



**CENTRE FOR PRODUCT DESIGN AND MANUFACTURING**  
**INDIAN INSTITUTE OF SCIENCE**

**Design Aptitude Test (DAT)**  
for admission to  
**M. Des. Programme in Product Design and Engineering**

**PART – I (Technical Thinking)**

There are **EIGHT** questions in this part, **FIVE** from **Questions 1-7** are to be attempted. Question 8 (Maths) is compulsory.

**Work out the problem** in the space provided below each question.

**You must show your choice** of correct answer on the cover page

Questions 1-7 carry **6 marks each**, Question 8 (Maths) carry **10 marks**, for the correct choice and work out. Unsuccessful but valid attempt get **50% mark**. No marks for skipping a question.

Maximum Total Marks (6x5+10) = 40

NAME:	APPLICATION NO.:
SIGNATURE:	

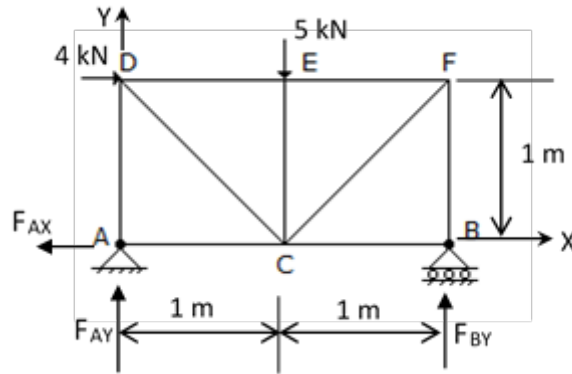
**Summary of your response:**

		Tick the correct answer (for Q 1-5) from the options below			
Question 1		(a)	(b)	(c)	(d)
Question 2		(a)	(b)	(c)	(d)
Question 3		(a)	(b)	(c)	(d)
Question 4		(a)	(b)	(c)	(d)
Question 5		(a)	(b)	(c)	(d)
Question 6		(a)	(b)	(c)	(d)
Question 7		(a)	(b)	(c)	(d)
Question 8	A	(a)	(b)	(c)	(d)
	B	(a)	(b)	(c)	(d)

# CPDM DAT Sample Questions

**Question 1:**

In the truss shown below, the force in the member CF is



- a. 0.707 kN (Tensile)
- b. 6.36 kN (Tensile)
- c. 1.414 kN (Compressive)
- d. 7.07 kN (Compressive)

Calculations:

**Question 2:**

Starting from rest, a skier slides 200 m down without any push in a 35 degrees slope. How much time does the run take if the coefficient of kinetic friction is 0.3?

- a. 10 sec
- b. 10.5 sec
- c. 11.25 sec
- d. 13.5 sec

Calculations:

CPDM DAT Sample Questions

### Question 3:

Calculate the time complexity of binary search on a list of N items?

- a.  $O(\log(N))$
- b.  $O(N \log(N))$
- c.  $O(N/2)$
- d.  $O(2N)$

Calculations:

CPDM DAT Sample Questions

**Question 4:**

It is required to cut screw threads of 2mm pitch on lathe. The lead screw has pitch of 6 mm and the spindle speed is 60 rpm, then the lead screw will be.....?

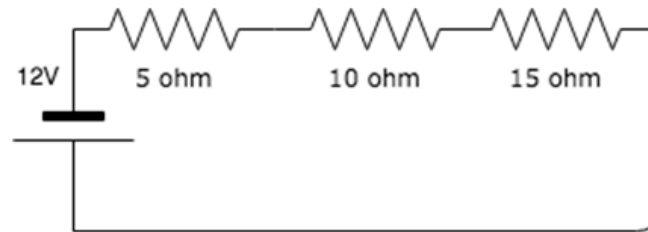
- a. 10 rpm
- b. 20 rpm
- c. 120 rpm
- d. 180 rpm

Calculations:

CPDM DAT Sample Questions

**Question 5:**

5. Calculate the voltage across the 15 ohm resistor.



- a. 4V
- b. 12 V
- c. 6 V
- d. 8 V

Calculations:

CPDM DAT Sample Questions

**Question 6:**

1Kg of ice (at 0°C) is mixed in 3Kg water at 20°C till temp till all of water comes down to nearly 0°C. Remaining ice is filtered out. Assuming no heat is transferred from surrounding, how much ice will be left over?

Latent heat of fusion = 333KJ/kg , Heat capacity of water 4.2 KJ/Kg/°C

- a. 0 gm (no ice left)
- b. 244 gm
- c. 488 gm
- d. 732 gm

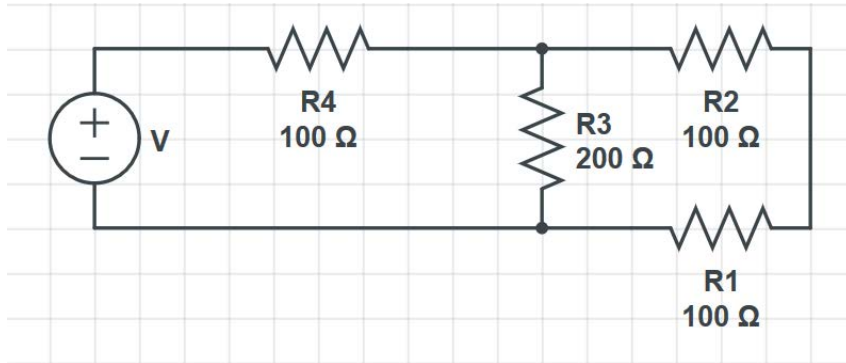
Calculations:

CPDM DAT Sample Questions



### Question 7:

Find the voltage  $V$  if the current  $i_3$  is measured a 10mA.

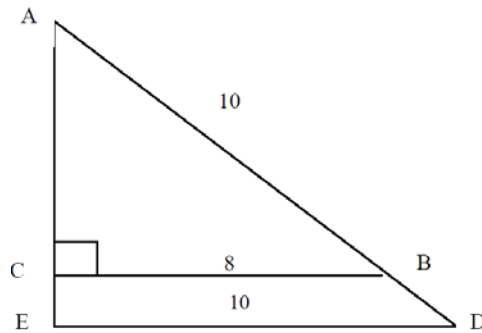


- a. 40V
- b. 4V
- c. 0.1V
- d. 1V

CPDM DAT Sample Questions

### Question 8 (Mathematics)

A. In the figure below, if length of AB is 10, the length of AD is:



- a.  $47/4$
- b. 12
- c.  $49/4$
- d.  $25/2$

CPDM DAT Sample Questions

B. If  $f(x) = 4x - 2$ , then  $f(x-1) =$

- a.  $4x^2 - 6x + 2$
- b.  $4x^2 + 2x + 2$
- c.  $4x + 2$
- d.  $4x - 6$





**Design Aptitude Test (DAT) for admission to**  
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**PART – I (Spatial Thinking)**

There are **FIVE** questions in this part, ALL of which are to be attempted.  
Work out the problem in the space provided below each question.  
Show your choice of correct answer on the cover page

Questions 1-4 carry 5 marks each (Correct answer: 5 marks, Unsuccessful attempt 2 marks, No attempt 0 marks)

Question 5 (Sketching) carries 10 marks

You will be **DISQUALIFIED** if you do not attempt Question 5

Maximum Total Marks (4x5+10) = 30

NAME:

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	Tick the correct answer (for Q 1-4) from the options below			
Question 1	(a)	(b)	(c)	(d)
Question 2	(a)	(b)	(c)	(d)
Question 3	(a)	(b)	(c)	(d)
Question 4	(a)	(b)	(c)	(d)

## General information about the “Spatial Thinking Test”

Spatial thinking concerns understanding and reasoning spatial relations among objects. In a spatial thinking test you need to mentally manipulate and reason about 2-dimensional and 3-dimensional objects.

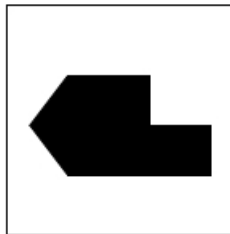
Indicative types of questions:

- You are given several 2D or 3D elementary shapes. A number of alternative 2D or 3D figures are also provided. You need to select the correct alternative figure that can be produced by combining the elementary shapes.
- You are given an image of a 3D object. A number of alternative 3D views are also provided. You need to select the correct alternative 3D view that can be produced by 3D rotation of the given object.
- You are given a 2D pattern which can be folded into a 3D shape. A number of alternative 3D shapes will be provided. You need to select the correct one.
- You are given a number of objects in a scene. If one or more objects in the scene or how the scene is viewed is changed, you will be asked to indicate how other objects or relations among these or the view would change.
- Sketching: In this section your ability to draw free-hand sketches using pencil is tested. The questions may involve drawing in perspectives and drawing with lines and shading.

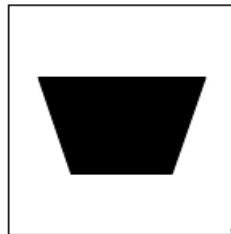
Sample Question 1:

Which image among options (a)-(d) can be made from the three shapes shown by combining them without overlapping?

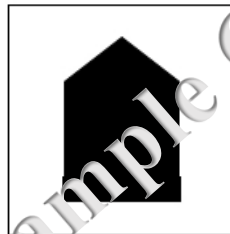
In the box below show the details of the composition for the selected option. Also explain why the other options were rejected.



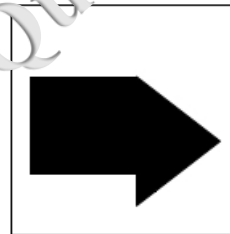
(a)



(b)



(c)



(d)

Composition of selected option

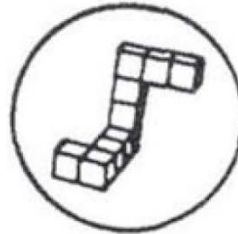
Explanation for rejected options

Sample Question 2:

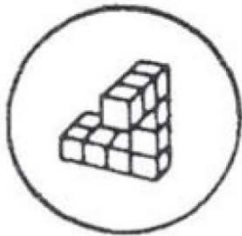
You are given an image of a 3D object. Four alternative 3D views, (a)-(d), are provided below. Select the correct 3D view that can be obtained by 3D rotation of the object.

In the box below show the rotation process visualized for the selected option. Also explain why the other options were rejected.

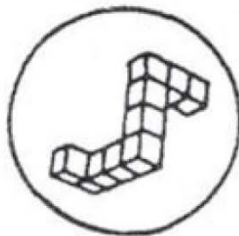
Object



Alternative views



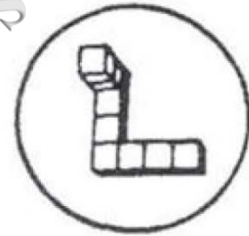
(a)



(b)



(c)



(d)

Rotation process for the selected option

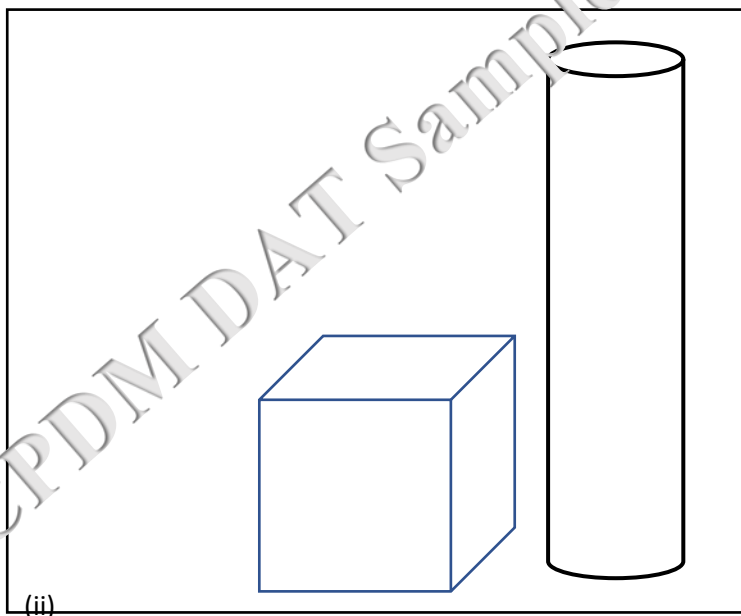
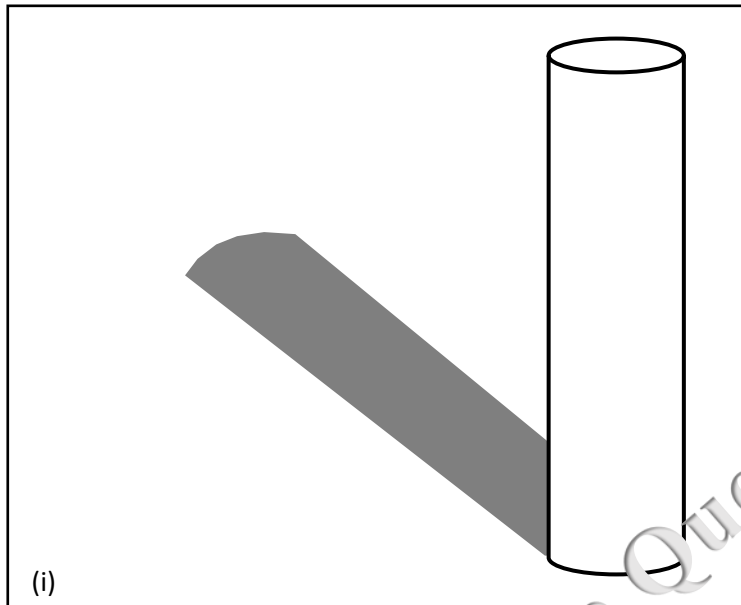
Explanation for rejected options





Sample Question 4:

With reference to shadow of the cylinder in image (i) below, sketch the shadow of the same cylinder in image (ii) after a cube is placed close to the cylinder as shown.



How many faces of the cube does the shadow of the cylinder fall on? Select the correct option from those given in (a)-(d)

(a) 0 faces	(b) 1 face	(c) 2 faces	(d) 3 faces
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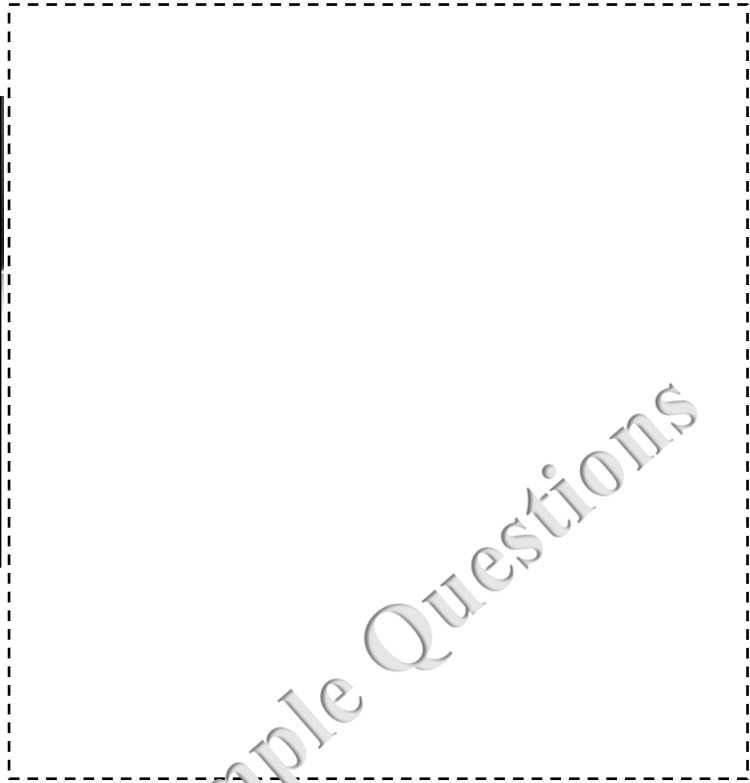
Sample Question 5:

- (a) The figure of a table is given below. Complete the figure by adding a closed book placed on the table-top such that one edge of the book matches an edge of the table top. Length of each book should be about  $\frac{1}{3}$  of the edge of the table.

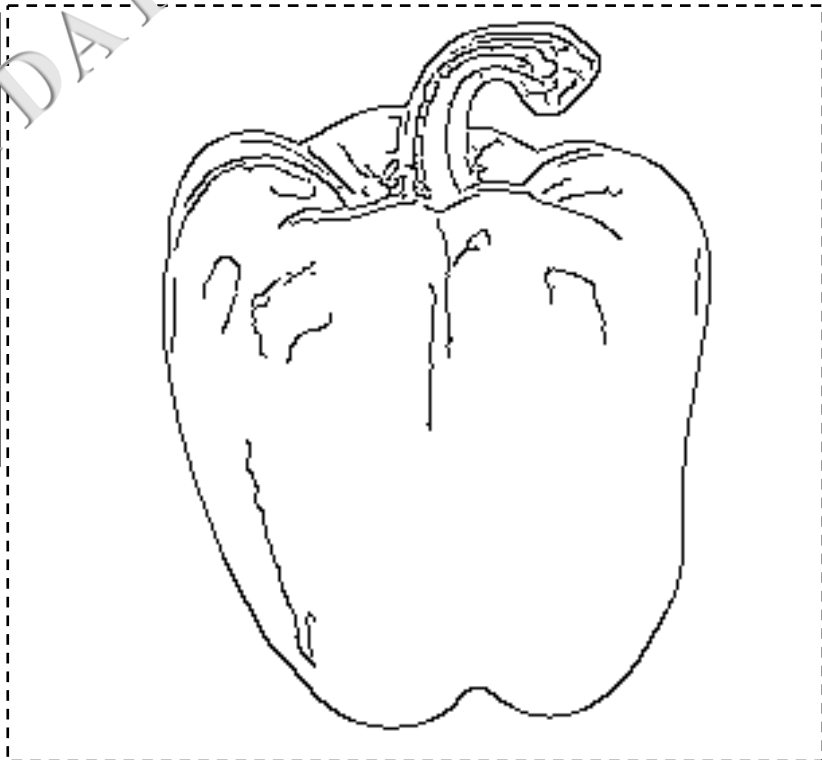
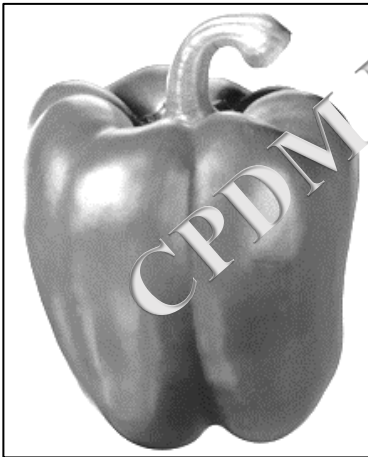
Do NOT shade the sketch. Only free hand line drawing is required.



(b) Sketch free hand outline of the figure below in the adjacent box.  
Do NOT shade.



(c) Copy the shading of the shaded figure below in the outline figure in the adjacent box





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**PART - II (Design Thinking)**

There are SEVEN (7) questions in this part

Answer all the questions

Each question carries 5 marks

Maximum Total Marks = 35

1. Mention THREE potential problems (i.e. difficulties) in any ONE of the two situations shown below



ANSWER:

Selected Situation: \_\_\_\_\_

Problem 1

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Problem 2

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Problem 3

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CPDM DAT Sample Questions

**2.** Choose any **ONE** *technology* item from the list below.

Write TWO sentences each to describe ***in which situation this technology is used*** and ***what is the principle on which it works***

*(e.g. the technology of electromagnetic induction is used in design of a calling bell.*

*This works by (a) passing current through a coil around an iron rod that turns into magnet to attract the hammer to the bell; (b) this in turn breaks the circuit and a spring takes the hammer back to its original position to close the circuit again)*

A.	Digital Human Models (DHM)
B.	Wire EDM
C.	Internet of Things (IoT)
D.	Collaborative Robots (COBOT)
E.	Automatic Manual Transmission (AMT)

ANSWER: Selected technology: \_\_\_\_\_

***(in which situation this technology is used)***

Sentence 1:

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Sentence 2:

---

***(the principle on which it works)***

Sentence 1:

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Sentence 2:

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**3.** Choose any ONE **product** from the list below.

Write FIVE distinct **features** of the product

*(e.g. two distinct features of Tata Nano Car are: (i) the engine is at the rear, (ii) each wheel has only three fixing bolts)*

A.	Microsoft Hololens
B.	LG 308L 3 Star Refrigerator
C.	TVS Apache RR 310
D.	SpaceX Falcon Heavy

ANSWER: Selected product: \_\_\_\_\_

Feature 1:

\_\_\_\_\_

Feature 2:

\_\_\_\_\_

Feature 3:

\_\_\_\_\_

Feature 4:

\_\_\_\_\_

Feature 5:

\_\_\_\_\_

\_\_\_\_\_

CPDM DAT Sample Questions

4. For each of the materials given below, identify one **property** and its **application** in some **products**

(e.g. material 'activated carbon' has 'high porosity' property which is used in 'water purification' applications)

A.	Polylactic Acid (PLA)
B.	Gorilla Glass
C.	Ductile Iron
D.	Cotton
E.	Manganese Oxide Polystyrene Nanocomposite (MOPN)

ANSWER:

	Material	Property	Application
#1	PLA		
#2	Gorilla Glass		
#3	Ductile Iron		
#4	Cotton		
#5	MOPN		



**5.** Read the text in the box then proceed.

Numerous living organisms possess biophotonic nanostructures that provide colouration and other diverse functions for survival. While such structures have been actively studied and replicated in the laboratory, it remains unclear whether they can be used for biomedical applications. Here, we show a transparent photonic nanostructure inspired by the longtail glasswing butterfly (*Chorinea faunus*). We exploit the phase separation between two immiscible polymers to form nanostructured features on top of a Si<sub>3</sub>N<sub>4</sub> substrate. The membrane thus formed shows good angle-independent white-light transmission, strong hydrophilicity and anti-biofouling properties.

Suggest TWO innovative improvements for any ONE existing household product of your choice using one or more of the **properties** of the material described above. **Note that only the properties, and NOT the material itself, need to be used in the proposed improvements.**

ANSWER: Selected product you wish to improve: \_\_\_\_\_

Improvement 1

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Improvement 2

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**6.** Two *writing alternatives* for students are under consideration; one is a (A) *metallic fountain-pen* and the other is a (B) *plastic ball-point pen*. First compare *five* different aspects (material, manufacturing etc.) of the two alternatives in the table below. Then take **ALL** five aspects into account to evaluate which one is BETTER.

ANSWER:

	(A) Fountain pen	(B) Ball-point pen
Aspect 1:		
Aspect 2:		
Aspect 3:		
Aspect 4:		
Aspect 5:		

**Evaluation:** Option \_\_\_\_\_ A/B \_\_\_\_\_ is better; because, \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- 7.** Paper bags have lower strength for carrying meats/vegetables and can easily get wet and lose strength. This makes these biodegradable but less functional. Plastic bags have greater strength and non-wetting properties but have several environmental problems. Propose **TWO novel design concepts** for carrying heavy and wet meats/vegetables, for personal use, which do not harm the environment when discarded and can be recycled/reused. Preferably use **labeled sketches** to present your proposals.

ANSWER:

CPDM DAT Sample Questions

CPDM DAT Sample Questions