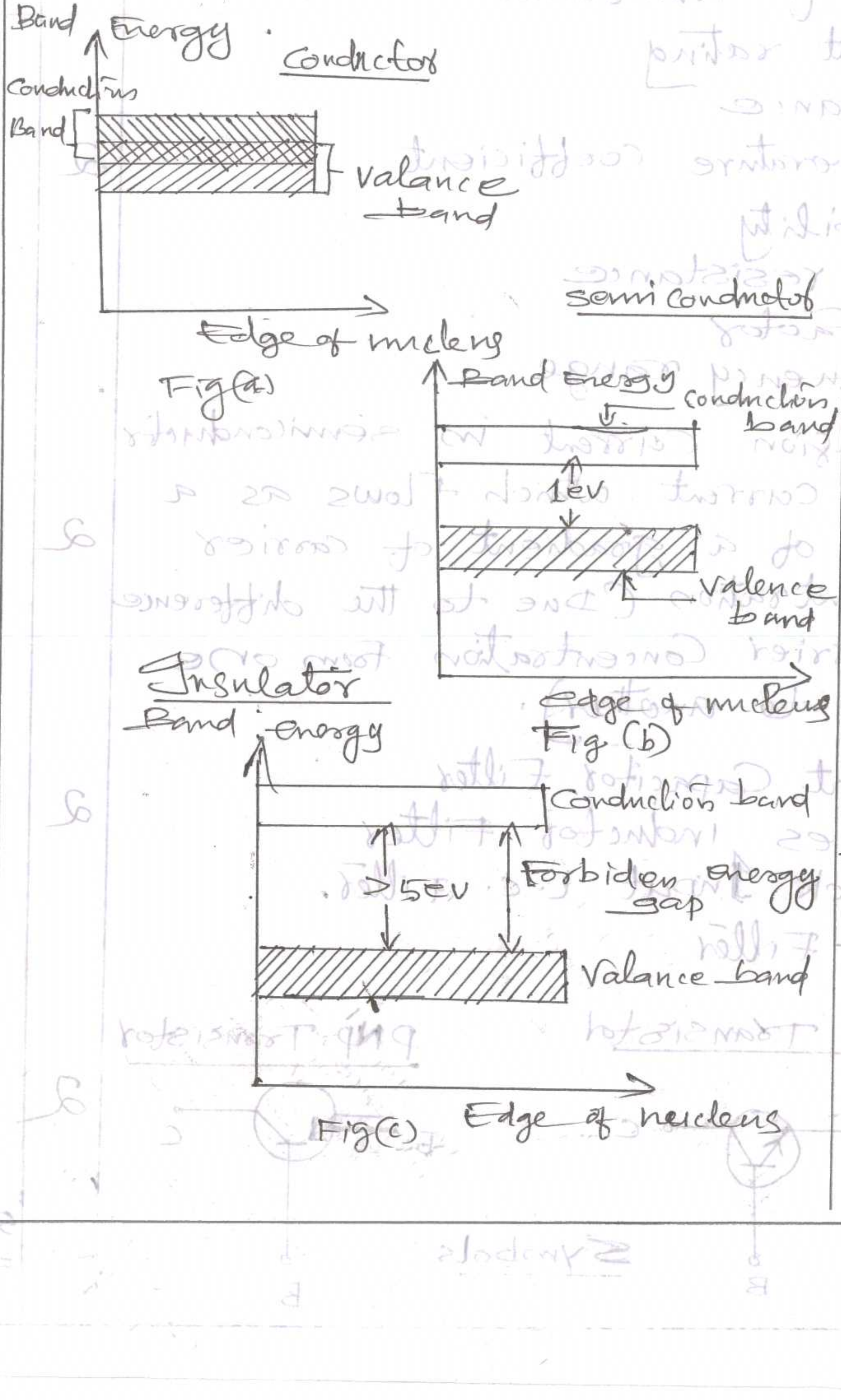
NPN Transistor



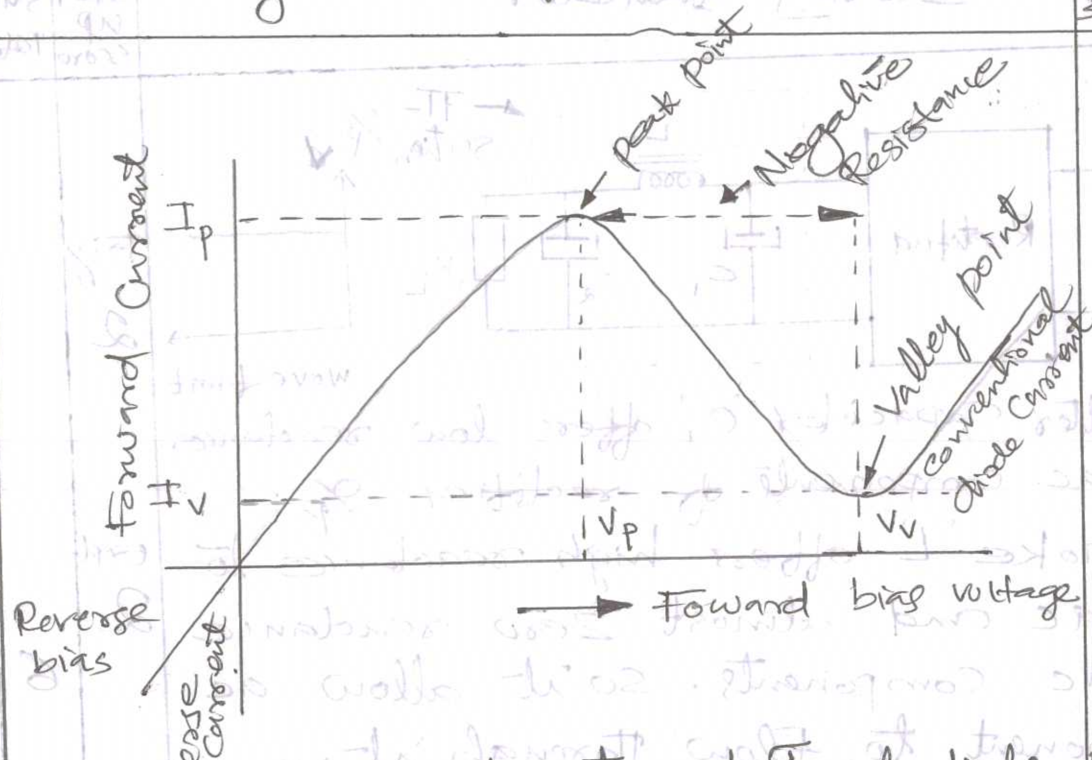
PNP Transistor



Symbols

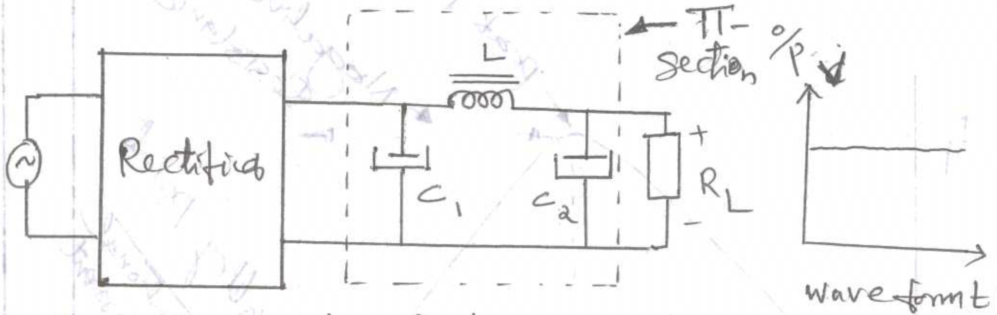
Qst No:	Scoring Indicator PART-B	Split up score	Sub Total	Total
II 1.	Value of Capacitance Working Voltage Tolerance Stability Leakage current Temperature coefficient	6x1 =6	6	
2.		3 Expl: 3	6	

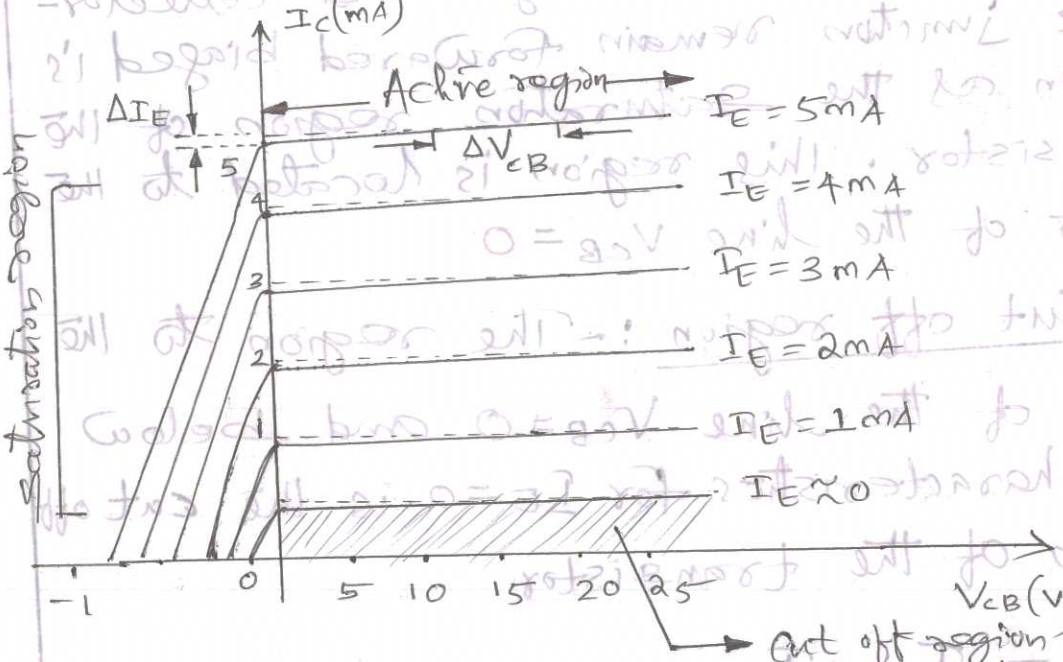
Qst. No.	Scoring Indicator	Split up score	Sub total	Total
3.				



VI characteristics of Tunnel diode — Fig 3+

Tunnel diode is a heavily doped junction diode. It has a negative resistance region at low forward bias. It works on the principle of tunneling which is obtained by creating an extremely thin depletion layer. It is also called ESAKI diode. The width of the junction barriers varies inversely as the squre root of the impurity concentration. For Such thin Potential energy barriers the electron will penetrate through the Junction rather than surrounding them. This quantum mechanical behaviour is refered to as tunneling and hence these high impurity density PN Junction device are called tunnel diodes. — Expl 3 — 6

Qst No	Scoring Indicator	SPLIT UP Score	Sub Total	Total
4.		fig 2		
	① Filter Capacitor 'C_1' offers low reactance to ac components of rectifier o/p. ② Choke 'L' offers high reactance to the ac and almost zero reactance to dc components. so it allow dc component to flow through it. ③ Filter Capacitor C_2 bypass the ac Component which the choke has faild to block. So pure dc appears across 'R_L'	Expl 2	6	
	<u>advantages</u>: 1. Ripple less output. 2. More output voltage. 3. Suitable to be used with both half wave and Full wave Rectifier	adv 2		
5.	TUF is defined as the ratio of d.c Output power to a.c. power supplied to it by the secondary winding. ie, $TUF = \frac{P_{dc}}{P_{ac}}$ (rated)	2	6	
	The ratio of r.m.s value of a.c component to the d.c. component in the rectifier output is known as ripple factor ie, Ripple factor = $\frac{\text{r.m.s. Value of a.c. Component}}{\text{Value of d.c. component}}$ $= \frac{I_{ac}}{I_{dc}}$	2		

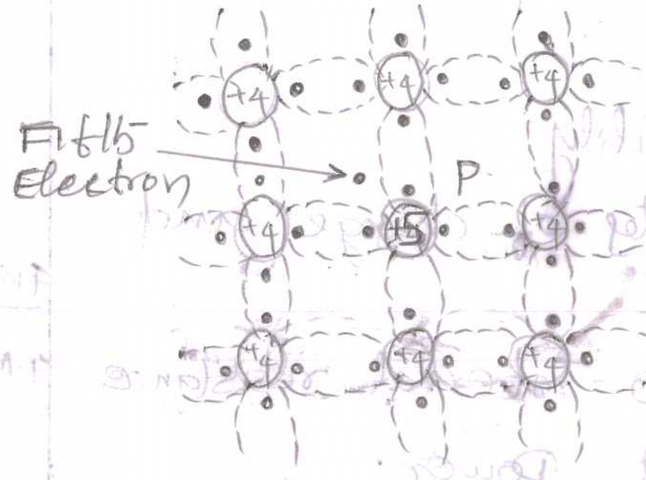
Qst. No:	Scoring indicators	Split up score	Sub-Total	Total
	The ratio of d.c. power output to the applied input a.c. power is known as rectifier efficiency ie, Rectifier efficiency, $\eta = \frac{\text{d.c. power O/P}}{\text{input ac power}}$	2		
6.		Fig 2		
	The plot of the collector current I_C as a function of the collector to base voltage V_{CB} with the emitter current I_E as a parameter is refered to as CB output characteristics The output characteristics can be divided into three distint regions * Active region * Saturation region * Cut off region	Rgn: 1		

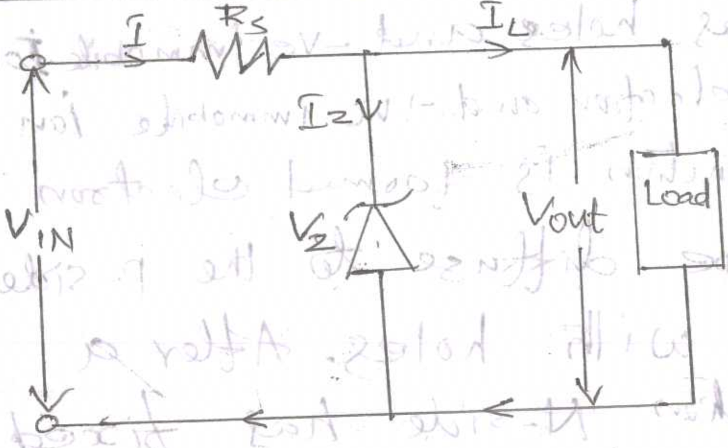
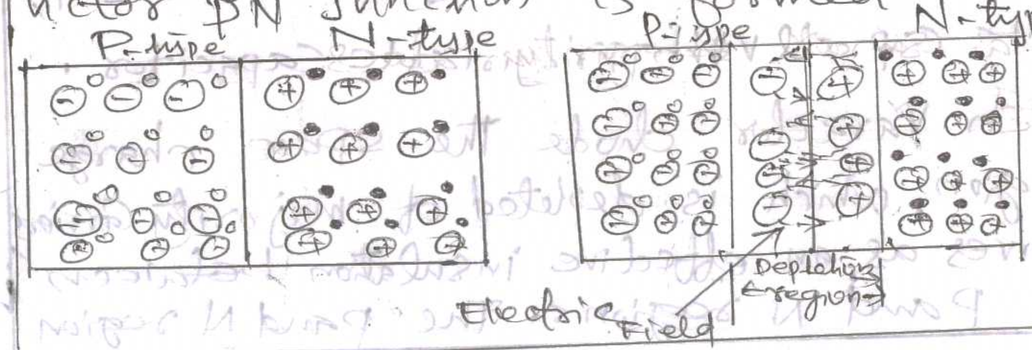
Qst No	Scoring Indicators	Split up Score	Sub Total
	(i) Active region :- This is the Normal operating region of a transistor when used as amplifier. In this region the emitter Junction will be in forward bias and collector junction will be in reverse bias		
	(ii) Saturation region :- The region, where both the emitter-base and collector-base junction remain forwared biased is known as the saturation region of the transistor. This region is located to the Left of the line $V_{CB}=0$	Expl 3	6
	(iii) Cut off region :- The region to the right of the line $V_{CB}=0$ and below the characteristic for $I_E=0$ is the cut off region of the transistor		
7	$I_E = I_B + I_C$ —— (1) Since $I_C/I_B = \beta$, $I_C/I_E = \alpha$ add Δ in —— (1) $\Delta I_E = \Delta I_B + \Delta I_C$ $\Delta I_B = \Delta I_E - \Delta I_C$ $\therefore \beta = \dfrac{\Delta I_C}{\Delta I_E - \Delta I_C}$ divide by ΔI_E		

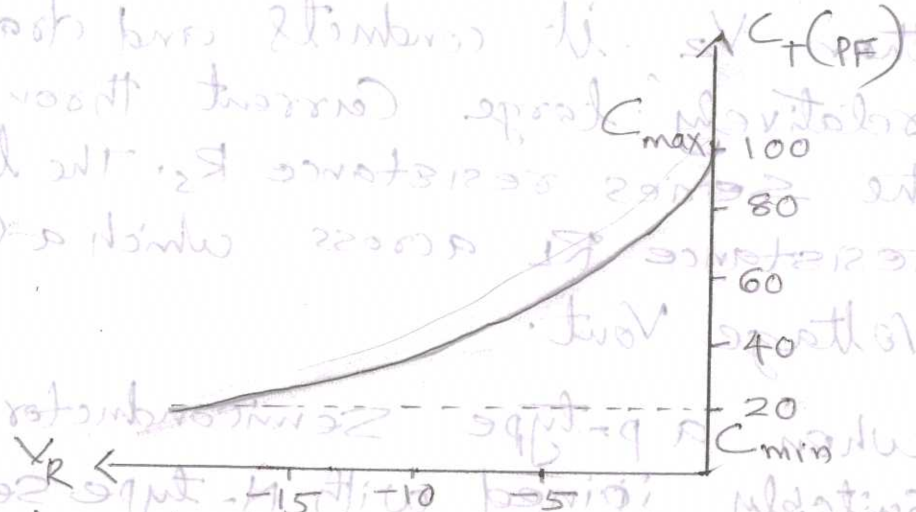
Qst No	Scoring Indicators	Split up Score	Sub Total
	$$\beta = \frac{\frac{\Delta I_C}{\Delta I_E}}{\frac{\Delta I_E}{\Delta I_E} - \frac{\Delta I_C}{\Delta I_E}} = \frac{\alpha}{1-\alpha}$$		
	$$\boxed{\beta = \frac{\alpha}{1-\alpha}}$$	3	6
	$$\beta(1-\alpha) = \alpha$$ $$\beta - \alpha\beta = \alpha$$ $$\beta = \alpha + \alpha\beta = \alpha(1+\beta)$$		
	$$\boxed{\alpha = \frac{\beta}{1+\beta}}$$	3	
	PART- C Unit-I		
III (a)	Areas of Application of electronics:- ① Entertainment & Communication ② Defence Application ③ Industrial Application ④ Medical Science ⑤ Instrumentation	List 3 Mark; Expl: 4 Mark	7
(b)	1. Potentio meter 2- Reheostate 3 - Preset	Type 3 Mark	

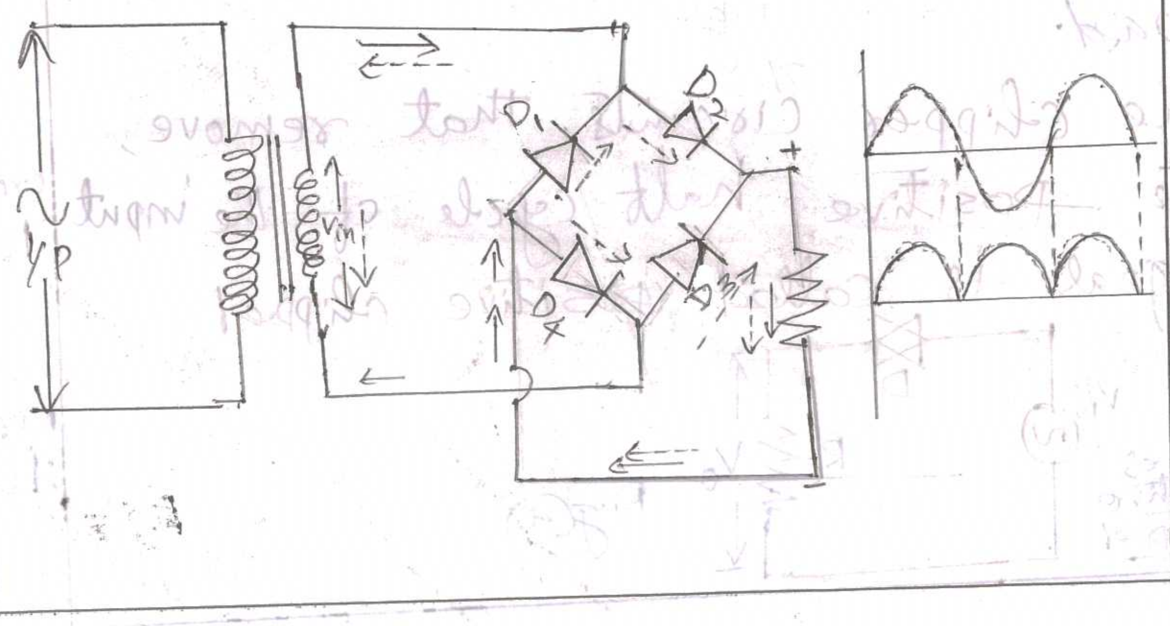
Scoring Indicators	Split up Score	Sub Total
Applications of Variable Resistors ① Potentiometer :- Used in circuits with smaller ~~power~~ demand such as volume control in audio equipments, brightness and contrast control in TV preset potentiometer in measuring instruments. ② Wire Wound Resistor :- As potential divider in several equipment, such as balance controller, small motor controller, servo controller, Television receiver, analog computers. ③ Rheostat :- To control voltage and current in AC and DC circuits such as temperature control, welding control, light dimmer, motor speed control.	Expl. 5	8
IV a → It is an electrochemical double layer capacitor (EDLC) → It has an unusually high energy density → It stores energy electrostatically by polarizing an electrolytic solution → No chemical reactions involved in its energy storage mechanism → This mechanism is highly reversible allowing the ultra capacitor to be charged and discharged million of ~~time~~	Expl. 5 mark	

Qst No	Scoring indicators	Split up Score	Total
	Advantages a) long life b) Good revesibility c) Very high rates of charge and discharge d) Extremely low internal resistance e) Hight output power f) improved safty g) Rapid charging h) Simple charging Methode	4 points 4 Mark	9 Mark
IV b	1) Iron Core inductors 2) Ferrite core inductors 3) powder core inductor 4) Air core inductor	4 Type 4 Mark	
	Application → Filtering the ripples in Power Supplies → AF choke to block AF signal in various circuits → RF choke Provide high impedance to RF	2 points 2 Mark	6

Qst No	Scoring Indicators	Split up Score	Total
V a		Fig: 5 Mark	
	N-type Semiconductor is an extrinsic semiconductor doped with a pentavalent impurity like, Antimony, phosphorus, Arsenic etc.	1 mark	
	Figer shows the Crystal structure obtained when a silicon is doped with a pentavalent impurity. Here four of the five valance electrons of impurity atom form covalent bonds with the surronding four silicon atoms and the fifth will be nominally un bounded and is free to move about the crystal. This electron can be easily excited from the valence band to the conduction band by applying negligible amount of Energy.	Expl: 4 Mark	

Qst No	Scoring Indicators	Split up Score	Total
V b.		Fig: 3	
	Zener diode as voltage Regulator A zener diode, when working in the break down region, can serve as a voltage regulator. In Fig. V_{IN} is the input d.c voltage whose variations are to be regulated. The zener diode is reverse connected across V_{IN}. when p.d. across the diode is greater than V_Z it conducts and draws relatively large current through the series resistance R_S. The load resistance R_L across which a constant voltage Vout.	Exp: 3	6 mark
VI a.	when a p-type semiconductor is suitably joined with N-type semiconductor PN junction is formed. 	Fig 5 mark	

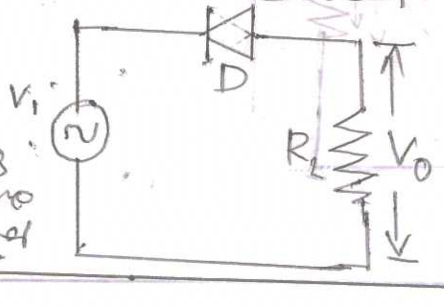
Qst No	Scoring Indicators	Split up Score	Total
	P-region has holes and -ve immobile ion. N-region has electron and +ve immobile ion. When PN junction is formed electron in the N-type diffuse to the p-side and combine with holes. After a few recombination N-side has fixed +ve charges and p-side fixed -ve charges. Thus a barrier is set up which prevents further movement of charge carriers. This region is called depletion region or space charge region.	Expl: 4 m	4 Mark
VI b.		Fig 2	
	Varactor diode is also called Varicap, Volta cap or voltage variable capacitor.		
	In Varactor diode the space charge region, which is depleted of majority carriers serves as an effective insulation between the P and N regions. The p and N region		

Qst No	Scoring Indicators	Split up score	Total
	act as the plate of the Capacitor while the Space-charge region act as the insulating dielectric. Fig shows the variation of Capacitance in a varactor diode with reverse bias Voltage. It indicates that the Capacitance decreases with increase in reverse bias, this is because of the increase in the width of the depletion layer and hence the distance between the plates. The Capacitance offered by PN Junction is given by the relation $C = \varepsilon A / W$ where, C is the Capacitance, A is the area of junction, W is the width of depletion region	Expl: 4	6
VII (a)		Diagram 4 mark, Expl: 3 mark, o/p wave 2 mark	9

Scoring Indicators	Split up Score	Total

During the +ve half cycle of the secondary voltage, diodes D_2 and D_4 are conducting and diodes D_1 and D_3 are non conducting. Therefor current flows through the secondary winding, diode D_2, load resistor R_L and diode D_4, as hown in figer. During -ve half-cycles of the secondary voltage, diodes D_1 and D_3 conducts, and the diodes D_2 and D_4 do not conduct. The current therefore flows through the secondary winding, diode D_1 load resistor R_L and diode D_3. In both cases, the current passes through the load resistor in the same direction. Therefore, a fluctuating unidirectional voltage is developed across the load.

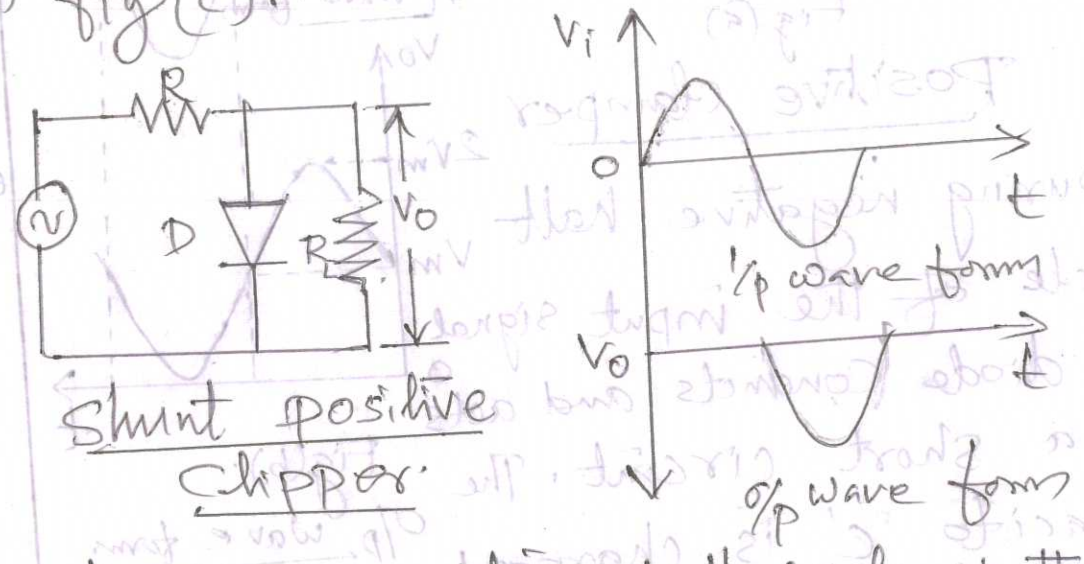
VII b) The clipper circuits that remove, the positive half cycle of the input signal is called positive clipper



Series positive Chipper

Fig(a)

Q.No	Scoring Indicators	Split up Score	Total
	Series positive clipper During the positive half cycle of the input signal the diode doesn't conduct and act as an open circuit. Hence the positive half cycle of the input signal doesn't appears at the output. During -ve half cycle of the input voltage the diode conducts and act as a short circuit. Thus only -ve half cycle will appear at the output as shown in fig (c).	Fig 3 Expl 3	6



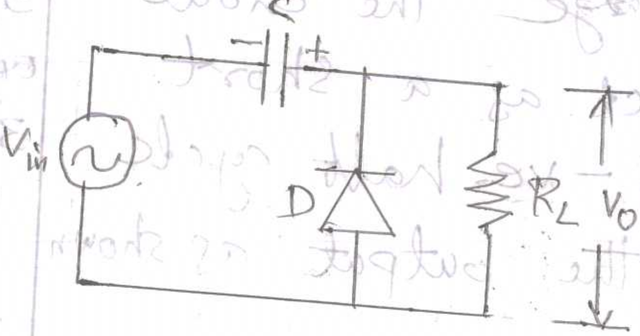
Shunt positive clipper

During positive half cycle of the input signal the diode conducts and acts as a short circuit. Hence there will be no voltage drop across diode. During -ve half cycle of the input voltage, the diode doesnt

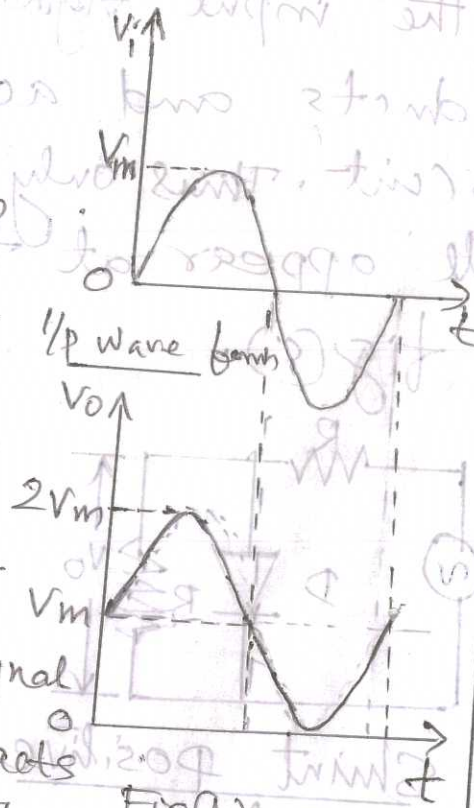
Qn No	Scoring Indicators	SPLIT UP Score	Total

Conduct and act as an open circuit. Thus the -ve half cycle of the input voltage appears at the output as shown in fig(c).

VIII a) clamper circuits simply clamp (i.e. shift up or down) the input signal to different d.c. level.



Fig(a)



Figs: 2 mark

Wave form 2 — 9

Fig(b)

O/p wave form

Positive clamper

During negative half cycle of the input signal the diode conducts and acts as a short circuit. The capacitor 'C' is charged to V_m at the ~~peak~~ -ve of the input signal with the polarity as marked.

Expl: 5

During +ve half cycle of the input signal capacitor acts like a battery of 'V_m' volts, which adds to the

Qst No.	Scoring Indicators	Split up Score	Total

positive half cycle: During +ve half cycle of the input signal, the diode is reverse biased and acts as an open circuit.

The output voltage across the load resistor R_L will be = $V_m + V_m = 2V_m$

VIII b

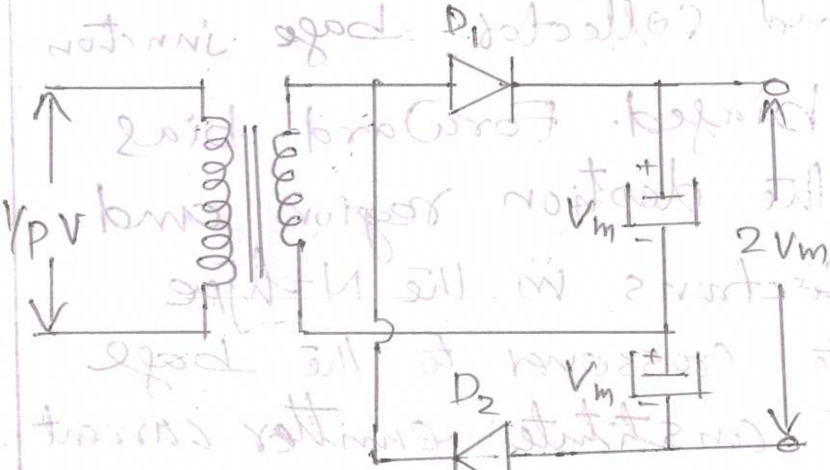


Fig 3 mark

During the positive half cycle of the secondary voltage diode D_1 conducts charging the capacitor C_1 to the peak voltage V_m. At this time diode D_2 is non conducting. During -ve half cycle diode D_2 conducts, charging the capacitor C_2 to V_m with polarity marked while diode D_1 is non conducting. Since both capacitor C_1 and C_2 in series, the final output voltage is aproximately $2V_m$

Expl: 3

6 m

Qst No	Scoring Indicators	Split up Score	Total

IX a)

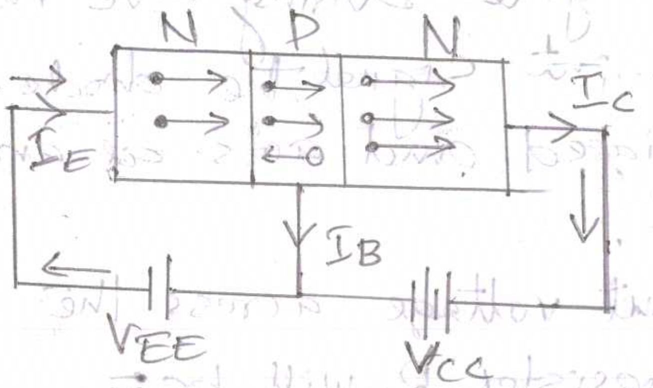


Fig 3

6

Emitter base junction is forward biased and collector base junction reverse biased. Forward bias reduces the deption region and causes electrons in the N-type emitter to crossover to the base region to constitute emitter current I_E. As base is lightly doped and thin, no of holes in the base is very small. Few electrons combine with holes at the base and constitute the base current I_B. When collector is reverse biased, the injected majority carrier will appear as minority carriers. To the minority carriers reverse bias appears as forward bias and easily cross to the collector region to constitute collector current I_C.

Expl 3

Qst No	Scoring Indicators	SPLIT UP SCOR	Total
IX b			

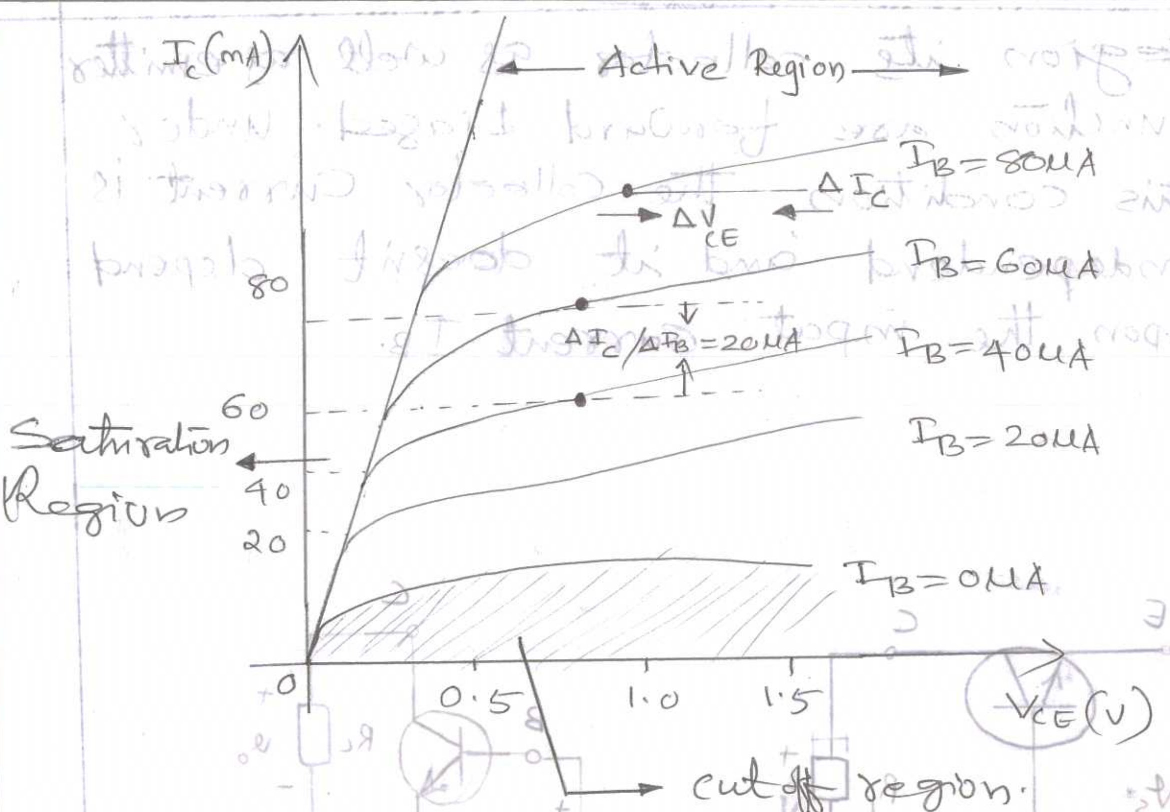


Fig 4

Here collector current I_C is plotted against the collector to emitter voltage V_{CE} with base current I_B as parameter. 9

Exp 5

Active Region

In this region the emitter junction is in forwared bias state and collector junction is in reverse bias. In the fig, the active region is above the curve for $I_B = 0$.

Cut off region

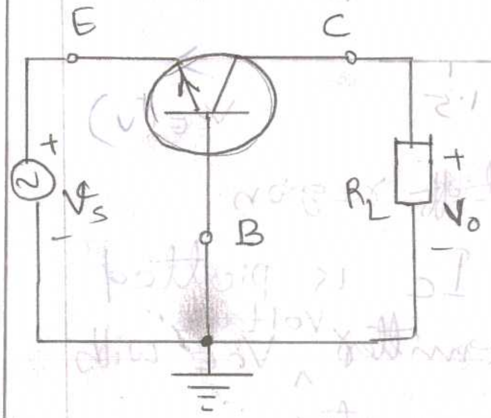
In this region both junctions of the transistor are reverse biased. It is the region to the right of the line $V_{CE} = 0$ and below the curve $I_B = 0$

Saturation region

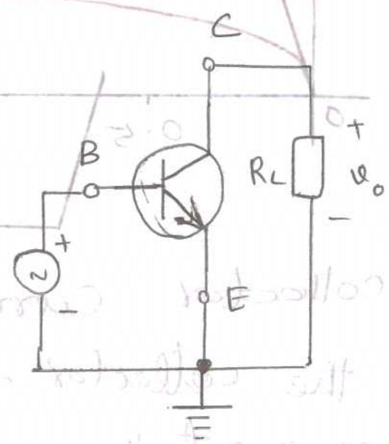
When a transistor operates in this

Qst No	Scoring Indicators	SPLIT UP Score	Total
	region its collector as well as emitter junction are forward biased. under this condition, the collector current is independend and it doesn't depend upon the input current I_B.		

X/a

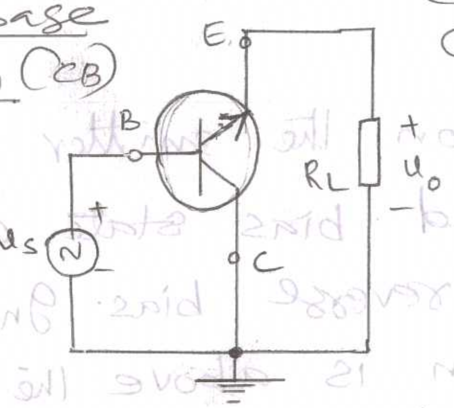


Common - Base Configuration (CB)



Common-Emitter Configuration

Fig 3



Common - Collector Configuration

Qest No	Scoring Indicators	Split up Score	Total

Comparision of Transistor Configuration.

characteristics	CB	CE	CC
* I/p resistance	Low (100 Ω)	Moderate (750 Ω)	high (750 KΩ)
* O/p resistance	High (500 KΩ)	Moderate (45 KΩ)	Low (50 Ω)
* current gain	∠1 (0.98)	High (400)	High (400)
* Voltage gain	About 150	About 500	∠1
* Leakage Current	Less (5 μA for Ge and 1 μA for si)	More (500 μA for Ge and 20 μA for si)	more (500 μA for Ge 20 μA fo si)
* Application	HF circuit	AF circuit	For impedance matching

Comp: 6 | 9

X b. The input resistance of a Transistor Can be found from the slop of the input characteristic curve. Here the dynamic input resistance is the ratio of change in emitter base voltage to the resulting change in emitter current at constant Collector-base voltage. 3

ie $r_i = \Delta V_{EB} / \Delta I_E \Big|_{V_{CB}}$ constant.

The typical value of input dynamic resistance falls within 20 ohms to 100 ohms 6

The dynamic output resistance is the ratio of change in collector to base voltage to the corresponding change in collector current at constant emitter current 3

ie $r_o = \Delta V_{CB} / \Delta I_C \Big|_{I_E}$ constant

Qest No	Scoring Indicators	Split up Score	Total
	Since the output characteristics curve are very flat, change in collector current correspondingly to the change in collector - base voltage is very little. Therefore the output resistance of CB configuration is very high of the order of megha ohms.		