**WEEK 4 YEAR 11 TECHNICAL DRAWING**

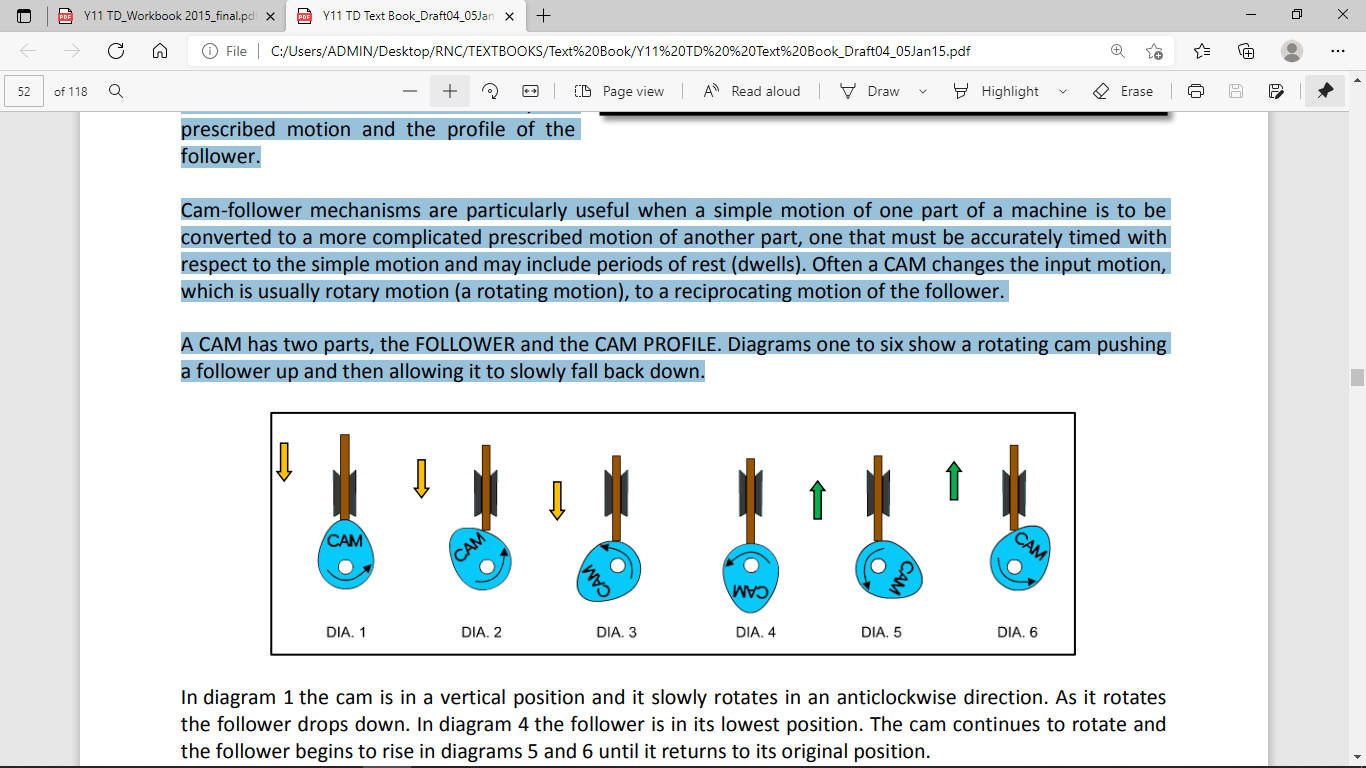
**STRAND: GEOMETRY**

**LESSON16: CAM**

**LEARNING OUTCOME: DEFINE CAM**

* A Cam is a machine component that either rotates or moves back and forth (reciprocates) to create a prescribed motion in a contacting element known as a follower.
* The shape of the contacting surface of the cam is determined by the prescribed motion and the profile of the follower.
* Cam-follower mechanisms are particularly useful when a simple motion of one part of a machine is to be converted to a more complicated prescribed motion of another part, one that must be accurately timed with respect to the simple motion and may include periods of rest (dwells).
* A CAM has two parts, the FOLLOWER and the CAM PROFILE.

Diagrams one to six show a rotating cam pushing a follower up and then allowing it to slowly fall back down.



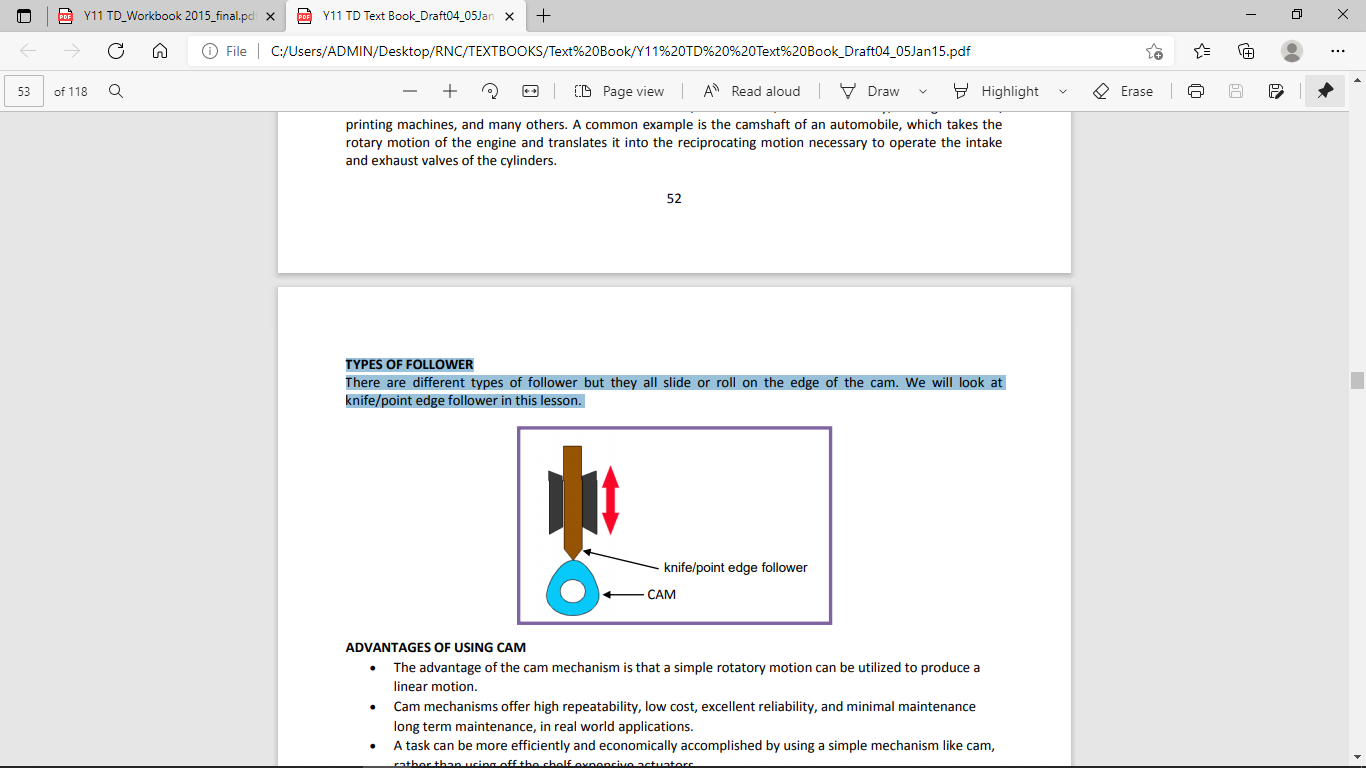
* In diagram 1 the cam is in a vertical position and it slowly rotates in an anticlockwise direction. As it rotates the follower drops down.
* In diagram 4 the follower is in its lowest position.
* The cam continues to rotate and the follower begins to rise in diagrams 5 and 6 until it returns to its original position.

**LESSON17: TYPES & ADVANTAGES OF CAM**

**LEARNING OUTCOME: IDENTIFY THE TYPES & ADVANTAGES OF CAM**

1. TYPES OF FOLLOWER

* There are different types of follower but they all slide or roll on the edge of the cam. We will look at knife/point edge follower in this lesson.



1. ADVANTAGES OF USING CAM

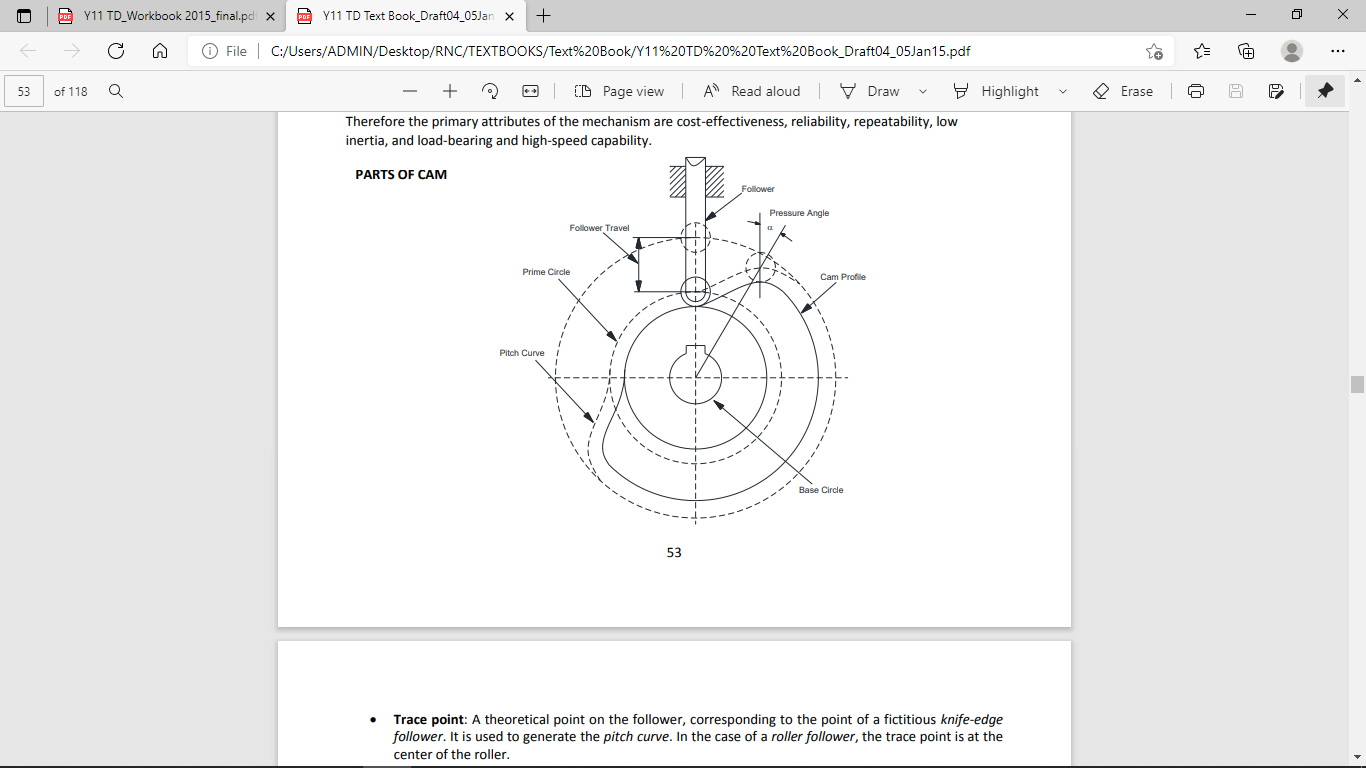
* a simple rotatory motion can be utilized to produce a linear motion.
* Cam mechanisms offer high repeatability, low cost, excellent reliability, and minimal maintenance long term maintenance, in real world applications.
* A task can be more efficiently and economically accomplished by using a simple mechanism like cam, rather than using off the shelf expensive actuators.

* In a given family of manufactured products, the range of overall size and geometric variation is usually small enough to be handled by a simple adjustable mechanism, rather than using expensive robotic joints with large degrees of freedom.

* Mechanisms are also useful for passive guidance of a rigid body through desired positions and orientations, as in an automobile suspension mechanism or a knee brace.

**LESSON18: PARTS OF CAM**

**LEARNING OUTCOME: IDENTIFY THE PARTS OF CAM**

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* **Trace point**: A theoretical point on the follower, corresponding to the point of a fictitious knife-edge follower. It is used to generate the pitch curve. In the case of a roller follower, the trace point is at the center of the roller.
* **Pitch curve**: The path generated by the trace point at the follower is rotated about a stationary cam.
* **Working curve**: The working surface of a cam in contact with the follower. For the knife-edge follower of the plate cam, the pitch curve and the working curves coincide. In a close or grooved cam there is an inner profile and an outer working curve.

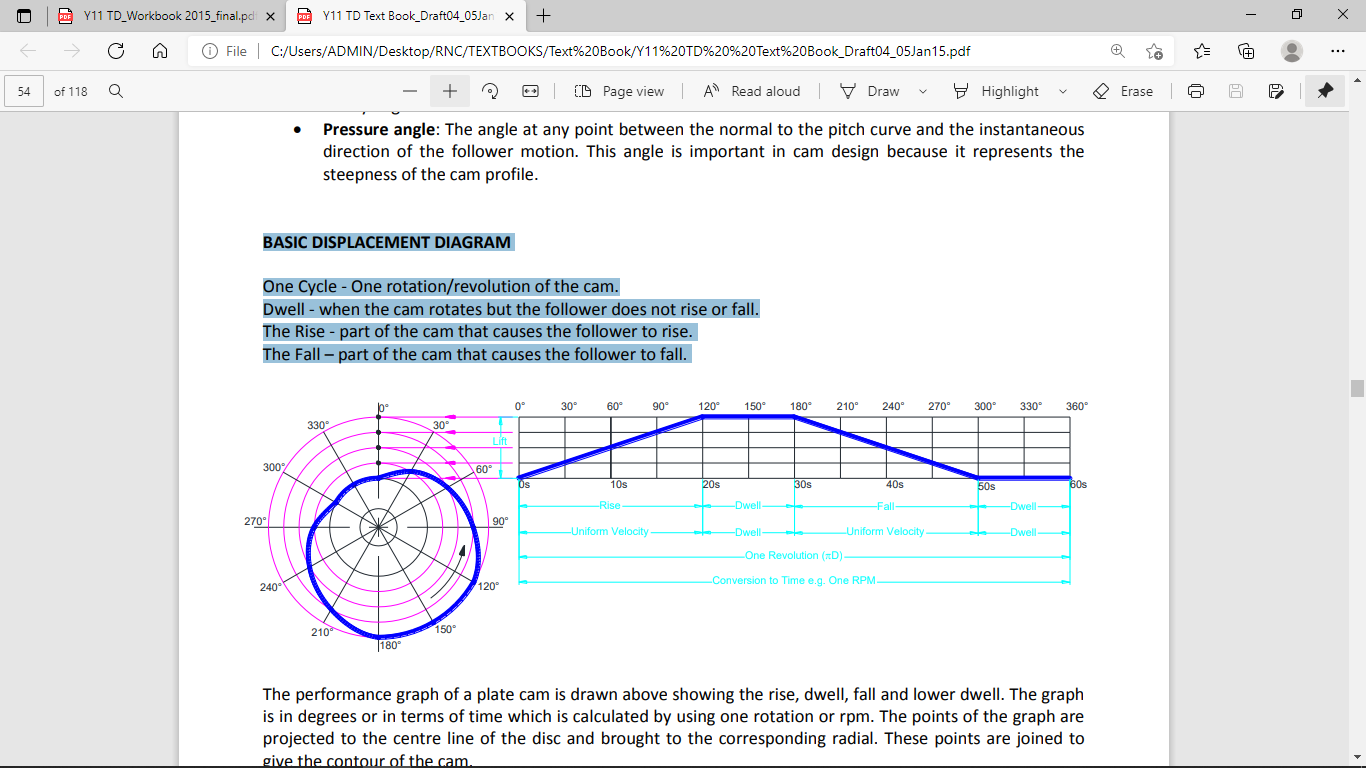
* **Pitch circle:** A circle from the cam center through the pitch point. The pitch circle radius is used to calculate a cam of minimum size for a given pressure angle.
* **Prime circle (reference circle):** The smallest circle from the cam center through the pitch curve.
* **Base circle**: The smallest circle from the cam center through the cam profile curve.
* **Stroke or throw**: The greatest distance or angle through which the follower moves or rotates.
* **Follower displacement**: The position of the follower from a specific zero or rest position (usually its the position when the follower contacts with the base circle of the cam) in relation to time or the rotary angle of the cam.
* **Pressure angle**: The angle at any point between the normal to the pitch curve and the instantaneous direction of the follower motion. This angle is important in cam design because it represents the steepness of the cam profile.

**LESSON19: DISPLACEMENT DIAGRAM**

**LEARNING OUTCOME: IDENTIFY THE THREE BASIC DISPLACEMENT OF CAM**

BASIC DISPLACEMENT DIAGRAM

* One Cycle - One rotation/revolution of the cam.
* Dwell - when the cam rotates but the follower does not rise or fall.
* The Rise - part of the cam that causes the follower to rise.
* The Fall – part of the cam that causes the follower to fall.

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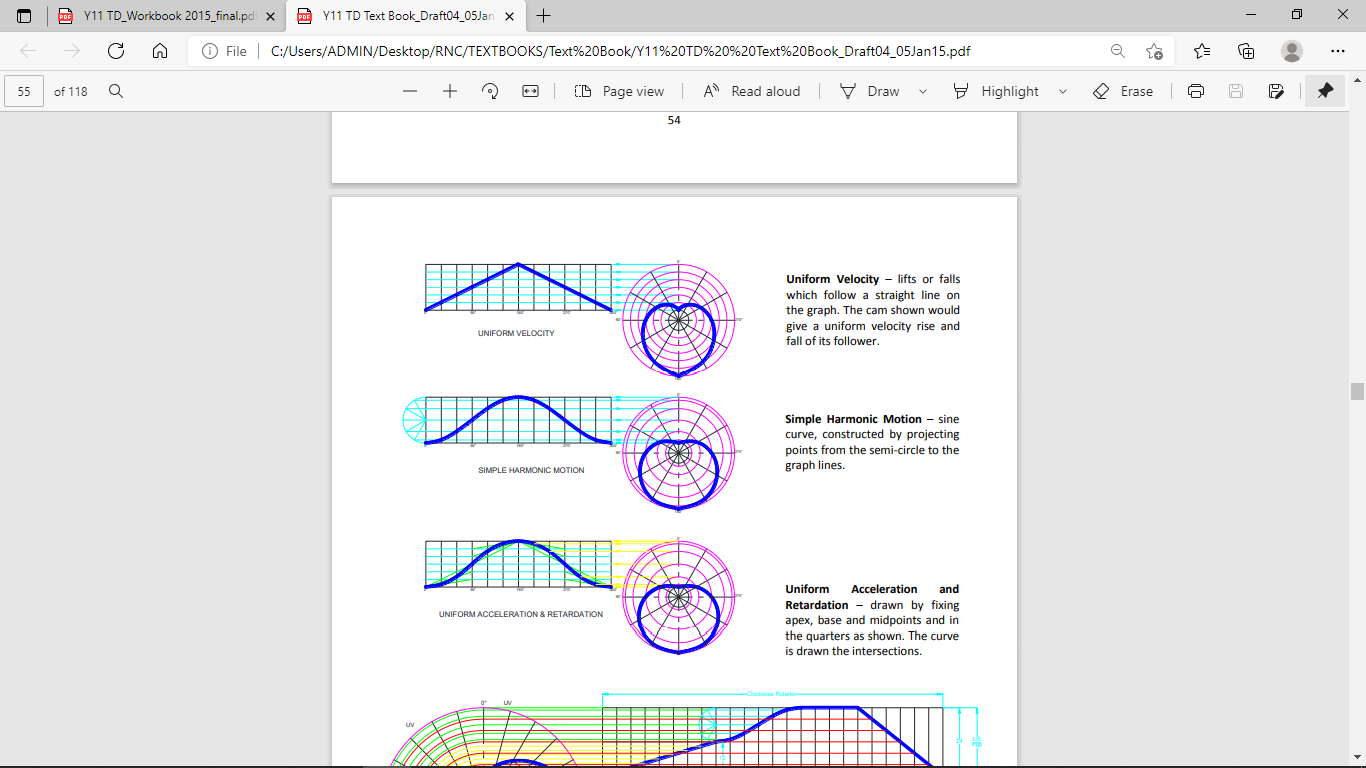
* The performance graph of a plate cam is drawn above showing the rise, dwell, fall and lower dwell.
* The graph is in degrees or in terms of time which is calculated by using one rotation or rpm.
* The points of the graph are projected to the centre line of the disc and brought to the corresponding radial.
* These points are joined to give the contour of the cam.

**LESSON20:**

**LEARNING OUTCOME: IDENTIFY THE THREE**

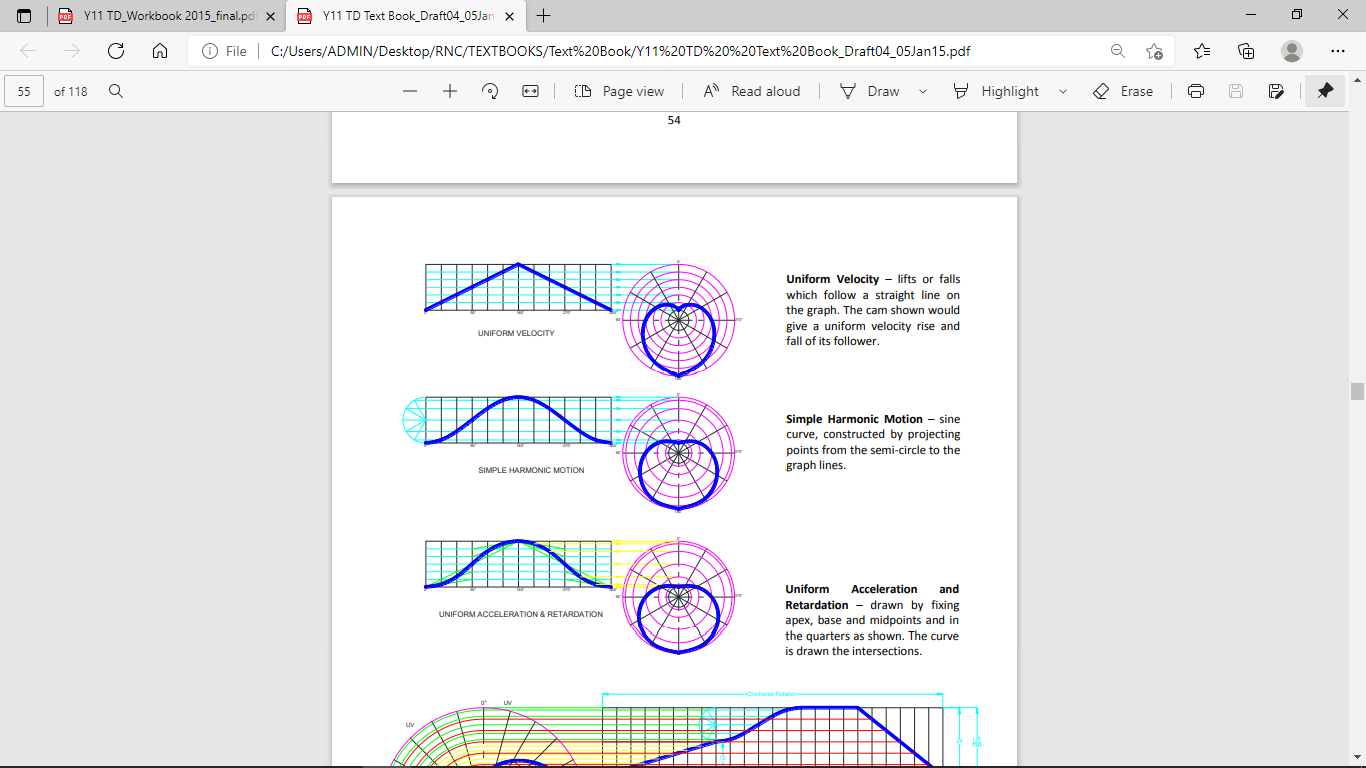
1. Uniform Velocity

* lifts or falls which follow a straight line on the graph.
* The cam shown would give a uniform velocity rise and fall of its follower.

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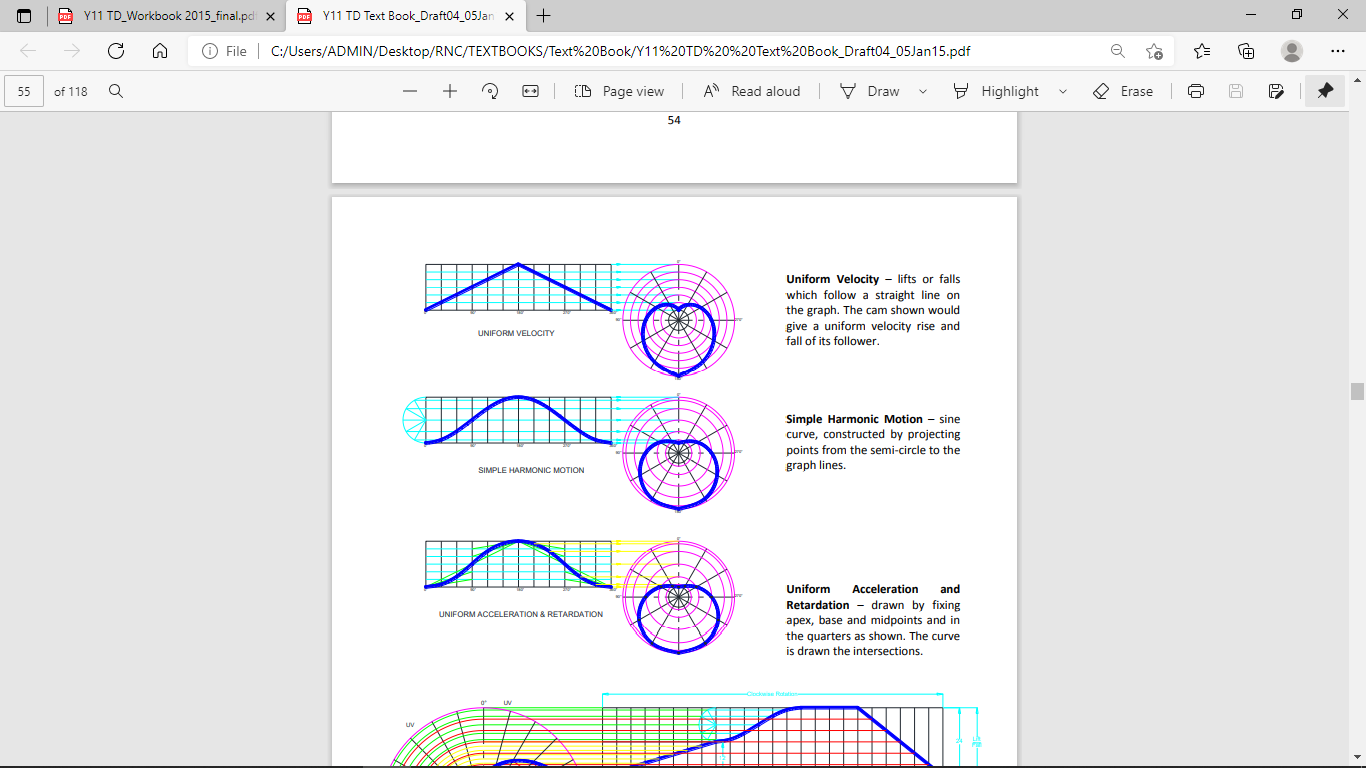
1. Simple Harmonic Motion

* sine curve, constructed by projecting points from the semi-circle to the graph lines.

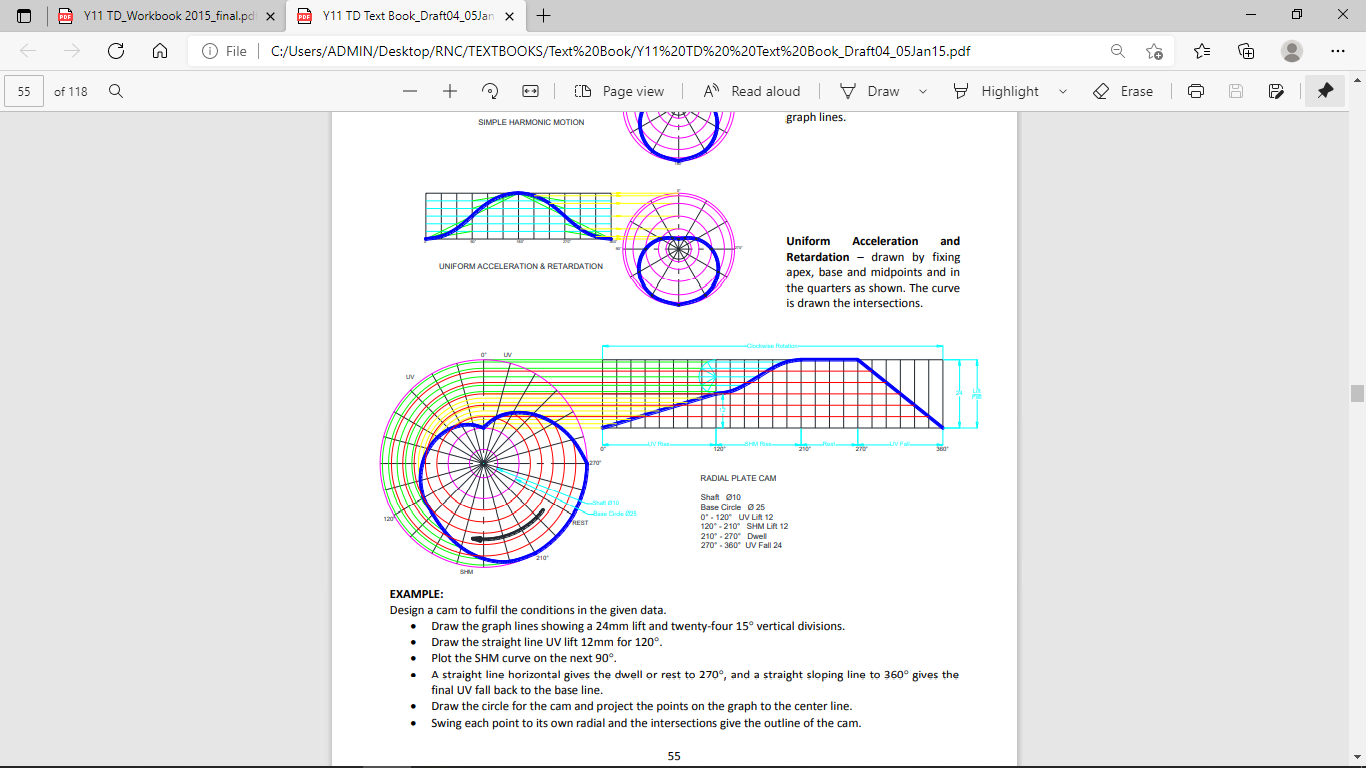


1. Uniform Acceleration and Retardation

* drawn by fixing apex, base and midpoints and in the quarters as shown.
* The curve is drawn the intersections.



EXAMPLE:



Design a cam to fulfil the conditions in the given data.

* Draw the graph lines showing a 24mm lift and twenty-four 15° vertical divisions
* Draw the straight line UV lift 12mm for 120°
* Plot the SHM curve on the next 90°

* A straight line horizontal gives the dwell or rest to 270° and a straight sloping line to 360° gives the final UV fall back to the base line.

* Draw the circle for the cam and project the points on the graph to the center line.• Swing each point to its own radial and the intersections give the outline of the cam.•