Indian Institute of Information Technology Design and Manufacturing, Kancheepuram Department of Mechanical Engineering PHY108T - Engineering Mechanics Assignment – 1

1. A welded connection is in equilibrium under the action of the four forces shown in Figure 1. Knowing that FA = 8 kN and FB = 16 kN, determine the magnitudes of the other two forces. [Ans: FC = 6.40 kN, FD = 4.80 kN] 2. A sailor is being rescued using a boatswain’s chair that is suspended from a pulley that can roll freely on the support cable ACB and is pulled at a constant speed by cable CD as shown in Figure 2. Knowing that alpha = 30° and beta = 10° and that the combined weight of the boatswain’s chair and the sailor is 900 N, determine the tension (a) in the support cable ACB (b) in the traction cable CD. [Ans: (a) 1213N, (b) 166.3 N] 3. A 600 N crate is supported by several rope-and-pulley arrangements as shown in Figure 3. Determine for each arrangement the tension in the rope. [Ans: (a) 300N (b) 300N (c) 200N (d) 200N (e) 150N] 4. A horizontal circular is suspended as shown in Figure 4 from three wires that are attached to a support at D and form 30° angles with the vertical. Knowing that the x component of the force exerted by wire AD on the plate is 110.3 N, determine (i) the tension in wire AD (ii) the angles that the force exerted at A forms with the coordinate axes. [Ans: 288N (b) 67.5°, 30°, 108.7°] 5. The ramp ABCD is supported by cables at corners C and D. The tension in each of the cables is 810 N. Determine the moment about A of the force exerted by (i) the cable at D, (ii) the cable at C. 6. Knowing that the tension in the cable AC is 1260 N, determine (i) the angle between cable AC and the boom AB, (ii) the projection on AB of the force exerted by cable AC at point A. [Ans: (a) 59° (b) 640N] 7. A dirigible is tethered by a cable attached to its cabin at B. If the tension in the cable is 1040 N, replace the force exerted by the cable at B with an equivalent system formed by two parallel forces applied at A and C. 8. A 4-m-long beam is subjected to a variety of loadings. Replace each of the loading with an

equivalent force-couple system at end A of the beam. 9. Two 150-mm-diameter pulleys are mounted on line shaft AD. The belts at B and C lie in vertical planes parallel to the yz plane. Replace the belt forces shown with an equivalent force-couple system at A. [Ans: R = (-420**j** – 339**k**)N; M = (1.125**i** + 163.9**j** -109.9**k**)N.m] 10. A 100-kg uniform rectangular plate is supported in the position shown by hinges A and B and by cable DCE that passes over a frictionless hook at C. Assuming that the tension is the same in both parts of the cable, determine (a) the tension in the cable, (b) the reactions at A and B. Assume that the hinge at B does not exert any axial thrust along x axis.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

Figure 10