

UNIVERSITY OF ESWATINI
FACULTY OF SCIENCE AND ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION NOVEMBER 2019

TITLE OF PAPER: ENGINEERING MECHANICS AND MATERIALS SCIENCE

COURSE CODE: EEE201

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. Answer all **five (5) questions**
2. Each question carries 20 marks.
3. Marks for different sections are shown in the right-hand margin.

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

Question 1

For a simply supported beam shown in Figure Q1,

- A) Determine the forces at point B and D. (4 marks)
- B) Determine expressions for the bending moment. (10 marks)
- C) Sketch the bending moment and shearing force diagrams. (6 marks)

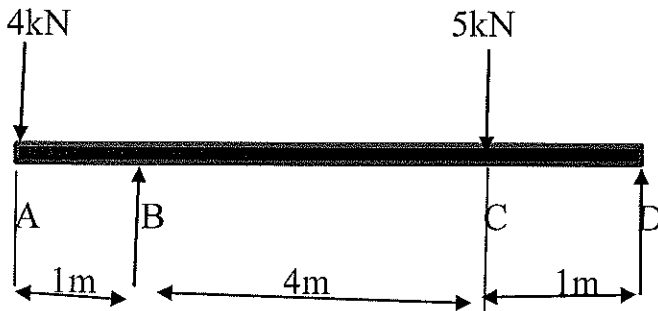


Figure Q1

Question 2

An aluminium test piece 8.93 mm in diameter and gauge length 50mm gave the following results when tested to destruction: Load at yield point 4 kN, maximum load 6.3 kN, extension at yield point 0.036 mm, diameter at fracture 7.6mm. Determine the following:

- A) The yield stress (4 marks)
- B) The Young's modulus (7 marks)
- C) The ultimate tensile strength (4 marks)
- D) The percentage reduction in the cross-section area (5 marks)

Question 3

For the circuit shown in Figure Q3 determine all internal and external forces. (20 marks)

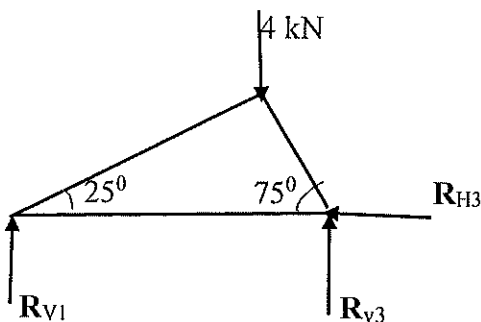
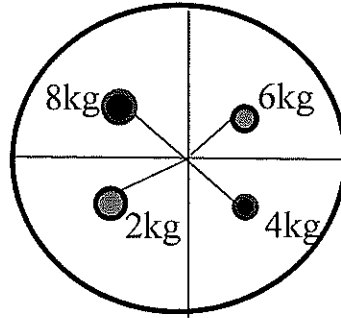


Figure Q3

Question 4

For an unbalance system shown in **Figure Q4**, obtain the mass required to balance this system. The 4 kg mass is at radius 300mm and -40° to the horizontal, the 6 kg mass is at radius 250mm and 45° to the horizontal, the 8 kg mass is at radius 200mm and 135° to the horizontal, and the 2 kg mass is at radius 250 mm and minus -160° to the horizontal. Note that the mass required to balance this system is to be placed at radius 100 mm.



(20 marks)

Figure Q4

Question 5

A composite gear shown in **Figure Q5** consist of a driver gear A, having 50 teeth, engaging with gear B, having 150 teeth. Attached to the same shaft as gear B, gear C has 60 teeth and meshes with gear D on the output shaft, having 80 teeth. If the speed of driver shaft is 1000 revolutions per minute, the input torque is 140 Nm and the force ratio is 3.5, for this gear system determine the following:

- A) The speed of the output shaft, (4 marks)
- B) The movement ratio (4 marks)
- C) The efficiency (4 marks)
- D) The input power (4 marks)
- E) The output power. (4 marks)

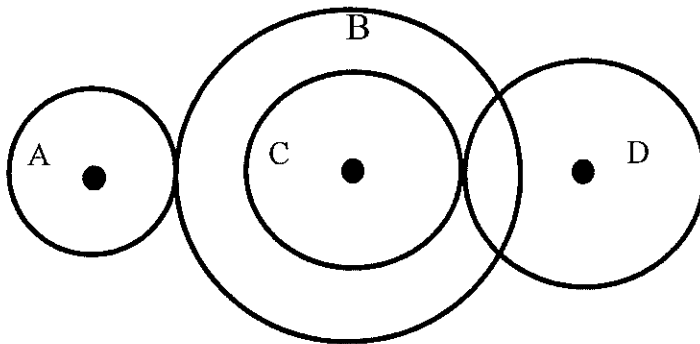


Figure Q5