# End Term Examination (December 2019)

**School:** School of Engineering     **Program:** B.Tech-Biomedical Engineering

**Course:** Biomechanics and Rehabilitation Engineering     **Course Code**: BME301

**Semester:** V          **MaxMarks:** 40          **Duration(mins) :** 90

**Answer any EIGHT questions**
**(Each question carries 5 marks)**
**(Scientific calculator is allowed)**                              **[40]**

1. The following diagram shows a man doing leg press with 220 Kg. The weight and length of the upper leg are 4 kg and 30 cm, of the lower leg are 3 kg and 27 cm and of the foot are 1.2 kg and 15 cm. The person is seated in a inclined plane with an angle of 60°. The angle between the upper and lower parts of the leg is 60°. Calculate the moment at the hip joint at this position.
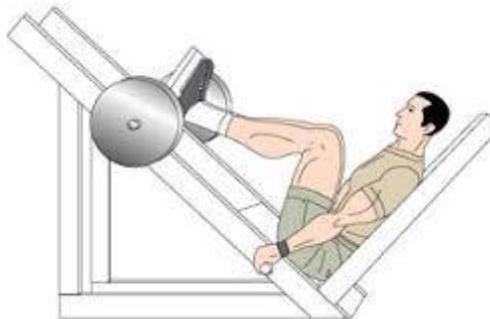


2. During an UTM test for a buffalo femur, the following are the readings. The circumference and the length calculated for the bone are 15 cm and 30 cm respectively. Draw a stress strain graph for the test and find the young's modulus of the femur bone, considering the bone to be a cylinder.

| Load (KN) | Displacement (mm) |
|-----------|-------------------|
| 2 | 2 |
| 6 | 5 |
| 10 | 10 |
| 12 | 20 |
| 9 | 24 |

3. In a zener model, the part with Maxwell body consists of a damper and a spring with spring constant 10 $Nm^{-1}$. The spring parallel to the Maxwell arrangement has spring constant 20 $Nm^{-1}$. If the total displacement is 20 cm. Then find the damping constant, if the displacement produced by the same is 12 cm. Also find the total force produced by the zener model.

4. Discuss about the abnormal spinal curve formation due to the asymmetrical forces acting upon it. What are the causes which result into this deformation?

5. Discuss about the piezoelectric properties of the bone. What is the advantage of the electrical conductivity properties of bones?

6. What is a Newtonian fluid? Find the shear stress of a Newtonian fluid moving with a velocity of 5 $ms^{-1}$ in a tube of diameter 5mm. The coefficient of viscosity of the fluid is 10 $Nsm^{-2}$.

7. Briefly explain about the effect of age on the fracture toughness of the teeth. Draw the stress and strain diagram for the dentine of a person at the age of 17 and at the age of 77 years.

8. With the help of a stress strain diagram explain about the loading rate upon the fracture toughness of the bone. What would be a suitable loading rate for an easy deformation or fracture in the bone?

9. Explain the following terms: (a) viscoelasticity of bones, (b) Maxwell model

10. Explain the following terms: (a) pressure ulcer prevention, (b) biomechanics of dentine

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