[1] A wire - pully system to pull a weight load (W_L) up and down inhtermediately . In order to keep the motor drive torque as constant and minimum as possible , a counter weight (Wc) and a brake force (F) are installed as shown in Fig - 1 .
(a) determine the counter weight (Wc) required in term of W_L , and μ_s (the friction coefficient between wire and pully), in order to maintain a constant applied torque (Ma) for both up and down condition .
(b) Is it possible to make the applied torque (Ma) equal to zero ? What is the corresponding counter weight (Wc) & brake force (F) then , expresses in terms of W_L & μ_s .

[2] A table hat (H) and counter weight (W) are connected by three cable -pulley- cylinder system (A) (B) and (C) as shown in Fig-2 , (a teleseope system) .
(a) Neglect the friction between cable and pulley , determine the balance counter weight W and expresses in terms of (W_H) , (Wc), (W_B), the weights of the cylinders .
(b) If the table hat (H) moving downward from position (K) , knowing that the velocity of the table hat is 12 cm/s as it passes through position (L) . Determine the change in the elevation, the velocity and the acceleration of the counter weight (W) and cylinder (Wc), assume W_H = 150 kg, Wc =15 kg, W_B =20 kg.

[3] A cam - roller - guided bar system as shown in Fig-3, is applied to video camera of weight W . The function of the cam-roller-guided bar combination is to keep the center of gravity of the video camera moving horizontal only .
(a) What is the balance position (P) of the cam - roller contact point, as the camera tilts an angle θ with respect to the vertical. represent angle ϕ in term of θ ,h ,l & r .
(b) Let the weight of cam and guided bar equals to (Ws) . What is the maintaning torque required to hold at position θ .

[4] Each of the gears A and B has a mass of 2 kg and a radius of gyration of 75 mm; gear C has a mass of 10 kg and a radius of gyration of 225 mm . If a couple M of constant magnitude 3 N-m is applied to gear C,
(a) determine the angular acceleration of gear A.
(b) the tangential force which gear C exerts on gear A.Ref to Fig - 4 .

[5] The gear train shown in Fig - 5 consists of four gears of the same thickness and of the same material; two gears are of radius r, and the other two are of radius nr. The system is at rest when the couple M is applied to shaft C. Denoting by J_o the moment of inertia of a gear of radius r,
(a) determine the angular velocity of shaft A if the couple M is applied for one revolution of shaft C.
(b) Let a motor with moment of inertia Jm is couple to the shaft C, and a load M_L is couple to shaft A. What is the dynamic equation of this system represent in term of angnlar velocity ω_A .

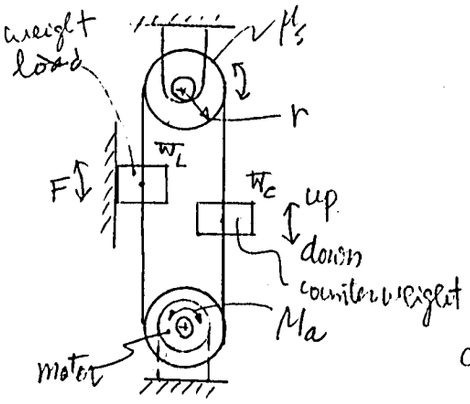

Fig-1.

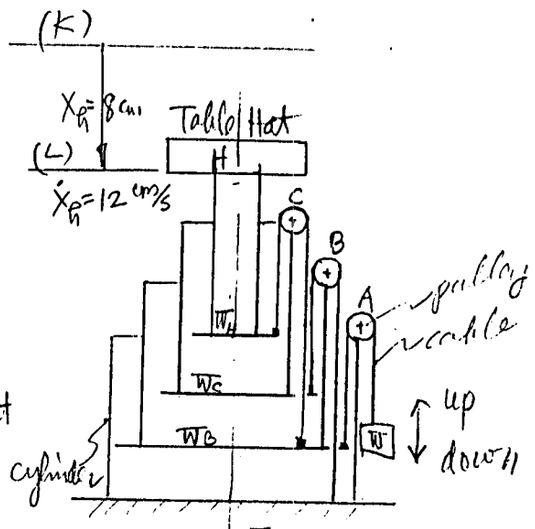

Fig-2.

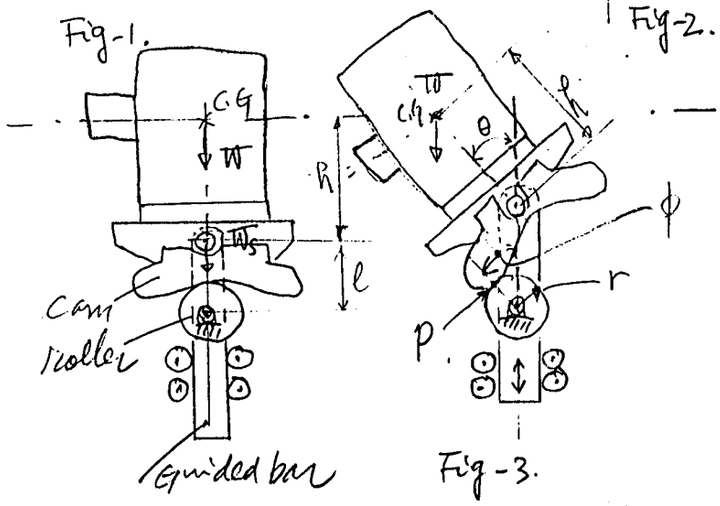

Fig-3.

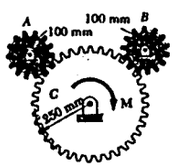

Fig-4.

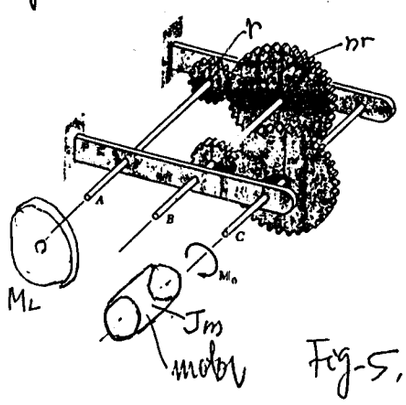

Fig-5.