TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
Department of Mechanical & Automotive Engineering
UNIVERSITY EXAMINATION FOR:
Diploma in Marine Engineering (Y2S1)
EMR 2209 : Applied Mechanics I (Paper 2)
SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: SEPTEMBER 2018
TIME: 2 HOURS
DATE: Sep 2018

Instruction to Candidates:

You should have the following for this examination

- *Examination Pass & Student ID Card*
- *Answer booklet*
- *Non-Programmable scientific calculator*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.
Maximum marks for each part of a question are as shown.
Do not write on the question paper.

Question ONE

a) A mild steel specimen was tested in tension. Sketch and name the points on the graph.

b) A mild steel rod of 12 mm diameter was tested for tensile strength with a gauge length of 60 mm. The following observations were made; Final length was 80 mm, Final diameter was 12 mm, Yield load was 3.4 kN and Ultimate load was 6.1 kN. Calculate,

   i. Yield stress
   ii. Ultimate tensile stress
   iii. Percentage reduction in area
   iv. Percentage elongation

c) Two coaxial shafts are to be connected by flanged coupling having four 15 mm diameter bolts equally spaced around 320 mm diameter pitch circle. Determine the shear stress in the bolts when 150 kN is transmitted at 320 rev/min.

i. Assuming bolts are equally loaded
ii. Assuming one bolt to be ahead of the others and carry the whole torque.

(20 marks)

Question TWO

A cantilever beam *ABCDE*, 8 m long, is horizontally fixed at *A*. It carries vertical loads of 2 kN, 4 kN, and 6 kN at *B*, *C* and *D*, respectively, and an upward vertical load of 5 kN at the free end *E*. *AB* = *BC* = *CD* = *DE* = 2 m. Draw the SF and BM diagrams.

(20 marks)

Question THREE

a) By considering a beam subjected to a constant bending moment along its length, derive the Bending Theory Equation.
b) A spring steel of selected homogenous material, 25 mm wide and 1.5 mm thick, is bent into an arc of a circle of 2 m radius. Calculate the bending moment necessary and maximum stress set up. Take *E* for steel = 200 GN/m^2.

(20 marks)

Question FOUR

The beam shown in **Fig. Q4** is 6 m long with a flexural rigidity of 300 MN/m^2. Determine the slope at the left end and deflection at the middle.

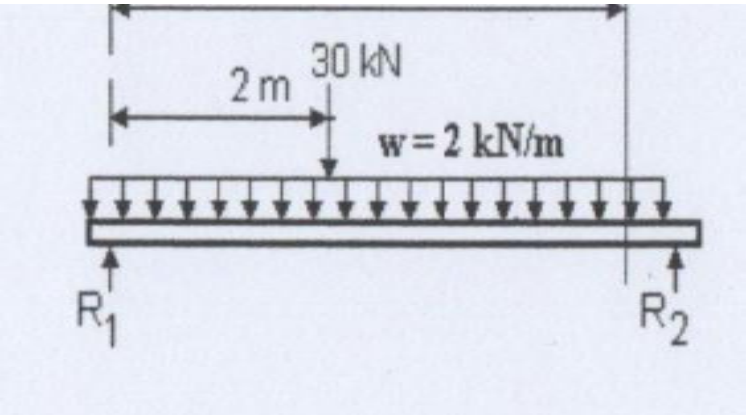

Fig. Q4

(20 marks)

Question FIVE

A steel cylinder is 0.5 m outer diameter and 0.4 m diameter and 1.5 m long. It is filled with concrete and used as a vertical column to support a weight of 30 kN. Determine the compression and the stresses in both the steel and concrete.

(20 marks)