Kingdom of Saudi Arabia
Ministry of Education
Umm Al-Qura University
College of Applied Sciences
Physics Department

Semester: 1st semester
Exam: 1st Class Test Exam
Program: Medical Physics
Course: Biomechanics.
Course Code: 4032293-3
Exam Time: 1 Hr
Exam Date: 5 / 2 /1440 A. H
Total Exam Marks: **15 Mark**

Student's Name: **Student ID:** **Group No.:**

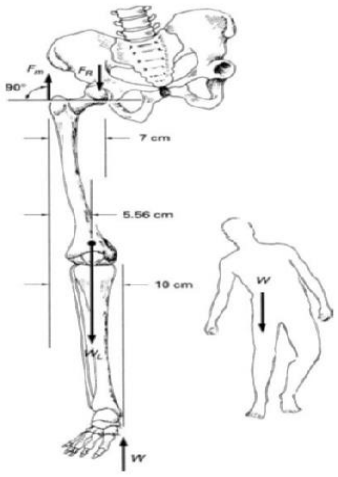
Please answer <u>Three</u> questions only: **اجب عن <u>ثلاثة</u> أسئلة فقط**

<u>Question One</u> *[5 Marks]*

From an elbow muscles figure data, Persons who have an injured hip limp by leaning الميل toward the injured side as they step on that foot. As a result, the center of gravity of the body shifts into a position more directly above the hip joint, decreasing the force on the injured area. Calculate:

(i) Muscles force "F_m"

(ii) the force of the hip joint "F_r".

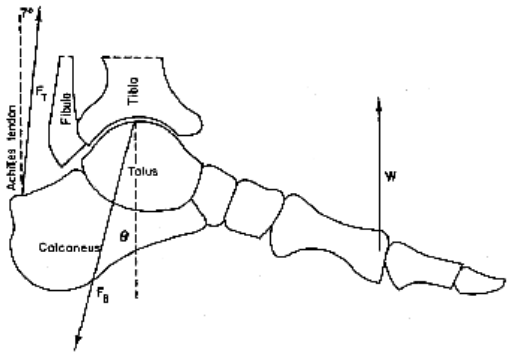


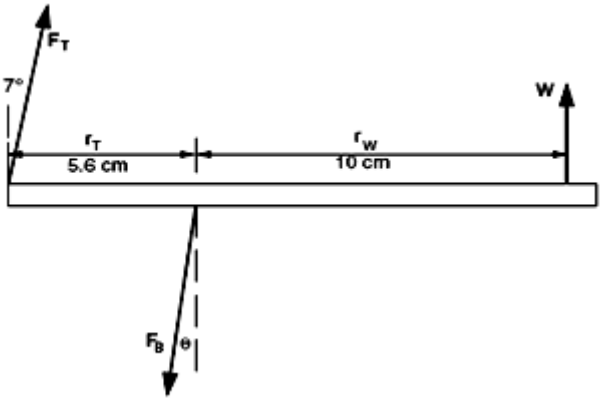
<u>Question Two</u> *[5 Marks]*

To calculate the force exerted by this tendon on the calcaneus كعب القدم when a person is standing on the ball of one foot, assume that the entire foot can be regarded as a rigid body.

<u>Calculate:</u>

1) **The force exerted by the tendon on the foot 'F_T' .**
2) **The force of the leg bones (tibia and fibula) on the foot 'F_B'.**
3) **The angle 'θ' of the force of the leg bones (tibia and fibula) On the foot.**





Question Three *[5 Marks]*

During each step of a 70 kg person mass, the joint rotates about 60^0. Since the radius of the joint is 3.0 cm and the joint slides about 3.0 cm inside the socket during each step? Knowing that:

F_R=2.4 W, μ_k (unlubricated bones) = 0.3 and μ_k (lubricated bones) = 0.003.

Calculate:(ANSWER TWO ITEMS ONLY)

(a) The work expended during each step?

(b) Does the center of gravity above joint ?

(c) What is the physical meaning of the distance of the work done with respect to the body weight ?

Put right sign (√) or wrong sign (x) for each sentence of the followings and re-correct the wrong one: مع ذكر الخطأ فقط و تصحيحه *[5 Marks]*

1) The lubricant synovial fluid between the joints of the human body increases the coefficient of friction by about a factor of 100 time s ( ).

2) A body is in stable equilibrium under the action of gravity of its center of mass is directly beside its base of support ( ).

3) The kinetic coefficient of friction "μ_k" for steel on ice is larger than the lubricated bone on joint of the human body ( ).

4) When carrying an uneven load, the body to compensate by shortening and bending the limbs, so that shift the center of gravity f back over the feet ( ).

5) The mechanical advantage "M" of a wheelbarrow of a lever class-2 does not save efforts ( ).

Question Five *[5 Marks]*

Complete each sentence of the followings:

1) The normal force "F_n" on a person with 70 kg person mass erected on an incline with an angle of 31^0 is .....

i. 650 N ii. 910N iii. 800 N iv. 588 N.

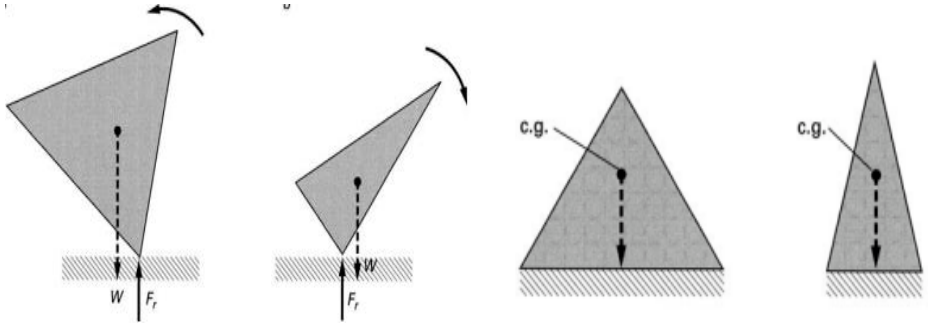
2) The frictional force "F_f " of a person erected on an incline with an angle of 31^0 of leather shoes with 70 kg mass during erecting on an oak and the static coefficient of friction 0.6 is .....

i. 352.8 N ii. 588N iii. 560.4 N iv. 219.7 N.

3) In unstable equilibrium, body is ....., the force of gravity accelerates it.

i. Supported ii. Attracted iii. Unattached iv. Unsupported.

4) Which one of the following figures will be toppled.....with respect to



i. ii. iii. iv.

5) A person erected on an incline with an angle of 31^0 of leather shoes onset of sliding when ……

i. $F_f > F_p$ ii. $F_f = F_p$ iii. $F_f < F_p$ iv. $F_f >>> F_p$.

6) A person erected on an incline with an angle of 31^0 of leather shoes will be static when ……

i. $F_f > F_p$ ii. $F_f = F_p$ iii. $F_f < F_p$ iv. all of them.

7) ……..friction plays an important role in the flow of blood and other biological fluids.

i. Static ii. Thermal iii. Viscous iv. Rolling

8) When the body is at stable equilibrium the reaction force (Fr) under these conditions at its base of support cancel when .....

i. $\Sigma F \neq \Sigma \tau$ ii. $\Sigma F > \Sigma \tau$ iii. $\Sigma F < \Sigma \tau$ iv. $\Sigma F = \Sigma \tau$.

9) When carrying an uneven load, the body to compensate by..... the limbs, so that shift the center of gravity back over the feet.

i. Erecting and bending ii. Bending and extending
iii. shortening and bending iv. Elongating and bending.

10) In stable equilibrium, the reaction force cancels……..

i. The force of gravity and force of pressing
ii. The force of density and the force of gravity,
iii. The force of gravity and the torque.
iv. All of the above.

مع أطيب التمنيات بالنجاح و التفوق بأذن الله تعالى.