In this video. We are presenting the contents of model number 6 titled Miller Indices part one of Unit 1 titled Crystal Structure. Outline of this presentation. Concept of Miller indices method to determine Miller indices of a direction, method to determine Miller indices of a plane. Important planes and directions in a cubic crystal, given Miller indices how to draw the plane. After learning all these topics, the students will be able to differentiate between Miller Indices of planes and directions. They'll be able to determine Miller indices of different directions and planes, and they will be able to identify the plane and direction of a crystal lattice for a given set of Miller indices. To start with, let us discuss the concept of Miller indices. Complete crystal structure can be investigated having the detailed knowledge of direction and planes. Miller bases are used to locate lattice planes and directions. Miller indices are defined as the reciprocals of the intercepts made by the plane on the crystallographic axis. When reduced to smallest numbers. Method to determine Miller indices of a direction. This step one. Determine the position coordinates of the head of the arrow drawn from the origin. See in this case, this is a. from origin this is drawn so. We need to keep track of the head of the arrow drawn from the origin. Remove fractions by multiplying with smallest possible factor. So, it is 1, three by four and half. Here the denominator for the first one is 1 and the second one is 4 and the third one is 2. So, the least common denominator is 4, and let us multiply so we get 4,3,2 the direction. Can be presented as 4,3,2. Within it square bracket includes the three integers in square bracket and h k I are the Miller indices of a direction. There are no comma. One need to take care. No comma to be put how it is presented h k I within the square bracket. And negative values are expressed with a bar over the number. Let's look into the family of directions, a set of directions which are not parallel and look physically identical form a set of family of directions. Let's consider 001 001 within a square bracket. Present one particular direction 001 within a square bracket. represent this direction inside the crystal but within the angle bracket 001 represent the family. The family means. Let's consider 001 101 and 110 and it's. 001 bar, zero 1 bar 0, and 1 bar 00. All these six sets of Directions. Can be presented. As the family of directions. yeah! And to present the family of direction, it is important to present it within a angle bracket. Similarly, face diagonals face diagonals in this case is 101, 101, this direction. This family 011 will include twelve such Directions and 111. So, in along X axis one, Y axis one and Z axis one. that one One Direction. That plane family. When we go, we write within the angle bracket 111 and there are eight such directions. Coming to method. To determine Miller indices of a plane step one, Step 2, step 3, Step 4 to be followed, and in general the plane is denoted by hkl where hkl are called Miller Indices of the respective plane. With an example, it will be better to understand. So let's consider this plane. The shaded plane in this picture or in this figure. If you look to the Intercept along X axis, unit vector is a and this plane is intersecting at a by two and along Y axis The plane is intersecting at one unit vector. That is b so intercept is b and as far as Z axis is concerned this plane is parallel to the Z axis. So the intercept to be taken as infinite. This is the first set to identify the intercepts of a plane inside the crystal unit lattice. Second step let us divide intercepts by the respective lattice parameter. So dividing a by 2 by a. I get half so similarly, b by b will give one. infinite by c will give you infinite. the next step reciprocal. Let us take reciprocal so one upon one by two, 1 upon 1, 1 upon infinite. that gives us 2 1 0. Just for the. Reason, let's write down 1 / 1, two divided by 1 or 0 / 1. that doesn't change the number. Then next step let's take the least common denominator of the denominators. Here the denominators are 1 1 1 and the least common denominator is 1. And let us multiply that to this ratio. So since it is 1 getting multiplied to this

ratios, what we get. Finally, the Miller indices 2 1 0. Now family or planes planes, just like the family of direction we need to also present the family of planes. A single plane is represented with Miller indices within round bracket, but a family of planes are represented. Similar indices within the curly bracket. They had a set of parallel planes. So let us, discuss some important planes and direction in a cubic crystal, look at the shaded region. Of this figure, a present a plane. With Miller Indices 100 and this vector arrow present the direction 100. So if you notice carefully always this direction with the same integer is perpendicular to the plane. With the same Miller indices. And here it is the plane is 0100 in the sense. Miller indices this is 010 This represent this plane and the arrow drawn here, that is within the square bracket. 010 represent the direction here. So again, the direction is perpendicular to the plane. And so also in case of Figure c. If we consider the plane. 100 then the family 100 includes the following six planes that is, 100, 1 bar 00, 0 1bar 0, 001, 001bar and 001 by. Same is the case here. Here the plane is 110 and the direction is also 110. If you see the direction is perpendicular to this plane. So also, in this case the plane is represented by Miller Indices 101 within the square bracket and the direction is presented within the square bracket the plane is presented within the round bracket and it is perpendicular to this plane. And figure c also the same, only the plane. Here is 011 plane. Given Miller indices, how to draw the plane? These are the following steps to be followed. For the given Miller Indices is to draw the plane. Let's go to example. We will understand better. So Miller indices given is 2 1 0. Let's take reciprocal of the. Integer say one upon 2 one by one that is 1 and one by zero that is infinite. And let us now multiply the reciprocal with the respective lattice parameter that becomes half into a, a by two, one into b ls b, an infinite into c is infinite. Now we can draw the plane for this unit cell. Keeping track that X axis intercept should be a by two. Y axis intercepts should be at b. and the plane should be parallel to the Z axis because the Intercept is at infinite. With this we come to an end of the Module 6.