



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

**THIRD YEAR SECOND SEMESTER EXAMINATION FOR, DIPLOMA IN
AUTOMOTIVE/PLANT ENGINEERING**

SEM 1317 - MECHANICS OF MACHINES II

DURATION: 2 HOURS

DATE: 17/12/2018

TIME: 2 – 4 P.M.

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a)
- i. Explain the difference between static balance and dynamic balance of rotating masses on a shaft (2 Marks)
 - ii. State THREE advantages and THREE disadvantages of chain drives when compared to belt drives (6 Marks)
 - iii. Explain a helical gear and state one way that a helical gear drive differs from a spur gear drive (3 Marks)
 - iv. Define the term “cam” (1 Mark)
 - v. Sketch any THREE classes of Cam followers (3 Marks)
- b)
- i. State TWO differences between the Ackermann and Davis steering mechanisms (4 Marks)
 - ii. Explain why balancing of rotating parts is necessary for high speed engines (3 Marks)
- c)
- i. The piston of an engine moves with simple harmonic motion. The crank rotates at 120 rev/min with a stroke of 2m. Find the velocity and acceleration of the piston, when it is a distance of 0.75 m from the centre. (4 Marks)
 - ii. Outline TWO conditions that must be satisfied in order to give the primary balance of reciprocating parts of a multi-cylinder engine (4 Marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

A shaft is supported in bearings 1.8m apart and projects 0.45m beyond bearings at each end. The shaft carries pulleys, one at each end and one at the middle of its length. The masses of end pulleys are 48kg and 20kg and their centers of gravity are 15mm and 12.5mm respectively from the shaft axis. If the pulleys are arranged so as to give static balance, determine;

- a. The relative angular positions of the pulleys
- b. The dynamic forces produced on the bearings when the shaft rotates at 300 rev/min

(20 Marks)

QUESTION THREE (20 MARKS)

- a)
- i. Show, by means of clear sketches, the displacement, velocity and acceleration of a uniformly accelerated and retarded motion of a cam follower. Let the full rotation of θ be divided into θ_1 and θ_2 where $\theta_1 < \theta_2$ (3 Marks)
 - ii. Show by means of clear sketches the displacement, velocity and acceleration of an SHM (Simple Harmonic Motion) of a cam follower (3 Marks)
- b) An engine of cylinder diameter 100 mm and stroke 120 mm has a piston of mass 1.1 kg and a connecting rod of length 250 mm. when rotating at 2000 rev/min, and on the power stroke with the crank at 20° from the top dead center position, the gas pressure is 700 KN/m^2 . Determine:
- i. The resultant load on the gudgeon pin
 - ii. The thrust on the cylinder wall (14 Marks)

QUESTION FOUR (20 MARKS)

- a) A reduction of speed from 360 rev/min to 120 rev/min is to be attained by the use of chain drive. The driving sprocket has 10 teeth.
- i. Find the number of teeth on the driven sprocket.
 - ii. If the pitch radius of driven sprocket is 250 mm and the centre to centre distance between two sprockets is 400 mm, find the pitch and the length of the chain (10 Marks)
- b) A four-bar chain ABCD has the following dimensions: $AB = 300\text{mm}$; $BC = CD = 360 \text{ mm}$; $AD = 600 \text{ mm}$. The link AD is fixed and the angle BAD is 60° . The driving link AB rotates uniformly at a speed of 100 rev/min clockwise.
- i. Determine the velocity at point C
 - ii. Determine the angular velocity of the driven link CD
 - iii. Find the actual mechanical advantage if the efficiency of the mechanism is 70% (10 Marks)