MURANG'A UNVERSITY COLLEGE
(A CONSTITUENT COLLEGE OF JOMO KENYATTA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY)
SCHOOL OF ENGINEERING & TECHNOLOGY

DIPLOMA AUTOMOTIVE ENGINEERING

DIPLOMA PRODUCTION ENGINEERING

DIPLOMA PLANT ENGINEERING

CODE: SEM 1317

COURSE TITLE: SOLID AND S TRUCTURAL MECHANICS

SEM I YEAR III EXAMINATIONS

DATE: 11TH DECEMBER, 2015 **TIME 2 HOURS**

SECTION A: COMPULSORY
SEME II

QUESTION ONE

. (a) A cantilever of length 3000 mm is carrying a point load of 25000N at the free end. If the moment of the beam is 10^8 mm^4 and the young's modulus E, is 2.1 $x10^5$ $N/mm^{2.}$ Determine

i. Slop of the cantilever at the free end
ii. Deflection at the free end

[3 marks]

(b) A cantilever of length 2500 mm carries a uniformly distributed load of 16400N per meter length over the entire length. Take the moment of inertia of the beam (I) to be 7.95 x 10^7 mm^4 and the young's modulus, E, to be $2x10^5$ N /mm^2 . Find the deflection at the free end.

[2 marks]

(c) A simply supported beam of length 5000 mm, carrying a point load of 5000N at a distance of 3000 mm from the left end. Take young's modulus to be, E, $2x10^5$ N/mm^2 and M.O.I, (I), as 1x10 mm^4

Find;

i. Slope at the left support
ii. Deflection under the load
iii. Maximum deflection

[6 marks**]**

(d) (1) Define the following terms

i. Resilience
ii. Proof resilience
iii. Modulus of resilience [1½ marks]

(d)(2) Tensile load of 60,000N is gradually applied to a circular bar of 40mm diameter and 5000mm long. Take E as $2.0x10^5$ Nmm^2

Find;

i. Stretch in the rod
ii. Stress in the rod
iii. Strain energy absorbed [1½ marks]

(d)(3) Calculate instantaneous stress produced in a bar 100mm^2 in area and 3000mm long by sudden application of a tensile load of unknown magnitude, if the extension of the bar due to suddenly applied load is 1.5mm Find the suddenly applied load, take E, to be $2x10^5$ N/ mm^2 [3 marks]

(d)(4) (a) Define the term spring\

(b) Outline TWO objectives of spring

(c) State and briefly explain three commonly used spring materials

(d) Design a helical compression spring to support an axial load of 3000N. The deflection under load is limited to 60mm. the spring index is 6. The spring is made of chrome vanadium steel and factor of safety is 2

(9 marks)

SECTION B
ANSWER TWO QUESTIONS

QUESTION TWO

(a) A cantilever 120mm wide and 200mm deep is 2500mm long . Determine the uniformly distributed load which the beam can carry in order to produce a deflection of 5mm at the free end. Take E to be $200x10^{9}$ N/mm^2

[10 marks]

(b) Abeam 6000mm long, simply supported at its ends, is carrying a point load of 50000 N at its centre. The a moment of inertial of the beam I is given as 78×10^6 mm^4 . Take E for material of the beam as $2.1x10^5$ N/mm^2 determine;

i. Deflection at the center of the beam

ii. Slope at the supports

[10 marks]

QUESTION THREE

3. (i) State the functions of LEAF Spring

(ii) A leaf of spring carries a central load of 3000N. The leaf spring is to be made of 10 steel plates 50 mm wide and 6 mm thick. If the bending stress is limiting to 150 N/mm^2 determine

i. Length of the spring

ii. Deflection at the centre of the spring. Take E= $2x10^5$ N/mm2

[10 marks]

b. (i) What is a helical spring

(ii) A closely coiled helical spring is to carry a load of 500N. Its mean coil diameter is to be 10 times that of the wire diameter. Calculate these diameters if the maximum shear stress in the material of the spring is to be 80N/mm^2

[10 marks]

QUESTION FOUR

A tension bar 5000 mm is made up of TWO parts, 3000 mm of its length has a cross-sectional area of 10 cm^2 while the remaining 2000 mm has a cross-sectional area of 20 cm^2. An axial load of 80 KN is gradually applied. Determine the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of the same length and having the same volume when under the same load. Take E to be $2x10^5$ N/mm^2

[20 marks]