Mahindra École Centrale

ME 101 Lecture outlines Fall semester, 2014

Lecture # 1: Monday, August 04, 2014

Introductory lecture presentation on MOODLE. Welcome, Purpose of the course, Syllabus, Assessment methods and weightage, expectations, project, etc.

Chant: "I will never plagiarize."

Assignment # 1 announced:

To read Chapter 4 in the Dieter text and to summarize in 250 words (a figure, if any, counts as 50 words, and every word in the figure counts in addition).

Due date: August 18, 2014 extended to September 01, 2014.

Lecture # 2: Wednesday, August 06, 2014

Handout (2 page, back-to-back print) of project description given out individually to students, and a brief discussion.

Lecture # 3: Monday, August 11, 2014

Expression of ideas on paper using drawings. Demonstration of an example of an engineering drawing: an architectural plan of a building. The concept of a plan as a view from the top looking down. The concept of an elevation as a view of an object from the front looking directly at the object. The concept of viewing the object from infinity so that the lines of sight are parallel.

Multiview drawings and principal views.

Lecture # 4 & 5: Wednesday, August 13, 2014 & Monday, August 18, 2014

Orthographic views of a sample object (a rectangular cuboid).

The concept of 1st and 3rd angle projections. Orthographic views of a sample object drawn in 3-D. The concept of picture planes as planes of projection, projectors, and hidden lines. Naming of the planes of projection – VP, HP, and PP.

Demonstration of the glass box concept to visualize orthographic projections. The enumeration of 6 principal views and 3 standard views.

Lecture # 6: Wednesday, August 20, 2014

Concept of the 6 principal views (in both, 1st and 3rd angle projections)

Concept of the 3 standard views (in both, 1st and 3rd angle projections)

Reference to Fig 8-23 in the text to demo layout of 1st angle standard views.

Modified the step and angled-face object by changing the orientation of the angled face to face the front direction. Drew the three views to demo how we can choose views so that a minimum number of hidden lines appear in the standard views (in this case, no hidden line).

Drawing three views without the fold in the paper by tracing the 45 degree line from the upper right hand corner of the bounding encasing the front view. This ensures that the top and RH views are separated from the front view by an equal distance.

Further modified the object by cutting a cylindrical hole in the front face and a half cylindrical cut out on the top face.

Demonstrated the use of center lines to draw items having circular symmetry.

Drew the front and top views to demonstrate how hidden lines ought to be drawn, and assigned the RH view to be drawn at home.

Showed how hidden (dashed) lines must meet other lines.

Chant: "We must draw centerlines."

Lecture # 7: Monday, August 25, 2014

Assignment # 2 handed out (orthographic projections).

The concept of the reduction scale explained.

Introduction to views other than the principal and standard views in orthographic projections.

Listed four such views:

- Partial views
- Local views
- Auxiliary views
- Sectional views

Introduction to sectional views:

- The concept of an imaginary cutting plane, the sectioning plane
- The idea of discarding a part of the object in order to peer into the object
- The convention of the viewing direction
- An example of a sectional view of a cylinder having a counterbored hole
- The idea of avoiding dimensioning hidden features
- The idea of exposing hidden features for the purpose of dimensioning
- Hatching of the sectioned view
- Nomenclature of the section view (section A-A or A-A)
- Convention for section line type (ISO, BIS and ANSI styles) and thickness
- Used the idea of cutting open a coconut to demonstrate sectioning

Lecture # 8: Wednesday, August 27, 2014

The convention of indicating tangent surfaces in orthographic projection. Explanation of two different conventions for indicating tangent surfaces.

Examples of sectional views including the section of a right circular cylinder sectioned by a plane passing through its central axis, an annular cylinder similarly sectioned, and an annular cylinder with one end counterbored and similarly sectioned.

The concept of a half section. Example of a part being half sectioned. The cutting plane and viewing directions identified and the problem of drawing the half section assigned as a home task to be discussed in the next lecture. Optional omission of one of the capital letters indicating the sectioning plane explained.

Lecture # 9: Monday, September 01, 2014

Further elaboration of sectional views using examples.

Lecture # 10: Wednesday, September 03, 2014

1st mid-semester examination review. Solution of Assignment 1, Problem 1. Solution of a problem from Chapter 20 based on a question by a student.

Lecture # 11: Monday, September 15, 2014

Assignment # 3 announced: To read Chapter 1 of the Dieter text and to summarize it in less than 150 words. Submission in class at the beginning of the lecture on Monday, the 29th Sept, '14.

Some comments on the general performance in the first mid-semester examination.

General rules for sectional views using examples:

1. Hatch separate areas of a section of the same component identically.
2. Space hatching lines proportional to the area hatched.
3. Hatching may follow contours on large areas.
4. Adjacent areas: hatch with different directions or spacings.
5. Interrupt hatching when not possible to annotate outside the hatching area.
6. Different materials indicated with different types of hatching. Make the meaning of each type of hatching clear in the drawings by mentioning it specifically or by reference to the appropriate standards.
7. Hatch thin sections entirely black.
8. General rules for layout apply, i.e. the standard views.
9. No need to identify the cutting plane if it is obvious.

Lecture # 12: Wednesday, September 17, 2014

General rules for sectional views using examples (contd.):

1. If the location of cutting planes is not obvious, it must be indicated using sectioning lines.
2. Placement of the phrase 'Section X-X' or 'X-X' either below or above the sectional view so. long as it is done consistently on any one drawing.
3. Underlining of the phrase 'Section X-X' or 'X-X' is optional.
4. Definition of the term 'shaft' as well as ribs and keys.
5. Definition of the term 'aspect ratio' and the L/D ratio.
6. Components such as shafts, fasteners, keys, ribs, spokes of wheels, etc., are not hatched when a cutting plane passes longitudinally through them.
7. If a part is sectioned by two intersecting cutting planes, then one of them is shown revolved into the plane of projection.

Lecture # 13: Monday, September 22, 2014

General rules for sectional views using examples (contd.):

a. Revolved section
b. Removed section
c. Symmetrical parts in half section
d. Local sections or broken section
e. Successive sections

Lecture # 14: Wednesday, September 24, 2014

Assignment No. 3 announced in 'A'-section with due date Wed, 8 Oct '14, at the beginning of the class. ('B'-section due date is unchanged and they will submit of Mon, 29 Sept '14). Task: To read Chapter 1 of the Dieter text and submit a summary in less than 100 words. Submit on A4 size paper.

Pictorial drawing introduced. Topics covered include:

a. Characteristics of pictorial drawings (pseudo 3-dimensional and single view)
b. Classification of pictorial projections/drawings (basis: the American system):
    i. Axonometric (Isometric, Dimetric, and Trimetric)
    ii. Oblique (Cavalier, Cabinet, and others)
    iii. Perspective
    iv. Others
c. Characteristics of axonometric projections (parallel projectors, perpendicular to the plane of projection, and hence fall in the class of orthographic projection).
d. Definition of isometric, diametric, and trimetric projections using the unit right hexahedron (cube) as an example. Meaning of isometric as being of equal measure.
e. Definition of isometric planes and isometric lines.
f. True lengths and foreshortening in isometric projection.
g. The isometric scale to reckon foreshortened lengths.
h. The difference between isometric projections and isometric drawings/views/sketches.
i. The idea of avoiding hidden lines in pictorial drawing as far as possible

Lecture # 15: Monday, September 29, 2014

Construction of isometric drawings (not projections):

a. Drawing the isometric box using the isometric axes and the outline dimensions of the object
b. Using the isometric box as a guide to lay out the isometric lines
c. Location of endpoints of oblique (nonisometric) lines
d. Construction of the isometric view of a circle

Repeat observations to avoid dimensioning isometric drawings, and to avoid drawing hidden lines on isometric drawings. Repeated the distinction between isometric projection and isometric drawing/view/sketch.

Oblique drawing:

a. Definition of oblique drawing and highlighting the fact that we do not bother with the concept of oblique projection. Highlighted the fact that our classification of pictorials is the American system where oblique pictorials classified separately from axonometric pictorials
b. Definition of the main face and the receding axes in oblique drawing
c. Angular orientation of the receding axis optional at 30, 45 or 60 degrees wrt the horizontal axis on the face
d. The method of oblique drawing presented using the unit cube
e. Four optional directions for the receding axes
f. Oblique drawings can be dimensioned and even used to guide production on the shop floor
g. Classification of oblique drawings into Cavalier and Cabinet drawings discussed

Lecture # 16: Wednesday, October 01, 2014

Project progress submission No. 1 due on Wednesday, 08 October, 2014 in class announced:

Task: The following documents to be submitted as a group :

a. Photocopy of the individual contributions to the preliminary ideas (3 to 6 original ideas sketched by each team member on one A4 size paper).
b. Photocopy of the 3 preliminary ideas selected by the group and drawn on one A4 size paper.
c. Photocopies of the Minutes of team meetings held so far
d. Photocopy of the Gantt chart showing the planned schedule, and progress made so far

Invited anonymous feedback on paper to be kept on the lecture theatre table so that the instructor may collect the same in class to help make the teaching more beneficial for the students.

Dimensioning:

Dimensions defined as being a numerical value in appropriate units of measurement which are indicated on drawings using lines, symbols, and notes. Classified dimensions into functional, non-functional, location/datum, and auxiliary.

Discussion of the fig. 3.10 in the text to highlight functional and non-functional dimensions.

Sketch of a part showing auxiliary dimensions which are always enclosed within parentheses.

Lectures # 17 & 18: Wednesday, October 08 & Saturday, October 11, 2014

Dimensions continued. The following topics were covered and illustrated with examples:

1. Dimension lines, Extension lines (also called Projection lines, but this is not the same as the projection lines used to project features from one view to another), and leader lines. All these lines are drawn in thin, solid linetype.
2. Termination of dimension lines, or terminators. Types of termination: arrowheads, oblique strokes, dots, and a small circle (usually 3 mm diameter) used as a source point. Method of indicating dimension when space is limited and dots are used.
3. Extension (projection) lines to be generally perpendicular to the feature being dimensioned. However, if necessary, they may be drawn obliquely, in which case the pair of extension lines to be parallel to each other.
4. Intersecting construction lines and projection lines shall extend slightly beyond their point of intersection as illustrated with a dovetail feature.
5. Generally, extension lines and dimension lines should not cross other lines, except when this is unavoidable.
6. Avoid intersections of extension lines with other dimension lines, but if it is unavoidable, do not break either line. The lines need to cross over.
7. A long feature may be drawn broken, but the dimension line should not be broken.
8. Can use a centreline or an outline of a part as an extension line, but not as a dimension line.
9. Size of terminations to be proportional to the size of the drawing, but not larger than is necessary to read easily.
10. Four styles of arrowhead illustrated having included angles between 15 degrees and 90 degrees, and open and filled arrowheads. The 90 degree open arrowhead to be used with caution as it is not permitted under certain conditions.
11. One style of arrowhead to be used on a drawing except in some small areas where oblique strokes and dots may be used. In hand sketching, it is common to use the oblique stroke as it is easier to draw compared with the arrowhead.
12. Can show arrowheads inside or outside the extension lines.
13. On a radius, there is a single termination, either inside, or outside the feature
14. Values to be legible and placed so that they are not crossed by any other line
15. Two methods of dimensioning: Aligned and Unidirectional
16. Examples of adaptation, which are frequent in drawing practice

Lecture # 19: Monday, October 13, 2014

1. Method of indicating out of scale dimensions
2. Shape indication: diameter, radius, spherical diameter/ radius, square, across flat dimension
3. Chain or continuous dimensioning and the concept of error accumulation
4. Dimensioning from a Common feature: Parallel or progressive dimensioning – avoids error accumulation, but occupies more space compared with chain dimensioning; Superimposed running dimensions – conserves space
5. Dimensioning by coordinates
6. Can combine chain dimensions with dimensioning from a common feature.
7. Method of differentiating between the dimension of a cord and an an arc

Lecture # 20: Wednesday, October 15, 2014

1. Equidistant feature dimensioning
2. Omission of angles if evident
3. Use of common abbreviations such as OFF (e.g., 4 OFF), TYP (typical), and PCD (pitch circle diameter with examples

Use of simplified representation of intersecting surfaces. An example of intersecting cylinders with offset axes was presented.

Some comments and discussion about the forthcoming second mid-semester examination.

Lecture # 21: Monday, October 27, 2014

Elaboration of "form follows function" as applicable to design.

Elaboration of the rules of "Modernist Design."

Lecture # 22: Wednesday, October 29, 2014

Assignment No. 5: Read chapter 2 of the Dieter text and summarize in less than 250 words. Due on Monday, Nov 3, 2014. This summary is to be brought to class for discussion, but not to be submitted.

Assignment No. 6: Read chapter 3 of the Dieter text and summarize in less than 250 words. Due on Wednesday, Nov 5, 2014. This summary is to be brought to class for discussion, but not to be submitted.

Detailed outline of the individual report to be submitted for the group design project.

Comments about the group presentation (less than 10 power point slides – in the first lecture of the semester it was mentioned as less than 8 slides, but in the second lecture the limit was raised to 10 slides).

Lectures # 23, 24, 25 & 26: November 3, 5, 10 & 12, 2014

Discussion of Morris Asimow's morphology of design. 7 phases of the product development process identified after the primitive need is encountered. The first 3 phases identified as the design phases. Parallels between Asimow and Dieter terminology highlighted.

Elaboration of the three design phases namely, feasibility, preliminary, and detail design phases.

Began looking at a case study of a well-known commercial product. Outlined the problem, the 'dream' of the sponsor, and the design criteria of this product.

Assignment No. 7 & 8: Read chapters 4, 5, and 6 the Dieter text and summarize in less than 250 words. Due on Nov 10, 12, and 17, 2014 respectively. These summaries to be brought to class for discussion, but not to be submitted.

Announcement of group presentation dates for the design project. Presentations will be made during the respective laboratory sessions in the week of Nov 17-20, 2014. Each group is to email a copy of their presentation to the instructor before the midnight ending Sunday, Nov 16, 2014.

Lectures # 27, 28, 29 & 30: November 17, 19, 24 & 26, 2014

Discussions on the case study of the well-known small car project. By looking at the specific events associated with this design project, various aspects of engineering design were exposed. The importance of physical realizability, economic viability and financial feasibility of the project was discussed in some detail. It was shown how designers do not work in isolation, but that they need to work closely with the sales and finance teams if a commercial design project is to succeed. A simple weighted decision matrix was also discussed which enables designers to make choices out of available design alternatives.

--xx--