



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MARINE ENGINEERING (DMAE 6)

EMR 2318 APPLIED MECHANICS IV

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: MARCH, 2014

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
 - Answer Booklet
 - Non-programmable Scientific Calculator
2. This paper consists of **FIVE** Questions.
3. Answer Question **ONE (Compulsory)**, **ONE** Question from Section **B** and **ONE** Question from Section **C**.
4. **This paper consists of THREE printed pages.**
SECTION A : (Compulsory)

Question ONE

- (a) Using sketches, derive the general equation of bending by considering a beam experiencing pure bending whose cross-section is uniform and its material obeys Hooke's Law. **(10 marks)**
- (b) (i) State **THREE** advantages and **TWO** disadvantages of gear drive.
(ii) List **THREE** gear materials stating their areas of applications. **(10 marks)**

SECTION B : (Answer only **ONE** Question)

Question TWO

- (a) A 4m long cantilever beam with a flexural stiffness of 20MNm^2 has a 1kN point load at the free end and a 300N/m uniformly distributed load along its entire length. Using the theory of superposition, calculate the slope and deflection at the free end. **(12 marks)**
- (b) A 8m long supported beam is carrying a uniformly distributed load of 5000N/m. If the deflection at the center is not to exceed 2mm, calculate the flexural stiffness and the gradient at both ends. **(8 marks)**

Question THREE

- (a) A beam of rectangular cross-section of a 100mm width carries a uniformly distributed load of 10kN/m and a point load of 5kN at centre. If the beam is 4m long it withstands a maximum bending stress of 8MPa and is simply supported, calculate the depth of the beam's cross-section. **(12 marks)**
- (b) Explain **FOUR** factors that determine the amount of bending or deflection of a beam. **(8 marks)**

SECTION C - (Answer **ONE** Question from this Section)

Question FOUR

In the epicyclic train shown in Figure 1C, shaft F rotates at 1500rpm in a clockwise direction while the driven shaft H rotates at 850rpm in an anti-clockwise direction. The number of teeth in various gears are: A, 18; B, 28; C, 47; E, 36; K, 32 and all are of the same module. If the torque input at shaft H is 75Nm, determine:

- (a) The speed and direction of rotation of the shaft L.
(b) The torques in shaft F and L stating whether these are inputs or outputs to and from systems respectively. **(20 marks)**

Question FIVE

The first and third, shafts of a double reduction spur gearbox are in line and a total reduction of approximately 10:1 is required. The module of the high speed pair is to be 5, that of the low speed pair are to be 8, and no wheel is to have less than 20 teeth:

- (a) Calculate suitable values of the centre distance between the first and the second shafts and the numbers of teeth on the wheels so as to satisfy the above conditions.
- (b) Determine the actual gear ratio.

(20 marks)