UNIVERSITY OF JOHANNESBURG
SPECIAL EXAMINATION

January 2015

COURSE: ENGINEERING
SUBJECT: *STRENGTH OF MATERIALS 2B (SLR2B21)*
Examiner : Prof E. T. Akinlabi
Moderator : Mr D. M. Madyira

TIME: 3 HOURS
MARKS: **100**

12/01/2015 12/1/2015

Instructions:

- **Answer all questions.**
- **Show your workings clearly in the answer booklet provided.**
- **Do not use Tipp-Ex or any correction fluid on your answer booklet.**

Question 1 **(25 marks)**

(a) With the aid of a sketch, give the four types of support or connection in engineering structures.

(b) The pin support A and roller support B of the bridge truss are supported on concrete abutments as shown in Figure 1. The load applied at pin support A is 750 kN and at roller support B is 500 kN. If the bearing failure stress of the concrete is $(\sigma_{fail})_b = 25$ MPa. Determine the required minimum dimension of the square bearing plates at C and D to the nearest millimetre. Apply a factor of safety of 2 against failure.

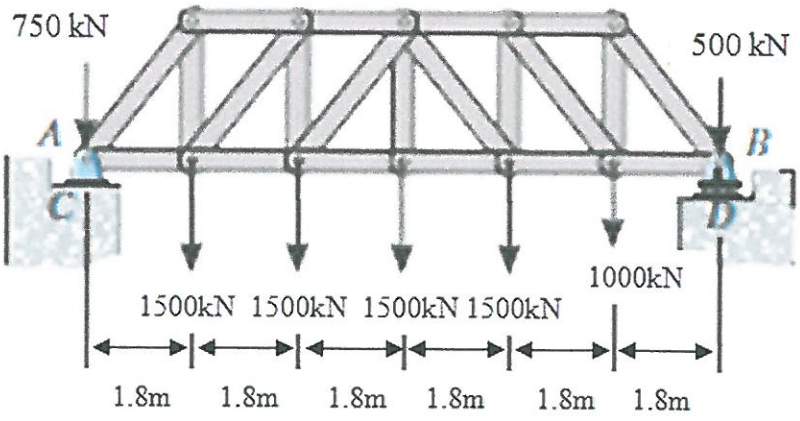

Figure1: A bridge truss

Question 2 **(15 marks)**

Figure 2 shows the motor M connected to the speed reducer C by the tubular shaft and coupling. If the motor supplies 15 kW and rotates the shaft at a rate of 600 rpm, determine the minimum inner and outer diameters d_i and d_o of the shaft if $\frac{d_i}{d_o} = 0.75$. Note that the shaft is made from a material having an allowable shear stress of $\tau_{allow} = 84$ MPa.

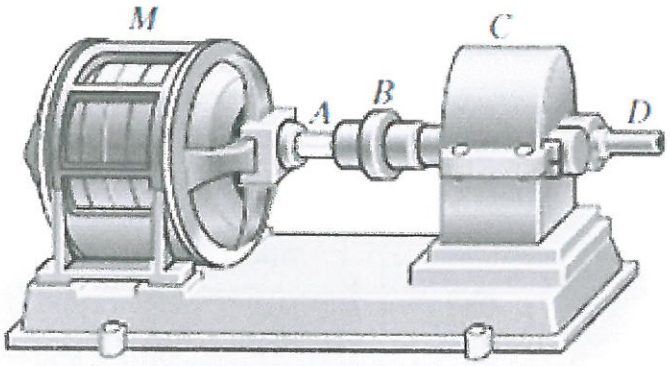

Figure 2: A Motor

Question 3 **(15 marks)**

The T-beam is subjected to an unknown bending moment M as shown in Figure 3. Determine:

(i) The location ỹ of the centroid from the bottom edge at D.
(ii) The second moment of area of the beam section.
(iii) The moment M that will produce a maximum stress of 70 MPa on the cross section.

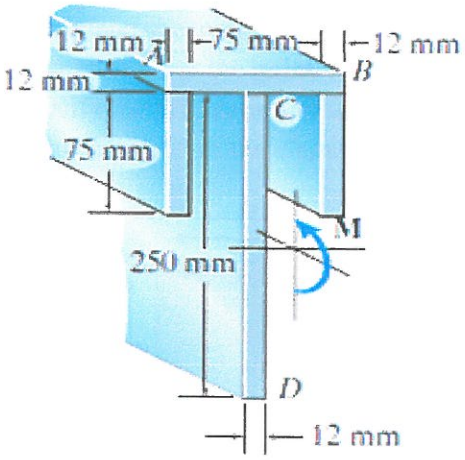

Figure 3: T-beam