MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL AND MANUFACTURING ENGINEERING

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN MECHANICAL ENGINEERING

MED-PR 302: STRENGTH OF MATERIALS II

DATE: 29/7/2019 **TIME: 2.00-4.00 PM**

INSTRUCTIONS:

- **This Examination contains two sections A and B**
- **Section A is compulsory**
- **Attempt any other two questions from section B**

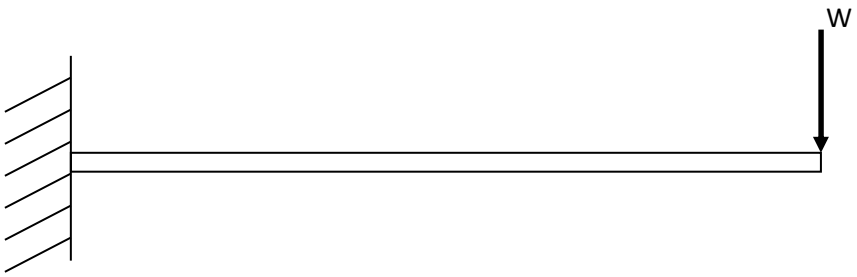
SECTION A: COMPULSORY

1. a) State the assumptions made in the theory of pure torsion. (3 marks)

   b) Show that for a given length of a uniform shaft the applied torque is directly proportional to the angle of twist. (7 marks)

   c) Derive the simple torsion theory equation (10 marks)

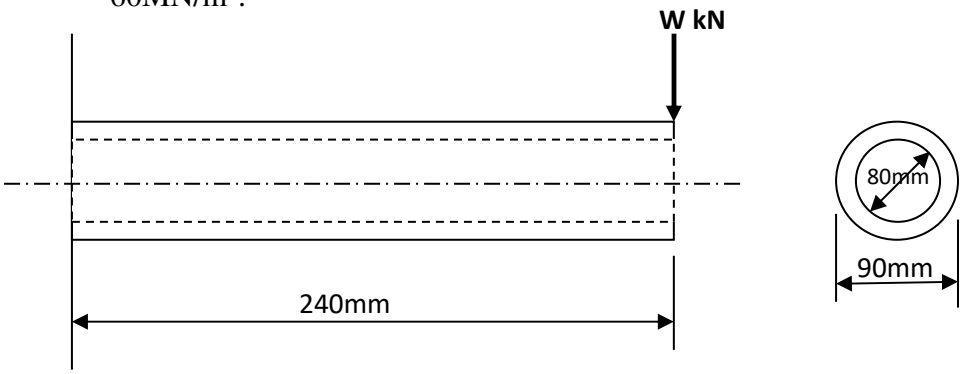
   d) Obtain expressions for maximum slope and maximum deflection occurring in the loaded cantilever beam shown below. (10 marks)



SECTION B: SELECT ANY TWO QUESTIONS

2. a) Derive the simple bending theory equation (12 marks)

b) The cantilever beam below is loaded by a single concentrated load W kN at the free end. It is of hollow section 90mm outside diameter, 80mm inside diameter. Calculate the maximum value of W if the bending stress is not to exceed $60MN/m^2$. (8 marks)



3. A beam of length 8m is simply supported at its ends and carries two concentrated loads of 20kN and 40kN respectively 2m and 6m from the left-hand end together with a distributed load of 15kN/m on the 4m between the concentrated loads. Calculate the deflection at the center and also the position and magnitude of the maximum deflection. $E = 200GN/m^2$ and $I = 0.18x10^{-3}m^4$. (20 marks)

4. A hollow shaft of 400mm external diameter transmits 9MW at 120rev/min. if the angle of twist measured over a length of 2m is 0.45^0 and G is $80GN/m^2$; estimate the internal diameter of the shaft, the maximum shearing stress and the strain energy per meter length of the shaft. Find the diameter of the solid shaft which will transmit the same power at the same maximum stress and find the ratio of the strain energy per meter length in this shaft to that in the hollow shaft. (20 marks)

5. A built-in beam of span 12m carries a u.d.l. of 10kN/m over its whole length together with concentrated loads of 20kN at 3m and 30kN at 8m from one end. If the bending stress is limited to $100N/mm^2$, Calculate the section modulus required and sketch the bending moment diagram. (20 marks)