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Department of Electrical Engineering
Assignment
Date: 14/04/2020

Course Details

Course Title: Power Electronics
Instructor: _____
Module: _____
Total Marks: 30

Student Details

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Note: Plagiarism of more than 20% will result in negative marking.
Similar answers of students will result in cancellation of the answer for all parties.

Q1.	(a)	An appliance circuit has a R-L connected in series with a diode. After some time, modification is done to the circuit and a free-wheeling diodein added in parallel to the R-L. Will it have any impact on the performance and output of the circuit. Back your answer with before & after data, facts and figures. Does adding a free-wheeling diode in parallel to a R-C circuit have the same effect, different effect or no effect.	Marks 7 CLO 1
	(b)	A Power Mosfet is connected in a circuit. The Drain to Source voltage, V_{DS}= (Last 2 digits of your student ID) V and Threshold Voltage, V_T= (Last 1 digits of your student ID) V. What is the minimum Gate to Drain Voltage, V_{GS}required for the P.Mosfet to be in saturation mood.	Marks 3 CLO 1
Q2.	(a)	A Power Electronics appliance of 500W, 220V, 500KHz rating is using a Power Mosfet for switching purpose. If the P.Mosfet is replaced with a Power Bipolar Junction Transistor what effect will it have on the performance, losses and efficiency of the appliance. Will any other changes to the circuit be required?Back your reasons with valid data, facts and figures.	Marks 5 CLO 1
	(b)	In the above appliance (Q2.a) if the P.Mosfet is replaced with a Silicon Controlled Rectifierwhat effect will it have on the performance, losses and efficiency of the appliance. Will any other changes to the circuit be required? Back your reasons with valid data, facts and figures.	Marks 5 CLO 1
Q3.	(a)	The bipolar transistor in the Figure below is specified to have β_F in the range of 8 to 40. The load resistance, R_C = (Last 2 digits of your student ID) Ω.	Marks 10

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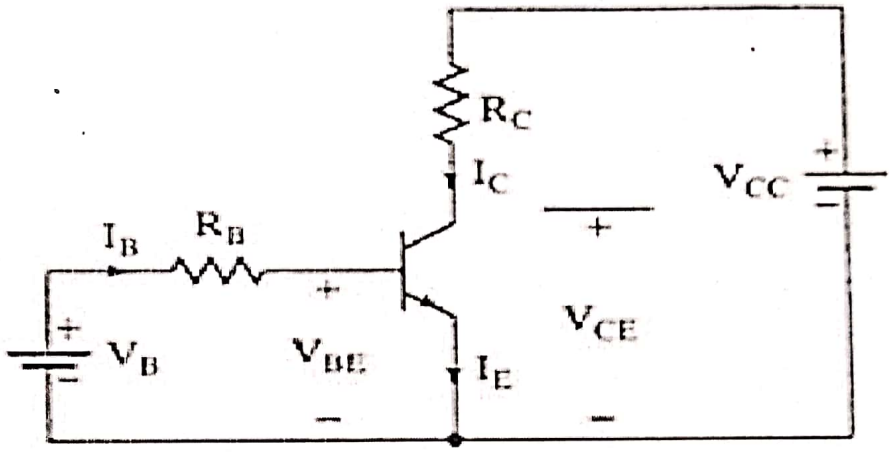
		The dc supply voltage, V_{CC} = (Last 3 digits of your student ID) V and the input voltage to the base circuit, V_B = 10 V. If V_{CE} = (First digits of your student ID) V and V_{BE} = 1.5 V, find (a) The mode of operation of the transistor (b) the value of R_B that results in saturation with an ODF of 5, (c) the β_{forced}, (d) the power loss, P_T in the transistor.	CLO 1
			

Question No: 1

(a) An appliance circuit has a R-L connected in series - - - - - - - - - - - - - - - - - - As given in Question Paper.

Answer:

Explanation

When diode is connected in series with R-L we know that the function of inductor is to store energy during positive cycle. And during the negative cycle inductor becomes . And creation of high voltage takes place and the K current also occurs during negative cycle. these high voltage will damage circuit. To aviode circuit from damage a free wheling diode is connected in parallel with R-L. the free wheling diode will provide a path to high voltage to aviode circuit from any damage. it will provide a path and become a forward bias to pass current for any critical damage.

P-T-O

In R-C circuit there is no need of free wheeling diode so no impact on circuit.

Question No: 1

(b) A Power Mosfet is connected in a circuit - - - - - - -

--- As given in Question Paper.

Solution:

Given Data

$V_{DS} = 53\ V$

$V_T = 3\ V$

Required

$V_{GS} = ?$

As we know that

For saturation

$V_{DS} = V_{GS} - V_T$

So $V_{GS} = V_{DS} + V_T$

putting values, we get

$V_{GS} = 53 + 3$

$V_{GS} = 56\ V$

Question NO : 02

(a) A power Electronic appliance of 500w, 220v - - - - - - - -

-- As given in Question Paper.

Solution:

Explaination

→ The switching rate of the above appliance will be decrease because the MosFet has high switching rate then BJT. (Performance)

→ The losses will be decreased. (Lossess have)

→ BJT does not operate at high frequency is one of the effect on Performance.

→ ON state on BJTs is low the efficiency of appliance will be improved.

→ Switching losses in BJT is high than MosFet this is one effect.

→ Conduction losses will be decrease because BJT has less conduction losses (Performance will be improved).

→ On high frequency BJTs are

P — T — O

Less efficient this is also effect on Performance.

→ The frequency of the appliance is high. And BJT has low frequency rate & switching frequency need to adjust to frequency because the frequency is high.

Question No: 02

(b) On the above appliance (Q2.a) if the P.Mosfet is replaced ---

--- As given in Question Paper.

Solution:

Explaination

P. Mosfet is replaced with SCR as a switch and impact its Performance, Lossess, efficiency is given below.

→ SCR has low capability to handle high frequency this is one of the impact on its Performance.

→ SCR can handle more power, voltage and current which increase the efficiency of appliance.

P-T-O

→ SCR switches are Protected because of fuse which decrease losses so Performance will be improved.
→ SCR is a easiy way to controll the appliance, so efficiency will be improved.
→ SCR allows to Protect from heating & temperature.

Question NO: 03

The bipolar transistor in the figure below is - - - - - - - - - - As given in the Question Paper.

Solution:

Given Data

$R_C = 53\Omega$

$V_{cc} = 053V$

$V_B = 10V$

$V_{CE} = 5V$

$V_{BE} = 1.5V$

(a) transistor Mode=?

transistor as a switch

(b) R_B=?

As we know that

$I_{CS} = \frac{V_{cc} - V_{CE}}{R_C}$ P- T-O

$$I_{CS} = \frac{053 - 5}{53}$$

$$I_{CS} = \frac{48}{53}$$

$$I_{CS} = 0.9$$

As we know that

$$I_{BS} = \frac{I_{CS}}{B_{F(min)}}$$

$$I_{BS} = \frac{0.9}{8}$$

$$I_{BS} = 0.1$$

So $I_B = ODF \times I_{BS}$

$I_B = 5 \times 0.1$

$I_B = 0.5$

Now

$$R_B = \frac{V_B - V_{BE}}{I_B}$$

$$R_B = \frac{10 - 1.5}{0.5}$$

$$R_B = 17$$

(C) $B_{forced} = ?$

$$B_{forced} = \frac{I_{CS}}{I_B}$$

$$B_{forced} = \frac{0.9}{0.5} = 1.8$$

P-T-O

(d) the power loss, P_T = ?

As

$$P_T = V_{BE} \times I_B + V_{CE} \times I_{CS}$$

$$P_T = 1.5 \times 0.5 + 5 \times 0.9$$

$$P_T = 5.25$$