GOVT. WOMEN ENGINEERING COLLEGE AJMER

MODEL ANSWER PAPER 2017-2018

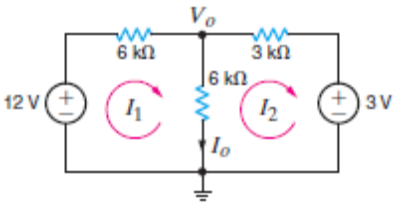
B. TECH (II SEM)

SUB: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Section-A)

Max. Marks: 20 **Time: 1Hr**

Q 1. Attempt all the questions. Each question carries three marks. **09**

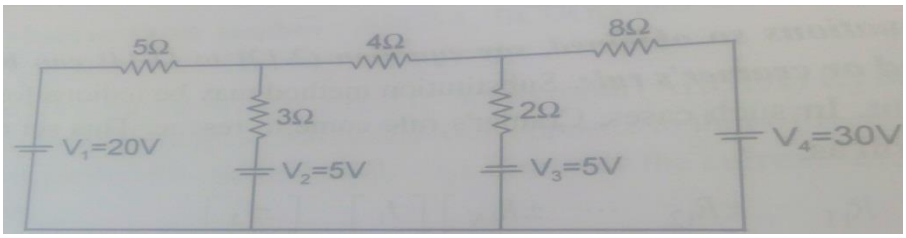
A. Find the current I_o in below network



B. State and explain Norton's theorem.

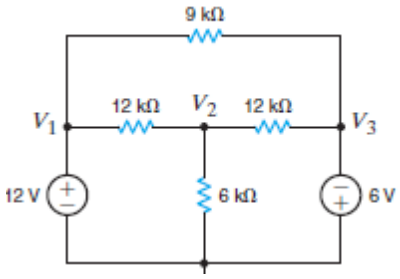
C. Differentiate between PNP and NPN transistor .

Q.2 For the circuit shown in Fig 1, determine the current supplied by 30V battery.



OR

Consider the circuit shown below and determine node voltages V_2 and branch currents in 9 kΩ resistor. 05



Q.3 Draw a sketch showing of an NPN transistor and explain the working in details

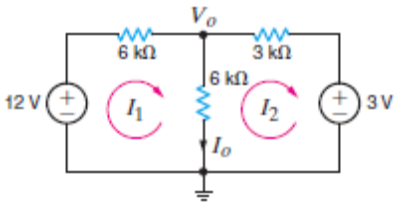
OR

Explain with a neat diagram, the working of a half wave rectifier?

Answer:

Q 1

A. Find the current I_o in below network



Apply KCL on top center node

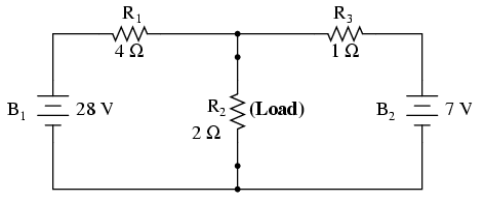
$$(Vo - 12)/6 + Vo/6 + (Vo - 3)\,3 = 0$$

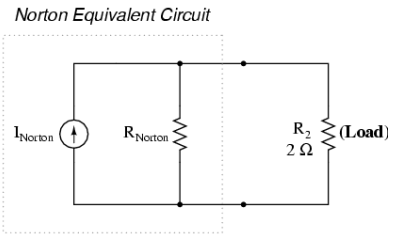
$$Vo = 9/2 \text{ V}$$

and then

$$I_o = Vo/6 = 3/4 \text{ mA}$$

B. Norton's Theorem states that it is possible to simplify any linear circuit, no matter how complex, to an equivalent circuit with just a single current source and parallel resistance connected to a load. Contrasting our original example circuit against the Norton equivalent: it looks something like this:

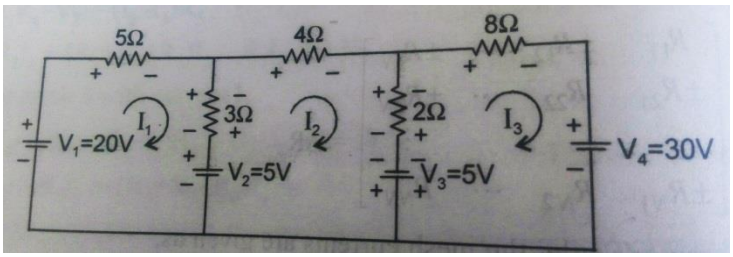




C.

NPN and PNP transistors are bipolar junction transistors, and it is a basic electrical and electronic component which is used to build many electrical and electronic projects. The operation of these transistors involves both electrons and holes. The PNP and NPN transistors allow current amplification. In PNP transistors, majority charge carriers are holes, whereas in NPN transistors, electrons are the majority charge carriers. But, field effect transistors have only one type of charge carrier. The main difference between the NPN and PNP transistor is, an NPN transistor turns on when the current flows through the base of the transistor. In this type of transistor, the current flows from the collector (C) to the emitter (E). A PNP transistor turns ON, when there is no current at the base of the transistor. In this transistor, the current flows from the emitter (E) to the collector (C).Thus, knowing this, a PNP transistor turns ON by a low signal (ground), where NPN transistor turns ON by a high signal (current).

Q.2 The above circuit has three meshes assuming the current in each mesh to be as shown in below Fig.



Now writing the mesh equations
KVL equation in mesh 1

$20-5I_1-3(I_1- I_2)-5=0$
$8\ I_1-3\ I_2=15$ ……(i)

KVL equation in mesh 2

$5-3(I_2- I_1)-4I_2-2(I_2- I_3)+5 =0$
$-3I_1 + 9I_2-2I_3 =10$ ……(ii)

KVL equation in mesh 3

$-5-2(I_3- I_2)-8I_3-30 =0$
$2I_2 -10I_3 =35$ ……(iii)

So according to Cramer's rule

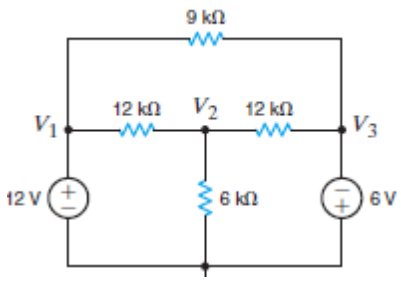
$$\begin{bmatrix} 8 & -3 & 0 \\ -3 & 9 & -2 \\ 0 & 2 & -10 \end{bmatrix} \begin{bmatrix} I1 \\ I2 \\ I3 \end{bmatrix} = \begin{bmatrix} 15 \\ 10 \\ 35 \end{bmatrix}$$

The current supplied by 30 V battery is I_3

$$I_3 = \frac{\begin{bmatrix} 8 & -3 & 15 \\ -3 & 9 & 10 \\ 0 & 2 & 35 \end{bmatrix}}{\begin{bmatrix} 8 & -3 & 0 \\ -3 & 9 & -2 \\ 0 & 2 & -10 \end{bmatrix}} = 8(315-20)+3(-105)+15(-6)\ \ /8(-90+4)+3(30)$$

I_3 = -3.26 Amp.

OR



This network has three nodes with labelled node voltages.

Current through the 9 kΩ resistor

(12 - (-6)) / 9 = 2 mA is from left to right.

Applying KCL at center node

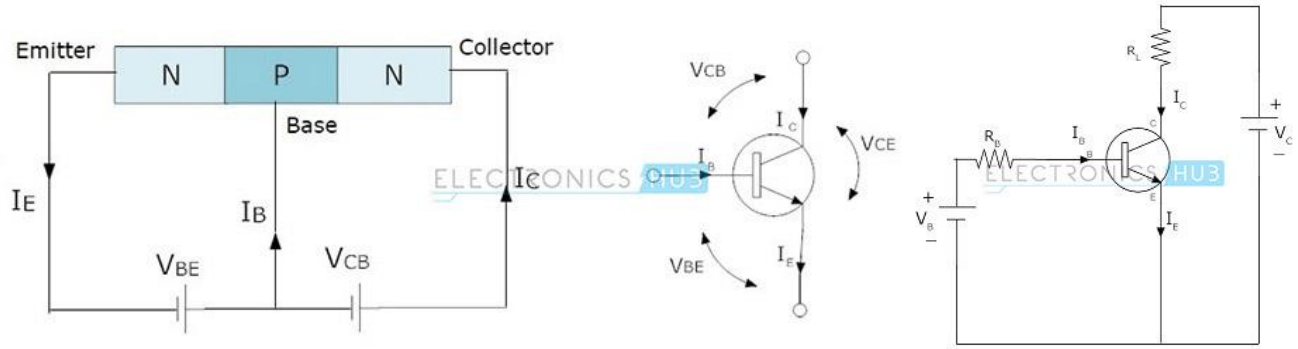
$(V_2 - V_1)/12 + (V_2 - 0)/6 + (V_2 - V_3)/12 = 0$

$(V_2 - 12)/12 + (V_2 - 0)/6 + (V_2 - (-6)/12 = 0$

$V_2 = 3/2$ V

Q.3

NPN transistor is one of the Bipolar Junction Transistor types. The NPN transistor consists of two n-type semiconductor materials and they are separated by a thin layer of p-type semiconductor. Here the majority charge carriers are the electrons. The flowing of these electrons from emitter to collector forms the current flow in the transistor. Generally the NPN transistor is the most used type of bipolar transistors because the mobility of electrons is higher than the mobility of holes. The NPN transistor has three terminals – emitter, base and collector. The NPN transistor is mostly used for amplifying and switching the signals.



The above figure shows the NPN transistor circuit with supply voltages and resistive loads. Here the collector terminal always connected to the positive voltage, the emitter terminal connected to the negative supply and the base terminal controls the ON/OFF states of transistor depending on the voltage applied to it.

If the base voltage is equal to the emitter voltage then the transistor is in OFF state. If the base voltage increases over emitter voltage then the transistor becomes more switched until it is in fully ON state. If the sufficient positive voltage is applied to the base terminal i.e. fully-ON state, then electrons flow generated and the current (IC) flows from emitter to the collector. Here the base terminal acts as input and the collector-emitter region acts as output. To allow current flow between emitter and collector properly, it is necessary that the collector voltage must be positive and also greater than the emitter voltage of transistor. Some amount of voltage drop presented between base and emitter, such as 0.7V. So the base voltage must be greater than the voltage drop 0.7V otherwise the transistor will not operate. The equation for base current of a bipolar NPN transistor is given by,

$$I_B = (V_B - V_{BE})/R_B$$

Where, I_B = Base current

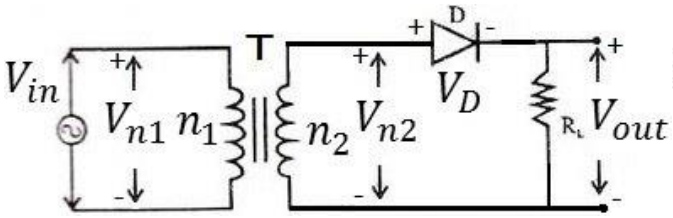
V_B = Base bias voltage

V_{BE} = Input Base-emitter voltage = 0.7V

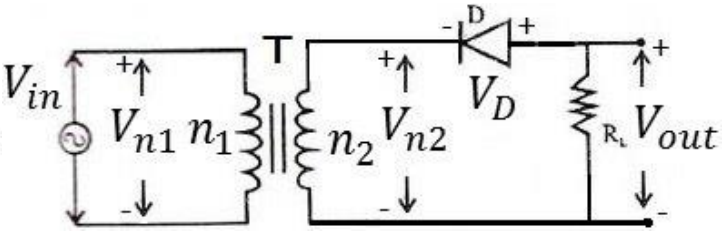
R_B = Base resistance

Q.3 OR

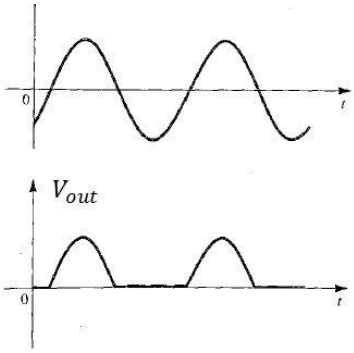
The half wave rectifier circuit is a rectifier circuit, which converts an ac voltage to dc voltage. These circuits are called half wave rectifier because it generates output of half cycle for input of full cycle. Another half cycle is wasted.

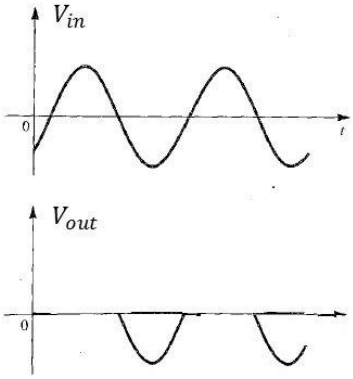


Positive half wave rectifier



Negative half wave rectifier





Working principal: For both circuit V_{in} is input voltage. Output is V_{out}. T is step down transformer. n_1 is the turn ratio of primary coil and n_2 is the turn ratio of secondary coil of transformer. A diode (D) is placed between V_{n2} and V_{out} . Voltage drop at diode is V_D. R is the load resistor.Input voltage is applied in primary coil of transformer. This voltage is step down and transferred to secondary coil. Based on the polarity of input voltage and the position of diode, the diode is forward biased (diode on) or reverse biased (diode off) and generates the output.

For positive half wave rectifier, when V_{n2} is positive diode is forward biased i.e. diode is on, output is positive. When V_{n2} is negative diode is reverse biased i.e. diode is off, output is zero. For negative half wave rectifier, when V_{n2} is positive diode is reverse biased because the position of diode is reverse in this circuit, so diode is off, output is zero. When V_{n2} is negative diode is forward biased i.e. diode is on, output is negative.