Department of Electrical Engineering
Midterm Exam
Date: 29/09/2020

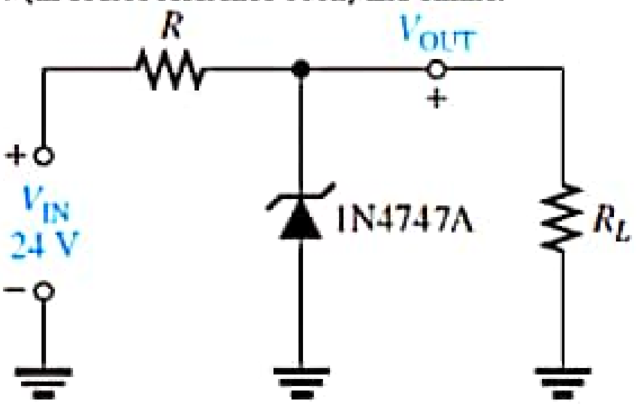
Course Details

Course Title: Electronic Devices and Circuits | **Module:** ______
Instructor: ______ | **Total Marks:** 50

Student Details

Name: ______ | **Student ID:** ______

Student Signature: ______

Q1.			The 1N4747A zener used in the regulator circuit of Figure 1 is a 15 V diode, determine the following: (a) Determine V_{OUT} at I_{ZK} and at I_{ZM}. (b) Calculate the value of R that should be used. (c) Determine the minimum value of R_L that can be used. The electrical characteristics and values of V_Z, I_Z, IZ_K, Z_Z can be found in diode datasheet Fig 3-7 (in course reference book) and online.  **Figure 1**	Marks 10 CLO 02
Q2.			Determine I_B, I_C, I_E, V_{BE}, V_{CE} and V_{CB} in the circuit shown in Figure 2.	Marks 05 CLO 02

Yasir Ahmad 13788

13788 Yasir Ahmad

CQ1

Ans

The 1N4747 Zener Diode used The regulation ckt in figure is 20V.

$V_Z = 20V$ $I_Z = 12.5mA$

$I_{ZK} = 0.25mA$ $Z_Z = 22\Omega$.

(a) for I_{ZK}

$V_{out} = V_Z - \Delta I_Z \cdot I_Z$

$= 20V - (I_Z - I_{ZK}) Z_Z$

$= 20V - (12.5mA - 0.25mA) \cdot 22\Omega$

$= 20V - (12.25mA)\ 22\Omega$

$= 20V - 0.267V$

$V_{out} = 19.73V.$

Calculate The Zener Diode maximum current the power dissipation in 1w

P#1

$I_{ZM} = P_{D Max} / V_Z = 1W / 20V = 50mA$

For I_{ZM}

$V_{out} = V_Z + \Delta I_Z Z_Z$

$= 20 V + (I_{ZM} - I_Z) Z_Z$

$= 20V + (50mA - 12.5mA) 22\Omega$

$= 20V + (37.5mA) 22$

$= 20V + 0.825$

$V_{out} = 20.825V.$

(b) Calculate the value of R for maximum zener current when there is no load as shown in figure

$$R = \frac{V_{in} - V_{out}}{I_{ZM}}$$

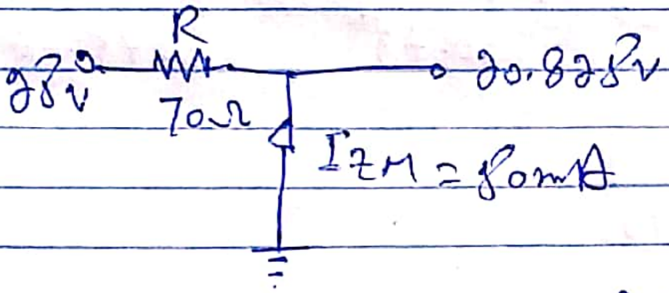
$$= \frac{24V - 20.825V}{50mA}$$

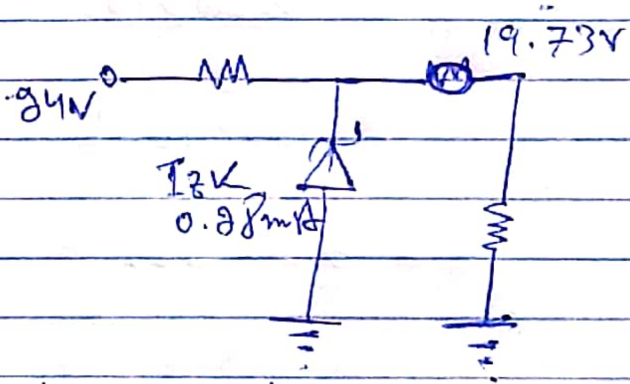
$= 63.5\Omega$

P#2

2

R = 70 Ω (Nearest largest standard)





(C) for Maximum load Resistance (Maximum Current)

The Zener diode Current minimum

(I_{ZK} = 0.28)

$$I_T = \frac{V_{IN} - V_{out}}{R} = \frac{24V - 19.73V}{70\Omega}$$

$$= 0.061A$$

$$I_T = 61\ mA$$

$$I_L = I_T - I_{ZK}$$

$$= 61 - 0.28mA$$

P#3

$I_L = 60.78 mA$

$R_L = V_{out} / I_L = 19.3 / 60.78 = 19.3 / 60.78 mA$

$= 19.3 / 0.0678$

$= 285.92 \Omega$

$R_L = 286 \Omega$

P#4

Q9

$I_B = ?$

$I_C = ?$

$I_E = ?$

$V_{BE} = ?$

$V_{CE} = ?$

$V_{CB} = ?$

solution.

$V_{BE} = 0.7V.$

$I_B = \frac{V_{BB} - V_{BE}}{R_B} = \frac{5V - 0.7V}{3.9K\Omega} = \boxed{1102\mu A}$

$I_C = \beta_{DC} \cdot I_B = (150)(1102) = \boxed{165.3mA}$

$I_E = I_C + I_B = 165.3mA + 1102\mu A$

$I_E \boxed{= 166.4mA}$

P#4

①

Solve for Vcc and VcB

$V_{CE} = V_{CC} - I_C R_C = 15V (165.3mA)(180\Omega)$

$= 15V - 29.V$

$= -14.7V$ Ans

$V_{CB} = V_{CE} - V_{BE} = -14.7V - 0.7V$

$= -15.4V$ Ans

Since the collector is at ~~Higher~~ Lower voltage then the base, collector-base junction is ~~reverse~~ Forword biased.

2

α ———— α ———— α ———— α ———— α

P#6

CO3

Bipolar Junction Transistor.

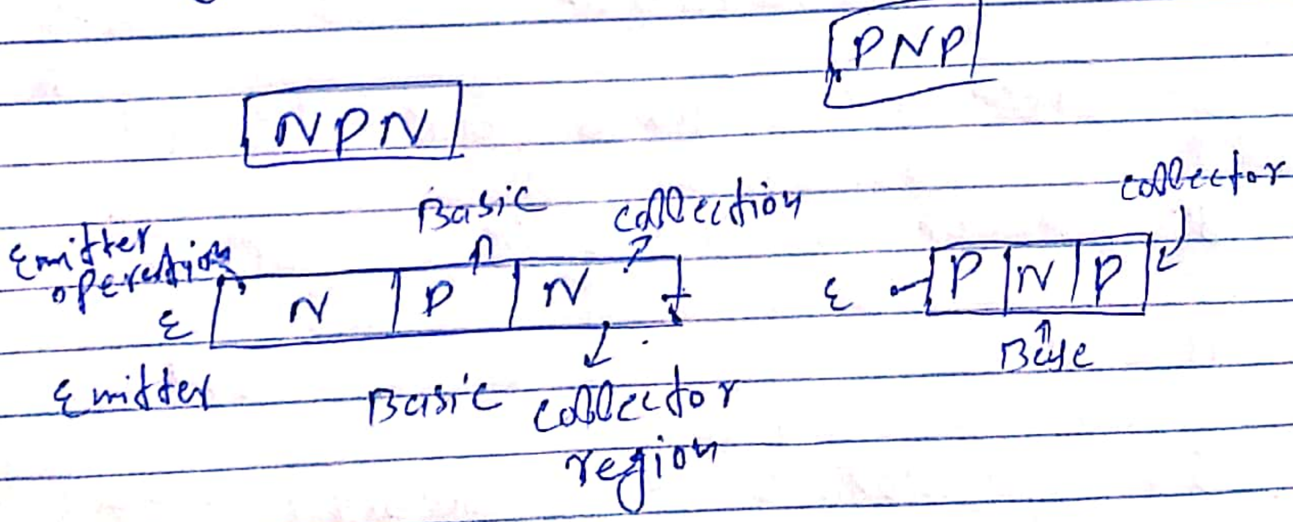
Ans

BJT

BJT Transistor as invented in Dec 1947 at bell labs at USA.

⇒ BJT is a three Terminal device and it is used in Amplication of weak signal used in switching operation.

→ physical structure



P#7

(1)

⇒ 2 Junction (N)

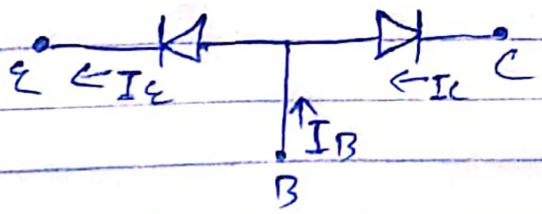
⇒ 1 Junction (P)

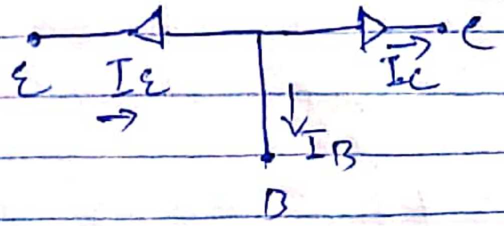
⇒ J_1 → emitter-base

⇒ J_2 → Collector-base

⇒ There is depletion region at J1

⇒ There is depletion region at J2



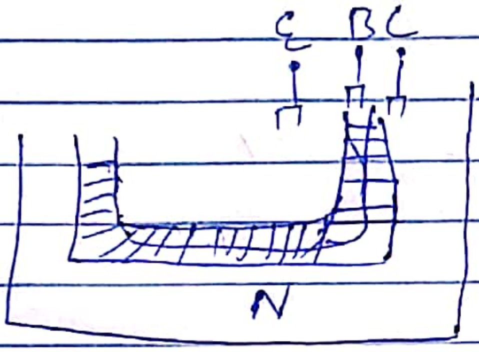


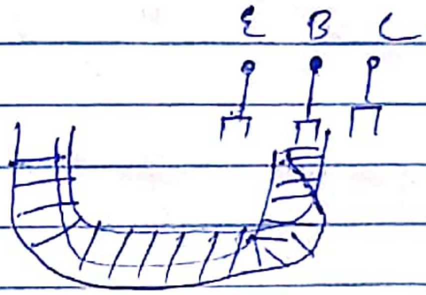
2

P#8

Cross Section view

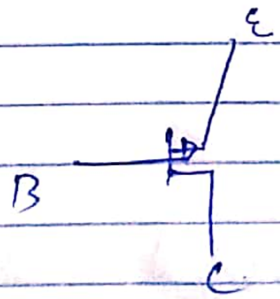
NPN



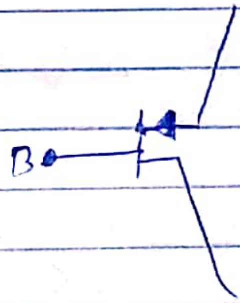


Symbol

NPN



PNP



increase of NPN the
will more from B→E

P#9

Now using The following relationship.

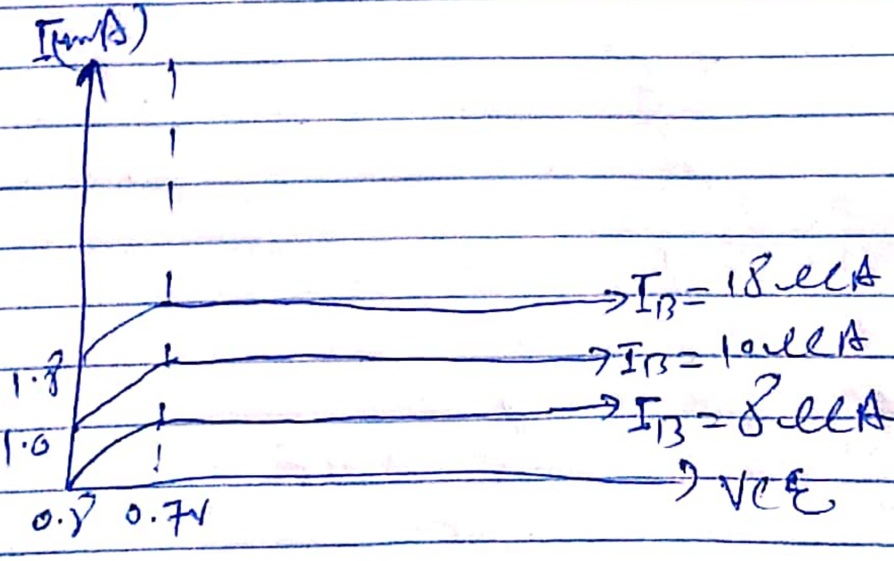
$I_C = \beta_{DC} \cdot I_B$

value of the I_C are Calculated and tabulated in below Table

The resulting curves are

Table

I_B	I_C
8 μA	0.8 mA
10 μA	1.0 mA
18 μA	1.8 mA



P#10

CO4

Ans

Transistor Fully ON (ON)

Transistor Fully OFF (OFF)

Input and base are at 0V (OFF)

Collector current $I_c = 0$ (OFF)

$V_{CE} = V_{CC}$ (OFF)

BE Junction is reverse bias (OFF)

BC Junction is forword bias (OFF)

Maximum of saturation current I_c flows

BE Junction is forword bias (ON)

BC Junction is Forword bas (ON)

$V_{CE} = 0V$ (ON)

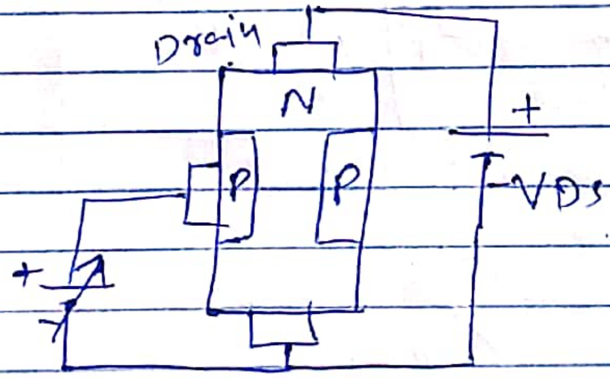
BE Junction is less than 0.7V (OFF)

(ON)

Q8
Ans

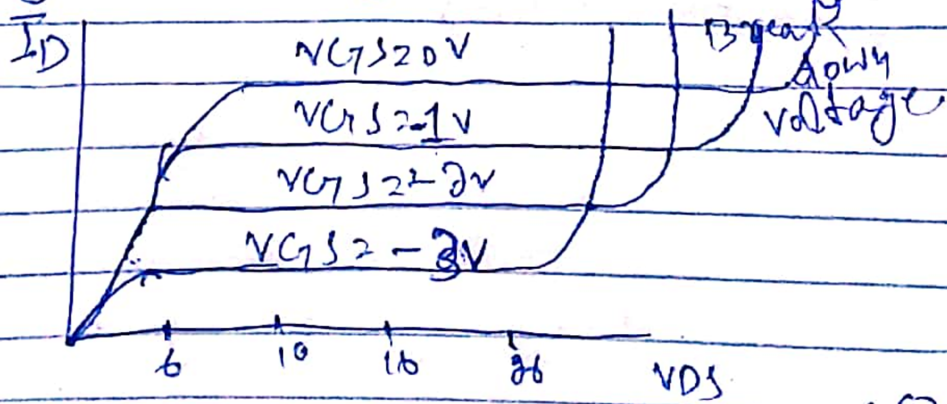
JFET is a Type of Junction field Effect Transistor.

which is voltage Controlled device as differ from ~~Controlled~~ BJT which is ~~Correct~~ Current Controlled

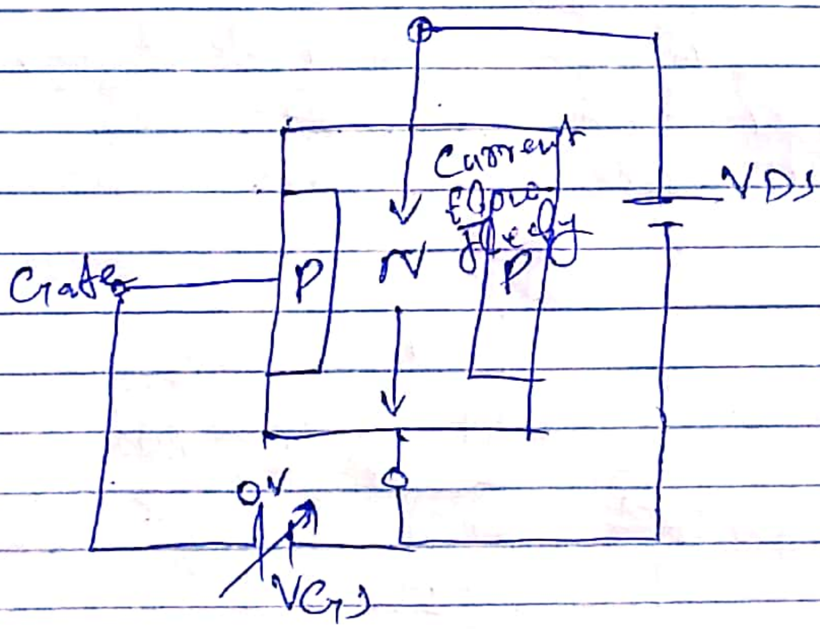


Actually in FET the Drain to Source current is controlled by the width of the channel the Electric field is produced by the

~~electric~~ gate to ~~g~~ Source voltage.

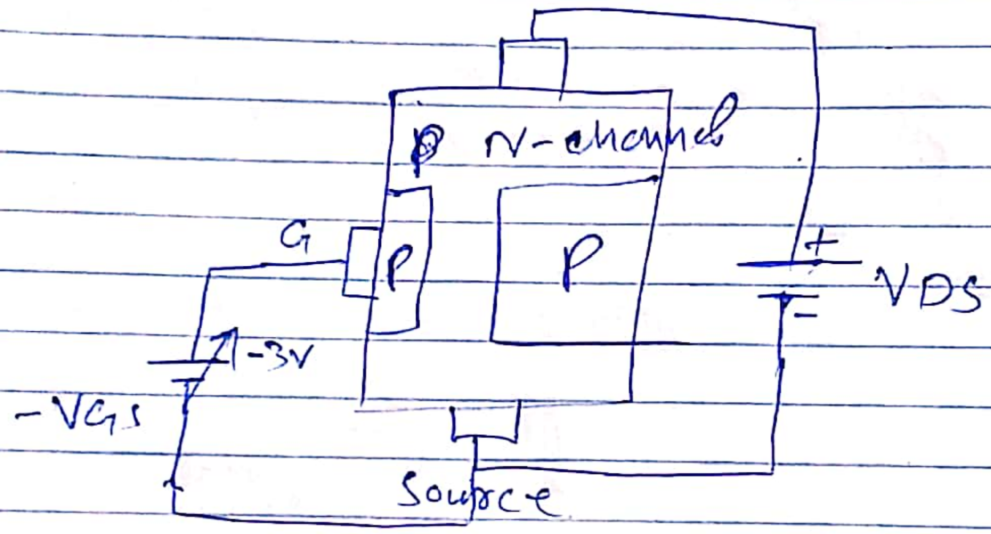


so if we see to the graph with the no voltage Applied to the gate the current flows. Frely.



The channel are under and Drain Current move Frely

if we move VGS to negetive value the channel width start to decreases and Current Cannot moves.



So VGS is more negetive so no current flows and this effects is called pinch off region no current or less current flows.

13788 Yasir Ahmad

Q6

Ans

(a) Find VCE = ?

when Vin = 0V

(b) I_B = ? B_{DC} = 125, VCE = 0.4V

solution.

when Vin 0V so Transistor is in Cutt OFF mode and

$V_{CE} = V_{CC} = 10V$

so $V_{CE} = 10V$.

(b). $I_C(sat) = \frac{V_{CC}}{R_C} = \frac{10V}{1k\Omega} = 0.01A = 10mA$

$I_B(min) = \frac{I_{CC}(sat)}{\beta_{DC}} = \frac{10mA}{128} = \frac{10 \times 10^{-3}}{128}$

$= 0.00008$

$I_B(min) = 80 \mu A$ P#

Ans

Scanned with CamScanner