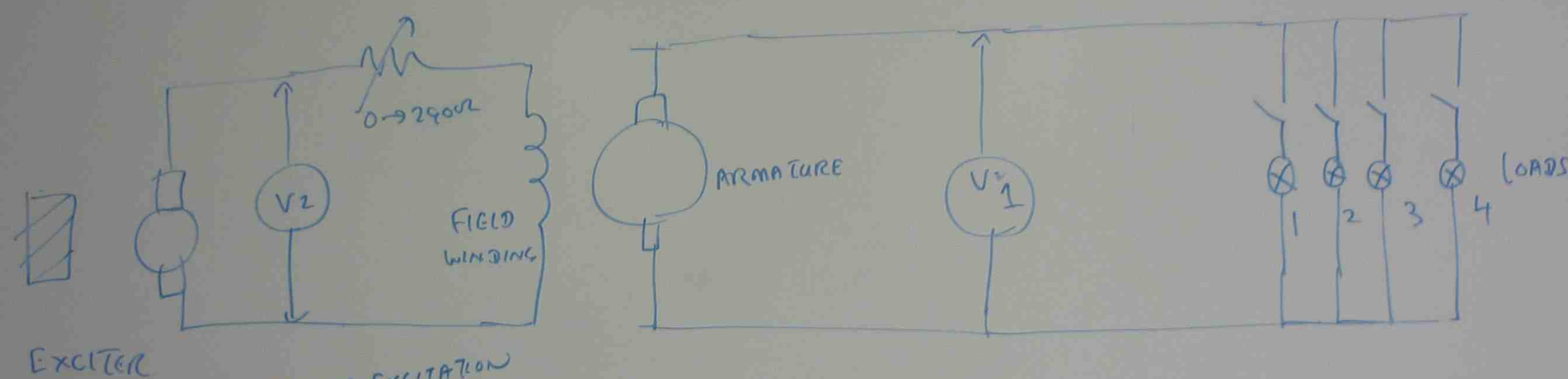
00.0
& TRIP
RESET
OFF
ON
250V D.C
0-280V
VARIAC OUTPUT ONLY
240V G.P.O
240V MAIN SWITCH
ELEC. ENG. CERT. S.T.C.
No. 2


Excitation Volt
POWER ON
+
89V
–
70V
Operating Volt 30 V
Maximum 70V
D. C. DRIVE
START
EMERGENCY STOP
STOP
LOAD
START
FWD
REV
STOP
A. C. DRIVE
Hz
V
A

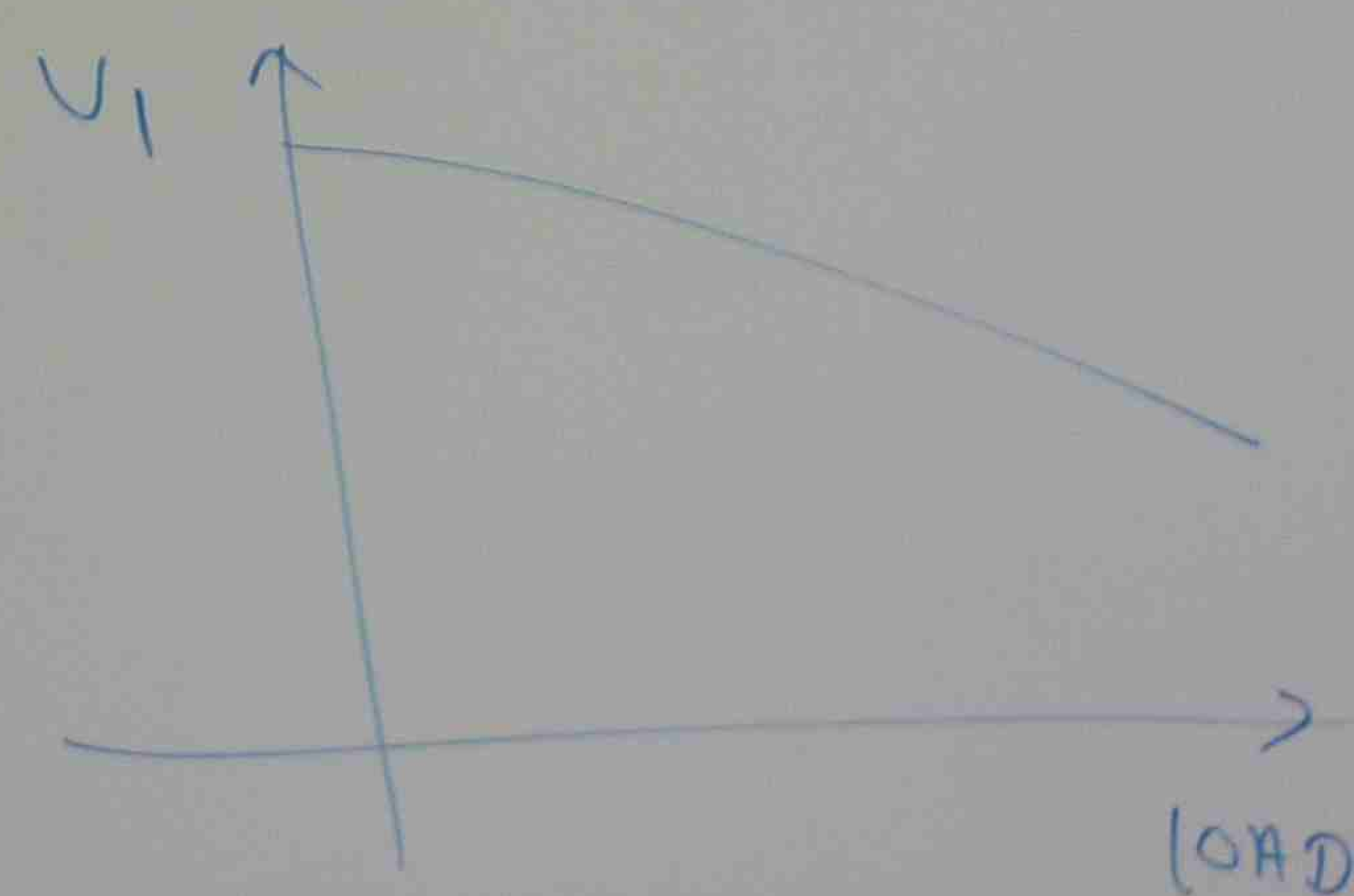

0–280V
VARIAC OUTPUT ONLY
6.3V A.C.
OFF
ON
250V D.C
RESET
24V A.C
REGULATED SUPPLY
COMMON
ISOLATING
SWITCH
240V G.P.O.
240V MAIN SWITCH

START
STOP
D. C. DRIVE
LOAD
SPEED
ABSORB
START
EMERGENCY
STOP
LOAD
510
290-Ω

DC GENERATOR CHARACTERISTICS TEST

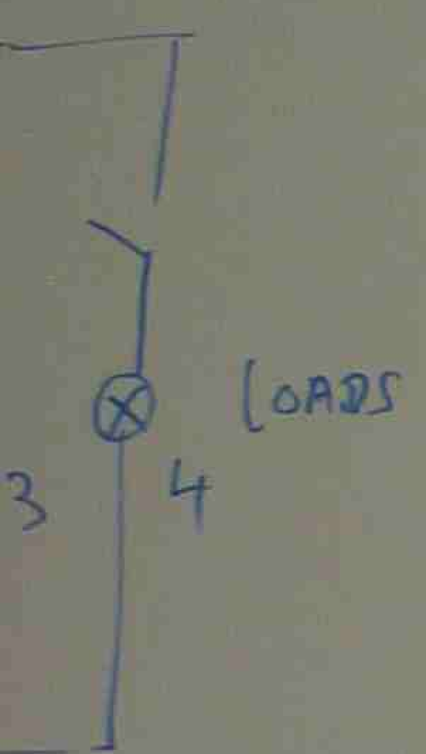


NO LOAD CURVE



LOAD CURVE

1. CON
2. OF
3. NO
4. ON
5. -

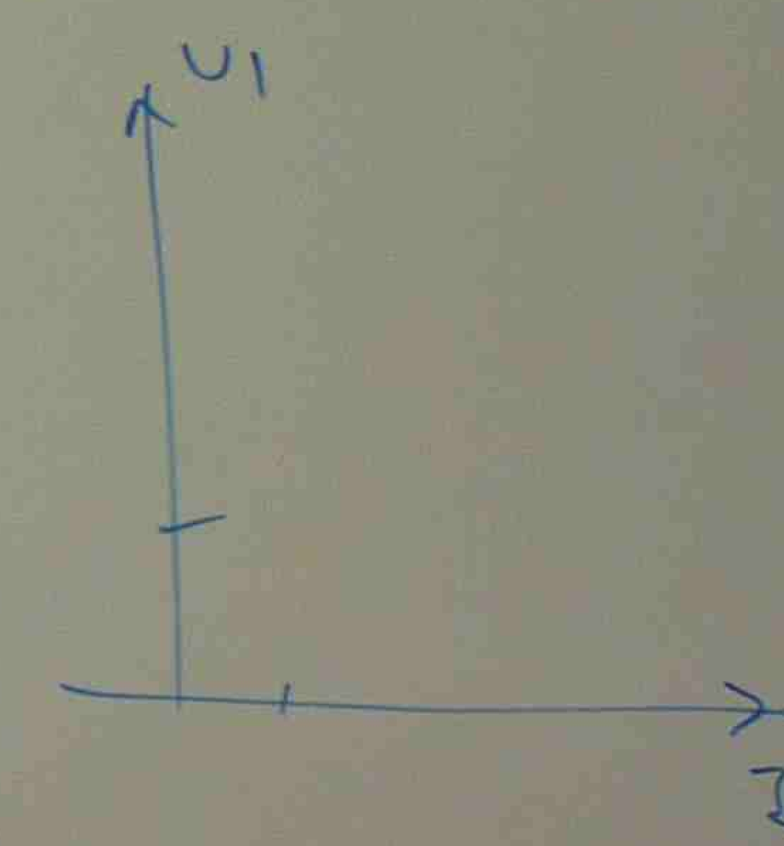


1. CONNECT THE GIVEN CIRCUIT
2. OFF THE FIELD EXCITATION SWITCH
3. NOTE THE TERMINAL VOLTAGE PRODUCED BY RESIDUAL MAGNETISM
4. ON THE FIELD EXCITATION SWITCH
5. REDUCE FIELD RESISTANCE AND NOTE TERMINAL VOLTAGE

FIELD RESISTANCE	$I_f = \frac{V_2}{\text{RESISTANCE}}$	V_1
FULL 290Ω		
$\frac{9}{10} \times 290$		
$\frac{8}{10} \times 290$		
$\frac{7}{10} \times 290$		
$\frac{6}{10} \times 290$		
$\frac{5}{10} \times 290$		
$\frac{4}{10} \times 290$		
$\frac{3}{10} \times 290$		

	V_1
$\frac{2}{10} \times 290$	
$\frac{1}{10} \times 290$	

PLOT FIELD CURRENT VS TERMINAL VOLTAGE

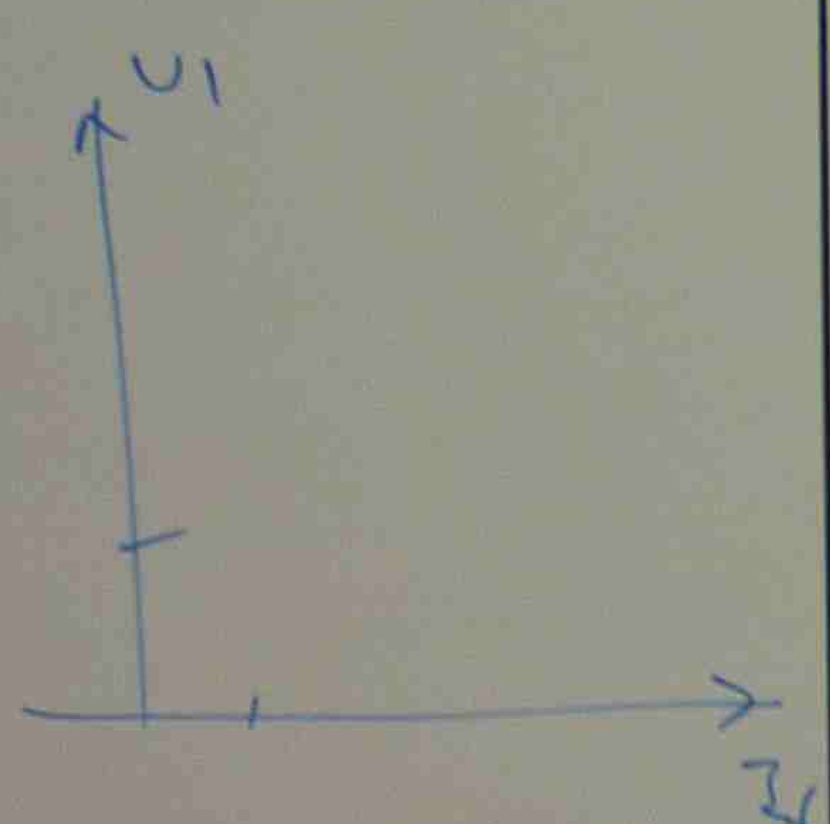


6. REDUCE

7.

IN

PLOT FIELD CURRENT VS TERMINAL VOLTAGE



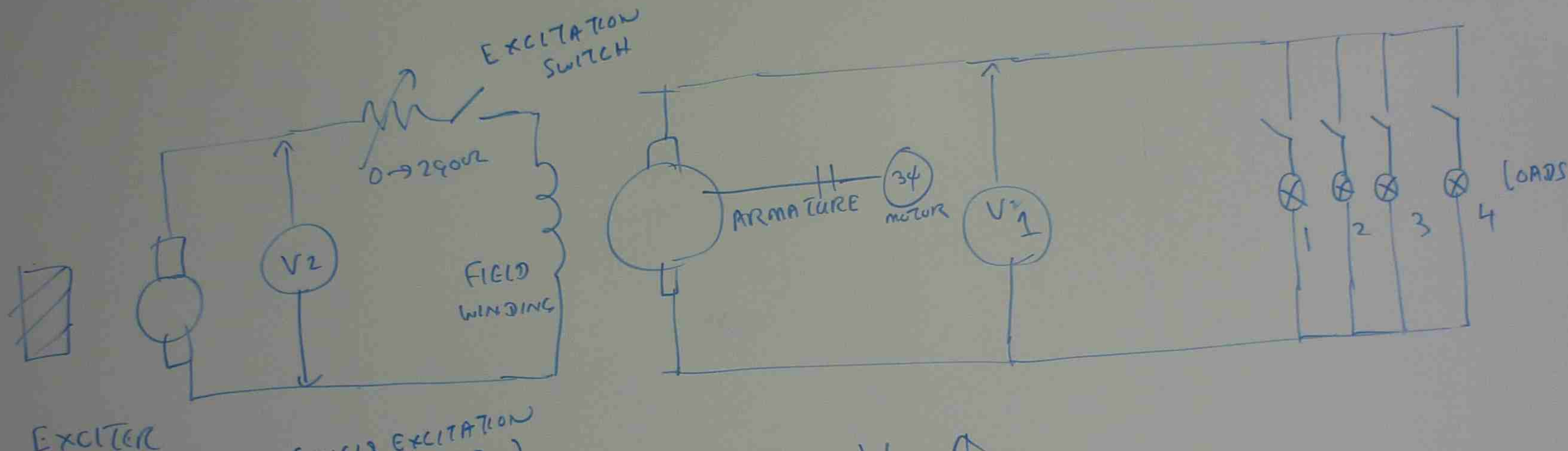
(6) REDUCE TERMINAL VOLTAGE TO 30V

(7) INCREASE THE LOADS AND NOTE TERMINAL VOLTAGE, FILL THE TABLE

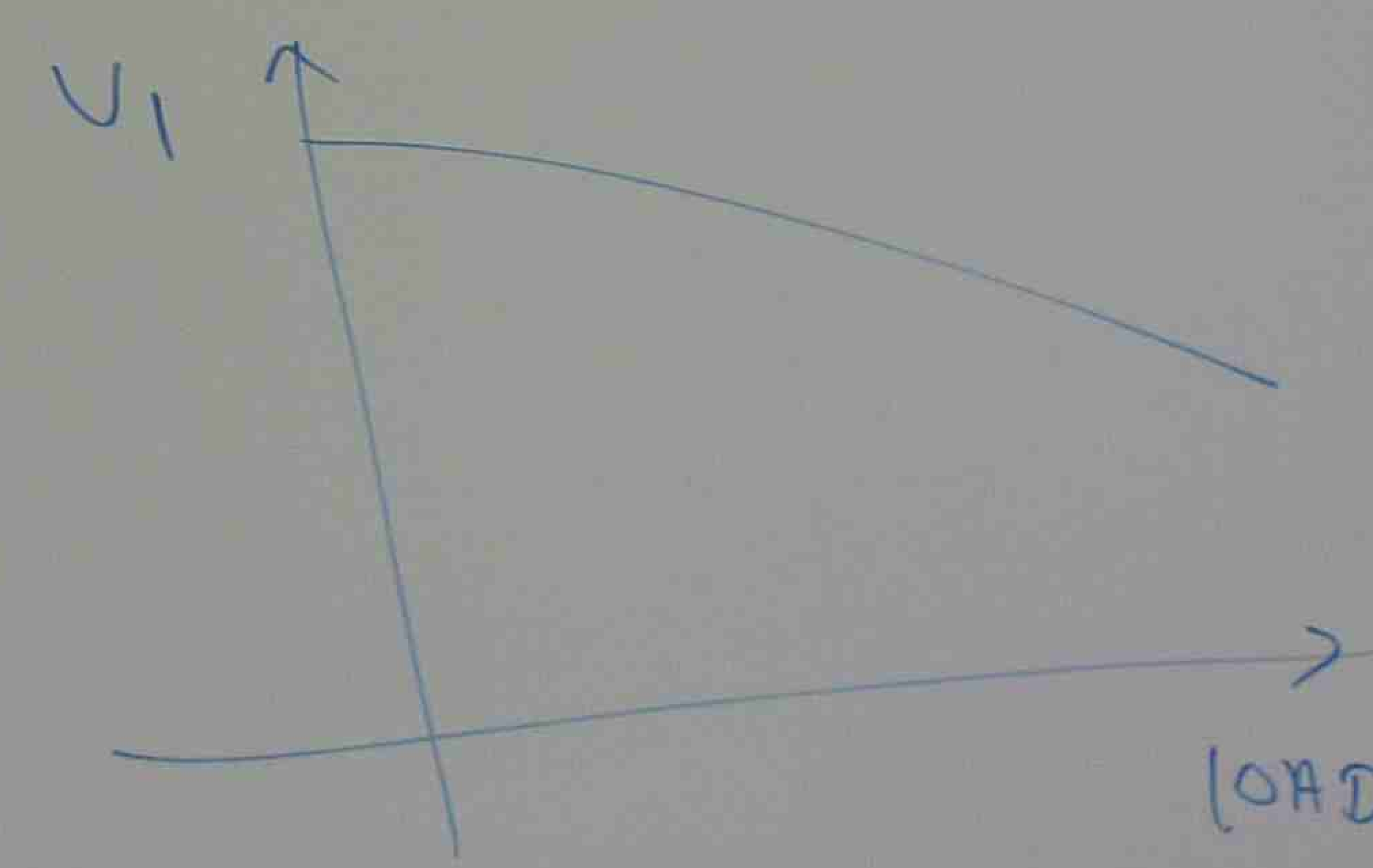
LOAD LAMP	V_1
1	
2	
3	
4	

PLOT LOAD VS TERMINAL VOLTAGE

DC GENERATOR CHARACTERISTICS TEST



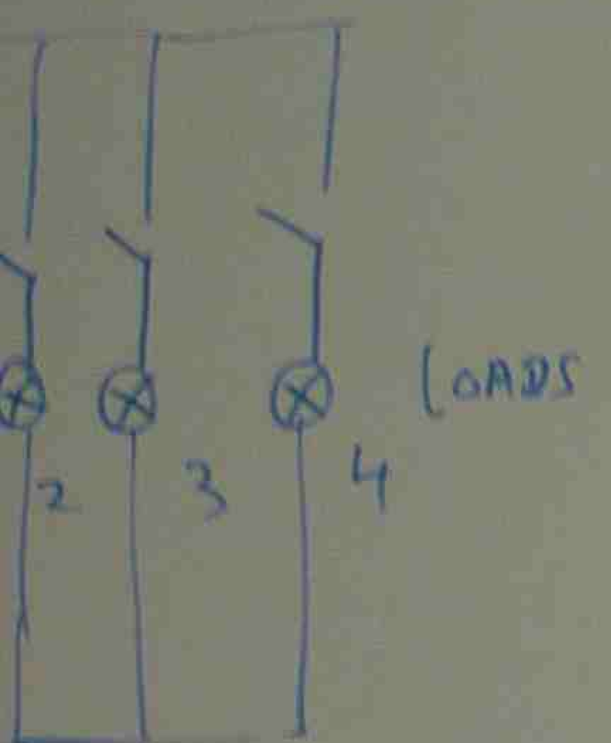
NO LOAD CURVE



LOAD CURVE

1. CONNECT
2. OFF THE
3. NOTE
4. ON THE
5. - REDU

FIELD
FULL
$\frac{9}{10}$
$\frac{8}{10}$
$\frac{7}{10}$
$\frac{6}{10}$



LOAD

1. CONNECT THE GIVEN CIRCUIT
2. OFF THE FIELD EXCITATION SWITCH
3. NOTE THE TERMINAL VOLTAGE PRODUCED BY RESIDUAL MAGNETISM
4. ON THE FIELD EXCITATION SWITCH
5. ~~REDUCE FIELD RESISTANCE~~ REDUCE FIELD RESISTANCE AND NOTE TERMINAL VOLTAGE

FIELD RESISTANCE	$I_f = \frac{V_2}{\text{RESISTANCE}}$	V_1
FULL $290\Omega + 100$		
$\frac{9}{10} \times 290 + 100$		
$\frac{8}{10} \times 290 + 100$		
$\frac{7}{10} \times 290 + 100$		
$\frac{6}{10} \times 290 + 100$		
$\frac{5}{10} \times 290 + 100$		
$\frac{4}{10} \times 290 + 100$		
$\frac{3}{10} \times 290 + 100$		

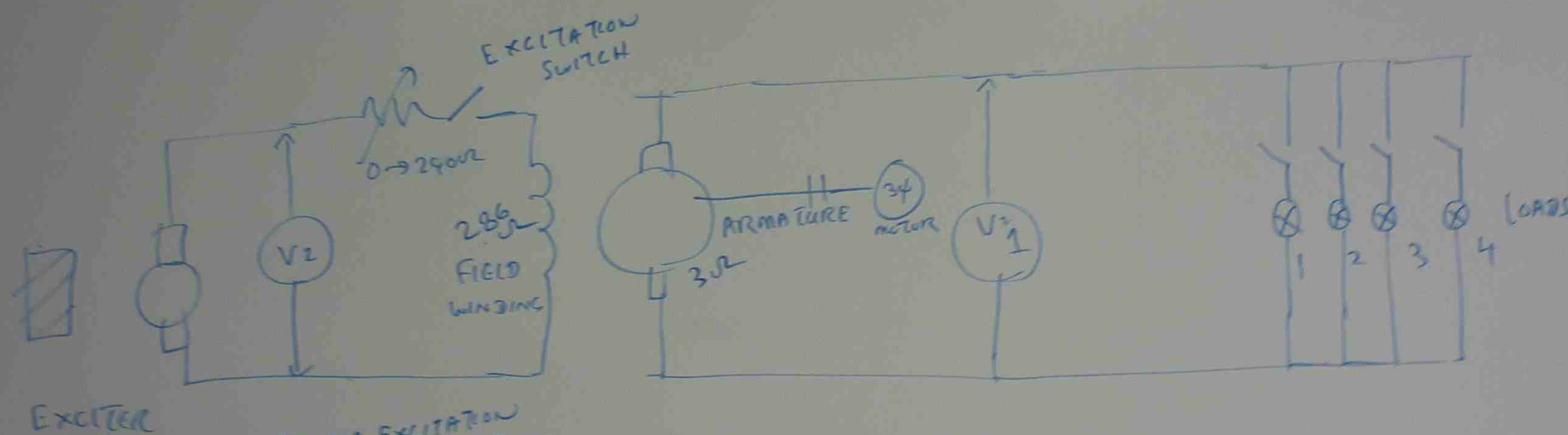
	V_1
$\frac{2}{10} \times 290 + 100$	
$\frac{1}{10} \times 290 + 100$	
100	

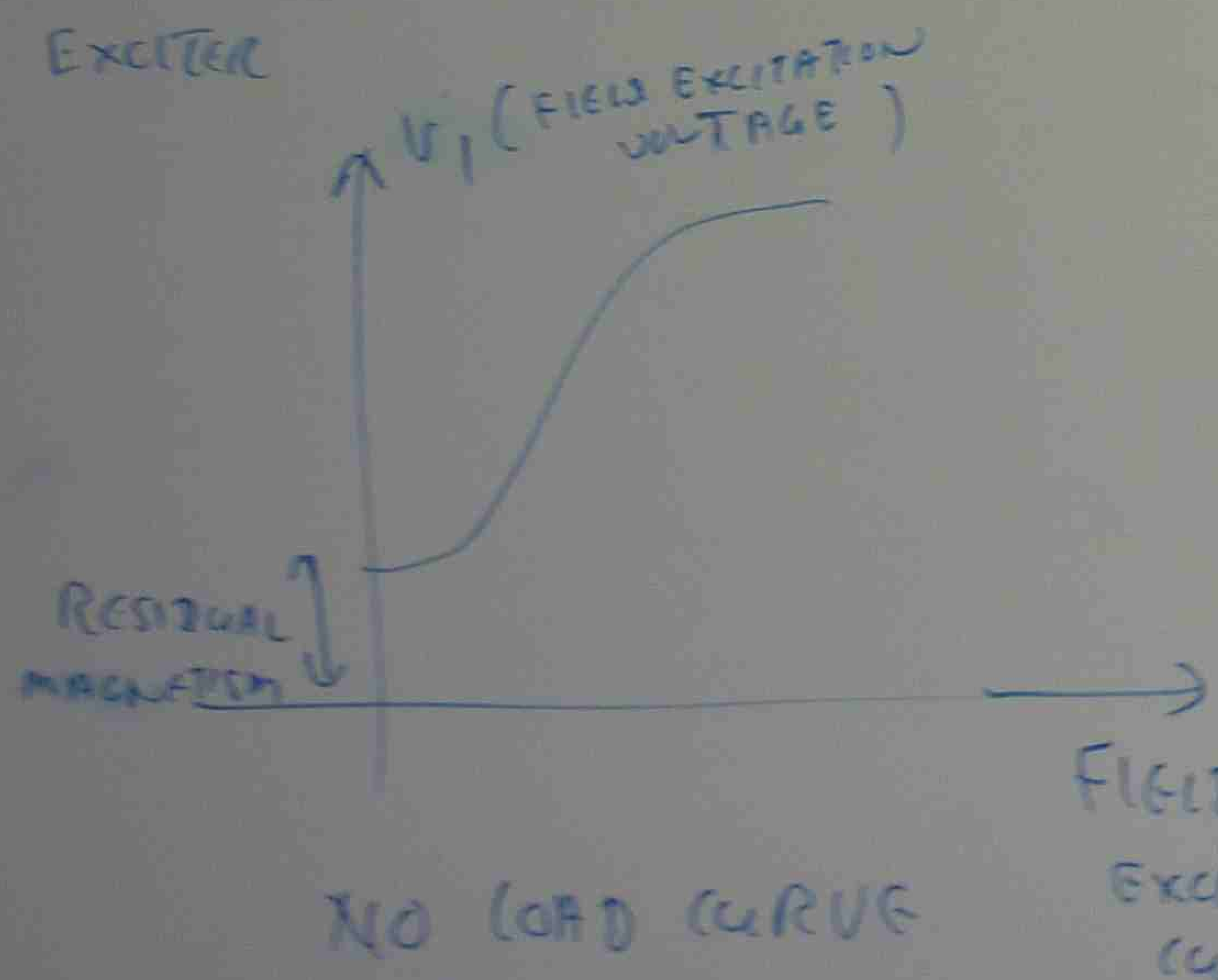
PLOT FIELD CURRENT VS TERMINAL VOLTAGE

6. REDUCE
7.

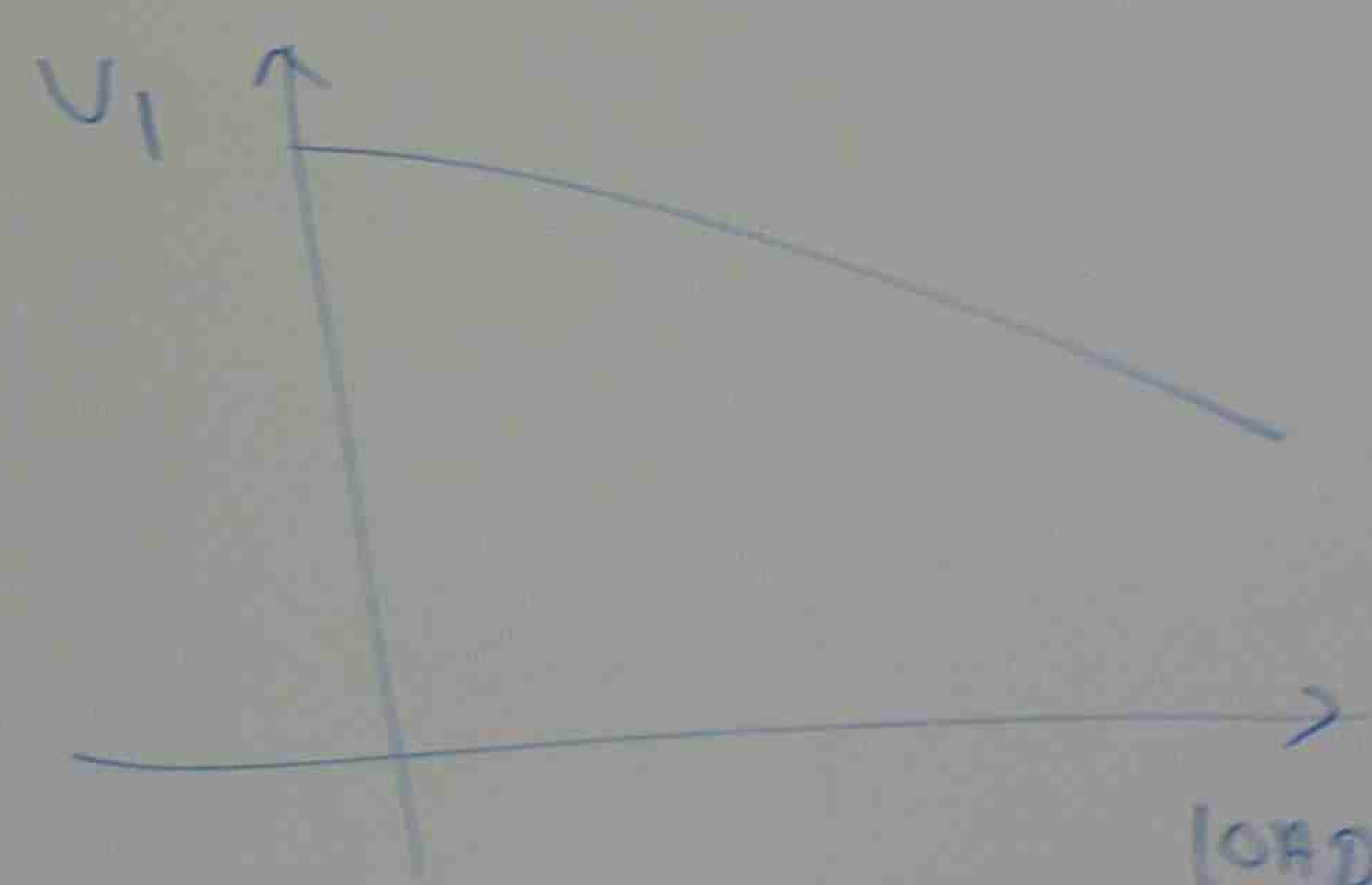
INC

DC GENERATOR CHARACTERISTICS TEST





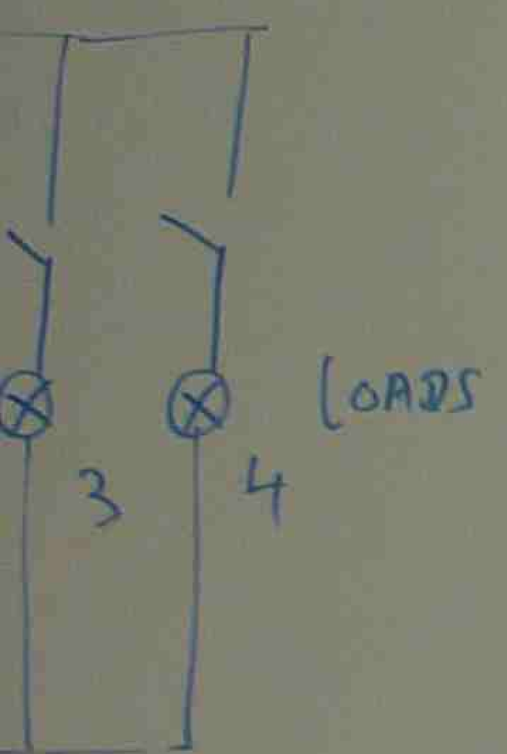
NO LOAD CURVE



LOAD CURVE

1. CONNECT
2. OFF TH
3. NOTE
4. ON THE
5. RESO

FIELD
FULL
9/10 ×
8/10 ×
7/10 ×
6/10
5/10
4/10
3/10

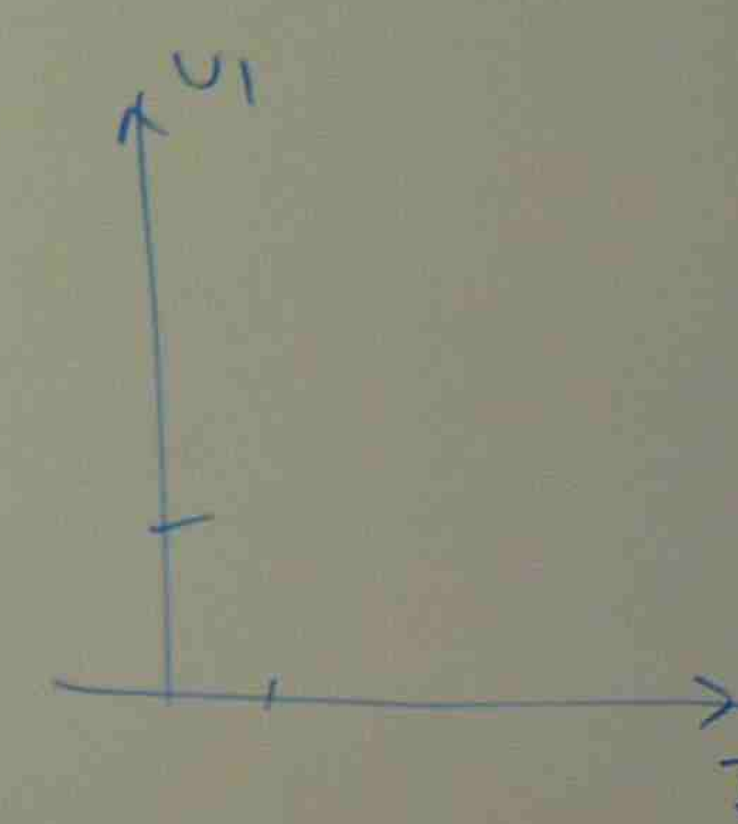


1. CONNECT THE GIVEN CIRCUIT
2. OFF THE FIELD EXCITATION SWITCH
3. NOTE THE TERMINAL VOLTAGE PRODUCED BY RESIDUAL MAGNETISM
4. ON THE FIELD EXCITATION SWITCH
5. – REDUCE FIELD RESISTANCE AND NOTE TERMINAL VOLTAGE

FIELD RESISTANCE	$I_f = \frac{U_2}{\text{RESISTANCE}}$	U_1
FULL $290\Omega + 286$		
$\frac{9}{10} \times 290 + 286$		
$\frac{8}{10} \times 290 + 286$		
$\frac{7}{10} \times 290 + 286$		
$\frac{6}{10} \times 290 + 286$		
$\frac{5}{10} \times 290 + 286$		
$\frac{4}{10} \times 290 + 286$		
$\frac{3}{10} \times 290 + 286$		

	U_1
$\frac{2}{10} \times 290 + 286$	
$\frac{1}{10} \times 290 + 286$	
286	

PLOT FIELD CURRENT VS TERMINAL VOLTAGE



6. REDU

7.

REVISION (1)

Q1 MOTOR PARTICULARS : SHUNT MOTOR 3.75 KW, 230V
18 Amp 1750 RPM. $R_a = 0.3\,\Omega$ BRUSH DROP
2V ON LOAD

CALCULATE (a) FULL LOAD TORQUE

(b) INITIAL RUSH OF ARMATURE CURRENT AND CORRESPONDING MOMENTARY MAXIMUM TORQUE AT THE INSTANT THE FIELD RHEOSTAT RESISTANCE IS INCREASED TO REDUCE THE FIELD FLUX TO 0.96 OF ORIGINAL VALUE

(c) FINAL ARMATURE CURRENT, SPEED AND POWER ASSUMING TORQUE IS AS IN (a)

1

3.75 KW

(a) P = 2

POWER

$T = \frac{60}{2\ldots}$

$= \frac{6}{2}$

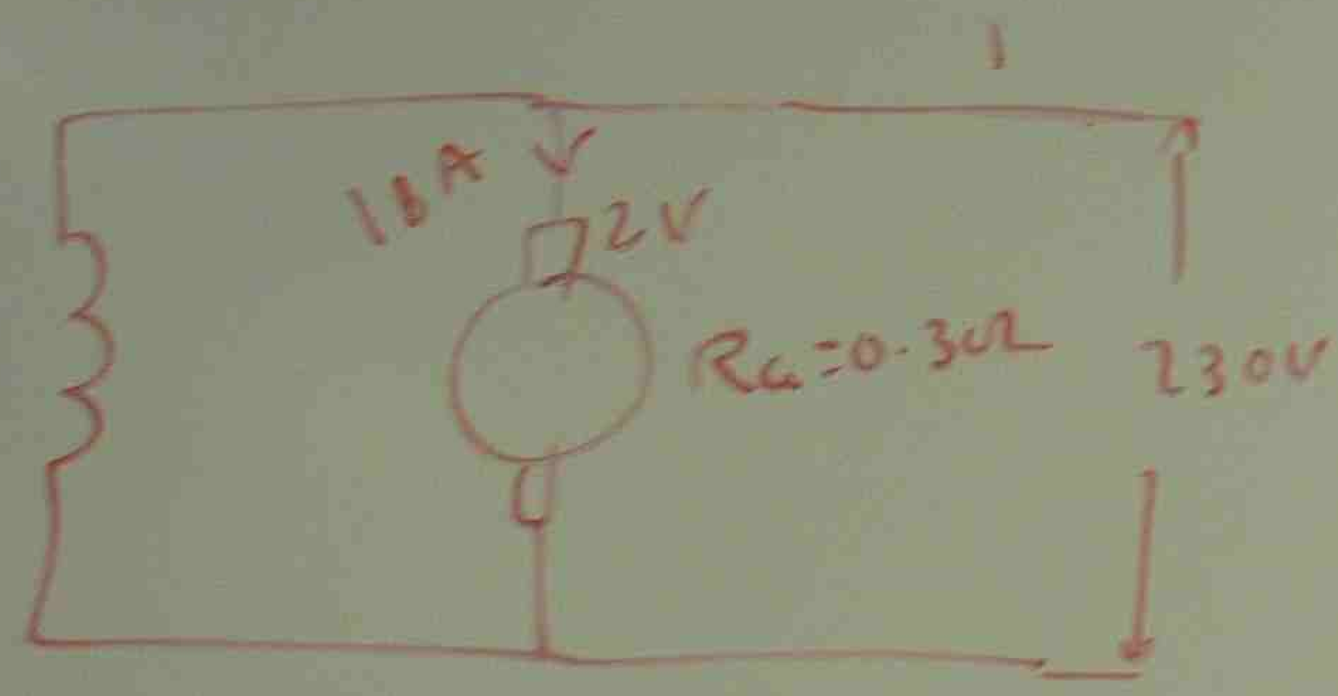
$= 2$

KW, 230V
DROP

URRENT AND
MUM TORQUE
STAT RESISTANCE
FLUX TO

PEED AND
IS AS IN (a)

1



3.75 KW

(a)

$$P = \frac{2\pi N T}{60}$$

POWER

$$T = \frac{60P}{2\pi N}$$

$$= \frac{60 \times 3750}{2 \times 3.1416 \times 1750}$$

$$= 20.4 \text{ N-m}$$

(b)

$$N_{FL} = \frac{V_t - \text{BRUSH DROP} - I_a R_a}{K\phi_a}$$

$$N_{FL} = \frac{230 - 2 - 18 \times 0.3}{K\phi_a}$$

$$1750 = \frac{222.6}{K\phi_a}$$

$$K\phi_a = \frac{222.6}{1750} = 0.1273$$

96% REDUCTION

$$K\phi_b = 0.96\ K\phi_a = 0.96 \times 0.1273$$

$$N_{FL} = \frac{V_t - \text{BRUSH DROP} - I_a R_a}{K\phi_a}$$

$$N_{FL} = \frac{230 - 2 - 18 \times 0.3}{K\phi_a}$$

$$= \frac{222.6}{K\phi_a}$$

$$= \frac{222.6}{1750} = 0.1273$$

UCTION

$$K\phi_a = 0.96 \times 0.1273$$

$$K\phi_b = \frac{V_t - \text{BRUSH DROP} - I_{a_2} R_a}{N_{FL}}$$

$$0.96 \times 0.1273 = \frac{230 - 2 - I_{a_2} \times 0.3}{1750}$$

$$I_{a_2} = 46.7 \text{ Amp.}$$

$$\frac{T_2}{T_1} = \frac{K\phi_b I_{a_2}}{K\phi_a I_{a_1}}$$

$$\frac{T_2}{20.4} = 0.96 \times \frac{46.7}{18}$$

$$T_2 = 20.4 \times 0.96 \times \frac{46.7}{18} = 50.56 \text{ N-m}$$

$$\% \Delta T = \frac{50.56 - 20.4}{20.4} \times 100 = 150\%$$

$\% \Delta I = 46.$

(c)

$N =$

$=$

$=$

$$K\phi_b = \frac{V_t - \text{BRUSH DROP} - I_{a_2} R_a}{N_{FL}}$$

$$.96 \times 0.1273 = \frac{230 - 2 - I_{a_2} \times 0.3}{1750}$$

$I_{a_2} = 46.7$ Amp.

$$\frac{T_2}{T_1} = \frac{K\,\phi_b\,I_{a_2}}{K\,\phi_a\,I_{a_1}}$$

$$\frac{T_2}{20.4} = 0.96 \times \frac{46.7}{18}$$

$$T_2 = \frac{20.4 \times 0.96 \times 46.7}{18} = 50.56\ \text{N-m}$$

$$\Delta T = \frac{50.56 - 20.4}{20.4} \times 100 = 150\%$$

$$\%\Delta I = \frac{46.7 - 18}{18} \times 100 = 160\%$$

(c)

$$N = \frac{V_t - \text{BRUSH DROP} - I_{a_2} R_a}{K\phi_b}$$

$$= \frac{230 - 2 - 46.7 \times 0.3}{0.96 \times 0.1273}$$

$$= 1751\ \text{RPM}$$

2 A 7

RESISTANCE

(a) IF

86 %.

CALCULAT

PLACED IN

NEW SPEED,

IN RESPECT

(a)

R_{sh}

62.2Ω

160%

...SH DROP $- I_{a_2} R_a$

V_b

46.7×0.3

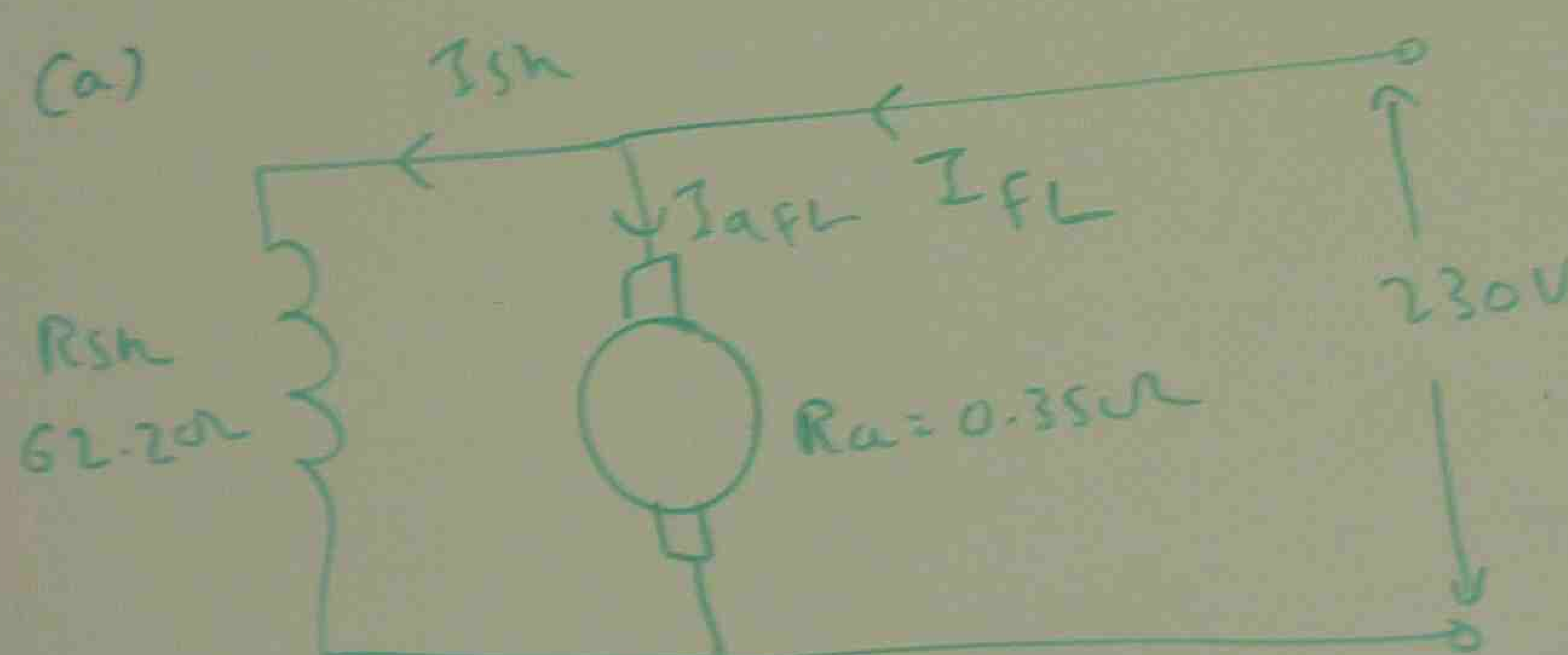
$.1273$

RPM

(2) A 7.46 kW, 230V, 1750 RPM SHUNT MOTOR ARMATURE RESISTANCE 0.35Ω HAS A SHUNT FIELD RESISTANCE 62.2Ω

(a) IF NO LOAD CURRENT IS 7.7 Amp AND FULL LOAD EFFICIENCY 86%. BRUSH DROP 3V AT FULL LOAD, 1 VOLT AT NO LOAD CALCULATE % SPEED REGULATION (b) A 2.65Ω RESISTANCE IS PLACED IN SERIES WITH THE ARMATURE CIRCUIT, CALCULATE THE NEW SPEED, % REGULATION AND POWER LOSS IN SERIES RESISTANCE IN RESPECT TO TOTAL POWER INPUT AT FULL LOAD

(a)



Full Load

Full Load input power $= \dfrac{7460}{0.86}$

$$I_{FL} = \frac{7460}{0.86 \times 230}$$

$= 37.7$ Amp

$$I_{sh} = \frac{230}{62.2} = 3.7 \text{ Amp}$$

$$I_{a\,FL} = I_{FL} - I_{sh} = 37.7 - 3.7 = 34 \text{ Amp}$$

$I_N = 7.7$ ...

$I_{sh} = 3.7$ ...

$I_{aN} = 7.7$ ...

$N = \dfrac{V_t - \dots}{k \dots}$

$N_{FL} = \dfrac{230 \dots}{\dots}$

$N_{NL} = \dfrac{23\dots}{\dots}$

% SPEED REG...

...PM SHUNT MOTOR ARMATURE
...ED RESISTANCE 62.2Ω
...P AND FULL LOAD EFFICIENCY
...LL LOAD, 1 VOLT AT NO LOAD
...A 2.65Ω RESISTANCE IS
...E CIRCUIT, CALCULATE THE
...ER LOSS IN SERIES RESISTANCE
...PUT AT FULL LOAD

Full load

Full load input power $= \frac{7460}{0.86}$

...OV

$I_{FL} = \frac{7460}{0.86 \times 230}$

$= 37.7$ Amp

$= 3.7$ Amp

$- I_{sh} = 37.7 - 3.7 = 34$ Amp.

$I_N = 7.7$ Amp

$I_{sh} = 3.7$ Amp

$I_{aN} = 7.7 - 3.7 = 4$ Amp.

$$N = \frac{V_t - \text{BRUSH DROP} - I_a R_a}{k\phi}$$

$$N_{FL} = \frac{230 - 3 - 34 \times 0.35}{k\phi} = \frac{215.1}{k\phi} \longrightarrow 1750 \text{ rpm}$$

$$k\phi = \frac{215.1}{1750}$$

$$N_{NL} = \frac{230 - 1 - 4 \times 0.35}{k\phi} = \frac{227.6}{k\phi}$$

$$\%\text{ SPEED REG} = \frac{N_{NL} - N_{FL}}{N_{NL}} \times 100$$

$$= \frac{\frac{227.6}{k\phi} - \frac{215.1}{k\phi}}{\frac{227.6}{k\phi}} \times 100 = 5.49\%$$

$$N_{FL_2} = \frac{V_t - \text{BR...}}{}$$

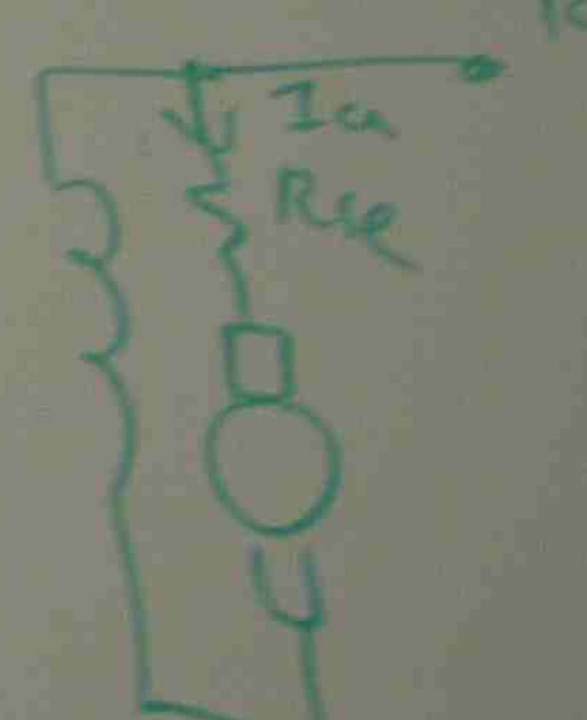
$= \frac{230 - ...}{}$

$N_{FL_2} = \frac{230 - ...}{...}$

$N_{FL_2} = \frac{...}{2...}$

% SPEED REG =

POWER LOSS IN ... RESIS...



$I_N = 7.7$ Amp

$I_{sh} = 3.7$ Amp

$I_{aN} = 7.7 - 3.7 = 4$ Amp

$$= \frac{V_t - \text{BRUSH DROP} - I_a R_a}{k\phi}$$

$$= \frac{230 - 3 - 34 \times 0.35}{k\phi} = \frac{215.1}{k\phi} \longrightarrow 1750 \text{ RPM}$$

$$k\phi = \frac{215.1}{1750}$$

$$= \frac{230 - 1 - 4 \times 0.35}{k\phi} = \frac{227.6}{k\phi}$$

$$\text{SPEED REG} = \frac{N_{NL} - N_{FL}}{N_{NL}} \times 100$$

$$= \frac{\frac{227.6}{k\phi} - \frac{215.1}{k\phi}}{\frac{227.6}{k\phi}} \times 100 = 5.49\%$$

$$N_{FL_2} = \frac{V_t - \text{BRUSH DROP} - I_a R_{a2}}{k\phi}$$

$$= \frac{230 - 3 - 34 \times (2.65 + 0.35)}{k\phi}$$

$$N_{FL_2} = \frac{230 - 3 - 34 \times 3}{k\phi} = \frac{125}{k\phi}$$

$$N_{FL_2} = \frac{125}{\frac{215.1}{1750}} = \frac{1750 \times 125}{215.1}$$

$$= 1016 \text{ RPM}$$

$$\% \text{ SPEED REG} = \frac{1750 - 1016}{1750} \times 100 = 41.4\%$$

POWER LOSS IN SERIES RESISTOR $= I_a^2 R_{se} = 34^2 \times 2.65$

$= 3063.4$ W

$$\% \text{ POWER LOSS} = \frac{3063.4}{7460} \times 100$$

$$= 41\%$$

$\frac{\ \ \ \ 8}{\ }\times 100 =$ 160%

t - BRUSH DROP $- I_{a_2} Ra$

$K\phi_b$

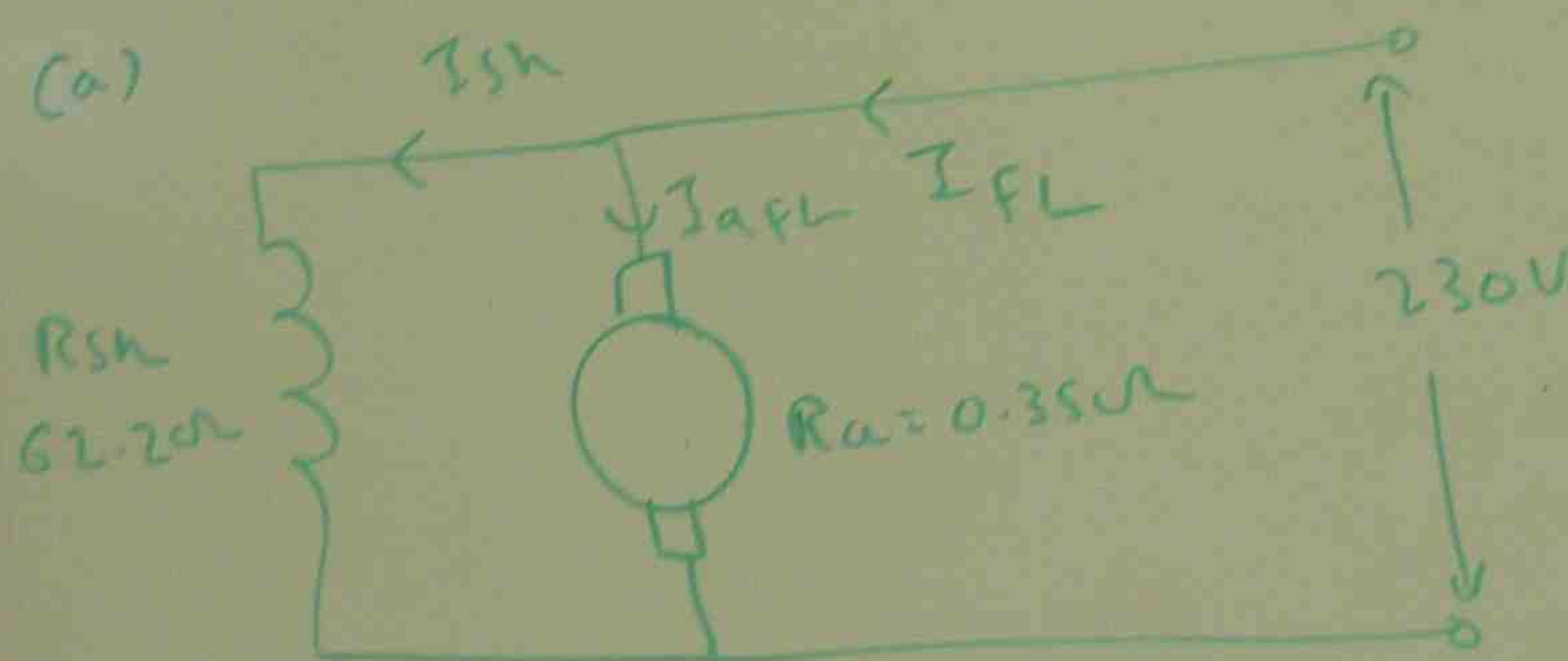
$-2 - 46.7 \times 0.3$

$.96 \times 0.1273$

$= 51$ RPM

② A 7.46 kW, 230V, 1750 RPM SHUNT MOTOR ARMATURE RESISTANCE 0.35 Ω HAS A SHUNT FIELD RESISTANCE 62.2 Ω. (a) IF NO LOAD CURRENT IS 7.7 Amp AND FULL LOAD EFFICIENCY 86%. BRUSH DROP 3V AT FULL LOAD, 1 VOLT AT NO LOAD CALCULATE % SPEED REGULATION (b) A 2.65 Ω RESISTANCE IS PLACED IN SERIES WITH THE ARMATURE CIRCUIT, CALCULATE THE NEW SPEED, % REGULATION AND POWER LOSS IN SERIES RESISTANCE IN RESPECT TO TOTAL POWER INPUT AT FULL LOAD

(a)



Full LOAD

$$\text{Full LOAD INPUT POWER} = \frac{7460}{0.86}$$

$$I_{FL} = \frac{7460}{0.86 \times 230}$$

$$= 37.7 \text{ Amp}$$

$$I_{sh} = \frac{230}{62.2} = 3.7 \text{ Amp.}$$

$$I_{a\,FL} = I_{FL} - I_{sh} = 37.7 - 3.7 = 34 \text{ Amp.}$$

$I_N = 7.7$ Amp

$I_{sh} = 3.7$ Amp

$I_{aN} = 7.7 - 3.7 =$

$$N = \frac{V_t - \text{BRUSH}}{K\phi}$$

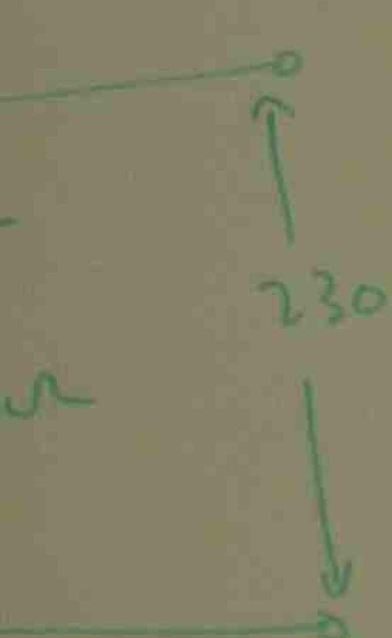
$$N_{FL} = \frac{230 - 3}{K}$$

$$N_{NL} = \frac{230 -}{}$$

% SPEED REG =

17 50 RPM SHUNT MOTOR ARMATURE
SHUNT FIELD RESISTANCE 62.2Ω.
IS 7.7 Amp AND FULL LOAD EFFICIENCY
AT FULL LOAD , 1 VOLT AT NO LOAD
LATION (b) A 2.65Ω RESISTANCE IS
ARMATURE CIRCUIT, CALCULATE THE
AND POWER LOSS IN SERIES RESISTANCE
POWER INPUT AT FULL LOAD

Full Load



Full Load Input Power $= \frac{7460}{0.86}$

$$I_{FL} = \frac{7460}{0.86 \times 230} = 37.7 \text{ Amp}$$

$$\frac{230}{62.2} = 3.7 \text{ Amp}$$

$$I_{aFL} = I_{FL} - I_{sh} = 37.7 - 3.7 = 34 \text{ Amp.}$$

$$I_N = 7.7 \text{ Amp}$$

$$I_{sh} = 3.7 \text{ Amp}$$

$$I_{aN} = 7.7 - 3.7 = 4 \text{ Amp.}$$

$$N = \frac{V_t - \text{Brush Drop} - I_a R_a}{k\phi}$$

$$N_{FL} = \frac{230 - 3 - 34 \times 0.35}{k\phi} = \frac{215.1}{k\phi} \rightarrow 1750 \text{ rpm}$$

$$k\phi = \frac{215.1}{1750}$$

$$N_{NL} = \frac{230 - 1 - 4 \times 0.35}{k\phi} = \frac{227.6}{k\phi}$$

$$\%\text{ Speed Reg} = \frac{N_{NL} - N_{FL}}{N_{NL}} \times 100$$

$$= \frac{\frac{227.6}{k\phi} - \frac{215.1}{k\phi}}{\frac{227.6}{k\phi}} \times 100 = 5.49\%$$

$$N_{FL_2} = \frac{V_t - \text{Brush Drop} - \ldots}{k\phi}$$

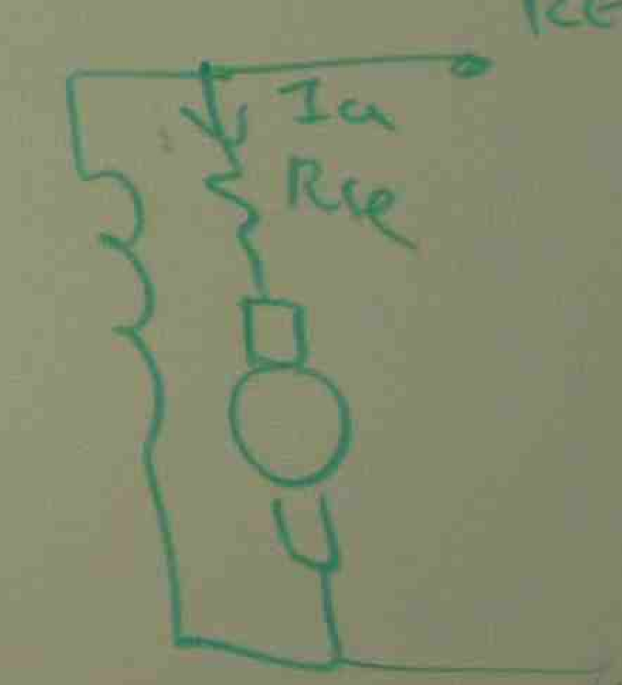
$$= \frac{230 - 3 - 3\ldots}{k\phi}$$

$$N_{FL_2} = \frac{230 - 3 - 34\times\ldots}{k\phi}$$

$$N_{FL_2} = \frac{125}{\frac{215.1}{1750}}$$

$$\%\text{ Speed Reg} = \frac{1750 - \ldots}{175\ldots}$$

Power loss in series resistor



% pow...

$I_N = 7.7$ Amp

$I_{sh} = 3.7$ Amp

$I_{aN} = 7.7 - 3.7 = 4$ Amp

$$N = \frac{V_t - \text{BRUSH DROP} - I_a R_a}{k\phi}$$

$$N_{FL} = \frac{230 - 3 - 34 \times 0.35}{k\phi} = \frac{215.1}{k\phi} \longrightarrow 1750 \text{ rpm}$$

$$k\phi = \frac{215.1}{1750}$$

$$N_{NL} = \frac{230 - 1 - 4 \times 0.35}{k\phi} = \frac{227.6}{k\phi}$$

$$\%\text{ SPEED REG} = \frac{N_{NL} - N_{FL}}{N_{NL}} \times 100$$

$$= \frac{\frac{227.6}{k\phi} - \frac{215.1}{k\phi}}{\frac{227.6}{k\phi}} \times 100 = 5.49\%$$

$$N_{FL_2} = \frac{V_t - \text{BRUSH DROP} - I_a R_{a2}}{k\phi}$$

$$= \frac{230 - 3 - 34 \times (2.65 + 0.35)}{k\phi}$$

$$N_{FL_2} = \frac{230 - 3 - 34 \times 3}{k\phi} = \frac{125}{k\phi}$$

$$N_{FL_2} = \frac{125}{\frac{215.1}{1750}} = \frac{1750 \times 125}{215.1}$$

$$= 1016 \text{ RPM}$$

$$\%\text{ SPEED REG} = \frac{1750 - 1016}{1750} \times 100 = 41.4\%$$

$$\text{POWER LOSS IN SERIES RESISTOR} = I_a^2 R_{se} = 34^2 \times 2.65$$

$$= 3063.4 \text{ W}$$

$$\%\text{ POWER LOSS} = \frac{3063.4}{7460} \times 100$$

$$= 41\%$$

(3) A 4 POLE WAVE WOUND ARMATURE OPERATING IN A FIELD OF FLUX 0.01 WEBER IS WOUND WITH 360 ARMATURE CONDUCTORS. DETERMINE THE EXPRESSION OF TORQUE AS A FUNCTION OF SPEED IF $V_t = 250V$, $R_a = 0.1\Omega$

$$T = \frac{k_t \phi V_t}{R_a} - \frac{k_e k_t \phi^2}{R_a} n$$

$$k_t = \frac{PZ}{2\pi a}$$

$a = 2m$

Simplex wave

$$k_t = \frac{4 \times 360}{2 \times 3.1416 \times 2}$$

$m = 1$

$a = 2 \times 1 = 2$

$$= 114.5$$

$$k_e = \frac{PZ}{60a} = \frac{4 \times 360}{60 \times 2} = 12$$

$T = 114.5$

$T = 2$

LE WAVE WOUND ARMATURE OPERATING IN A FIELD

X 0.01 WEBER IS WOUND WITH 360 ARMATURE

RS DETERMINE THE EXPRESSION OF TORQUE AS A

OF SPEED IF $V_t = 250V$, $Ra = 0.1\Omega$

$$\frac{\phi \; V_t}{Ra} - \frac{K_e K_t \phi^2}{Ra} N$$

$$t = \frac{PZ}{2\pi a}$$

$a = 2m$

Simplex wave

$m = 1$

$$t = \frac{4 \times 360}{2 \times 3.1416 \times 2}$$

$a = 2 \times 1 = 2$

$= 114.5$

$$K_e = \frac{PZ}{60a} = \frac{4 \times 360}{60 \times 2} = 12$$

$$T = \frac{114.5 \times 0.01 \times 250}{0.1} - \frac{12 \times 114.5 \times (0.01)^2}{0.1} N$$

$$T = 2860 - 1.38 N$$

(3) A 4 POLE WAVE WOUND ARMATURE OPERATING IN A FIELD OF FLUX 0.01 WEBER IS WOUND WITH 360 ARMATURE CONDUCTORS. DETERMINE THE EXPRESSION OF TORQUE AS A FUNCTION OF SPEED IF $V_t = 250V$, $R_a = 0.1\Omega$

$$T = \frac{k_t \phi V_t}{R_a} - \frac{k_e k_t \phi^2}{R_a} N$$

$$k_t = \frac{PZ}{2\pi a}$$

$a = 2m$

SIMPLEX WAVE

$m = 1$

$a = 2 \times 1 = 2$

$$k_t = \frac{4 \times 360}{2 \times 3.1416 \times 2}$$

$$= 114.5$$

$$k_e = \frac{PZ}{60a} = \frac{4 \times 360}{60 \times 2} = 12$$

$T = 114.5 \times$

$T = 286$

(4) THE M

EQUATION

FOR LOAD (i

(ii

CALCULA

(i) $T =$

$T =$

$2860 -$

2860

$N = ?$

...AVE WOUND ARMATURE OPERATING IN A FIELD ...01 WEBER IS WOUND WITH 360 ARMATURE ...TERMINE THE EXPRESSION OF TORQUE AS A ... SPEED IF $V_t = 250V$, $Ra = 0.1\Omega$

$$\frac{...Vt}{} - \frac{Ke\,Kt\,\phi^2}{Ra} N$$

$\dots Z$ / $\dots\pi a$ $\qquad a = 2m$

SIMPLEX WAVE

$m = 1$

$a = 2 \times 1 = 2$

$$\frac{4 \times 360}{\times 3.1416 \times 2} = 114.5$$

$$\frac{\dots Z}{60a} = \frac{4 \times 360}{60 \times 2} = 12$$

$$T = \frac{114.5 \times 0.01 \times 250}{0.1} - \frac{12 \times 114.5 \times (0.01)^2}{0.1} N$$

$$T = 2860 - 1.38N$$

④ THE MOTOR HAS THE FOLLOWING CHARACTERISTICS EQUATION $T = 2860 - 1.38N$

FOR LOAD (i) $T = 50 + 1.25N$

(ii) $T = 50 + 6.25 \times 10^{-4} N^2$

CALCULATE SPEED.

(i) $T = 2860 - 1.38N$

$T = 50 + 1.25N$

$2860 - 1.38N = 50 + 1.25N$

$2860 - 50 = (1.38 + 1.25)N$

$$N = \frac{2810}{2.63} = 1068\ \text{Rpm}$$

(ii) $T = 2\dots$

$T = \dots$

$2860 - 1.38N = \dots$

$6.25 \times 10^{-4} N^2 \dots$

$A x^2 \dots$

$$x = \frac{-B \pm \dots}{\dots}$$

$$= \frac{-(1.38)\dots}{\dots}$$

$$= \frac{-1.38\dots}{\dots}$$

$$= \frac{-1.32\dots}{1\dots}$$

$$\frac{114.5 \times 0.01 \times 250}{0.1} - \frac{12 \times 114.5 \times (0.01)^2}{0.1} N$$

$$2860 - 1.38 N$$

... MOTOR HAS THE FOLLOWING CHARACTERISTICS

...N $T = 2860 - 1.38 N$

(i) $T = 50 + 1.25 N$

(ii) $T = 50 + 6.25 \times 10^{-4} N^2$

...CULATE SPEED.

$T = 2860 - 1.38N$

$T = 50 + 1.25 N$

$...0 - 1.38N = 50 + 1.25N$

$...60 - 50 = (1.38 + 1.25) N$

$$\frac{2810}{2.63} = 1068 \text{ Rpm}$$

(ii) $T = 2860 - 1.38N$

$T = 50 + 6.25 \times 10^{-4} N^2$

$$2860 - 1.38N = 50 + 6.25 \times 10^{-4} N^2$$

$$6.25 \times 10^{-4} N^2 + 1.38N - 2810 = 0$$

$$A x^2 + B x + C = 0$$

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

$$= \frac{-(1.38) \pm \sqrt{(1.38)^2 - 4 \times 6.25 \times 10^{-4} \times (-2810)}}{2 \times 6.25 \times 10^{-4}}$$

$$= \frac{-1.38 \pm \sqrt{1.9044 + 7.025}}{12.5 \times 10^{-4}}$$

$$= \frac{-1.38 \pm 2.98}{12.5 \times 10^{-4}} = \frac{-1.38 + 2.98}{12.5 \times 10^{-4}}$$

$$\frac{1.6}{12.5 \times 10^{-4}} = 1280 \text{ RPm}$$

(5) THE RESIS...

OF A 240 V D...

ASSUMING THAT ...

THE CURRENT A...

TO 200% OF ...

AND THE FULL...

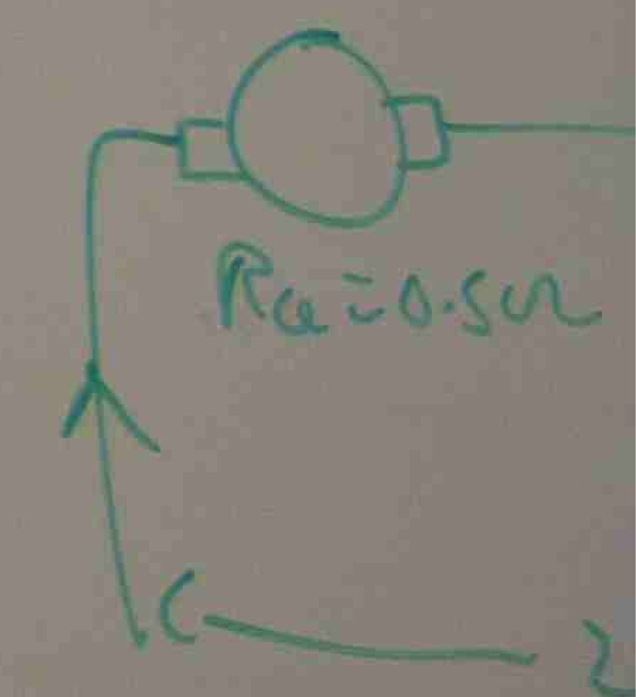
DETERMINE (...

THE ARMATU...

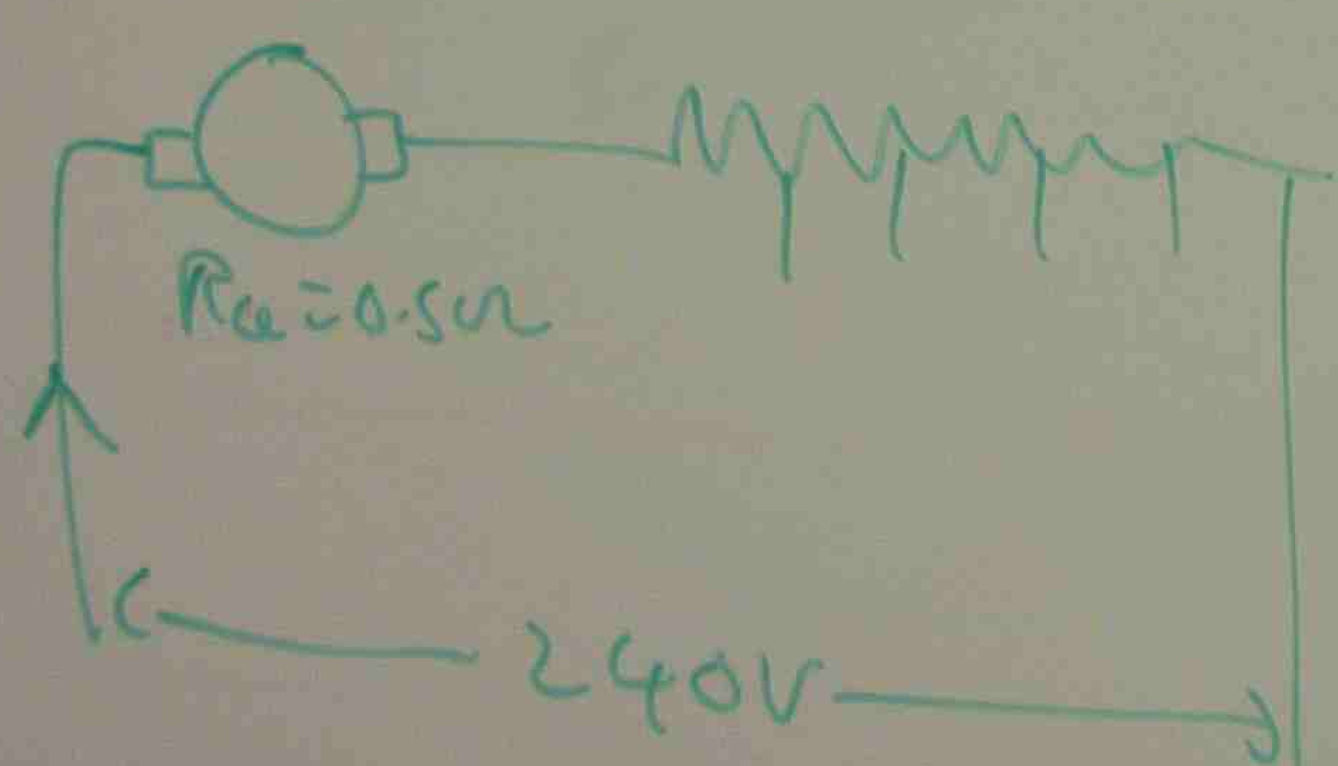
(b) THE NUM...

STARTER ...

EACH STUD.



(5) THE RESISTANCE OF AN ARMATURE OF A 240 V DC SHUNT MOTOR IS 0.5Ω. ASSUMING THAT IT IS REQUIRED THAT THE CURRENT AT STARTING BE LIMITED TO 200% OF THE FULL LOAD CURRENT AND THE FULL LOAD CURRENT IS 15 amp DETERMINE (a) TOTAL RESISTANCE OF THE ARMATURE CIRCUIT AT STARTING (b) THE NUMBER OF STUDS ON THE STARTER (c) THE RESISTANCE BETWEEN EACH STUD.



$I_s = 200\%\ I_{FL}$

$= 2 \times 15 = 30A$

(a) $R_1 = \frac{Vt}{I_s} = \frac{240}{30} = 8\ \Omega$

$$\left(\frac{I_s}{I_R}\right)^n = \frac{R1}{Ra}$$

$$\left(\frac{30}{15}\right)^n = \frac{8}{0.5}$$

$$2^n = 16$$

$$2^n = 2^4$$

$$n = 4$$

(b) NO. OF STUDS = $n+1 = 4+1 = 5$

$R_2 =$

$R_3 =$

$R_4 =$

$R_5 =$

$= 8\,\Omega$

$\frac{R_1}{R_2}$

$\frac{8}{0.5}$

$= n+1 = 4+1 = 5$

$$R_2 = R_1 \times \frac{\delta r}{\delta s}$$

$$= 8 \times \frac{15}{30} = 4\,\Omega$$

$$R_3 = R_2 \times \frac{\delta r}{\delta s}$$

$$= 4 \times \frac{1}{2} = 2\,\Omega$$

$$R_4 = R_3 \times \frac{\delta r}{\delta s}$$

$$= 2 \times \frac{1}{2} = 1\,\Omega$$

$$R_5 = R_4 \times \frac{\delta r}{\delta s}$$

$$= 1 \times \frac{1}{2} = 0.5\,\Omega$$

$$r_1 = R_1 - R_2 = 8 - 4 = 4\,\Omega$$

$$r_2 = R_2 - R_3 = 4 - 2 = 2\,\Omega$$

$$r_3 = R_3 - R_4 = 2 - 1 = 1\,\Omega$$

$$r_4 = R_4 - R_5 = 1 - 0.5 = 0.5\,\Omega$$