LAB RECORD **(Weight: 20 %)**

Step 3: TABLE A :

Decrease the input V_A from 7 Volts and then increase it in the steps given and enter the corresponding values of the other variables.

Table A

	V_A Volts	V_B Volts	I mA	T_p sec
Decreasing ↓	**7**			
	6			
	5			
	4			
	3			
Increasing ↓	**3.5**			
	4.5			
	5.5			
	6.5			

Steps 4 & 5 : **MECHANICAL & ELECTRICAL LOADING**

Table B

	FL Position	V_A Volts	V_B Volts	I mA	T_p sec
	Fully Released	**6**			
MECHANICAL LOADING	FL Setting#1	**6**			
	FL Setting #2	**6**			
	FL Setting #3	**6**			
ELECTRICAL LOADING	Switch EL to Right, 30 Ω Load	**6**			
	Switch EL to Left, 10 Ω Load	**6**			

TA Signature : ………………………..

LAB REPORT (Weight: 60 %)

Determination of motor constant K ($=K_b=K_T$).

From the data of Table A , calculate and enter ω values in the table below:

V_B Volts	Speed ω radians/s

Plot the voltage V_B (magnitude only) against ω(radians/sec) using all the values recorded in the above table. Determine the slope of the 'best fit' straight line through the points [Linear regression software such as that available in Excel™ etc may be used].This gives the nominal value of the 'Back- Emf' constant K_b in Volt-second /radian. Obtain K_b from the 'best fit' line. The numerical value also corresponds to the torque-constant K_T in Newton-metre / ampere.

K_b = …………………..Volt-sec/radian (= K_T , in N-m/amp)

Determination of the Torque-Speed characteristic ['Loading curve']

From the data of TABLE B (Mechanical & Electrical loading)and the value of K_T, calculate and enter values for the torque T against the ω values in the table below:

	MECHANICAL LOADING				ELECTRICAL LOADING	
	RELEASED	FL#1	FL#2	FL#3	EL>Right	EL>Left
Torque **T** mN-m						
Speed ω radians/s						

Plot the torque T against ω(radians/sec) using all the values recorded in the above table. Determine the slope of the 'best fit' straight line through the points [Linear regression software such as that available in Excel™ etc may be used].This will yield the nominal values of the constants k_1 and k_2 given earlier.

Continued>>>>

(LAB REPORT Continued)

[Note that if T and ω are in units of mN-m and radians/sec, respectively, when plotting in Excel™, k_1 and k_2 will also be expressed in mN-m and mN-m-sed/radian.]

Effective Viscous Friction in the unloaded condition : From the table used to plot the loading characteristic, determine the approximate viscous friction 'seen' by the driving motor A when it is not additionally loaded (use the data in the first column of the table):

$B = T/\omega =$………………………… Nm-sec/radian

Effective Armature circuit Resistance R_a: From the data of Table A , determine the values of R_a corresponding to the nine data values , using

$$R_a = \frac{V_t - E_b}{I} = \frac{V_A - V_B}{I}$$

and hence obtain an average value:

Average R_a =………………………… Ω

Speed regulation:

From the data of TABLE B , let the 'no load' condition be defined by FL being fully released and switch EL in its center position. Choose any one of the loaded condition as 'full load' and calculate the Speed Regulation S :

No-Load Speed $\omega_{no\ load}$ = . ……………..

Full-Load Speed $\omega_{full\ load}$ = ……………….. [State chosen load condition]

Speed Regulation S = 100 […… − …….] / (……..) = ………………%

Efficiency: With the same reference values used for calculating S above, determine the efficiency η :

V_A = 6 volts , I = …………….mA

and ω = ………………rad/sec

$P_{out} = T\omega = K_T I \omega$ = ………………….Watts

$P_{in} = V_A I$ = …………………………..Watts

Hence ,

Efficiency $\eta = 100\ P_{out}/P_{in}$ = ………………………… %.

DISCUSSION & CONCLUSION: [Discuss possible reasons for any differences observed between theory and the experimental results. Express, in your own words, what you learnt upon doing this experiment.]

[An attempt may be made to correlate the experimentally obtained values of the constants k_1 and k_2 with the constants of the Torque-Speed equation $\frac{KV_t}{R_a}$ and $\frac{K^2}{R_a}$ derived in the tutorial section]