APL-100 Engineering Mechanics (First Semester 2017-18)
Minor Test #2
7 Oct 2017, 9:30 a.m. to 10:30 a.m.
Maximum Marks: 50

1. **(a)** A light plate [Figure 1(a)] is hinged at *A*, has ball and socket support at *B*, a rough support at *D* and a fixed support at *E*. It is subjected to 3-dimensional loads. The hinge, ball and socket are frictionless. Complete its FBD which has been partially drawn. **[4]**

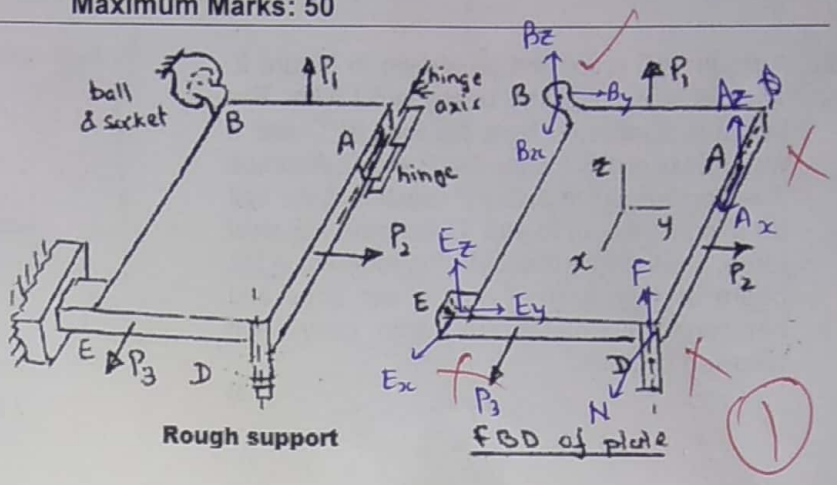

Figure 1 (a)

1. **(b)** The thin bar *ABO* [Figure 1(b)] is subjected to coplanar loads. The hinge and roller supports are frictionless. Complete the FBD of the part *AB* of the bar which has been partially drawn. **[2]**

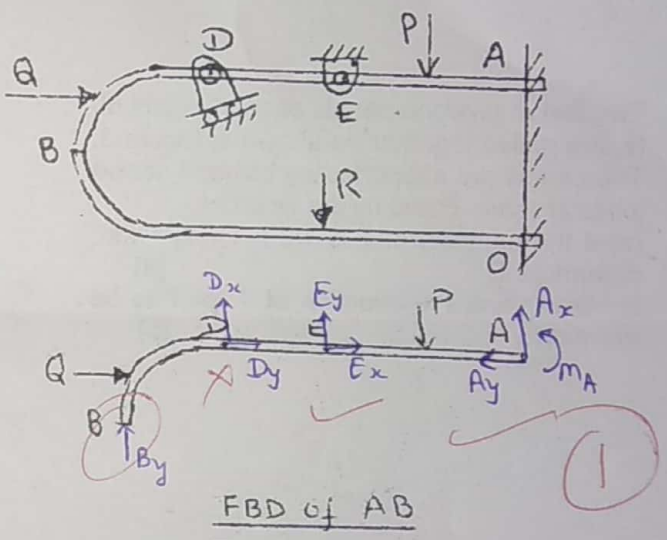

Figure 1 (b)

1. **(c)** A truss is loaded as shown in Figure 1(c). Identify the zero force members which can be located by inspection. **[4]**

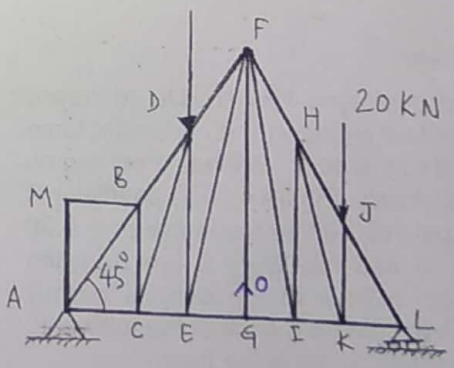

Figure 1 (c)

2. A beam *AC* is loaded as shown in Figure 2. The self-weight of the beam is 50 N/m. The beam is supported by a pin joint at *C* and a weightless rod *BD* pinned at *B* and *D*. A torque *T* is applied to the pulley *P*, such that the belt on it is just about to slip. Determine the axial force, shear force and bending moment in the beam at 4 m from *A*. For shear force and bending moment use the sign convention followed in class. **[13]**

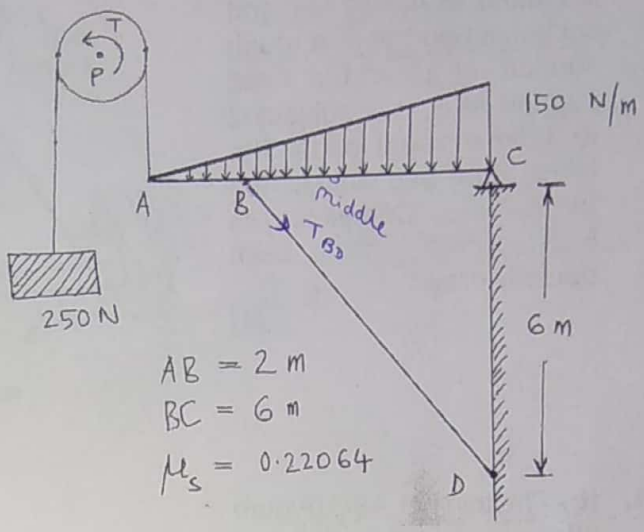

Figure 2

3. Two 2x4 m plywood panels each of weight 60 N, are nailed together as shown in Figure 3. The panels are supported by ball-and-socket joints at *A* and *F* and by the wire *BH*.
(a) If the direction of **T** is 1/3 (- **i** + 2**j** + 2**k**), determine T. **[8]**
(b) Determine the direction of ***T*** for *T* to be minimum. **[5]**

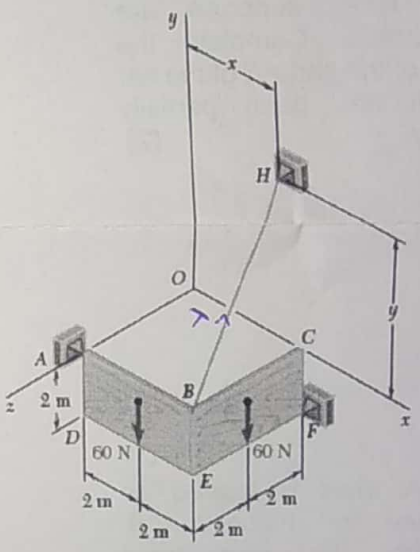

Figure 3

4. A 3 m beam, weighing 4.8 KN, is to be moved to the left onto the platform. A horizontal force **P** is applied to the dolly, which is mounted on frictionless wheels (Figure 4). The coefficients of friction between all surfaces are $\mu_s = 0.30$ and $\mu_k = 0.25$, and initially $x = 0.6$ m. Knowing that the top surface of the dolly is slightly higher than the platform answer the following:
(a) At which two points is the beam supported?
(i) *A* & *D* or (ii) *B* & *C* **[1]**
(b) Draw the FBD of beam AB and the dolly. **[3]**
(c) Determine the reactions at the locations where beam is supported. **[5]**
(d) Determine the forces required to start moving the beam. **[5]**

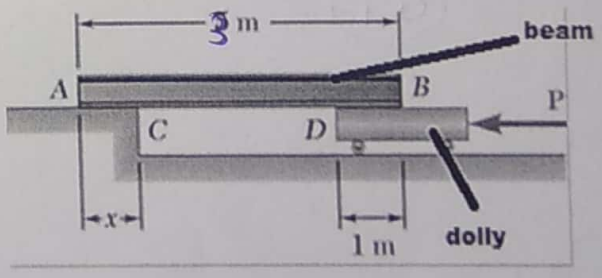

Figure 4