

<b>Course code</b>	<b>ES-109A</b>							
<b>Course title</b>	<b>Engineering Graphics&amp; Design</b>							
<b>Scheme and Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Major Test</b>	<b>Minor Test</b>	<b>Total</b>	<b>Time</b>
	<b>1</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>75</b>	<b>25</b>	<b>100</b>	<b>3h</b>

#### **Course Outcomes**

<b>Objective</b>	To expose students to the basics of Engineering Drawing, graphics and Projections.
<b>CO-1</b>	<b>To learn about construction of various types of curves and scales.</b>
<b>CO-2</b>	<b>To learn about orthographic projections of points, lines and planes.</b>
<b>CO-3</b>	<b>To Learn about the sectional views of Right regular solids</b>
<b>CO-4</b>	<b>To Learn about the developments of Right regular solids</b>
<b>CO-5</b>	<b>To Learn about the construction of orthographic views from Isometric views.</b>
<b>CO-6</b>	<b>To Learn about the construction of Isometric Projections from Orthographic views.</b>

#### **UNIT - I**

##### **Introduction to Engineering Drawing:**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

#### **UNIT - II**

##### **Orthographic Projections:**

Principles of Orthographic Projections-Conventions-Projections of Points and lines inclined to both planes; Projections of planes inclined to one principal Plane.

##### **Projections of Regular Solids:**

Solid with axis inclined to both the Planes;

#### **UNIT - III**

##### **Sections and Sectional Views of Right Regular Solids:**

Sectional views of simple right regular solids like prism, pyramid, Cylinder and Cone. Development of surfaces of Right Regular Solids-Prism, Pyramid, Cylinder and Cone;

#### **UNIT - IV**

##### **Isometric Projections:**

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

**Suggested Books:**

1. Engineering Graphics using AUTOCAD 2000: T. Jeyapoovan, Vikas Publishing House.
2. Engineering Drawing: Plane and Solid Geometry: N.D. Bhatt and V. M. Panchal, Charotar Publishing House.
3. Engineering Drawing: Amar Pathak, Dreamtech Press, New Delhi.
4. Thomas E. French, Charles J. Vierck, Robert J. Foster, “Engineering drawing and graphic technology”, McGraw Hill International Editions.
5. Engineering Graphics and Drafting: P.S. Gill, Millennium Edition, S.K. Kataria and Sons.
6. A Primer on Computer aided Engineering Drawing-2006, published by VTU, Belgaum.
7. A. Yarwood, Introduction to AutoCAD 2017, Published by CRC Press.
8. O. Ostrowsky, Engineering Drawing with CAD applications, Butterworth Heinemann, 1999.
9. BSI, Technical production documentation (TPD) – specification for defining, specifying and graphically reporting products, BS8888, 2002.
10. Corresponding set of CAD Software Theory and User Manuals.

**Note: The paper setter will set the paper as per the question paper templates provided.**

**LECTURE PLAN**  
**Engineering Graphics & Design**  
**ES-109A**

Month	Class	Topic/Chapter Covered	Academic Activity	Test/Assignment
Jan.	2 <sup>nd</sup> Semester	Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance.	Teaching	
Jan.	2 <sup>nd</sup> Semester	Usage of Drawing instruments	Teaching	
Jan.	2 <sup>nd</sup> Semester	Lettering	Teaching	Assignment
Jan.	2 <sup>nd</sup> Semester	Conic sections including the Rectangular Hyperbola (General method only)	Teaching	
Jan.	2 <sup>nd</sup> Semester	Cycloid, Epicycloid	Teaching	
Jan.	2 <sup>nd</sup> Semester	Hypocycloid and Involute	Teaching	Assignment
Jan.	2 <sup>nd</sup> Semester	Scales – Plain, Diagonal Scales	Teaching	
Jan.	2 <sup>nd</sup> Semester	Vernier Scale	Teaching	Assignment
Jan.	2 <sup>nd</sup> Semester	<b>Orthographic Projections:</b> Principles of Orthographic Projections-Conventions	Teaching	
Jan.	2 <sup>nd</sup> Semester	Projections of Points	Teaching	
Jan.	2 <sup>nd</sup> Semester		Teaching	Assignment
Jan.	2 <sup>nd</sup> Semester		Teaching	
Feb.	2 <sup>nd</sup> Semester	Lines inclined to both planes	Teaching	
Feb.	2 <sup>nd</sup> Semester		Teaching	
Feb.	2 <sup>nd</sup> Semester		Teaching	
Feb.	2 <sup>nd</sup> Semester	Lines inclined to both planes	Teaching	
Feb.	2 <sup>nd</sup> Semester		Teaching	
Feb.	2 <sup>nd</sup> Semester		Teaching	Assignment
Feb.	2 <sup>nd</sup> Semester	Projections of planes inclined to one	Teaching	

Feb.	2 <sup>nd</sup> Semester	principal Plane	Teaching	
Feb.	2 <sup>nd</sup> Semester		Teaching	Assignment
Feb.	2 <sup>nd</sup> Semester	<b>Projections of Regular Solids:</b>	Teaching	
Feb.	2 <sup>nd</sup> Semester	Solid with axis inclined to both the	Teaching	
March	2 <sup>nd</sup> Semester	Planes	Teaching	
March	2 <sup>nd</sup> Semester	<b>Projections of Regular Solids:</b>	Teaching	
March	2 <sup>nd</sup> Semester	Solid with axis inclined to both the	Teaching	
March	2 <sup>nd</sup> Semester	Planes	Teaching	Assignment
March	2 <sup>nd</sup> Semester	<b>Sections and Sectional Views of Right Regular Solids:</b>	Teaching	
		Sectional views of simple right regular solids like prism.		
March	2 <sup>nd</sup> Semester	Sectional views of simple right regular solids like pyramid, Cylinder.	Teaching	
March	2 <sup>nd</sup> Semester	Sectional views of simple right regular solids like Cone.	Teaching	Assignment
March	2 <sup>nd</sup> Semester	Development of surfaces of Right Regular Solids-Prism.	Teaching	
March	2 <sup>nd</sup> Semester	Development of surfaces of Right Regular Solids- Pyramid, Cylinder.	Teaching	
March	2 <sup>nd</sup> Semester	Development of surfaces of Right Regular Solids- Cone.	Teaching	Assignment
April	2 <sup>nd</sup> Semester	<b>Isometric Projections:</b>	Teaching	
		Principles of Isometric projection		
April	2 <sup>nd</sup> Semester	Isometric Scale, Isometric Views	Teaching	
April	2 <sup>nd</sup> Semester	Conventions; Isometric Views of lines, Planes.	Teaching	
April	2 <sup>nd</sup> Semester		Teaching	
April	2 <sup>nd</sup> Semester	Simple and compound Solids	Teaching	Assignment

April	2 <sup>nd</sup> Semester	Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.	Teaching	
April	2 <sup>nd</sup> Semester		Teaching	
April	2 <sup>nd</sup> Semester		Teaching	Assignment

## TUTORIAL SHEET-1

- 1: Explain different types of line used in engineering drawing.
- 2: Explain various types of projections and difference between first and third angle Orthographic Projections.
- 3: Draw the projections of following points.
  - a) Point A, 25 mm in front of V.P and 15 mm above H.P
  - b) Point B, in the H.P and 25 mm behind the V.P
  - c) Point C, 25 mm below the H.P and 35 mm behind the V.P
  - d) Point D, 25 mm in front of V.P and 25 mm below the H.P
  - e) Point G, in both the H.P and V.P.
- 4: A straight line AB, 60 mm long makes an angle of  $25^{\circ}$  to the HP and  $55^{\circ}$  to the VP. The one end of the straight line AB lies in the HP and is 20 mm in front of VP. Draw the projections of the line AB.
- 5: Projection of Straight Lines – A line CD is 65 mm long, has its end point C 15 mm above HP and 10 mm in front of VP & end point D 45 mm above HP and 50 mm in front of VP. Determine true inclinations of the line CD with HP and VP.
- 6: Projection of Straight Lines – The top view and the front view of the line EF, measures 60 mm and 50 mm respectively. The line is inclined to HP and VP by  $30^{\circ}$  and  $45^{\circ}$ , respectively. The end E is on the HP and 10 mm in front of VP. Other end F is in the 1st quadrant. Draw the projections of the line EF and find its true length.
- 7: Projection of Straight Lines – A line AB 60 mm long is parallel to V.P. & H.P. both. The end A is 30 mm above H.P. and 40 mm in front of V.P. Draw the projection of line AB.
- 8: Projection of Straight Lines - A line PQ 80 mm long is parallel to V.P. and inclined to H.P. by  $55^{\circ}$ . The end point P is 20 mm below H.P. and 30 mm behind V.P. Draw the projections of the line PQ.
- 9: A rectangular plot of area 50,000 square metre, is represented on a map by a similar rectangle of 80 square centimeter. Calculate the RF of the scale of the map. Construct a diagonal scale which can read up to single metre. Also show a distance of 234 m on it.
- 10: Construct a scale of RF=  $1/25$  to show meters and decimeters and by a vernier to read centimeters to measure up to 4 metres. Mark on it a distance of 2.48 m.

## **TUTORIAL SHEET-2**

- 1: Draw the projection of a circle of 60 mm diameter resting on the H.P. on a point A of the circumference. The Plane is inclined to the HP such that plan of it is an ellipse of minor axis 40 mm. The plan of the diameter through the point A is making an angle of  $45^\circ$  with the V.P. Measure the angle of the plane with the H.P.
- 2: A hexagonal lamina of 40mm side is resting on one of its corner in the H.P. Its plane is inclined at an angle of  $30^\circ$  to H.P and perpendicular to V.P. Draw its projections.
- 3: A square lamina of side 80 mm rests on a corner on H.P. and it is inclined with H.P. such that its plan is a rhombus with a diagonal of 40 mm. The long diagonal is inclined with the V.P. at  $45^\circ$ . Determine its inclination with H.P. and draw it's projections.
- 4: A pentagonal plate of side 60 mm is held on V.P. on one of its corner. The edge opposite to that corner makes an angle of  $25^\circ$  with the H.P. The flat surface of pentagon is inclined at  $40^\circ$  to the V.P. Draw the projections.
- 5: A pentagonal pyramid, axis 50mm and edge of base 25mm, is resting on one of the its base edge on the HP an inclined at  $30^\circ$  to VP. Draw its projections.
- 6: An isosceles triangle plate ABC having its base 50 mm and altitude 90 mm resting on H.P. on its base. The isosceles triangle is inclined at an angle  $40^\circ$  to the H.P. And the altitude in the top view is inclined at the angle  $60^\circ$  to the V.P. Draw the projections.
- 7: A hexagonal prism of 30 mm side of base and 70 mm height, resting on the H.P. such that the axis is inclined at  $30^\circ$  to the H.P. and  $60^\circ$  to the V.P. Draw its projections. Keep the top end of the prism near to the V.P
- 8: A hexagonal pyramid of side of base 30 mm and axis length 90 mm rests on one of its slant edge on the H.P. such that the plane containing that slant edge on which it rests on H.P. is inclined at  $45^\circ$  to V.P. and the apex is near to the V.P. Draw the projection of it.
- 9: An equilateral triangle of 30mm sides has a corner in V.P. and 20mm away from H.P. Draw its Projections and traces when the plane is parallel to the H.P. and one of its sides inclined at  $45^\circ$  to the V.P.
- 10: A circular plate, of 50 mm diameter, is held such that its plane is perpendicular to H.P. and inclined at  $30^\circ$  to V.P. with its centre 30 mm above the H.P. and 20 mm in front of the V.P. Draw its projections. Also show its traces.

## **TUTORIAL SHEET-3**

- 1: A hexagonal pyramid of side of base 40 mm and height of axis 110 mm is resting on one of its inclined vertical surface on H.P. such that its axis remains parallel to the V.P. It is cut

by a plane which is inclined at an angle  $45^\circ$  with H.P. and bisecting the axis of the pyramid. Draw front view, sectional top view.

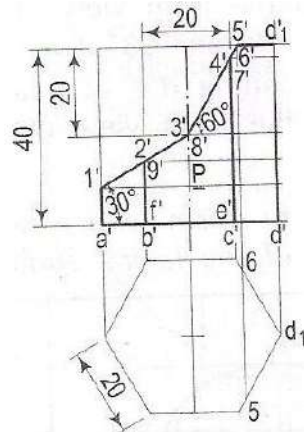
2: A cone of base diameter 60 mm and axis height 90 mm is resting on its base on V.P. One cutting plane parallel with V.P. and perpendicular to H.P. is cutting the cone such that true shape of the section of the cone is a circle of diameter 35 mm. Draw sectional front view and top view of the cone.

3: A hexagonal prism is resting on H.P. on its base with two edges/sides of base parallel to V.P. One equilateral triangular shape of size 20 mm is cut from the prism such that the axis of the triangle is perpendicular to V.P. & parallel to H.P. & passing through the center of the height & width of the prism. Develop the surface of the prism. Take side of base 30 mm and height of axis 80 mm of the prism.

4: A cylinder of diameter of base 60 mm and axis height 110 mm is resting on its base on H.P. It is cut by a cutting plane perpendicular to V.P. and inclined at an angle  $60^\circ$  with the H.P. and passing through the distance of 20 mm from the top end of the cylinder and on the axis. Develop the lateral surface of the cylinder.

5: A pentagon prism of 25 mm base edges and 50 mm long is resting on its base with an edge of base at  $45^\circ$  to VP. The prism is cut by a section plane VT inclined at  $30^\circ$  to HP and passes through a point 25 mm from the base along its axis. Develop the lateral surfaces of the truncated prism.

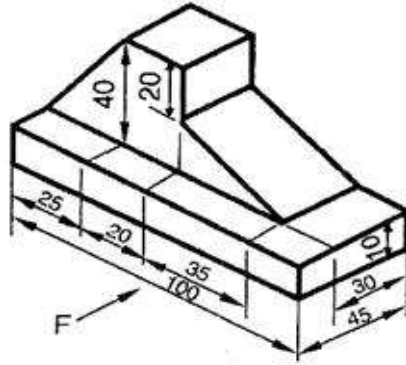
6: Draw the development of the lateral surface of the Part of the hexagonal prism shown in the figure.



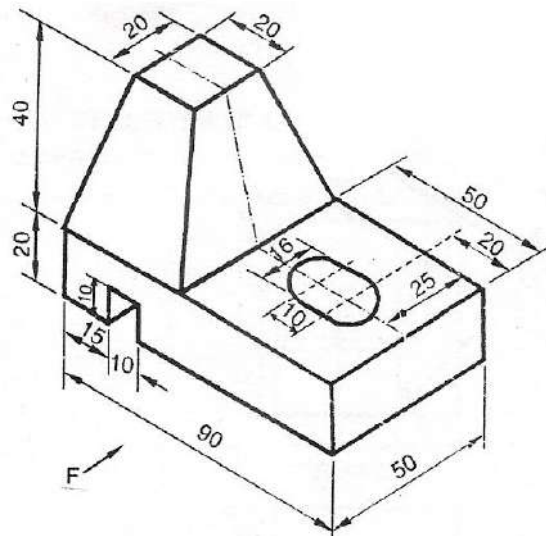
7: A pentagonal pyramid, edge of base 25 mm and height of axis 55 mm, has its base on the horizontal plane and edge of the base parallel to VP. It is cut by a horizontal section plane and passes at a distance of 30 mm above the base along the axis. Draw its front view and sectional top view.



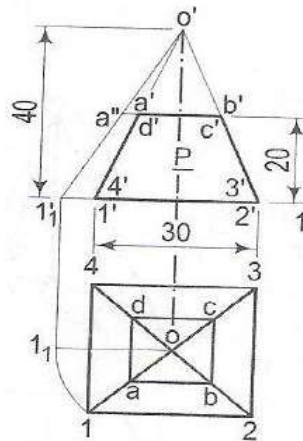




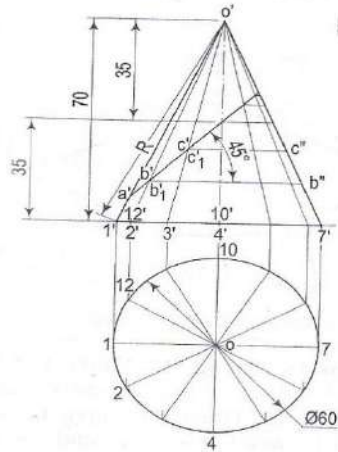
4: Draw the front view, top view and side view of the following object:



5: Draw the development of the lateral surface of the frustum of the square pyramid as shown in the figure.



6: Draw the development of the lateral surface of the truncated cone as shown in the figure.



7: What is isometric scale? Explain method to draw isometric scale.

8: A square prism of side 30 mm and 40 mm height is resting on H.P. A vertical square bore of 10 mm side is cut through its face reaching other square face of the prism. Draw the isometric projection of the prism.

9: A hexagonal pyramid of side 30 mm and altitude 60 mm is resting on HP on its base with two of the base sides perpendicular to VP. The Pyramid is cut by a plane inclined at  $30^\circ$  to HP and perpendicular to VP and is bisecting the axis. Draw the development of the remaining portion of the pyramid.

**BT-2/M-18**  
**ENGINEERING DRAWING AND GRAPHICS**  
**ME-105N**

Time: Three Hours

Maximum Marks:

75

Note: Attempt Five questions in all, selecting at least one question from each Unit.

**Unit-I**

1. Draw the projections of the following points on a common reference line:

- (a) Point P 30 mm above HP and 20 mm in front of VP
- (b) Point Q 40 mm above HP and 25 mm behind VP
- (c) Point R 28 mm below HP and 45 mm behind VP
- (d) Point S 32 mm below HP and 20 mm in front of VP
- (e) Point H 34 mm above HP and in VP

2. One end of the line PQ of True length 60 mm is 30 mm above HP and 25 mm in front of VP. Line is inclined at  $40^\circ$  to HP and  $30^\circ$  to VP. Draw its projections and locate its traces.

**Unit-II**

3. A pentagonal plate of 30 mm side is inclined at  $40^\circ$  to HP and perpendicular to VP. Draw its projections if one edge of the plate is inclined at  $30^\circ$  to VP.

4. Draw the projection of Pentagonal pyramid of base side 30 mm long and height 55 mm long. The pyramid is resting on one base side on HP with its Axis parallel to VP and inclined at  $40^\circ$  to HP.

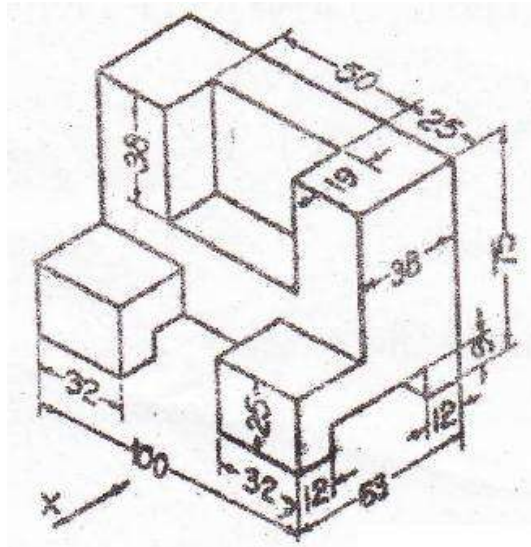
**Unit-III**

5. A pentagonal pyramid of height 60 mm and base side 30 mm long is resting on its base in HP with one base side inclined at  $30^\circ$  to VP. A section plane perpendicular to VP and inclined at  $40^\circ$  to H.P. bisects through the axis of the solid. Draw the true and apparent section of the truncated solid.

6. A pentagonal pyramid of base side 30 mm, axis length 55 mm is resting on its base in HP with one base side parallel to VP. A cutting plane perpendicular to VP and inclined to HP cuts through the solid, bisecting the axis. Draw the development of the truncated solids.

#### Unit-IV

7. Draw- the front view, top view and right side view of the following object:



8. Describe the applications of the following Auto CAD commands :

- (a) Fillet
- (b) Offset
- (c) Chamfer
- (d) Trim
- (e) Mirror.

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<b>Course title</b>	<b>Engineering Graphics &amp; Design Practice</b>							
<b>Scheme and Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Practical</b>	<b>Minor Test</b>	<b>Total</b>	<b>Time</b>
	-	-	3	1.5	30	20	50	3h
<b>Pre-requisites(if any)</b>	-							

<b>Aim: To make student practice on engineering graphics and design software's and provide exposure to the visual aspects of engineering design.</b>	
<b>CO-1</b>	<b>To give an overview of the user interface and toolboxes in a CAD software.</b>
<b>CO-2</b>	<b>To understand to customize settings of CAD software and produce CAD drawing.</b>
<b>CO-3</b>	<b>To practice performing various functions in CAD softwares.</b>
<b>CO-4</b>	<b>To learn about geometric dimensioning through CAD softwares.</b>
<b>CO-5</b>	<b>To learn about 3D wire-frame for engineering analysis.</b>
<b>CO-6</b>	<b>To Learn about solid modelling and demonstration of a simple team design project.</b>

### **Module 1: Overview of Computer Graphics:**

Listing the computer technologies that impact on graphical communication, Demonstrating Knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus(Button Bars),The Command Line(where applicable),The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

### **Module2: Customization & CAD**

#### **Drawing:**

Setup of the drawing page and the printer ,including scale settings, Setting up of units and drawing limits ;ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

### **Module3: Annotations, layering & other functions:**

Applying dimensions to objects ,applying annotations to drawings ;Setting up and use of Layers ,layers to create drawings ,Create ,edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen);Printing documents to paper using the print command ;orthographic projection techniques; Drawing sectional views of

composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation ,Computer-aided design(CAD) software modeling of parts and assemblies .Parametric and non-parametric solid, surface, and wire frame models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises .Dimensioning guide lines, tolerancing techniques; dimensioning and scale multi views of dwelling;

**Module4: Demonstration of a simple team design project:**

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blue print form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors and fixtures such as WC, bath ,sink ,shower ,etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

**Suggested Books (ES-113LA):**

1. Chris McMahon and Jimmie Browne, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.
2. Chougule N.K.; CAD/CAM /CAE, Scitech Publications India Pvt. Ltd.
3. Vikram Sharma; Computer Aided Design and Manufacturing, S.K. Kataria and Sons.
4. Rogers, D.F. and Adams, A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
5. Ibrahim Zeid, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
6. M.P. Groover, Automation, Productions systems and Computer-Integrated Manufacturing by Prentice – Hall.
7. A Primer on Computer aided Engineering Drawing-2006, published by VTU, Belgaum.
8. A.Yarwood, Introduction to AutoCAD 2017, Published by CRC Press.
9. O. Ostrowsky, Engineering Drawing with CAD applications, Butterworth Heinemann,1999.
10. BSI, Technical production documentation (TPD) – specification for defining, specifying and graphically reporting products, BS8888, 2002.
11. (Corresponding set of)CAD Software Theory and User Manuals

12. Ibrahim Zeid, Mastering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
13. P. Radhakrishnan, S. Subramanian and V.Raju, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
14. Groover M.P. and Zimmers E. W., CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
15. Dr. Sadhu Singh, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
16. Thomas E. French, Charles J. Vierck, Robert J. Foster, “Engineering drawing and graphic technology”, McGraw Hill International Editions.



<b>Course code</b>	<b>ES-111LA</b>							
<b>Course title</b>	<b>Manufacturing Processes Workshop</b>							
<b>Scheme and Credits</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>Practical</b>	<b>Minor Test</b>	<b>Total</b>	<b>Time</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>60</b>	<b>40</b>	<b>100</b>	<b>3h</b>
<b>Pre-requisites (if any)</b>								

<b>Aim:</b> To make student gain a hands on work experience in a typical manufacturing industry environment.	
<b>CO-1</b>	To familiarize with different manufacturing methods in industries and work on CNC machine.
<b>CO-2</b>	To learn working in Fitting shop and Electrical and Electronics shops,
<b>CO-3</b>	To practice working on Carpentry and Plastic moulding/glass cutting jobs.
<b>CO-4</b>	To gain hands on practice experience on Metal casting and Welding jobs.

## **Manufacturing Processes Workshop**

### **Contents**

1. Manufacturing Methods-casting, forming, machining ,joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding ,glass cutting
7. Metal casting
8. Welding(arc welding & gas welding), brazing

### **Suggested Books:**

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology" , 7th edition, Pearson Education India Edition.
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., " Elements of Workshop Technology" , Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, " Processes and Materials of Manufacture" , 4th edition, Prentice Hall India, 1998
5. Rao P.N., " Manufacturing Technology" , Vol. I and Vol. II, Tata McGraw-Hill House,2017.