



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology
DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION 2013/2014

THIRD YEAR SECOND SEMESTER UNIVERSITY EXAMINATION FOR
THE DEGREE OF BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2310 : GEAR MECHANISMS

TIME: 2 HOURS

SERIES: DECEMBER, 2013

INSTRUCTIONS TO CANDIDATES

1. You are required to have the following for these examinations:
 - Drawing Instruments
 - Scientific Calculator
2. This paper has **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions carry equal marks.
5. Maximum marks for each part of the question are shown.
6. This paper consists of **FOUR Printed pages**.

QUESTION 1

- (a) List the advantages, obtained by increasing the addendum height for a pinion while maintaining the same working depth.
- (b) For a pair of gears with involute tooth profile and module is equal to addendum, deduce an expression for maximum number of teeth to be cut on the pinion if interference is not to occur.
- (c) A single reduction spur gears has a gear ratio of 19 to 1. The teeth are of involute form and standard properties, with pressure angle of $22\frac{1}{2}$. Distance between centres is the between 600 and 620mm.

Find:

- (i) The nearest standard module if no interference is to occur
- (ii) The number of teeth on each wheel

(20 marks)

QUESTION 2

- (a) Discuss the properties and application of worm and worm wheel drive. **(3 marks)**
- (b) Give merits of hypoid gearing. **(2 marks)**
- (c) Using a diagram show proportions of a pinion bevel gear. **(5 marks)**
- (d) A worm gearing connects two shafts at right angles. The worm has four 4 teeth of normal module of 20mm and the speed ratio between other worm and the wheel is 5. The pitch diameter of the worm is 40mm. Calculate:
 - (i) The tooth angles of the worm and wheel
 - (ii) distance between the shaft centres
 - (iii) If the efficiency of the gears is 90% the worm being the driver, find the coefficient of friction between the tooth surfaces.

(10 marks)

QUESTION 3

- (a) Explain the meaning of the term ‘contact ratio’ as applied to gear wheels. **(3 marks)**
- (b) Drive an expression for the path of recess path of approach and hence the path of contact. **(10 marks)**
- (c) Two gear wheels of involute teeth profile have 20 and 29 teeth. The pressure angle is 20° , module 6.5mm and the addendum is standard. Calculate the length of contact.

QUESTION 4

Figure 1 shows a compound epicyclic gear train. Shaft F is driven at 3000 r.p.m while the annulus A_2 is driven at 1000 r.p.m in the opposite direction. Determine the speed and direction of rotation of shaft Q. **(20 marks)**

QUESTION 5

A driving motor is geared to rotate at 20 times the speed of the winding drum. The motor shaft is fitted with a brake drum. A load is being lowered by the hoist.

- (a) Sketch the lifting arrangement
- (b) Determine the pulls at the end of the brake band to stop the descent of the load in a distance of 0.3m.

Data

Effective diameter of winding drum	=	0.35m
Effective diameter of brake drum	=	0.35m
Brake band total contact arc	=	240°
Moment of inertia of motor and brake drum	=	4kg/m ²
Moment of inertia of winding drum	=	2kgm ²
Speed of the load	=	45m/min
Coefficient of friction between the drum and the brake band	=	0.5

(20 marks)