



MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST SEMESTER SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN MECHANICAL ENGINEERING (AUTOMOTIVE AND PLANT)

2502/202/SM: STRENGTH OF MATERIALS (MODULE II TIVET)

DATE: 3/9/2021

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

ATTEMPT ALL QUESTIONS.

1.
 - (a) A rubber pad for a machine mounting is to carry a load of 5kN and compress 5mm under this load. If the stress in the rubber is not to exceed 280kN/m^2 , determine the diameter and thickness of a pad of circular cross-section. Take E for rubber as 1MN/m^2 . (7 marks)
 - (b) A solid coupling transmits 100kw at 2rev/s through eight equally spaced bolts. If the bolts are 12mm diameter and are on a pitch circle of 150mm diameter, calculate the average shear stress in each bolt. (8 marks)
 - (c) A steel strut, 40mm diameter is turned down to 20mm diameter for one-half its length. Calculate the ratio of extension in the two parts due to axial loading. (5 marks)
2. A beam A E D B C carries the following loadings. A uniformly distributed load of 4kN/m run from A to B, a concentrated load of 5kN a metre from A and a 7kN load 3metres from E, and a concentrated load of 2kN at point C. $DB = BC = 1\text{m}$, the beam is simply supported at points A and B. Draw to scale the S.F and B.M diagrams and determine the;
 - (a) Position and magnitude of the maximum B.M (14 marks)
 - (b) Position of any point of contraflexure (6 marks)

3. A cantilever beam A B C D E 8m long is horizontally fixed at A. It carries vertical downward loads of 2KN, 4KN and 6KN at B, C and D respectively, and an upward vertical load of 5KN at the free end E. $AB=BC=CD=DE=2m$. Draw to scale the S.F and B.M diagrams and insert the principal values and find the position on the cantilever where there is no bending moment and the value of the shearing force at this point. (20 marks)
4. (a) State any four assumptions made in the theory of pure bending. (4 marks)
- (b) A uniform T-section beam is 100mm wide and 150mm deep with a flange thickness of 25mm and a web thickness of 12mm. If the limiting bending stresses for the material of the beam are 80MN/m^2 in compression and 160MN/m^2 in tension, find the maximum UDL that the beam can carry over a simply supported span of 5m. (16 marks)
5. (a) A uniform cantilever is 4m long and carries a concentrated load of 40KN at a point 3m from the support. Determine the vertical deflection of the free end of the cantilever if $EI = 65\text{MNm}^2$. (10 marks)
- (b) How would this value change if the same total load were applied but uniformly distributed over the portion of the cantilever 3m from the support. (10 marks)