

**Question 1 (4 marks): Ethics**

**Indicate at the left column space whether the statement aside is True (T) or False (F).**

	Ethics can be defined as culturally and religiously based distinctions of right/wrong.
	Engineers may perform services outside of their areas of competence as long as they inform their employers or clients.
	Toxic waste can be unconditionally dumped into the sea far from residential areas.
	Engineers shall acknowledge their errors after consulting with their employers or clients.
	Ethically, engineers should uphold <u>all of</u> the health, safety, and public confidence.
	Whistleblowing is the act of informing authorities of harmful, dangerous, or illegal activities.
	From highest to lowest importance, ethical responsibility of the professional engineers is: the client, society as a whole, the profession, oneself.
	Signing plans prepared by an unknown person without thoroughly reviewing them is considered unethical.

**Question 2 (4 marks): legal regulations: Patent, copyright and trademarks**

**Indicate at the left column space whether the statement aside is True (T) or False (F).**

	Patents registered in the United States are automatically protected in Europe and vice versa.
	Programmer can apply for a patent for their distinguished, novel and useful programs.
	To prevent others from copying his ideas, the engineer should not send drawings with the patent application.
	Copying a product and improving it is not patent violation.
	To qualify for trademark protection, the mark must have actually been used on goods that were shipped or sold.
	A copyright protects original works of authorship.
	While dealing with leaking of trade secrets, legal action can be taken only after the secret has been revealed.
	Licensing a trademark generally involves an authorizing agreement.

**Question 3 (4 marks):**

Fill the Table #2 using the best **ONE** selection that much each of its terms from the Table #1.

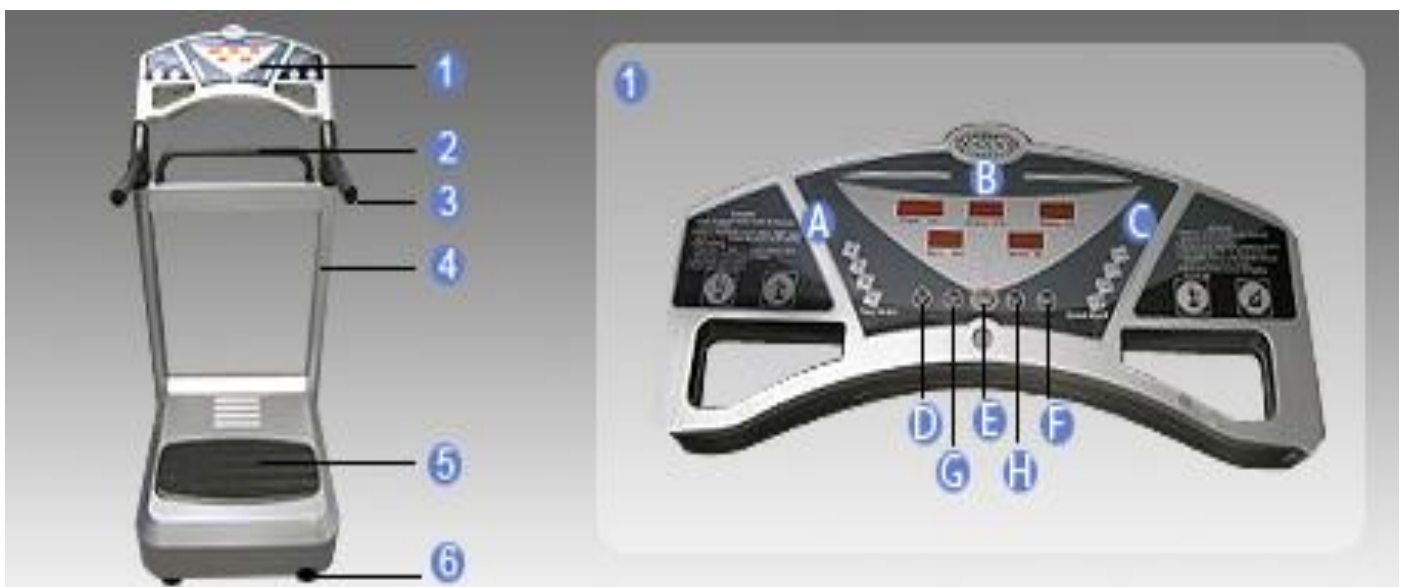
- NOTE:**
- All terms in TABLE#1 should be used.
  - Fill each empty cell in Table#2.

Table #1	
1	Quality standards of the engineering profession
2	Petroleum engineer
3	Proof of knowledge
4	Good communication skills
5	Wastewater
6	Leadership
7	Creative
8	IEEE
9	Ethical
10	Welfare

Table #2		
1	Competency	
2	Natural gas	
3	ABET	
4	Personal	
5	Public obligation	
6	Professional conduct	
7	Professional engineering society	
8	Professional engineering thinking	
9	Civil engineer	
10	Managerial	

**Question 4 (5 marks): Human factors**

The following Figures show a fitness machine



Fitness Unit Components, as in the figures, are:

**1. Control Panel**

- a. Timer Shortcut Button
- b. Digital Displays for time, calories, distance, count, speed
- c. Speed Shortcut Button
- d. Timer "+" Button
- e. E. Start/Stop
- f. F. Speed Control "-" Button
- g. Timer "-" Button
- h. H. Speed Control "+" Button

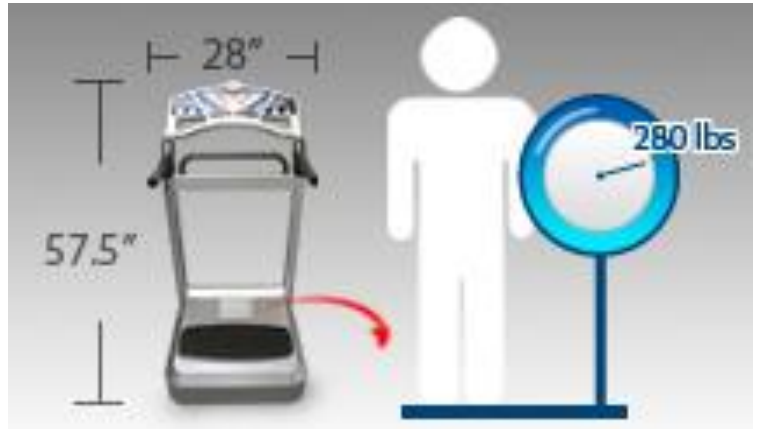
**2. Support Bar**

**3. Handles**

**4. Frame**

**5. Stepping Board**

**6. Foot Cushion**



The table below lists ten features that are considered in the design of a fitness machine unit (figures) to satisfy human comfort.

The symbols A, B, C, and D in the last four columns indicate human factors with:

[A] for anthropometric;

[B] for ergonomic;

[C] for physiological;

[D] for psychological

**Circle one human factor symbol that is most related to each of the ten design features in the list**

1	Dimensions of the fitness machine (Height, width) are suitable for elderly persons	A	B	C	D
2	The adjustable vibration speed range is fully suitable for operators	A	B	C	D
3	Digital Displays For Calories, Time, Speed, Count & Automatic Modes response to various inputs for working environments	A	B	C	D
4	Interpretation of information from Control Panel is very easy	A	B	C	D
5	The fitness vibration unit has 25 choices of vibration speed, including 3 automatic programs easy to Decision-making.	A	B	C	D
6	Foot Cushion make the fitness machine stabile during the exercising and provide operator protection	A	B	C	D
7	Stepping Board is designed to comfort various trainer weight until maximum 127 Kg	A	B	C	D
8	The distance between the Handles is suitable for family members of all ages	A	B	C	D
9	When press on the buttons D, G, F, H and E (see the figures) are responding in about 10 seconds.	A	B	C	D
10	The vibration unit action is engineered to benefit circulation for muscle and whole body vibrations.	A	B	C	D

**Question 5 (9 marks): Problem definition**

In the table below several items of a need analysis required for the problem formulation of the design of a refrigerator are listed. The symbols A, B, C, D, and E represent the basic design steps that need to be defined, as follows:

- (A) Problem statement,
- (B) Objectives,
- (C) Constraints,
- (D) criteria,
- (E) Design specifications

Circle the most appropriate design step indicator corresponding to the twelve items shown in the given table. **Only one step indicator should be selected for each item.**

1	The refrigerator must use newly environmental friendly refrigerant to protect the ozone layer.	A	B	C	D	E
2	The temperature and humidity must be easily controlled meaning an easy operation.	A	B	C	D	E
3	The volume should be more than 1m <sup>3</sup> with a maximum height of 1.2 m in order to store sufficient amount of medicines.	A	B	C	D	E
4	The refrigerator will provide remote and isolated areas with medicines and vaccines.	A	B	C	D	E
5	It is desired to design a solar refrigerator to be used in remote areas to store medicines and vaccines.	A	B	C	D	E
6	The refrigerator must store vaccine and medicines at specific temperatures and must use only solar energy	A	B	C	D	E
7	The price of the refrigerator should not be more than 3000 SR	A	B	C	D	E
8	The maintenance cost should be low.	A	B	C	D	E
9	The inside of the refrigerator must have several closed compartment with glass windows	A	B	C	D	E
10	The different parts should easily assembled and dismantled	A	B	C	D	E
11	The refrigerator must be 100 % powered by solar energy	A	B	C	D	E
12	The body of the refrigerator must be highly resistant to the environment conditions in order to exhibit long life.	A	B	C	D	E

**Question 6 (10 marks):**

It is required to design a clock. Use the following functions and options to answer the question given below:

- **Functions (Features):**

<b>1</b>	Energy Source	<b>3</b>	Motion Transmission	<b>5</b>	Material
<b>2</b>	Motor	<b>4</b>	Shape		

- **Options** *(See the last page for some helpful graphical illustrations)*

<b>1</b>	Circular	<b>8</b>	Hexagonal	<b>15</b>	Vibration
<b>2</b>	Electric Motor	<b>9</b>	Solar	<b>16</b>	Plastic
<b>3</b>	Pinion Drive	<b>10</b>	Square	<b>17</b>	Small
<b>4</b>	Battery	<b>11</b>	Wood	<b>18</b>	Elliptical
<b>5</b>	Metal	<b>12</b>	Chain Drive	<b>19</b>	Support
<b>6</b>	Manual Winding	<b>13</b>	Light weight	<b>20</b>	Spring Motor
<b>7</b>	Worm Drive	<b>14</b>	Polymer		

- a) Carry out a morphological analysis and obtain **THREE (3)** potential combinations by completing the table below.

FUNCTIONS	OPTION 1	OPTION 2	OPTION 3	OPTION 4
<b>Energy Source</b>				
<b>Motor</b>				
<b>Motion Transmission</b>				
<b>Shape</b>				
<b>Material</b>				

- b) Select from this analysis three potential concepts.

1.

2.

3.

c) Evaluate the **THREE (3)** concepts defined in part (b) using the weights and rates technique and determine the best design considering the following:

- Criteria:
  - (1) Efficiency
  - (2) Economy
  - (3) Low cost
  - (4) High safety
  - (5) High durability
- Equal weights (**compromise**)
- Rate 1 for worst and 10 for best

Criteria Concept		Efficiency	Economy	Low cost	High safety	High durability	Score
Weights	W						
Design 1	R						
	W*R						
Design 2	R						
	W*R						
Design 3	R						
	W*R						

**Best Design:**

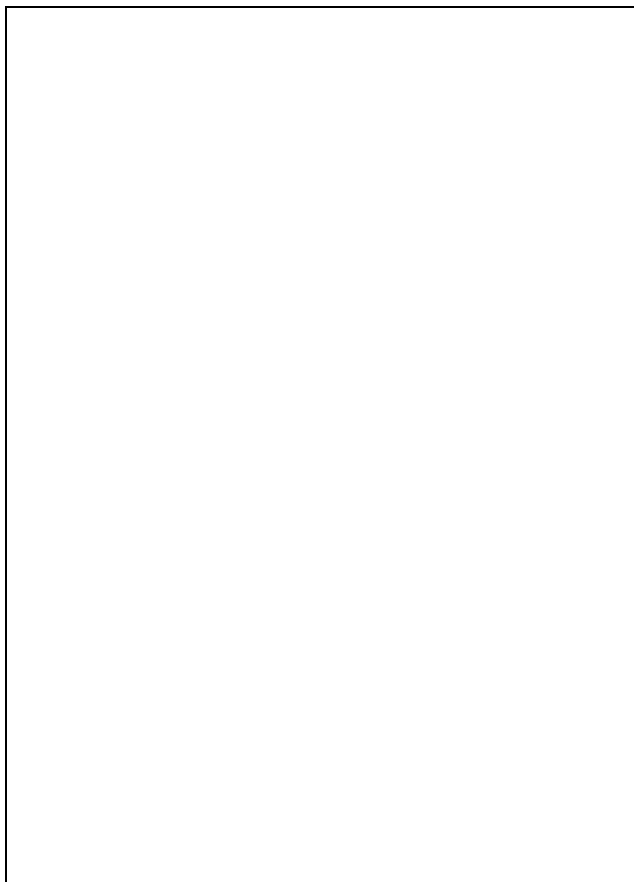
**Question 7 (4 Marks):**

The figures below show an engineering design solution for recycling plastic bottles wastes.

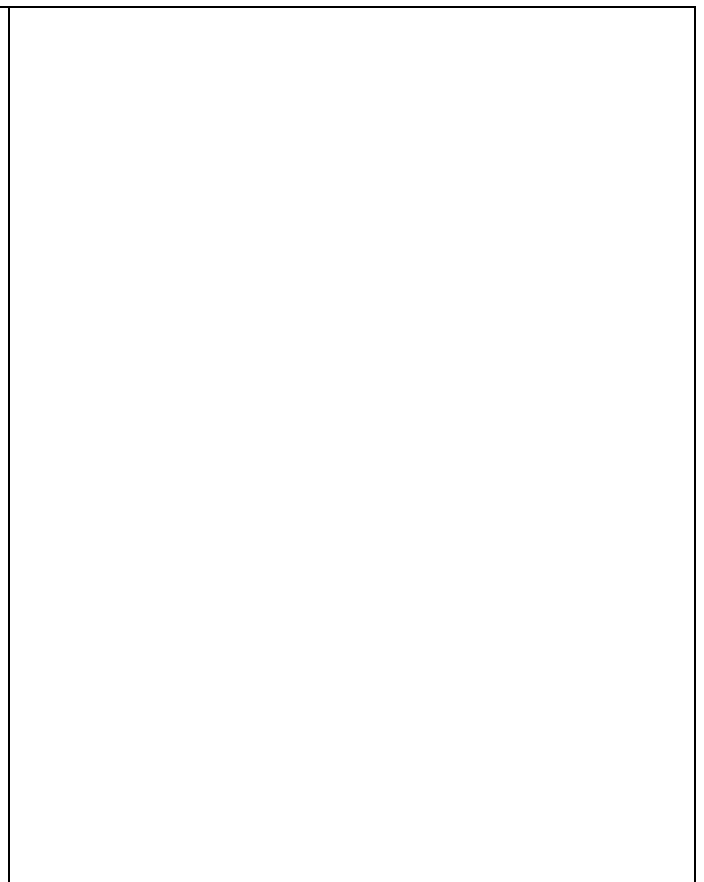


**Sketch two different **alternatives**** that can provide the same functions and efficiency as the design shown in the figure.

**Alternative 1**

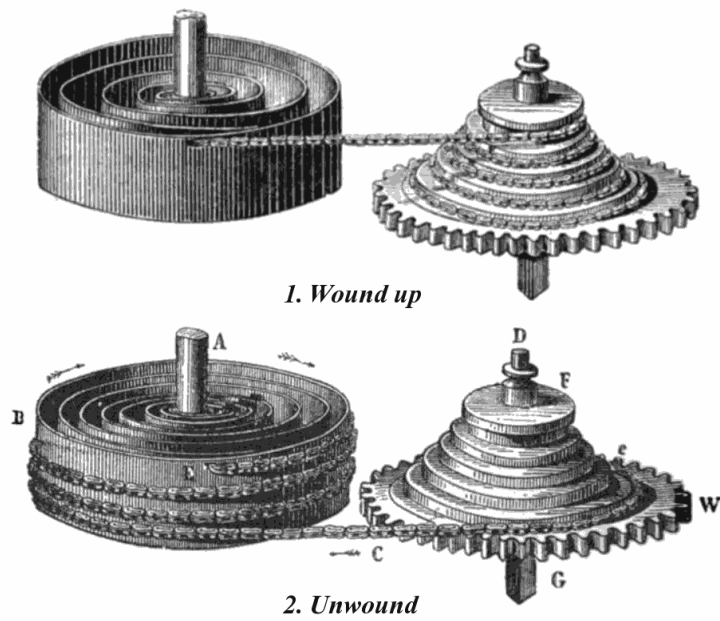


**Alternative 2**



Graphical illustrations for question 6:

Winding process



Chain drive



Spring Motor



Pignon



Worm drive

