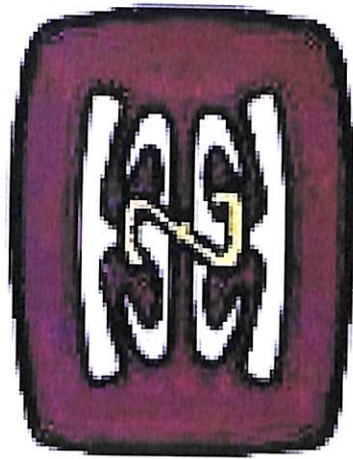


**PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY  
DEPARTMENT OF MECHANICAL ENGINEERING**

**EXAMINATION QUESTION PAPERS**



**ME 311  
MECHANICS OF MACHINES**

**SEMESTER ONE - 2024**

THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY  
EXAMINATIONS

SEMESTER I-2024  
ME 311 Mechanics of Machines

Monday 27<sup>th</sup> May, 2024 [8:20 AM-11:20PM]

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. You have 10 minutes to read the paper. You must not begin writing this time.
2. Answer All questions
3. Do not use pencil for writing except for drawings and sketches.
4. Start each question on a new page and show all your calculations in the answer book provided.
5. Write down your full name and student number clearly on the front page.
6. Non-programmable calculator is permitted in the examination room.
7. Notes, textbooks or smart phones are not allowed.
8. Any candidate cheating the examinations will be disqualified.

### QUESTION 1

Having studied Mechanics of Machines this semester, apply the knowledge you received and design any mechanism of your choice providing;

- (i) the objective/s of the mechanism
- (ii) Conceptual design of the mechanism
- (iii) kinematic diagram of the mechanism;
- (iv) what powers the motion and the reason behind your choice of power.

### QUESTION 2

- (a) The Figure 1 below shown the sketch of a backhoe digging machine, Draw the kinematic diagram and number the links of the mechanism.
- (b) Calculate the possible degree of freedom of the mechanism using Gruebler' s equation

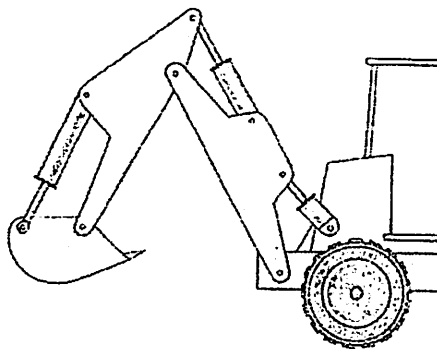


Figure 1

### QUESTION 3

- (a) In Figure 2 bellow a truck lift mechanism used in the street light maintenance and other construction industries is shown, if  $a = 24\text{in}$ ;  $b = 36\text{in}$ ;  $c = 30\text{in}$ ;  $d = 50$ ;  $e = 6\text{ft}$  and  $f = 10\text{ft}$ , determine the vertical height of the basket which carries the maintenance personnel. State your answer in millimeter (mm)

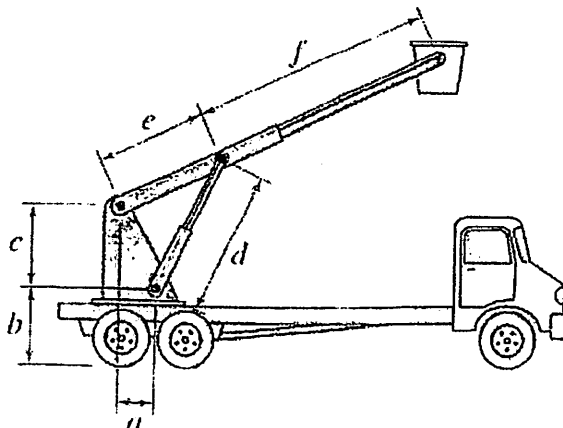


Figure 2

### QUESTION 4

- (a) Why are position and displacement analysis very important in understanding the movement of links in a mechanism.
- (b) Graphically position the links for the foot-operated air pump shown in Figure 3. Then reposition the links as the air cylinder retracts to 175 mm. Determine the resulting angular displacement of the foot pedal and the linear displacement of point X.

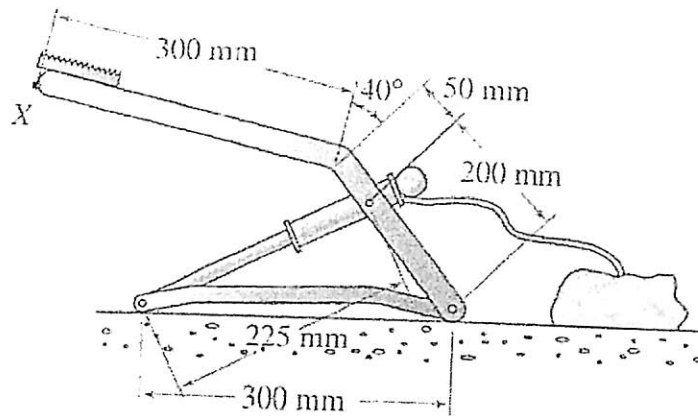


Figure 3

### QUESTION 5

The device in Figure 4 is a drive mechanism for the agitator on a washing machine. For the configuration shown, use the relative velocity method to graphically evaluate the angular velocity of the segment gear as the crank is driven clockwise at 50 rpm.

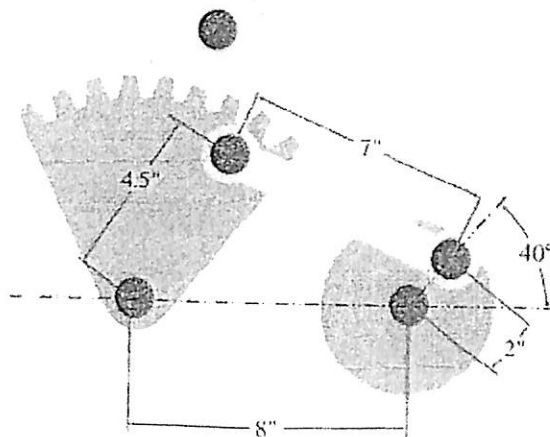


Figure 4