# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**
Dundigal, Hyderabad -500 043

## AERONAUTICAL ENGINEERING

## COURSE DESCRIPTOR

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | ENGINEERING DRAWING | | | | |
| **Course Code** | AME001 | | | | |
| **Program** | B.Tech | | | | |
| **Semester** | I | AE\| ME\|CE | | | |
| **Course Type** | Core | | | | |
| **Regulation** | IARE - R16 | | | | |
| **Course Structure** | **Theory** | | | **Practical** | |
| | **Lectures** | **Tutorials** | **Credits** | **Laboratory** | **Credits** |
| | 2 | | 4 | 3 | 4 |
| **Chief Coordinator** | Prof. B.V. S. N. Rao, Professor | | | | |
| **Course Faculty** | Mr. S. Devaraj, Assistant Professor,<br>Mr. T. Mahesh Kumar, Assistant Professor | | | | |

## I. COURSE OVERVIEW:

One of the best ways to communicate one's ideas is through some form of picture or drawing. This is especially true for the engineer. An engineering drawing course focuses on usage of drawing instruments, lettering, construction of geometric shapes, etc. Students study use of dimensioning, shapes and angles or views of such drawings. Dimensions feature prominently, with focus on interpretation, importance and accurate reflection of dimensions in an engineering drawing. Other areas of study in this course may include projected views, pictorial projections and development of surfaces. This course also gives basic concepts for studying machine drawing, building drawing, circuit drawings etc.

## II. COURSE PRE-REQUISITES:

| Level | Course Code | Semester | Prerequisites | Credits |
|---|---|---|---|---|
| UG | AHS002 | I | Linear Algebra and Differential Equations | 4 |

## III. MARKSDISTRIBUTION:

| Subject | SEE Examination | CIA Examination | Total Marks |
|---|---|---|---|
| Engineering Drawing | 70 Marks | 30 Marks | 100 |

## IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✔ | Chalk & Talk | ✔ | Quiz | ✔ | Assignments | ✘ | MOOCs |
| ✔ | LCD / PPT | ✔ | Seminars | ✘ | Mini Project | ✔ | Videos |
| ✘ | Open Ended Experiments | | | | | | |

## V. EVALUATION METHODOLOGY:

The SEE is conducted for 70 marks of 3 hours duration. The question paper pattern is as follows: two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question. All the drawing related courses are evaluated in line with laboratory courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks in each semester.

The emphasis on the questions is broadly based on the following criteria:

| | |
|---|---|
| 50 % | To test the objectiveness of the concept. |
| 50 % | To test the analytical skill of the concept OR to test the application skill of the concept. |

## VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

| Program Outcomes (POs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PO 1 | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. | 2 | Assignments |
| PO 2 | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences | 2 | Term paper, Seminars |
| PO 4 | **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | 2 | Assignments |

**3 = High; 2 = Medium; 1 = Low**

## VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| Program Specific Outcomes (PSOs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PSO 1 | **Professional skills:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products | 2 | Lecture, Assignments. |
| PSO 2 | **Problem solving skills:** imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles | - | - |
| PSO 3 | **Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies | - | - |

| Program Specific Outcomes (PSOs) | | Strength | Proficiency assessed by |
|---|---|---|---|
| PSO 4 | **Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats | - | - |

**3 = High; 2 = Medium; 1 = Low**

## VIII. COURSE OBJECTIVES (COs):

| The course should enable the students to: | |
|---|---|
| I | Understand the basic principles of engineering drawing and construction of curves used in engineering field |
| II | Apply the knowledge of interpretation of projection in different quadrants. |
| III | Understand the projections of solids, when it is inclined to both planes simultaneously |
| IV | Convert the pictorial views into orthographic view and vice versa. |
| V | Create intricate details of components through sections and develop its surfaces. |

## IX. COURSE LEARNING OUTCOMES (CLOs):

| CLO Code | CLO's | At the end of the course, the student will have the ability to: | PO's Mapped | Strength of Mapping |
|---|---|---|---|---|
| AME001.01 | CLO 1 | Understand the BIS conventions of engineering drawing with basic concepts, ideas and methodology | PO 1 | 3 |
| AME001.02 | CLO 2 | Recognize the need of single stroke lettering in defining the components | PO 1 | 3 |
| AME001.03 | CLO 3 | Understand the different line types according to BIS standards to engineering drawings. | PO 1 | 3 |
| AME001.04 | CLO 4 | Sketch the various types of polygons for applying in solid modeling | PO 2 | 2 |
| AME001.05 | CLO 5 | Discuss the various types of scales for engineering application like maps, buildings, bridges. | PO 2 | 2 |
| AME001.06 | CLO 6 | Visualize parabolic and elliptical profiles in buildings and bridges | PO 2 | 2 |
| AME001.07 | CLO 7 | Visualize cycloidal and involute profiles in developing new products like gears and other engineering applications. | PO 4 | 1 |
| AME001.08 | CLO 8 | Solve specific geometrical problems in plane geometry involving points and lines. | PO 4 | 1 |
| AME001.09 | CLO 9 | Understand the theory of projection in planes located in various quadrants and apply in manufacturing processes. | PO 2 | 2 |
| AME001.10 | CLO 10 | Understand the orthographic projection concepts in solid modeling and apply the concepts in the areas of design. | PO 2 | 2 |
| AME001.11 | CLO 11 | Apply the terminology of development of surfaces in the area of chimneys and chutes. | PO 1 | 3 |
| AME001.12 | CLO 12 | Visualize the components by isometric projection by representing three dimensional objects in two dimensions in technical and engineering drawings. | PO 1 | 3 |
| AME001.13 | CLO 13 | Interpret plumbing drawings typically found in construction by using transformation of projection. | PO 1 | 3 |
| AME001.14 | CLO 14 | Convert the orthographic views into pictorial views by using transformation of projection. | PO 1, PO 2 | 3 |
| AME001.15 | CLO 15 | Convert the pictorial views into orthographic views by using transformation of projection.. | PO 2 | 2 |

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## X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| (CLOs) | Program Outcomes (POs) | | | | | | | | | | | | Program Specific Outcomes (PSOs) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CLO 1 | 3 | | | | | | | | | | | | 1 | | |
| CLO 2 | 3 | | | | | | | | | | | | 1 | | |
| CLO 3 | 3 | | | | | | | | | | | | 1 | | |
| CLO 4 | | 2 | | | | | | | | | | | | | |
| CLO 5 | | 2 | | | | 1 | | | | | | | | | |
| CLO 6 | | 2 | | | | | | | | | | | | | |
| CLO 7 | | | | 1 | | | | | | | | | | | |
| CLO 8 | | | | 1 | | | | | | | | | | | |
| CLO 9 | | 2 | | | | | | | | | | | 1 | | |
| CLO 10 | | 2 | | | | | | | | | | | 1 | | |
| CLO 11 | 3 | | | | | 1 | | | | | | | | | |
| CLO 12 | 3 | | | | | | | | | | | | | | |
| CLO 13 | 3 | | | | | | | | | | | | | | |
| CLO 14 | 3 | 2 | | | | | | | | | | | 1 | | |
| CLO 15 | | 2 | | | | | | | | | | | | | |

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## XI. ASSESSMENT METHODOLOGIES–DIRECT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CIE Exams | PO 1 | SEE Exams | PO 1 | Assignments | PO 2 | Seminars | PO 2 |
| Laboratory Practices | PO 2 | Student Viva | - | Mini Project | - | Certification | - |
| Term Paper | | | | Project | | | |

## XII. ASSESSMENT METHODOLOGIES-INDIRECT

| | | | |
|---|---|---|---|
| ✔ | Early Semester Feedback | ✔ | End Semester OBE Feedback |
| ✘ | Assessment of Mini Projects by Experts | | |

## XIII. SYLLABUS

| UNIT-I | FUNDAMENTALS OF ENGINEERING DRAWING, SCALES AND CURVES |
|---|---|
| Introduction to engineering drawing: Drawing instruments and accessories, types of line, lettering | |

| | |
|---|---|
| practice and rules of dimensioning, geometrical constructions, basic geometrical shapes; Scales: Types of scales, units of length and their conversion, construction of scales, plain scale, diagonal scale, vernier scale; Curves used in engineering practice and their constructions; Conic sections, construction of ellipse parabola and hyperbola, special curves, construction of cycloid, epicycloids, hypocycloid and involutes.. | |
| **UNIT-II** | **ORTHOGRAPHIC PROJECTION, PROJECTION OF PLANES** |
| Orthographic projection: Principles of orthographic projections, conventions, first and third angle projections, projection of points, projection of lines, lines inclined to single plane, lines inclined to both the planes, true lengths and traces; Projection of planes: Projection of regular planes, planes inclined to one plane, planes inclined to both planes, projection of planes by auxiliary plane projection method. | |
| **UNIT-III** | **PROJECTION OF SOLIDS** |
| Projection of solids: Projections of regular solid, prisms, cylinders, pyramids, cones. Solids inclined to one plane, solids inclined to both planes, projection of solid by auxiliary Page \| 5 plane projection method. | |
| **UNIT-IV** | **DEVELOPMENT OF SURFACES, ISOMETRIC PROJECTIONS** |
| Development of surfaces: Development of lateral surface of right regular solids, prisms, cylinders, pyramids and cones; Isometric projections: Principle of isometric projection, isometric scale, isometric projections and isometric views, isometric projections of planes, prisms, cylinders, pyramids, and cones. | |
| **UNIT-V** | **TRANSFORMATION OF PROJECTIONS** |
| Transformation of projections: Conversion of isometric views to orthographic views and conversion of orthographic views to isometric views.. | |
| **Text Books:** | |
| 1. N. D. Bhatt, "Engineering Drawing", Charotar Publications, 49thEdition, 2012.<br>2. C. M. Agrawal, Basant Agrawal, "Engineering Drawing'', Tata McGraw Hill, 2ndEdition, 2013. | |
| **Reference Books:** | |
| 1. K.Venugopal, "Engineering Drawing and Graphics", New Age Publications, 2ndEdition, 2010.<br>2. K. C. John, "Engineering Drawing", PHI Learning Private Limited", 2nd Edition, 2009.<br>3. Dhananjay. A. Johle, "Engineering Drawing", Tata McGraw Hill, 1st Edition, 2008. | |

## XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

| Lecture No | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 1 | Principles of engineering drawing – various drawing instruments and their uses. (General exercises). | CLO 1 | T1:1.1 |
| 2 | Conventions in Drawing–Lettering –BIS. | CLO 2 | T1:1.1 |
| 3 | Geometrical constructions. | CLO 2 | T1: 2.1 |
| 4 | Construction of various scales for engineering use-Plain and diagonal. | CLO 2 | T1:2.2<br>R1: 2.2.3 |
| 5 | Construction of various scales for engineering use-Vernier scales | CLO 1 | T1: 2.3 |
| 6 | Construction of various curves.-general method. | CLO 2 | T1: 3.1 |
| 7 | Construction of various curves- ellipse, parabola and hyperbola. | CLO1 | T1:3.3 |
| 8 | Construction of various curves cycloid, epicycloids, hypocycloid and involutes. | CLO 2 | T1:3.4,<br>R1: 4.1 |
| 9 | Projection of points and lines inclined to single plane. | CLO 2 | T1: 4.1 |
| 10 | Projection of lines inclined to both planes. | CLO1 | T1: 4.3 |
| 11 | Projection of planes-simple position. | CLO 1 | T1: 4.3.2 |
| 12 | Projection of planes- inclined to a both planes. | CLO1 | T1:4.3 |
| 13 | Projection of solids inclined to single plane. | CLO 2 | T1: 4.4 |
| 14 | Projection of solids inclined to a both planes. | CLO 2 | T1: 5.2 |
| 15 | Projection of solids Auxiliary plane method. | CLO 2 | T1: 5.2.3 |
| 16 | Draw the development of surfaces. | CLO 1 | T1: 6.1 |

| Lecture No | Topics to be covered | Course Learning Outcomes (CLOs) | Reference |
|---|---|---|---|
| 17 | Draw the isometric projections | CLO 2 | T1: 8.1 |
| 18 | Convert the pictorial views to orthographic views | CLO 2 | T1:8.1.2 |

## XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

| S No | Description | Proposed actions | Relevance with POs | Relevance with PSOs |
|---|---|---|---|---|
| 1 | Increase ability to communicate with people. | Seminars | PO 1, PO 2, | PSO 1 |
| 2 | Learn to take data and transform it into graphic drawings | Guest Lectures | PO4, PO 5 | PSO 2 |
| 3 | Students will become familiar with office practices and standards. | Assignments / Laboratory Practices | PO9, PO10 | PSO 3 |

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