Mechanical Eng. Dept.
December 2020

Taibah University
College of Engineering

Machine Design I
ME 351

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Final Term Exam (Time allowed: 1.5 Hr)-- [Open book]

Student Name: ………………………………………….. I.D. #:……………………..

Solve the following 4 problems (you can assume any missed data)

Problem	Max. Degree	Student degree
Stress Analysis	15	
Shrink-Fitting	10	
Mech. Spring	10	
Welded joints	5	
Total (Max.) degree	40	

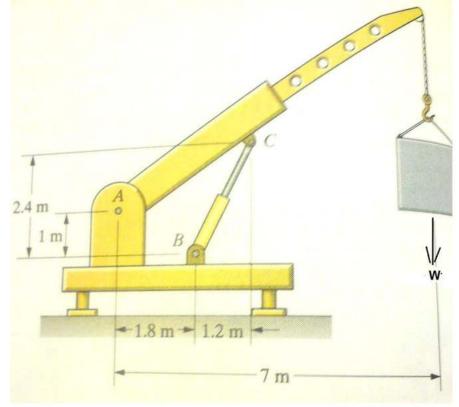**Course Coordinators: Prof. / Badr Azzam**
                                Dr./ Badr Bedairi

Problem (1) Stress Analysis [15 Marks]

The following figure shows a hydraulic crane of maximum capacity **W= X tons (X is the first right digit in your Univ. ID #)**. The crane is operated by the hydraulic cylinder **BC** with maximum oil pressure of **100 bars**. For the shown dimensions of the crane parts, find the following:

a- The hydraulic cylinder force.
b- Bore diameter of cylinder (D_i)
c- Cylinder wall thickness (**t**), assume its material is **St.70** with safety factor= **5**.
d- Piston rod diameter (**d**), S_y = **420 MPa** and safety factor= **5.**
e- Pin diameter at **C,** assume its martial is steel of grade 8.8 (S_{ut}= **880 MPa**) and safety factor= **3).**

2

Problem (4) [5 marks]

For the welded joints shown in figure below, find the weld size (**h**) under the following applied loads, (if its allowable shear strength = **100 MPa**).

Axial force, **F= XX kN (XX** are the first two right digits in your **Univ. ID #)** and Torsional load, **T = 1 kN.m**.