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

Course Details

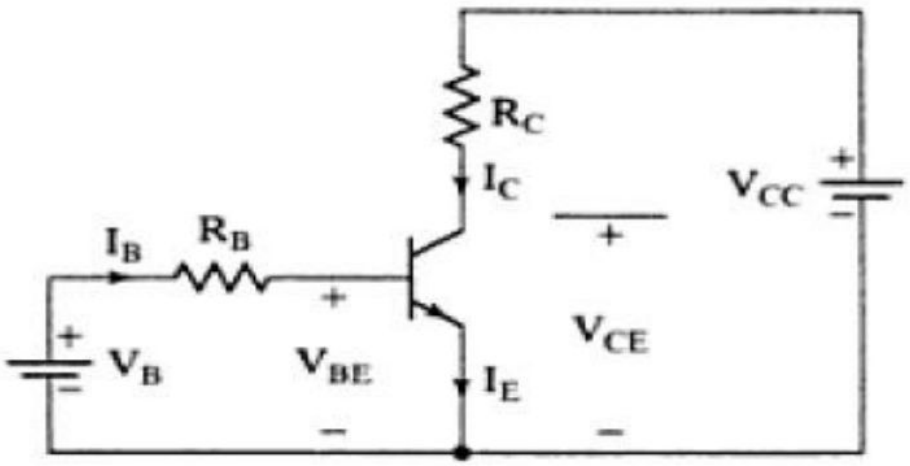
Course Title: Power Electronics **Module:** _____
Instructor: Engr Shayan Tariq Jan **Total Marks:** 30

Student Details

Name: Muhammad Saqib Khalil **Student ID:** 13342

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 diode in 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 Rectifier 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
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

		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
			

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Subject : Power Electronics

Semester : 8th

Submitted to : Engr. Shayan Tariq Jan

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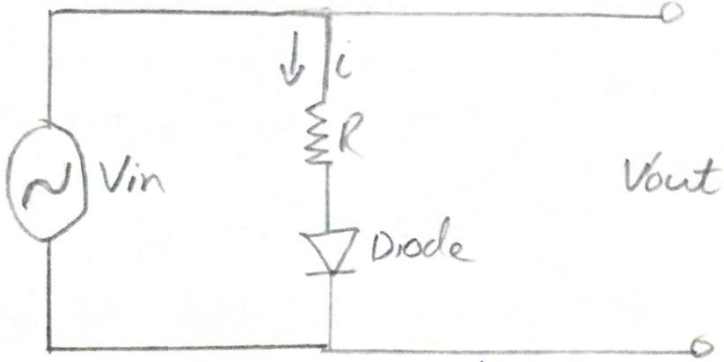
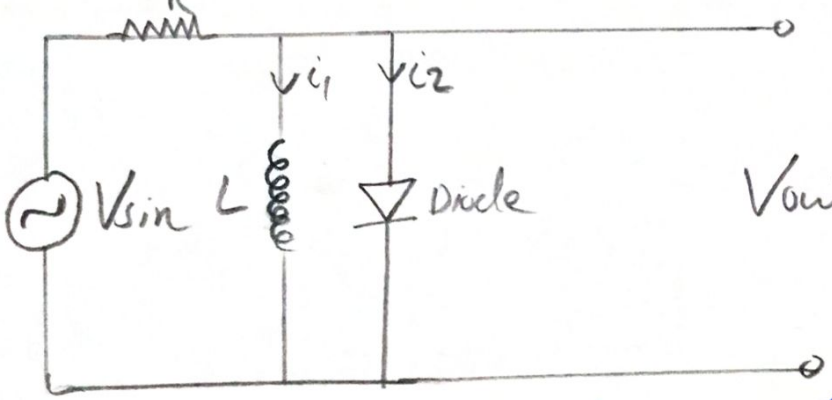
Question # 1 (a)



When free wheeling diode is connected in series with RL circuit so, the flow of current through circuit will depend on forward & reverse biase of diode. The output voltage will be the combine voltage drop of inductor and diode barrier potential (0.7V)



When diode is connected in parallel of RL circuit So current flow will be depend of forward/Reverse biase of diode, current will flow that path which have minimum resistence. Output voltage will be only diode barrier potential (0.7V)

connecting free wheeling diode in parallel of RL circuit will have different effect then connecting the free wheeling diode is series of RL circuit.

Q.1 (b)

Given data

$V_T = 2V$

$V_{DS} = 42V$

V_{GS} in Saturation mode ?

For saturation mode

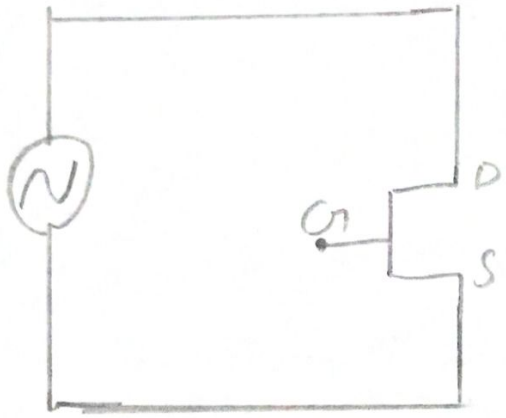
$V_{DS} = V_{GS} - V_T$

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

$V_{GS} = 42 + 2$

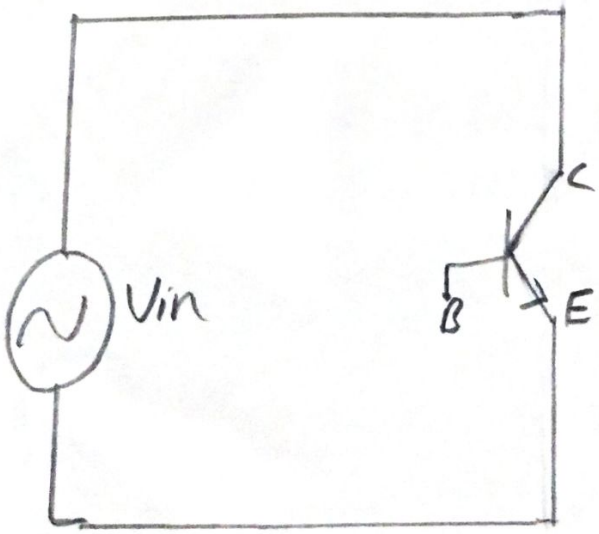
$\boxed{V_{GS} = 44V}$

Q#2 (a)



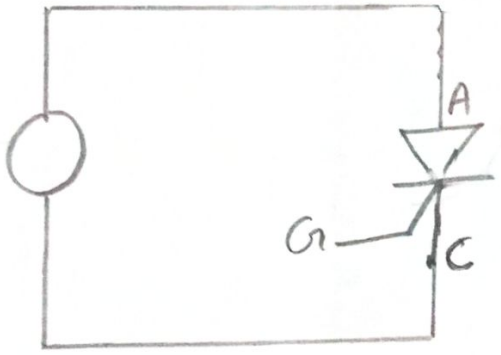
when power MosFET is connected in power electronics circuit, it have fast switching, high efficiency and low losses.

when power MosFET is replace by power bipolare Junction Transistor, so its switching speed decrease, efficiency decrease and its losses increasees, as power bipolar junction transistor is mainly use for amplification



Q#2 (b)

When power bipolar junction transistor is replace by silicon controlled rectifier so, on ouput we get controlled output voltage and switching



In case of silicon controlled rectifier we get fast switching then power BJT but less then power MOSFET, variable efficiency and low losses

Q.3 13342

Given data

$V_{cc} = 342V$

$V_B = 10V$

$V_{CE} = 1V$

$V_{BE} = 1.5V$

$R_c = 42\Omega$

Part (a)

Saturation Mode

Part (b)

$R_B = ?$

$$I_{cs} = \frac{V_{cc} - V_{CE(sat)}}{R_c}$$

$$= \frac{342 - 1}{42}$$

$$= \frac{341}{42}$$

As

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

$$= \frac{8.1}{8}$$

$$\boxed{I_{BS} = 1.0125}$$

when know that

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

$$= 5 \times 1.0125$$

$$\boxed{I_B = 5.0625 A}$$

we know that

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

$$= \frac{10 - 1.5}{5.0625}$$

$$\boxed{R_B = 1.6790 \Omega}$$

c)

$$B_{force} = \frac{I_{cs}}{I_B}$$

$$= \frac{8.11}{5.0625}$$

$$\boxed{B_{force} = 1.6019 \text{ A}}$$

D)

$P_T = ?$

As

$$P_T = V_{BE} I_B + V_{CE} I_C$$

$$= \cancel{(1.5)(2.5) + (1)(8.11)}$$

$$= V_{BE} I_B + V_{CE} I_C$$

$$= (1.5)(5.0625) + (1)(8.11$$

$$= 7.593 + 8.11$$

$$\boxed{P_T = 15.70375 \text{ watt}}$$