ES151

Objective

1. Calibration of sensors (potentiometer and tachogenerator) used in ES151.
2. Find the gain and time constant of the servo by modeling it as a first order system.

Set zero Adjustment

1. Set the compensation switch to “out”. Turn the power on.
2. Connect the per-amplifier and the servo amplifier by connecting terminal Q to W and terminal S to Z.
3. Rotate the preamplifier set zero knob on both sides and observe the effect on the motor.
4. Adjust the set zero till the motor stops and draws the least current possible.
5. This adjustment, called the *set zero adjustment*, has to be made at the start of every experiment.

Methodology

Part I

Calibration of the potentiometer

Procedure

1. Set the compensation switch to “in”.
2. Connect the pre-amplifier to the servo amplifier. Adjust the pre-amplifier as mentioned in set zero adjustment.
3. Set the input potentiometer to zero and connect its output to one of the input terminals of the pre-amplifier.
4. Use an oscilloscope to measure the output of the tachogenerator.
5. Rotate the disk by 10-15 degree and note the output voltage from the potentiometer.
6. Complete the 360 degree same way.

Angle (degree)	Potentiometer output (V)	Angle (degree)	Potentiometer output (V)	Angle (degree)	Potentiometer output (V)
0		120		240	
10		130		250	
20		140		260	
30		150		270	
40		160		280	
50		170		290	
60		180		300	
70		190		310	
80		200		320	
90		210		330	
100		220		340	
110		230		350	

Part II

Calibration of the tachogenerator

Procedure

1. Set the compensation switch to “in”.
2. Connect the pre-amplifier to the servo amplifier. Adjust the pre-amplifier as mentioned in set zero adjustment.
3. Set the input potentiometer to zero and connect its output to one of the input terminals of the pre-amplifier.
4. Use an oscilloscope to measure the output of the tachogenerator.
5. Rotate the motor shaft by giving finite voltage and measure the angular speed by measuring the time taken for 5 or 10 rotations using a stopwatch.
6. Alternatively, angular speed can be calculated by analyzing the angular position vs time plot in the oscilloscope.

Tachogenerator Output (V)	Time taken for 5 round(s)	Tachogenerator Output (V)	Time taken for 5 round(s)

Part III

Determine the DC gain and time constant of the transfer function between the armature voltage and the motor shaft speed.

Common Procedure

1. Give input voltage of 1V, 2V, 4V, 6V for 3 different load values of 0, 2, 3, 5.
2. For the load value of 0, don’t apply input voltage above 2V because the motor speed saturates at an rpm.

Measurement of DC gain

$$\boldsymbol{gain} = \frac{Steady\ state\ output - Initial\ output}{\Delta Input}$$

Input (V)	1	2	4	6
Load 0			-	-
Load 2				
Load 3				
Load 5				

Measurement of time constant

Time constant is the time required for the output value to reach 63.2% of the steady state value.

Input (V)	1	2	4	6
Load 0			-	-
Load 2				
Load 3				
Load 5				