1. Each candidate should be prepared to produce, upon request, his/her library card.

2. READ AND OBSERVE THE FOLLOWING RULES:
   - No candidate shall be permitted to ask questions of the invigilators, except in the cases of supposed errors or ambiguities in examination questions.
   - **CAUTION** – Candidates suspected of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action.
     - (a) Having at the place of writing communication devices, any books, papers or memoranda, audio or visual cassette players, or other memory aid devices other than that specifically approved by the instructor.
     - (b) Speaking or communicating with other candidates.
     - (c) Purposely exposing written papers to the view of other candidates. The plea of accident or forgetfulness shall not be received.

\[
\begin{array}{l|l|l|l|l|l|l|l|l}
\hline
Q1 & Q2 & Q3 & Q4 & Q5 & Q6 & Q7 & \text{Total} \\
\hline
10 & 10 & 5 & 5 & 5 & 5 & 10 & 50 \\
\hline
\end{array}
\]
Question 1  (10 Marks)

Consider the L-system given above. Starting with the axiom Q, show the first four productions using the rules given.

\[
\begin{align*}
Q &
\rightarrow WF[+A] \\
W &\rightarrow Q \\
A &\rightarrow AF
\end{align*}
\]

<table>
<thead>
<tr>
<th>Axiom</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production 1</td>
<td></td>
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<tr>
<td>Production 2</td>
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<tr>
<td>Production 3</td>
<td></td>
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<tr>
<td>Production 4</td>
<td></td>
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</tbody>
</table>

Using a turning angle of 60°, draw the “turtle interpretation” of the string shown in Production 4 on the following grid. The initial configuration for the turtle is at the black dot, heading in the up direction.
Question 2 (10 marks)

Prove that a parametric cubic curve can be non-planar.
Question 3  (5 marks)

Suggest some reasons why specialized modelling techniques such as fractals and L-systems are needed in computer graphics.

Question 4  (5 marks)

Suppose you had a display device with a dynamic range of 2000. How many bits per pixel would you need to represent all the perceivable intensities on this device?
Question 5  (5 marks)

Describe the difference between discrete and continuous input devices (give examples of each). Are continuous devices actually continuous?

Question 6  (5 marks)

Pick your favorite polyhedron and show how you’d represent it using the two methods described in the book, pointers to an edge list and pointers to a vertex list. Include a diagram.
Question 7  (10 marks)

Recall that a uniform B-spline segment is defined by the equation

\[ Q_i(t + t_i) = \frac{(1 - t)^3}{6} P_{i-3} + \frac{3t^3 - 6t^2 + 4}{6} P_{i-2} + \frac{-3t^3 + 3t^2 + 3t + 1}{6} P_{i-1} + \frac{t^3}{6} P_i, \quad 0 \leq t < 1. \]

Show that \( Q_i \) and \( Q_{i+1} \) are \( C^0 \), \( C^1 \), and \( C^2 \) continuous where they join.
Extra space in which to work.