

TECHNICAL UNIVERSITY OF MOMBASA
DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING
SPECIAL/SUPPLEMENTARY UNIVERSITY EXAMINATIONS 2015/2016
THIRD YEAR FIRST SEMESTER UNIVERSITY SPECIAL/SUPPLEMENTARY
EXAMINATION FOR THE DEGREE IN BACHELOR OF SCIENCE IN MECHANICAL
ENGINEERING (BSME)

EMG 2310: GEAR MECHANISM

SERIES: AUGUST 2016

TIME: 2 HOURS

INSTRUCTION TO CANDIDATES:

1. You should have the following for this examination:-
 - Answer Booklet
 - Scientific Calculator
2. This paper consists of FIVE Questions
3. Question ONE is COMPULSORY
4. Attempt any other TWO Questions
5. Question ONE carries 30 Marks and the other FOUR questions carry 20 Marks each
6. All symbols have their usual meaning unless specified otherwise

QUESTION ONE: (COMPULSORY: 30 Marks)

- a) With the aid of a sketch, formulate the condition for constant velocity of toothed wheels. (12 Marks)
- b) State the FIVE (5) general rules that can be used to simplify design of gears (10 Marks)
- c) Gear Mechanism is the most versatile and widely accepted means of power transmission in machines and mechanisms. Give FIVE advantages and THREE disadvantages of toothed wheels. (8 Marks)

QUESTION TWO: (20 Marks)

A pair of single helical gears is required to give a speed reduction of 4.2:1. The gears are to have a normal module of 4 mm, a pressure angle of 20° and a helix angle of 30° . If the shaft centre-lines are to be approximately 500 mm apart, determine the number of teeth on each wheel and the exact centre distance. (This should be given to the nearest 0.01 mm.)

The pinion is supported in bearings equally spaced on either side of the centre line of the gear. If the speed of the pinion is 1000 rev/min and 80 kW is being transmitted, find the end-thrust on the pinion shaft and the load on each bearing. Assume that the end-thrust is carried by a separate thrust bearing.

QUESTION THREE: (20 Marks)

(a) A gear wheel and a pinion, which are in mesh, have 50 and 25 teeth respectively. Determine the velocity of sliding between the gear teeth faces:

- I. At the point of engagement
- II. At the pitch point
- III. At the point of disengagement.

Take $\phi = 20^\circ$;

$m = 8$ addendum = 2 mm;

N (pinion) = 1800 rpm.

(16 Marks)

(b) Find the angle through which the pinion in (a) above turns when a pair of teeth move from engagement to disengagement. (4 Marks)

QUESTION FOUR: (20 Marks)

a) With the aid of sketch, describe the following terms as used in relation to gearing:

- I. Addendum (2 Marks)
- II. Dedendum (2 Marks)
- III. Module (2 Marks)
- IV. Clearance (2 Marks)
- V. Working depth (2 Marks)

- b) Two (2) spur gears have a velocity ration of $1/3$. The driven gear has 72 teeth and the module is 8 mm and rotates at 400 rpm. Calculate:
- I. Number of teeth (2 Marks)
 - II. Speed of driver (2 Marks)
 - III. Pitch line velocity (2 Marks)
- c) The number of teeth of a spur gear are 50 and it rotates at 300 rpm. Determine its circular pitch and pitch line velocity if it has a module of 2 mm. (4 Marks)

QUESTION FIVE: (20 Marks)

Mating gears have 30 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum of each wheel is to be made of such a length that the line of contact on each side of the pitch point has $\frac{1}{2}$ the maximum possible length. Determine:

- I. The addendum height of each wheel.
- II. Length of path of contact
- III. Arc of contact
- IV. Contact ratio (20 Marks)