Department of Electrical Engineering

Assignment

Date: 20/04/2020

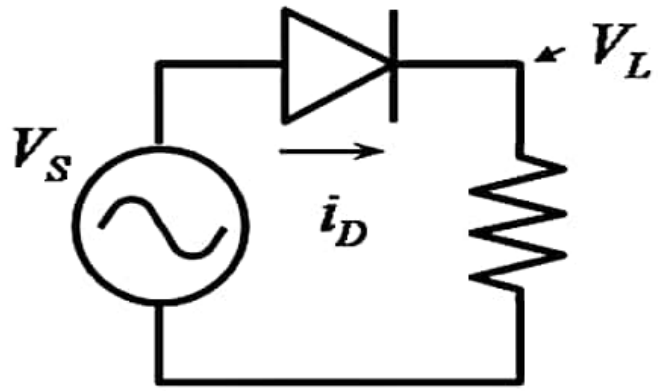
Course Details

Course Title: Power Electronics **Module:** 4rth

Instructor: ENGR. AMIR AMAAN **Total Marks:** 30

Student Details

Name: SALMAN FAROOQ **Student ID:** 15276

Q1.	(a)	In some applications, power semiconductor diodes are required to conduct several kilo amperes of current in the forward direction with very little power loss while blocking several kilo volts in the reverse direction. Explain the main differences of constructional features of a power diode and a signal diode. Illustrate your answer with the help of sketches to make a clear difference between the two.	Marks 10 CLO 1
Q2.	(a)	Explain operational features of the power MOSFET. Support your explanation using MOSFET operation as a switch. Also, illustrate the conditions to derive power MOSFET in the different regions of operation.	Marks 10 CLO 1
Q3.	(a)	 Consider Vs = 220Sin2wt, R = 1000kΩ and 1N4004 uncontrolled rectifier diode for the circuit shown above. Find i) V_{avg} ii) I_{oavg} iii) V_{rms} iv) I_{orms} v) Output Power vi) Input Power Factor	Marks 10 CLO 2

			vii) Conduction angle of a diode viii) Extension angle of diode ix) Comparison of both conduction angle and extension angle of diode x) Peak Inverse Voltage xi) Circuit turnoff time, t_c xii) By putting inductor of your own choice repeat all the findings and compare both circuits result and comment.	

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Name: Salman farooq

ID: 15276

Answer No 1 :-

SIGNAL DIDOE Diodes are often used as straight forward rectifiers as mixers in compounding the signal and as switches to open or close a circuit Diodes in the mixers are utilized for defecting the signal and these diodes are typically reffered as signal diodes. The simple and conventional application of signal diodes is that it acts as a basic diode switch. Signal diode enable the current capability up to 100 millionps and they are know for processing the information found in electrical signal sent from electrical transmiter Covermanium diodes have a forward voltage drop about 0.3 volts are used as delecting cercuits in rodios. The pN function signal diode is usually fabricated in glass case or plastic case and generally has a black or a red band at the callode end of the therminal.

POWER DIODE :-

Definition :- A diode that as two termind

Name :- Salman farooq

ID : 15276

like cathode and two layers like p & N used in the power electronics circuits is as power diode. This diode is more complex in construction as well as in operation becaus low power device has to change to make them appropriate in high power Application: The junction of normals diodes can be formed thrgh semiconduction like p-type and n-type the terminal and p-type is known as anode where the terminal at the n-type is known as the cathode In power electronic circuts this diode plays and essential rode it can be used as the rectifeer in converter circuits voltage regulation circuits.

Answer No # 2 :-

Switching characteristic of MOSFET :-

In power conversion, a mosfet is essentially used as a switch. AS MOSFET switching characteristic the turn-on delay time Td (on), rise time tr, turn off delay time Td (off), and fall time tf are generally indicated for exampl, the turn-on off ~~day~~ delay time may be couled the on/off delay time and the rise/fall time may be the falling time and so on, ~~dissing~~/

Name:- Salman farooq

ID :- 15976

page No # 3

turn-on delay time: Time from 10% of the rise of VGS.

> Rise time: Time from 10% to 90% of the rise of VDS.

> turn-off delay time: Time from 90% of the fall of VGS until 90% of the fall of VDS.

> fall time: Time from 90% to 10% of the fall of VDS.

the three operating regions of MOSFET is

1). ohmic region at law voltage vds here the current is proportional to vds for given vgs.

2). The knee region at slightly higher value vds here the current is not on vds value at all [practically very less in micro ampere level]

3). Breakdown region at very high value of vds. The device breaks down.

Answer 3:-

$V_S(t) = \frac{V_{pmk}}{\pi}$ or V_m

for half wave Rectifier and sinusoided Input voltage.

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Name:- Salman Farooq

ID :- 15976

Page No 4

$$V_{avg} = \frac{V_{peak}}{\pi} \quad \therefore V_{peak} = V_m = V_i$$

$$V_{RMS} = \frac{V_{peak}}{2}$$

1) $V_{avg} = \frac{V_{peak}}{\pi} = \frac{220}{\pi} = 70.02V$

2) $I_{oavg} = \frac{V_{avg}}{R} = \frac{70.02}{100K} = 70\ \mu A$

3) $V_{RMS} = \frac{V_{peak}}{2} = \frac{220}{2} = 110V$

4) $I_{ORMS} = \frac{V_{RMS}}{R} = \frac{110}{100K} = 110\ KA$

5) Input power factor $\cos\phi = \frac{V_{RMS}}{V_{peak}}$

$\cos\phi = \frac{110}{220} = \frac{1}{2} = 0.5$

6) Diode is conducting only for 1st half therefore conduction angle $\theta_p = \pi$

(7) out put power.

$$P_o = I_{RMS}^2 R$$

$$= (110\ uA)^2 \times 100\ K\Omega$$

$$P_o = 0.0121w$$

8) Extension angle of diode:-

Diode is conduction up to π

Name:- Salman Farooq

ID :- 15976

Page No # 5

(first cycle)

So, $B = \pi$

(9) In all diode rectifier circuits:

conduction Angle (δ)	Extension Angle (β)

(10) Peak Inverse value (PIV)

During negative half cycle diode acts as open circuit and therefore all voltage appears across diode Thus.

11) Circuit turn-off time t_c

$\omega t_c = \pi$

$t_c = \pi/\omega$; assuming $f = 50$ Hz

$t_c = \pi/2\pi f = 0.01000$