



KIBABII UNIVERSITY

2017/2018 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER

SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE ENERGY AND
BIOFUELS TECHNOLOGY

COURSE CODE: PRD 221

COURSE TITLE: SOLID MECHANICS 1

DATE: **08/10/2018**

TIME: **11:30-1:30PM**

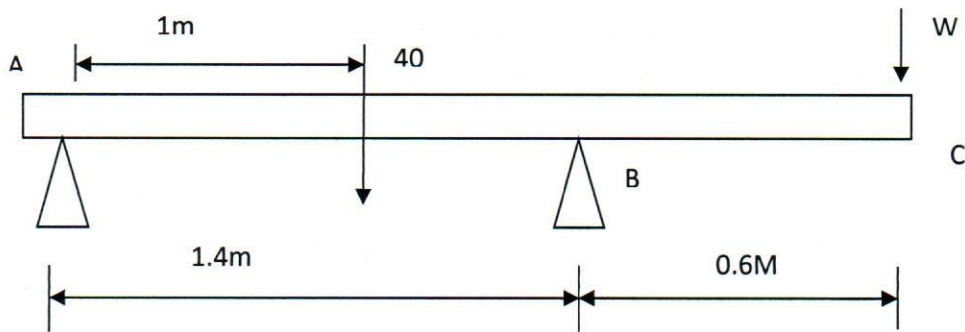
INSTRUCTIONS TO CANDIDATES

Answer question ONE and any other three questions

This paper consists of 3 printed pages. Please Turn over

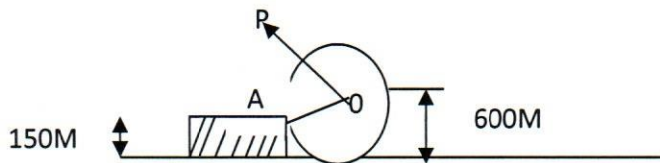
Question One

- i) Explain mathematically what is meant by moment of force (3marks)
- ii) State the law of moments (3marks)
- iii) A uniform plank ABC of weight 50N and 2M long is supported at one end A and at a point B which is 1.4m from A as shown in figure below.(7marks)



Find the maximum weight W, that can be placed at C so that the plank does not topple.

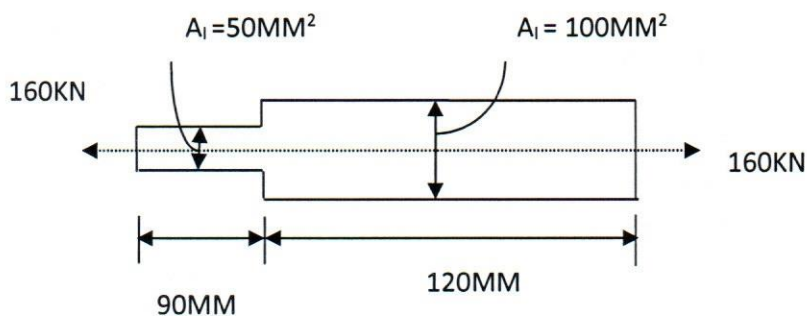
- iv) A uniform wheel of 600 mm diameter, weighing 5KN rests against a rigid rectangular block of 150mm height as shown.



Find the least pull, through the centre of the wheel required just to turn the wheel over the corner A of the block – Also find the reaction of the block. (7marks)

QUESTION TWO

- a) An automobile component shown below is subjected to a tensile load of 160KN. Determine the total elongation of the component, if its modulus of elasticity is 200GPa.



QUESTION THREE

If the tension test is found to taper from $(D+a)$ MM diameter to $(D-a)$ MM diameter, Prove that the error involved in using mean diameter to calculate Young's modulus is $(10a/D)^2$ percent. (20mks)

QUESTION FOUR

- A) Define the term bending stress and explain clearly the theory of simply bending (5MKS).
- B) State the assumptions made in the theory of simple bending (3MKS)
- C) Prove the relation
$$M/I = \delta/Y = E/R$$
Where M = Bending moment
 I = Moment of inertia
 δ = Bending stress in fibre at a distance Y from neutral axis
 E = Young's modulus
 R = Radius of curvature
- D) Discuss the difference of procedure in finding out the bending stress in
 - a) Symmetrical section
 - b) An unsymmetrical section
- E) Explain the term strength of a section.

QUESTION FIVE

- a) Define stress, strain and elasticity. Derive a relation between stress and strain of an elastic body.
- b) State clearly the Hooke's law.
- c) Derive from fundamental, the relation for the deformation of a body when it is subjected to:
 - i) A tensile force
 - ii) Its own weight
- d) Establish a relation for the stress in a bar of uniformly tapering section

QUESTION SIX

- a) A steel rod 1M long and 20MM, 20MM in cross-section is subjected to a tensile force of 40KN. Determine the elongation of the rod, if modulus of elasticity for the rod material is 200GPa.
- b) A load of 5KN is to be raised with the help of a steel wire. Find the maximum diameter of the steel wire if the stress is not to exceed 100MPa.

QUESTION SEVEN

A steel plate of 20MM thickness tapers uniformly from 100MM to 50MM in a length of 400MM. What is the elongation of the plate if an axial force of 80KN acts on it? Take $E=200$ GPa. (20MKS)