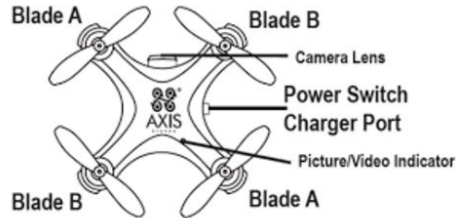


**Question \*\* (25 marks: 25%): (CLO\_c: 70%)**

Drone is an Unmanned Aerial Vehicle (UAV) i.e. an aircraft without a human pilot aboard. Drones have a variety of uses. It is worth to mention here, in our College of Engineering at King Saud University, Prince Sultan Center took an honorable job to design and fly drones.

(a)



Schematic figure of a four bladed drone; (b) Picture of a four bladed drone

A sample design of a **four** bladed drone is shown in figure (a) and picture (b), respectively. **Each blade** is driven by **an electric motor**. The main features and options matrix is shown in **Table 1**.

**Table 1: Main features and options matrix**

Feature	Option 1	Option 2	Option 3	Option 4
Blade				
	<b>A1: \$9.0</b>	<b>A2: \$6.0</b>	<b>A3: \$10.0</b>	<b>A4: \$12.0</b>
Electric motor				
	<b>B1: \$350.0</b>	<b>B2: \$ 250.0</b>	<b>B3: \$300.0</b>	<b>B4: \$400.0</b>
Camera (Price: \$10.0 per MP)				
	<b>C1: 40 Megapixel(MP)</b>	<b>C2: 80 Megapixel(MP)</b>	<b>C3: 60 Megapixel (MP)</b>	<b>C4: 50 Megapixel (MP)</b>
Battery				
	<b>D1: \$ 200.0</b>	<b>D2: \$ 250.0</b>	<b>D3: \$350.0</b>	<b>D4: \$300.0</b>
Operating range	<b>E1: 4500 m</b>	<b>E2: 5000 m</b>	<b>E3: 6000 m</b>	<b>E4: 5400 m</b>
Maximum flight time	<b>F1=30 min</b>	<b>F2=40 min</b>	<b>F3=30 min</b>	<b>F4=60 min</b>

(a) Using the letters (A,B,C,D,E,F) shown in **Table 1** for options, select the features of three designs to complete **Table 2**:

**Table 2: Concepts generation**

<b>Design</b> <b>Feature</b>	<b>Design 1</b>	<b>Design 2</b>	<b>Design 3</b>
<b>Blade</b>			
<b>Electric motor</b>			
<b>Camera</b>			
<b>Battery</b>			
<b>Operating range</b>			
<b>Maximum flight time</b>			

(b) Fill in **Table 3** with the total cost for each design.

**Table 3: Concept total cost**

<b>Feature</b>	<b>Design 1</b>		<b>Design 2</b>		<b>Design 3</b>	
	<b>No. of components</b>	<b>Cost</b>	<b>No. of components</b>	<b>Cost</b>	<b>No. of components</b>	<b>Cost</b>
<b>Blade</b>						
<b>Electric motor</b>						
<b>Camera</b>						
<b>Battery</b>						
<b>Total cost</b>						

(c) Fill in **Table 4** with the weight and rate using **Table 2** and **Table 3** in order to obtain the best design.

**Table 4: Weight and rate**

		<u>Weight and rates matrix</u> Rate: 10 best .....1 worse				Score
		Criteria				
		Low cost	High resolution	High speed	High distance range	
	Weight (W)	30	20	30	20	
<b>Design 1</b>	Rate (R)					
	W×R					
<b>Design 2</b>	Rate (R)					
	W×R					
<b>Design 3</b>	Rate (R)					
	W×R					

(d) Circle the best design

Design	1	2	3
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