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MATRIC NUMBER: 15/ENG05/014

Course: MCT 510

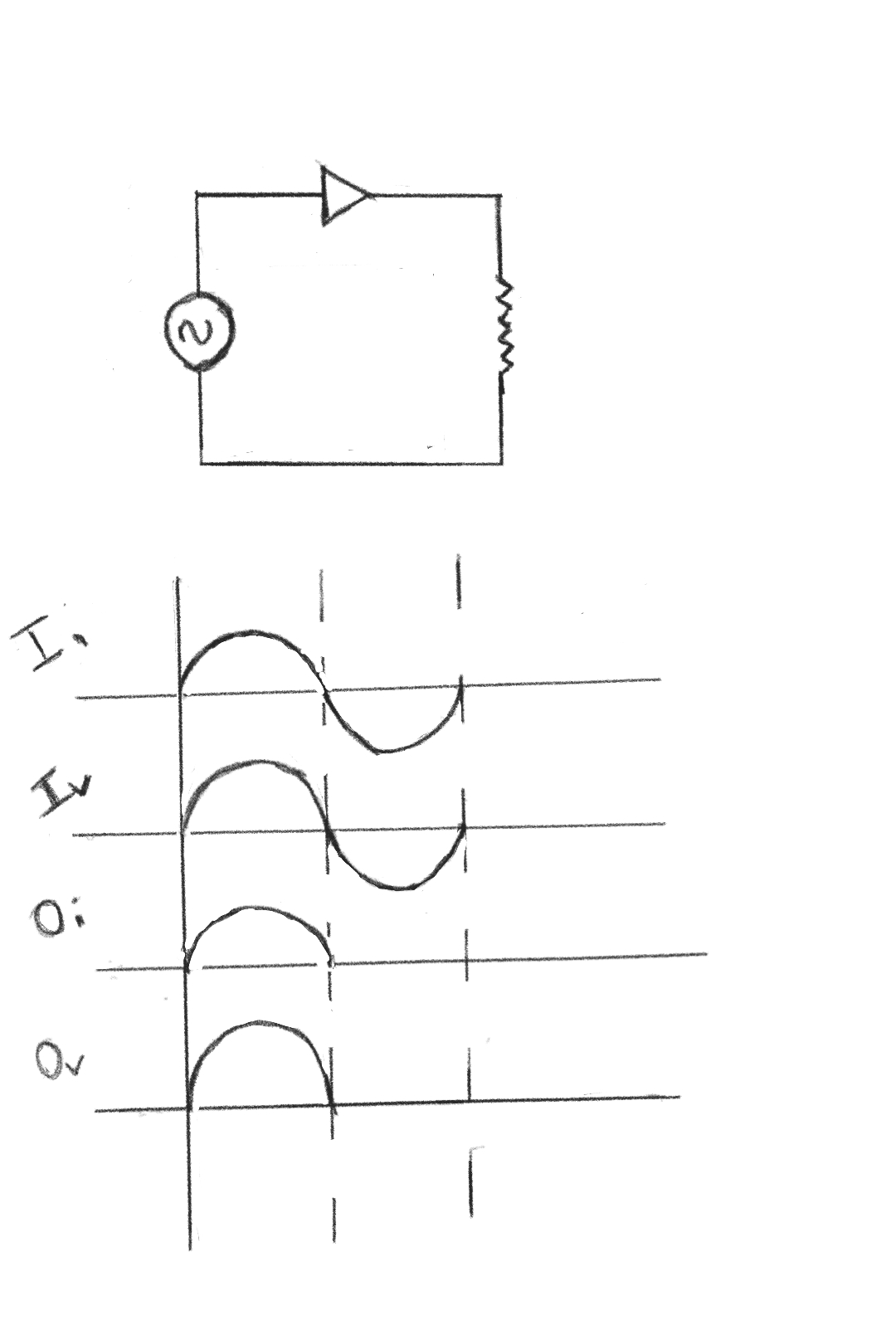
DEPARTMENT: MECHATRONICS ENGINEERING

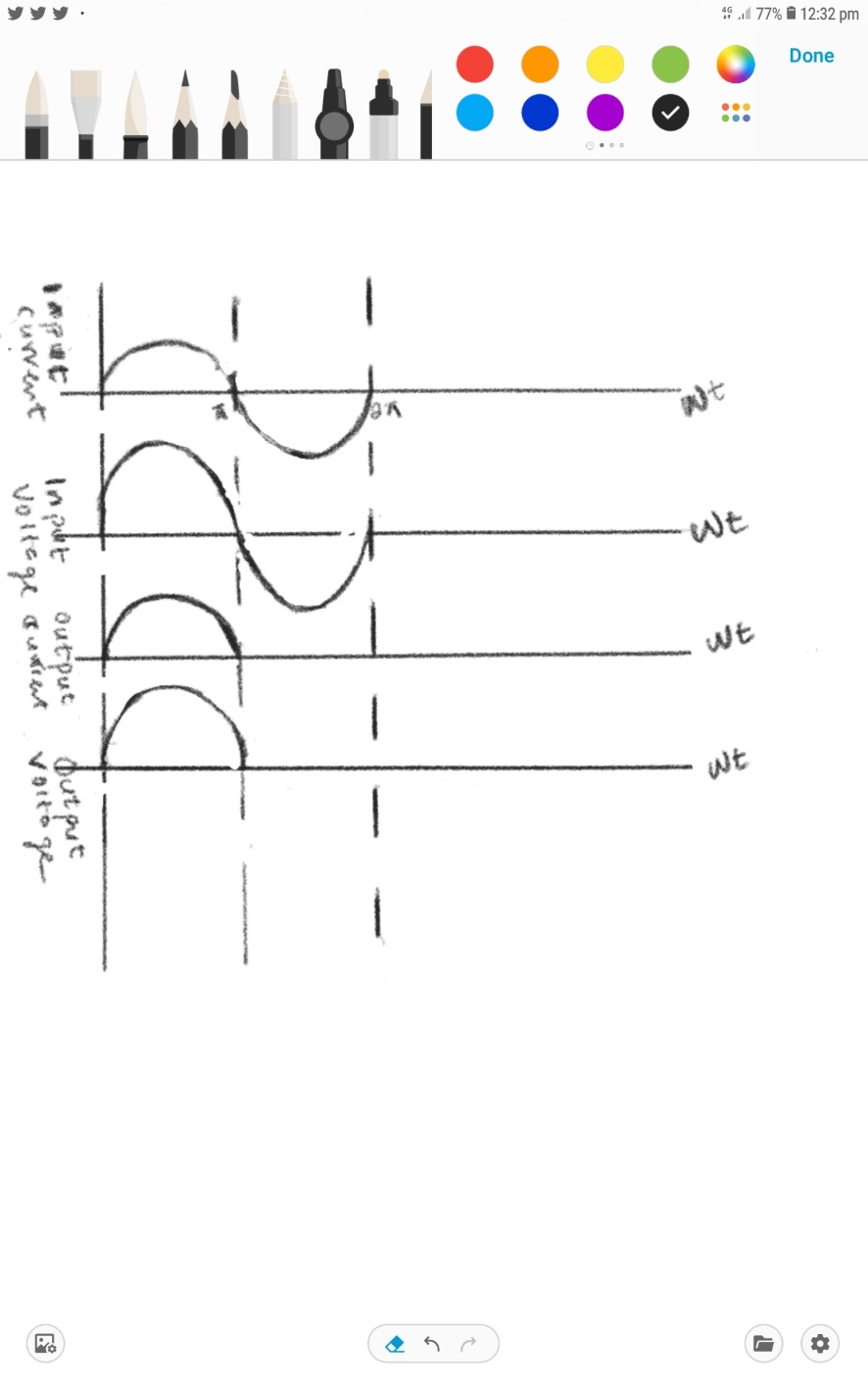
DATE: 3-06-2020

ASSIGNMENT 4:

1. Draw the circuit of a single phase half wave diode rectification feeding a resistive load. Neglect the forward resistance Rf of the diode and given that the input voltage is VmSinաt with a load resistance R. find the following
2. DC output current
3. Dc output voltage
4. Rms output current (Irms)
5. Vrms
6. Pdc
7. Pac
8. Efficiency
9. Form factor
10. Ripple factor
11. Transformer utilization Factor

Solution





Parameters

Vm= 230 v, RT = R + RF = 10 +50 =60Ω,

1. Idc

= --------------- 1

But , -------------------------------- 2

From V = IR, I = Vm/R ----------------------- 3

Substitute Equations 2 and 3 into 1

----------------------------- 4

Integrating equation 4

= -------------------- 5

But π = 180

Substituting the value of π into equation 5

=

Substituting the values of Vm and R

= =

1. Vdc

Vdc= Idc \* R -------------------- 1

But Idc = --------------------- 2

Substitute the value of Idc -------- 1

= 35 .01

1. Irms

= ---------------------- 1

But , I = V/R --------------------------- 2

Substitute equation 2 into 1

------------------- 3

Integrating equation 3

From trigonometry ------------- 4

Irms = ------- 5

=

=

=

= Irms = = = 0.9166 A

1. Vrms

Vrms = Irms \* R

From (iii), the value of Irms = 0.9166 A

0.9166 \* 60 = 54.996 volts

1. Pdc = Vdc \* Idc

= 20.4283 w

1. Pac

=

= 50.4166 w

1. Efficiency

= = = 0.405 \* 100 = 40.5%

1. Form Factor

= = = 1.571

1. Ripple Factor

= =

1. TUF

=

= = 0.28

1. Relationship between Ripple factor and Form Factor

Show that Ripple Factor =

Solution

Form Factor = --------------------- 1

But

Vrms = Irms \* R ------------------------------ 2

Vdc = Idc \* R --------------------------- 3

Substitute Equations 2 and 3 into 1.

---------------------------- 4

Equation (4) expresses Form Factor = ----------------------------- 5

Ripple Factor (RF) is given as ------------------- 6

Where Iac is the rms value of A.C component and Idc is the value of DC

Component

Irms = ------------------------------------ 7

Equation 7 can be re written as ------------------- 8

Substitute Equation 8 into Equation 6 and squaring equation 6 to balance

both sides

----------------- 9

Simplifying Equation 9

------------------ Equation 10

Recall Form Factor = from Equation 5

Substitute form factor into Equation 10

------------------------ 11

Simplifying the Left hand side of equation 11