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 1. 6.0 Isometric Projections (Using Solidworks) SEMESTER: I/II COURSE TITLE: COMPUTER AIDED ENGINEERING GRAPHICS COURSE CODE: 22MED13/23 Solution Manual Prepared by : Dr P R Venkatesh, Associate Professor Room No 2, Ground Floor, Mech Engg Dept RVCE, Bengaluru Dr P R Venkatesh, Mech Dept, RVCE 2. Dr P R Venkatesh, Mech Dept, RVCE What Is Isometric Projection? • Isometric drawing, also commonly called isometric projection, is a method of graphic representation of three-dimensional objects through drawing. • In isometric projection, the plan shows the three visible sides of the object from the same angle to each other. Hence, the isometric projection shows the sides of the object at an angle of 1200 to each other. These lines of the object are called isometric axes. • In isometric projection, two isometric axes are held at an angle of 300 with the horizontal plane. While the third axis forms an angle of 900 with the horizontal plane. • Graphic representations of three-dimensional objects used by engineers, technical illustrators, and architects are made using the Isometric projection. 3. Dr P R Venkatesh, Mech Dept, RVCE Isometric Scale An isometric projection is formed using an isometric scale. Using this scale, the actual dimensions of the object are converted to isometric dimensions. In the fig 1, line DP the line shows the true scale, while the line DA gives the isometric length. From the similar triangles DPO and DAO, OD is the common side which may be written as DPcos450 = DA cos300 Fig 2 Fig 1 1 3 2 2 0.816 2 3 2 2 3 DP DA DA DP DP DP = = = = Isometric length= 0.816 True length 0.82 True length Fig 2 shows the graphical method to obtain isometric length from true lengths, which is based on the above relationship. 4. Dr P R Venkatesh, Mech Dept, RVCE Lines in Isometric Projection • A line drawn parallel to the isometric axis of the object is called the isometric line and its length is reduced by 82%. • A line in isometric drawing that is not parallel to the isometric axis is called a non- isometric line. • Vertical lines on an object are also vertical in isometric projection, while the horizontal lines on an object are drawn at an angle of 300 with the horizontal in isometric projection. • The main difference between orthographic and isometric projection is that the orthographic drawing represents a two-dimensional view of the object, while isometric drawing represents three-dimensional views of the same object. 5. Dr P R Venkatesh, Mech Dept, RVCE The term "isometric" comes from the Greek for "equal measure", reflecting that the scale along each axis of the projection is the same. Isometric Projection of circle. The isometric projection of a is an ellipse, whose major axis is equal to actual radius of the circle. 6. Dr P R Venkatesh, Mech Dept, RVCE 6.1 A regular pentagonal prism of base edge 30 mm and axis 60mm is mounted centrally over a cylindrical block of 80 mm diameter and 25mm thick. Draw isometric projection of the combined solids. Solution: 1. Draw the orthographic projections of the cylinder and pentagonal prism co axial with it. 2. Enclose the pentagonal prism in a rectangle (in top view) touching all corners and outer edges. This is to obtain box which will be a rectangular prism whose height is equal to the length of axis of the prism. 3. However, the enclosure for a cylinder need not be shown as it will be a square prism with base side equal to diameter of cylinder and height equal to length of axis of cylindrical block. 4. Obtain the isometric projection of cylindrical block using 4 center approximate method (to obtain elliptical shape of the top & bottom faces in isometric projection) 5. Obtain the isometric projection of pentagonal prism by marking the corners of the pentagon w.r.t the corners of the rectangular box and place it coaxially with the cylinder. Note: • To obtain isometric projection, enclose the given object in a box and tip the box on a corner such that the horizontal edges of the box are at 300 and the vertical edges of the box remain vertical, but the dimensions will be 82% of the true dimensions (Scale ratio 0.816 can be used in solidworks). The corners of the object must be marked w.r.t corners of the box. 7. X Y VP HP 3 0 O 80 25 60 3 0 ° 3 0 ° 46.17 48.54 6.1 A regular pentagonal prism of base edge 30 mm and axis 60mm is mounted centrally over a cylindrical block of 80 mm diameter and 25mm thick. Draw isometric projection of the combined solids. Iso 25 Iso 60 Iso 80 Iso 48.54 Iso 46.17 Dr P R Venkatesh, Mech Dept, RVCE Note: 1. In isometric projections, outer visible edges must be thick, and the hidden lines /curves must be thin. 2. Iso 80 means Isometric length of 80 = (0.816 x 80) = 65.28 mm and so on. 8. Q 6.2 A cone of base diameter 40mm and height 50mm rests centrally over a frustrum of a pentagonal pyramid of base side 45mm, top side 35 mm and height 55 mm. Draw isometric projections of the combination of solids. 3 5 O 40 55 50 3 0 ° 3 0 ° 72.81 Iso 72.81 69.25 Iso 69.25 Iso 55 Iso 50 Iso 40 45 Dr P R Venkatesh, Mech Dept, RVCE 9. Q 6.3 A hexagonal pyramid 30mm side and height 60mm rests on the center of the top of a square block of side 60mm and height 20mm. The base edge of the pyramid is parallel to the top edge of the square block. Draw the isometric projection of the combination of the solids. 60 q 3 0 20 60 51.96 3 0 ° 3 0 ° Iso 51.96 Iso 20 Iso 60 Iso 60 Dr P R Venkatesh, Mech Dept, RVCE 10. 6.4 The frustum of a square pyramid of sides of top face 20mm, bottom face 40mm and height 60mm rests centrally on top of a square block of side 60mm and height 20mm. The base edges of the pyramid are parallel to the top edges of the square block. Draw the isometric projection of combination of solids. 60 q 40 q 20 q 20 60 3 0 ° 3 0 ° Iso 60 Iso 20 Iso 40 Iso 20 Iso 60 Dr P R Venkatesh, Mech Dept, RVCE 11. Q 6.5 A sphere of diameter 60mm is placed centrally on the top face of a square prism side 60mm and height 70mm. Draw the isometric projection of the combination. 70 60 q O 60 S 3 0 ° 3 0 ° Iso 70 Iso 60 Iso 30 A sphere, will appear as a circle of actual radius when looked at any angle, and hence isometric projection of a sphere will be a circle. However, the center to center height will be a vertical dimension and hence it will be isometric length of the radius of sphere. O 60 S Dr P R Venkatesh, Mech Dept, RVCE 12. Q 6.6 Draw the isometric projection of a hexagonal prism of side of base 40mm and height 60mm with a right circular cone of base 50mm diameter and height 60mm, resting on its top such that the axes are collinear. O 50 60 40 60 69.28 80 3 0 ° 3 0 ° Iso 60 Iso 80 Iso 60 Iso 50 Dr P R Venkatesh, Mech Dept, RVCE 13. Dr P R Venkatesh, Mech Dept, RVCE Q 6.7 Draw the isometric projection of the combination of solids shown in Figure 6.1. Iso 20 3 0 ° 3 0 ° Iso 50 Iso 70 Iso 60 Iso 40 Last Updated on: December 30, 2024 by Saif M Ever wondered how air conditioning works in your car? and how it keeps you cool on those scorching hot days. …Read moreLast Updated on: September 23, 2024 by YousefIn this article, you'll learn what is a Battery Ignition System. 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In the figure, the lines which are parallel to these lines are called isometric lines, and those lines which are not parallel to these lines are called Non-isometric Lines. Two isometric axes make an angle of 30° with the horizontal line. While the third axis makes an angle of 90°. Isometric Scale: Since, in isometric projection, the isometric line makes an angle of 30° with the horizontal lines, therefore, their length is not equal to the actual length, but it is only 82% of the actual length. The isometric scale is prepared to form an isometric projection. With the help of this scale, the actual dimensions are transformed into isometric dimensions. Method of Drawing Isometric Scale: Following method is used for drawing isometric scale: After drawing a horizontal line, draw two lines at 45° and 30° angle with it. Put marks on the 45° line according to the actual scale. Now draw perpendicular offsets from 45° line up to 30° line which will represent the isometric scale. Difference between Isometric Drawing and Isometric Projection. The method of drawing Isometric Drawing and Isometric Projection is the same. All the dimensions in the isometric drawing are actual while in the Isometric projection, the isometric scale is to be used. As a result, the dimensions are less than the actual ones. To get isometric dimension from the actual dimension, it is to be multiplied with 82/ 100. Isometric lines, circles, and curves; The lines which are drawn parallel to the isometric axes in forming isometric projection are called isometric lines. The represented length is not equal to the actual length, but it is 82% of it. In the same way, isometric circles are also not the actual circles, but they are elliptic ones: For drawing such circles, first of all, the isometric square is constructed. Then the four centers of an ellipse are shown. These are in fact, the points of intersection of the corner of the bigger angle of the isometric square and the bisector of the sides confronting it. The circle is completed by drawing arcs from these points. If some other arc is to be constructed, then the same method is to be adopted. Methods OF Drawing Isometric Drawing. Following are the two methods of drawing isometric drawing: 1. Box Method. 2. Off-set Method. 1. Box Method: This method of drawing isometric drawing is easy and intelligible. However, it takes much time for the drawing. In this method, the maximum length, breadth, and height of an object are noted. A box is constructed in accordance with these dimensions. These dimensions of the box are represented according to isometric projection. These make angles of degrees 30, 30 and 90 with the horizontal line. After this other parts of the object are shown. For this purpose, isometric lines are drawn parallel to the isometric axis. After this, non-isometric lines, circles, and other curves are drawn. Moreover, lastly, extra lines are erased. 2. Off-set Method: In this method, for preparing isometric view, by selecting the side, the length, and breadth of the object are drawn parallel to the isometric axis. After this, the other isometric and non-isometric lines are drawn according to the dimensions. Lastly, circles and curves are drawn, and the drawing is completed by erasing extra lines. Read Also: Auxiliary View – Its Types, Methods. [A Comprehensive Guide]. Read Also: Oblique Drawing, Projection – its Types, Examples. Enjoy sharper detail, more accurate color, lifelike lighting, believable backgrounds, and more with our new model update. Your generated images will be more polished than ever.See What's NewExplore how consumers want to see climate stories told today, and what that means for your visuals.Download Our Latest VisualGPS ReportData-backed trends. Generative AI demos. 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Our original video podcast covers it all—now on demand.Watch Now The isometric projection of an object on a vertical plane of projection by placing the object in such a way that its three perpendicular edges make equal inclinations with the plane of projection.Since the three perpendicular edges of an object are projected in the isometric projection at equal axonometric angles, the angles between those edges in the isometric projection will be at 120º. The lengths of the three perpendicular edges of an object in the isometric projection are foreshortened in the same proportion.To understand the principles of isometric projection and to know the extent to which the edges are foreshortened. A cube is placed with three of its perpendicular edges making equal inclinations with the vertical plane of projection and is projected on it. As shown in figure a.The projections of a cube when placed on HP such that two of its square faces making equal inclinations with the plane of projection.Next, tilt the cube towards the observer such that it rests on the front bottom corner with the solid diagonal opposite to the corner in which it rests and passing through the top front corner, is perpendicular to the plane of projection.The Figure-B illustrates this position of the cube. As seen in the left view, the solid diagonal a "c1" is perpendicular to the plane of projection. In this position, the front and top views are projected. The three perpendicular edges AB, AD & AA1 will be equally inclined at an angle of 35° 16′ to the plane of projection.But the projection of these edges, i.e., a'b', a'd' & a'a1′ are at an angle of 120º to each other and also they are foreshortened to the same length. The front view of the cube, therefore, represents its isometric projection.Read also: Dimensions and Types of Dimensioning SystemsTo find the extent to which the lengths of the edges are foreshortened. Draw a square d'Ab'C od sides equal to the actual length of the edges of the cube with d'b' as the common diagonal. d'C is the actual length of the edge, whereas corresponding edge d'c' in the isometric projection is foreshortened. This foreshortened length is known as isometric length of the edge of the cube.i.e., Isometric Length = 0.816 Actual Length. Thus in the isometric projection, the actual lengths of the objects are reduced in the ratio of 2:3. Or the isometric length is 0.816 of the actual length.When an isometric projection is to be drawn, all the edges of the object parallel to the three isometric axes, have to be reduced to their corresponding isometric lengths which will be equal to 0.816 times their actual length.In isometric projection, all edges of the object along the direction of three isometric axes are foreshortened to 0.816 times their exact lengths. To facilitate the easy and quick method of measurement of lengths of the various edges in their reduced sizes while drawing the isometric projection of the object, a special scale known as the isometric scale is constructed.On this scale, the isometric lengths corresponding to the given actual lengths can be obtained directly. The isometric scale is constructed as follows:Draw a horizontal line OA. THrough O draw OP and OQ at 30º & 45º to the horizontal respectively. On OQ mark the actual scale in mm. Draw verticals from each of the division points on the actual scale to cut OP at the corresponding divisions. The division points obtained on OP, called isometric scale, measure the distances reduced to isometric lengths.To draw the isometric projection of an object, every dimension of the object along the isometric axes, have to be reduced to the isometric scales.This has two disadvantages:First, it is time-consuming andIt is on such a drawing when required the distances between any two points along the isometric axes cannot be measured directly with the actual scale.To overcome these difficulties, an object can be quickly represented in the isometric form using the actual scale instead of the isometric scale. Such a view will be precisely is of the same shape but larger than that drawn to the isometric scale. The Figure-A shows a cube of 20mm sides drawn to the isometric scale.The Figure-B shows the cube of the same dimensions drawn to the actual scale. 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The surface XYZ is an oblique surface in isometric.An object in isometric projection may be shown in eight different positions as shown in the Figure. Anyone particular position may be selected so as to illustrate all the important details of the object clearly. However, the object will be drawn in isometric with its longest measurement either vertical or horizontal. The position in figure-B is known as an isometric projection with axis reversed is drawn when the underneath surface of the object is to be shown.That's it. Thanks for reading if you have any questions about "Isometric Projection" ask in the comments I'll respond to you. Share this post if it's worth sharing.If you like this article then please share it with your friends. And also you can download the free PDF file of this article by clicking below.Subscribe to the newsletter to get notifications of our new posts. It's Free.You might like to explore more in our blog: The isometric projection of an object on a vertical plane of projection by placing the object in such a way that its three perpendicular edges make equal inclinations with the plane of projection.Since the three perpendicular edges of an object are projected in the isometric projection at equal axonometric angles, the angles between those edges in the isometric projection will be at 120º. The lengths of the three perpendicular edges of an object in the isometric projection are foreshortened in the same proportion.To understand the principles of isometric projection and to know the extent to which the edges are foreshortened. A cube is placed with three of its perpendicular edges making equal inclinations with the vertical plane of projection and is projected on it. 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For the square pyramid, it describes locating the midpoint of the base square and extending a line from it to form the slanted axis up to the apex point.100%(1)100% found this document useful (1 vote)336 views14 pagesThe document provides instructions for drawing isometric projections of a square prism and square pyramid with given dimensions. For the square prism, it describes drawing the base square an…AI-enhanced title and description