...kh University
...of Engineering
...partment: Electrical Engineering
Year: 3rd (2007)/2017-2018
Subject: Electric Tests (2)
Name: Dr. Amlak Abaza

Date: 14-1-2018
Time Allowed: 3 hours
Full Mark: 60
Final Eaxm: 2nd Term
Acadimic Code: EPM3005

Answer Model

Question 1: (a) The connection diagram to perform

(i) The Load characteristic curve of separately-excited DC generator

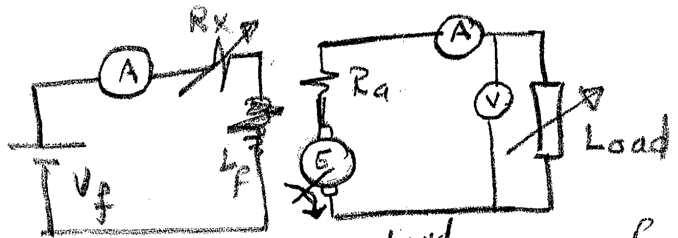


Fig 1: Connection of load c/cs curve of separately excited DC generator

(ii) Load characteristic curve of self-excited DC shunt generator.

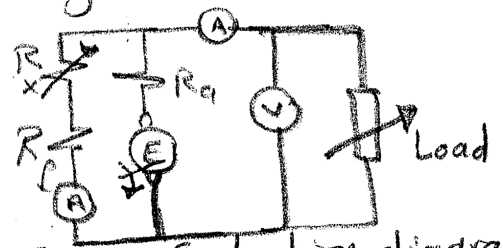


Fig. 2: Connection diagram of DC shunt gen

(b) An experiment to perform Load test of separately-excited DC generator

1- Connect the circuit As shown in Fig-1 at no Load.
2- Rotate the prime-mover of the generator at rated speed
3- Adjust the field resistance to control the output Voltage of the generator.
4- After the o/p voltage reaching the rated voltage ... the Load resistance to maximum Value.

record the ammeter and voltmeter (of the external Load) reading

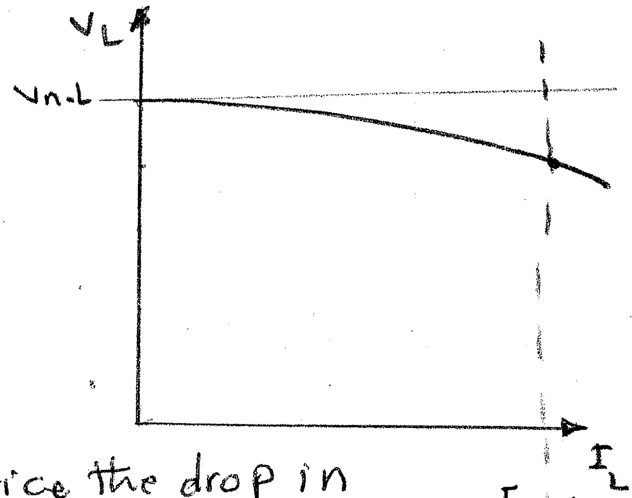
5- Change the Load resistance to increase the Load Current by steps and record the terminal voltage and current (V_L, I_L) at each step.

6- At each step be sure that the speed is at its rated rpm

I_L	—	—				$I_L = I_{rat}$
V_L	—	—				

7- If the speed changed, adjust the field resistance to restore it to its nominal value

8- Draw the external characteristic curve (I_L - V_L)



9- Notice the drop in terminal voltage with increase the load current

* Interpertation of The Results

It is noticed that $V_L \downarrow$ with $I_L \uparrow$, this is because :

$V_L = E_a - I_a R_a$, $I_L = I_a$

$\Rightarrow V_L = E_a - I_L R_a$, R_a is the armature resistance

$\because E_a = k\phi n$ = Const

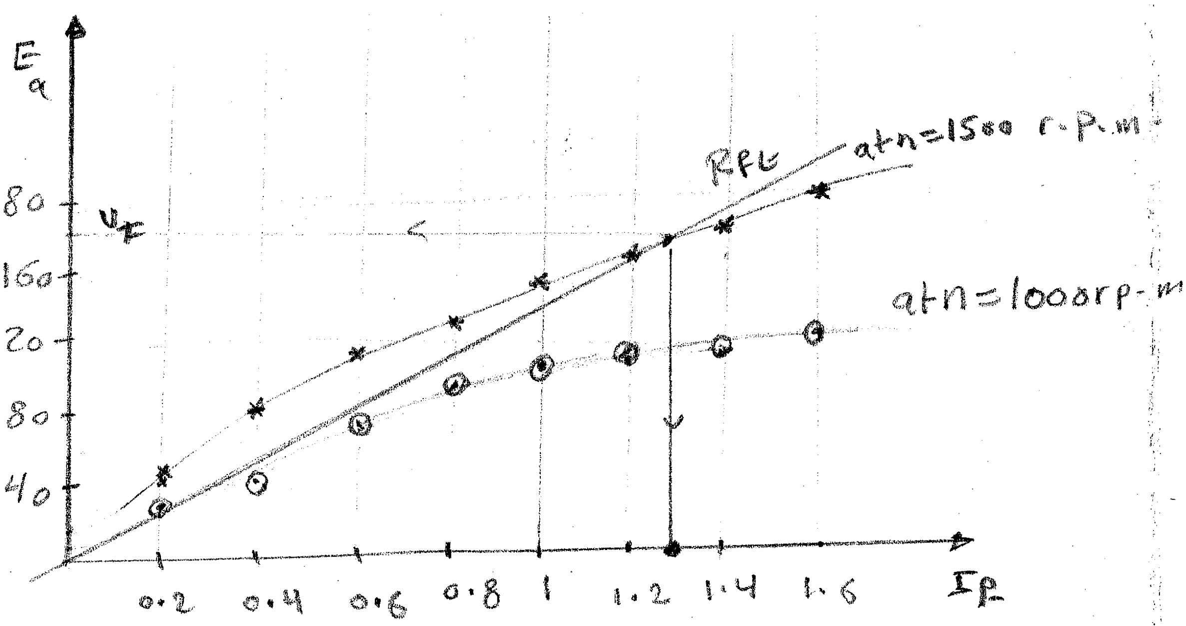
$\rightarrow$ by increasing I_L $\Rightarrow$ decreasing V_L (voltage drop on the R_a)

(c) The opencircuit c/cs curve of separately excited Dc generator At 1500 r.p.m

$\because E_{a2} = E_{a1} * \frac{I_{f2}}{I_{f1}} \cdot \frac{n_2}{n_1} \Rightarrow E_{a2} = E_{a1} * \frac{1500}{1000}$ | at the same I_f

I_f /A	0.2	0.4	0.6	0.8	1	1.2	1.4	1.6
E_a | n=1000 r.p.m	30	55	75	90	100	110	115	120
E_a | 1500 r.p.m	45	82.5	112.5	135	150	165	172.5	180

(i)



(ii) Yes the generator produces em.f at $I_f = 0.0$
this due to residual magnetizm (B_r) in the core.
and at n = rated value ⇒ small E_a

(iii) $R_{ft} = \frac{V_T}{I_f} = \frac{170}{1.25} = 136\ \Omega$ $\because R_{ft} = R_f + R_x$

$\Rightarrow R_x = 130\ \Omega$

Q2: (a) Starting test of Dc Shunt (generator / or motor)

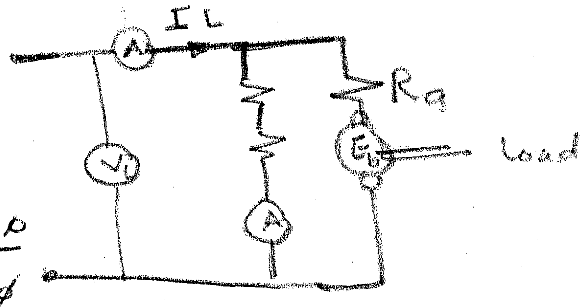
(b) If a Dc shunt motor is Loaded the speed can be adjusted by the; ......

(i) Input voltage

(ii) field resistance ⟶ It is a prefered method because it gives a smooth changes in ...

5. $V_L = 200\,V$, $P = 5\,kW$, $R_a = 0.05\,\Omega$
(operates as shunt motor

To limit I_{Lst} to 110% of full Load current :



Dc shunt motor

$\because I_{Lrat} = \frac{P_{in}}{V_L} = \frac{5000}{200} = 25\,A$

[Assuming % efficiency → $P_{in} \approx P_o$]

$\therefore I_{L,st} = \frac{110}{100} \times 25 = 27.5\,A$

At starting $n = 0.0 \Rightarrow E_b = 0.0$

$\because I_L = \frac{V_L - E_b}{R_a} \Rightarrow I_{L,st} = \frac{V_L}{R_{at}}$

∴ to make $I_{L,st}$ as 27.5 A → It must insert a series resistance with armature limit the starting current ⇒

$R_{at} = \frac{200}{27.5} = 7.272\,\Omega$

$R_{at} = R_a + R_{add}$

$R_{add} = R_{at} - R_a = 7.272 - 0.05 = 7.222\,\Omega$

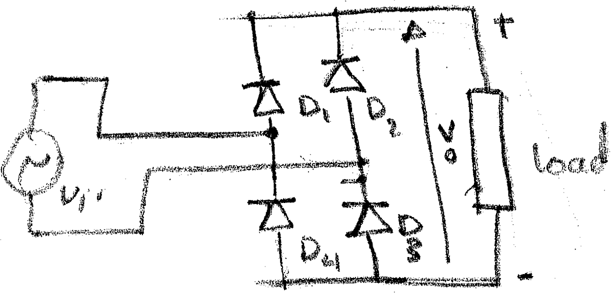
This method has a drawback, as the Power loss on the Radd

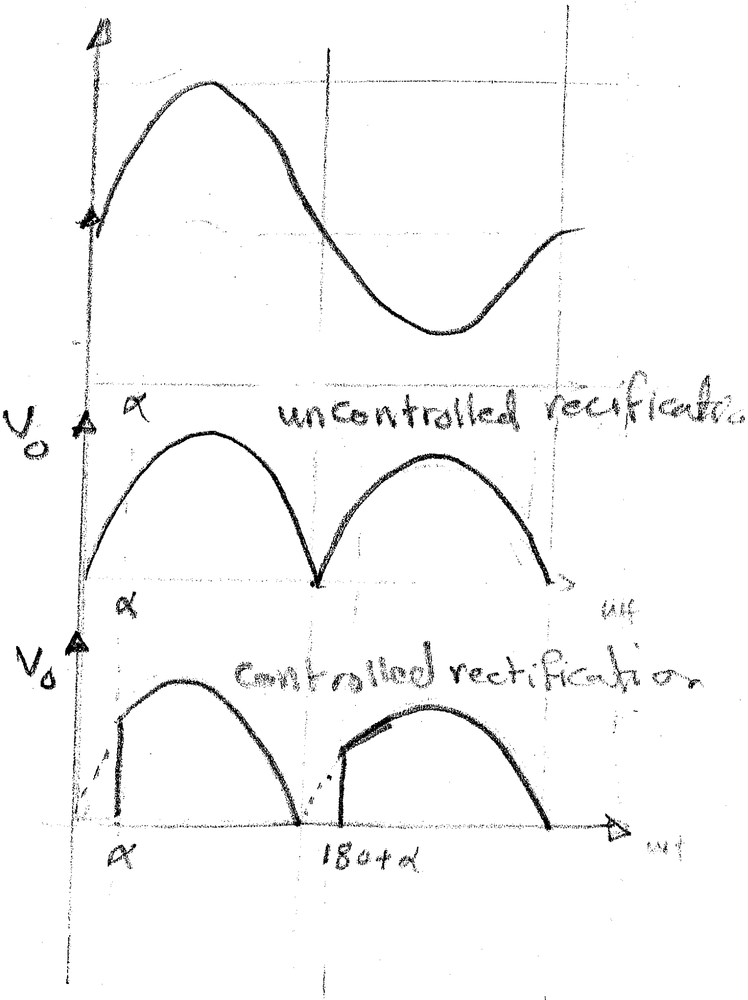
<u>Another method</u> :

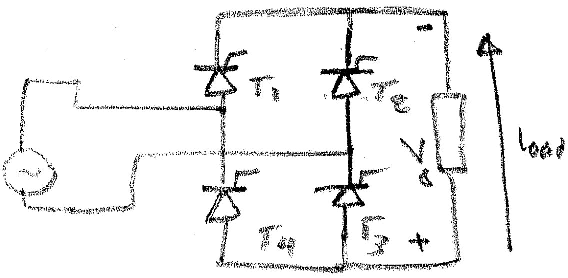
We can start Dc shunt motor by adjust the input voltage at starting (start with small value until the E_b exist and then ... its rated value

Q3:

(a) DC source from 1-ph AC (full wave uncontrolled and controlled recification)



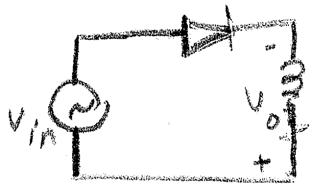


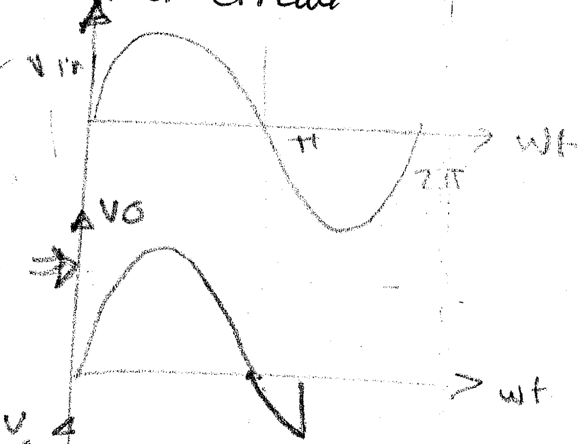


(b) The effect of:

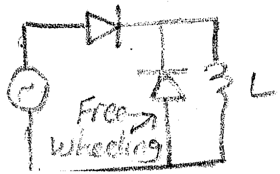
(i) Inductive Load for the rectifier circuit

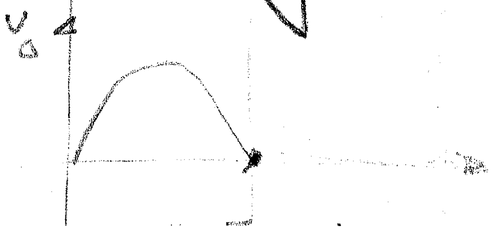
For half-wave uncontrolled rectifier



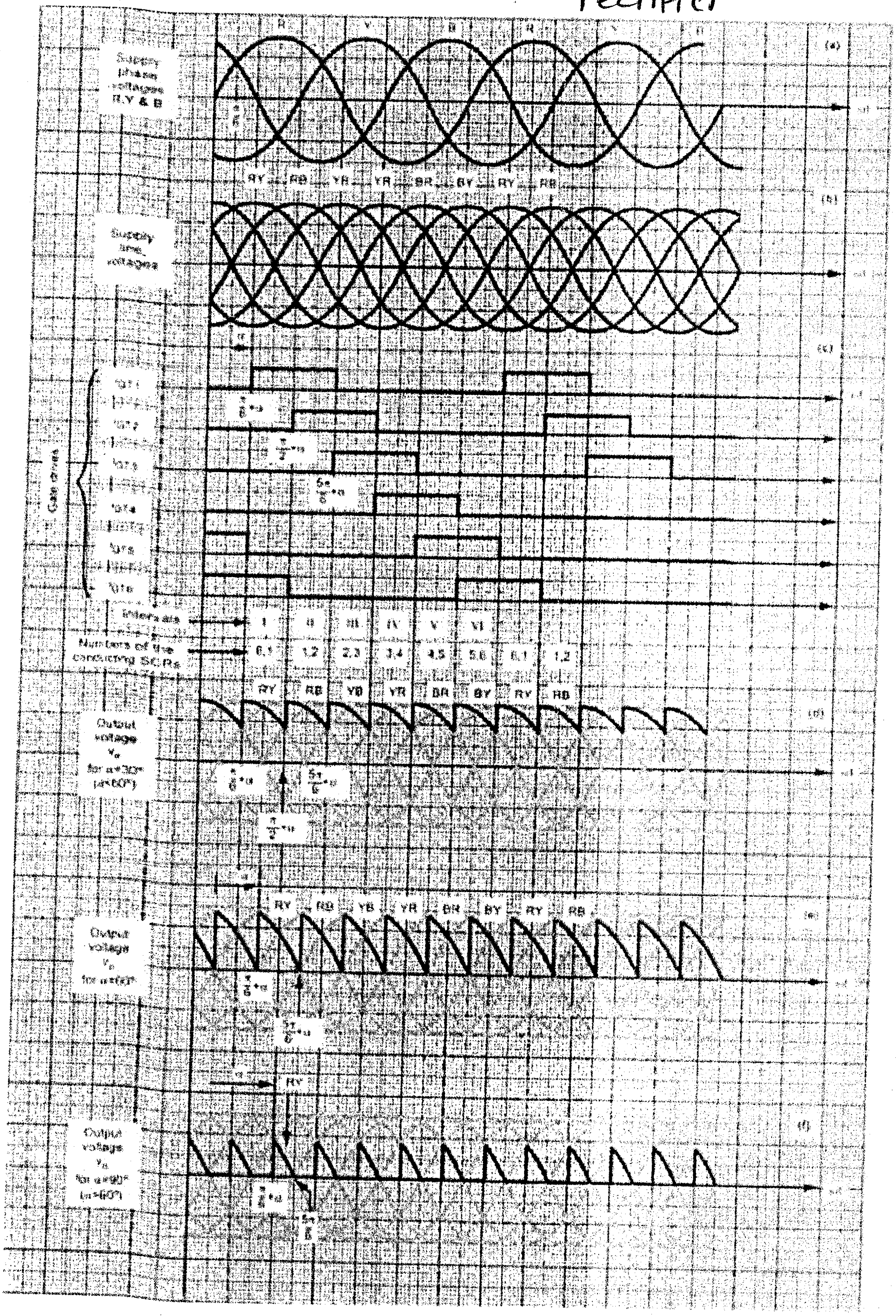


(ii) Freewheeling diod





Q4: o/p voltage From Three phase full wave controlled rectifier



For $\alpha = 30°$

For $\alpha = 60°$

For $\alpha = 90°$

For $\alpha = 120$

$V_o = 0$ - d

Fig 4: Waveform of Three Phase Fully Controlled Bridge Rectifier

Q4 :

(b)

(i) The terminal voltage of self-ex. DC generator $V_T = 0.0$ because

① There is no residual magnetizm

② reverse connection of armature Terminal

(ii) Speed increase with increase R_{xf} (added resistance to field): (DC shunt motor)

Because :

$$n \propto \frac{E_a}{\phi} \Rightarrow n \propto \frac{V_L - I_a R_a}{K(I_f)}$$

If we increase the external field resistance ⇒ decrease the field current, I_f, and then increase the speed of the motor

(iii)