

本試題是否可以使用計算機: 可使用, 不可使用 (請命題老師勾選)

1. Please translate the following sentences into Chinese

- (a) (12%) A redundant support is one that could be removed and still leave the supported member in equilibrium. When redundant supports are present, the simple equations of equilibrium no longer suffice to determine the magnitude of load carried by any of the supports. In addition, it will add the stiffness to the structure.
- (b) (13%) In science courses we learn to compute the behavior of nature in a series of established experiments and phenomena. In engineering courses we learn to compute currents and voltages in amplifiers and motors, forces and power in leakages and engines, reaction rates in chemical systems, earth transfer in road building, and the like. This is good educational policy; learning applied mathematics is difficult for most of us and is best done in the disciplined operation of a school rather than left to be picked up on the job.

2. Answer the following questions briefly: (5% each)

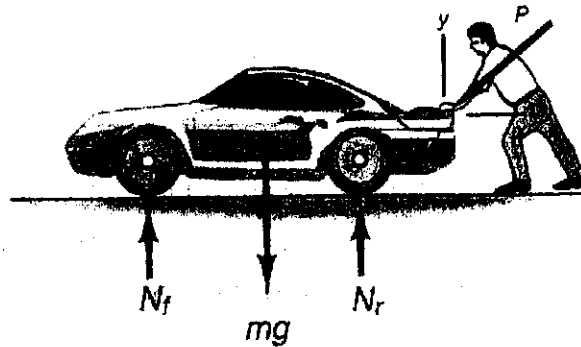
- (a) How to determine the **stability of equilibrium** by using the potential energy of the system?
- (b) Explain the terms of **statically determinate** and **statically indeterminate**.
- (c) Define the **moment of inertia** of a mass.
- (d) What is the definition of **free-body diagram**?
- (e) Draw an appropriate figure to show what **external force** and **internal force** are.

3. The man in the following figure at the right is pushing on the rear of the car, and a horizontal friction force exists between the rear tires and the ground if the front tires are assumed to be free to rotate. Note that you need more information to complete the free-body diagrams.

- (a) (9%) Try to provide more required information (such as geometric data, etc) so that the required applied force P to move the car could be determined.
- (b) (8%) Draw the free-body diagrams of the car and the man.
- (c) (8%) List the required equations of the car to solve the forces P , N_f and N_r .

(背面仍有題目,請繼續作答)

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Problem 3

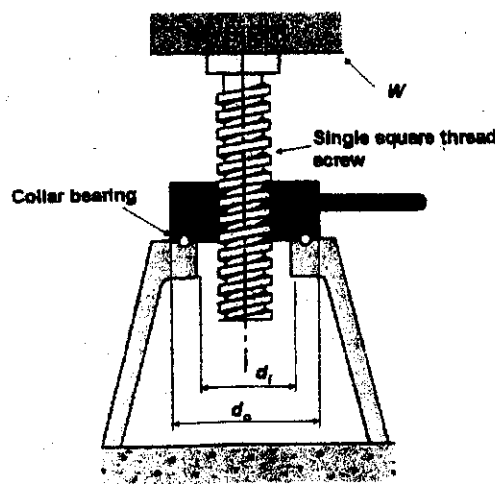
4. A screw jack as shown is used to raise or lower a weight of W . This screw has a single square thread of mean diameter equal to d and with a pitch of p . Coefficients of friction are f for the thread surface and f_c for the collar bearing surface. The collar bearing has the inner diameter of d_i and the outer diameter of d_o .

(a) (10%) Neglecting the collar bearing friction, derive the torque $T_u = \frac{Wd(f\pi d + p)}{2(\pi d - fp)}$ for

raising the weight and the torque $T_l = \frac{Wd(f\pi d - p)}{2(\pi d + fp)}$ for lowering the weight.

(b) (10%) Assume the pressure is uniform between the surfaces of the collar bearing. Again, determine the torques for raising and lowering the weight by adding the consideration for the collar friction.

(c) (5%) $d=30\text{mm}$, $p=4\text{mm}$, $f=0.1$, $f_c=0.08$, $d_i=35\text{mm}$, and $d_o=50\text{mm}$. Determine whether this screw jack is self-locking and explain why.



Problem 4