Lok Jagruti Kendra University
University with a Difference

Diploma in Automation & Robotics

LJ Polytechnic

Course Code: 025120105

Engineering Graphics

Programme / Branch Name			Diploma in Automation & Robotics			
Course Name	Engineering Graphics				**Course Code**	025120105
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
2	0	4	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Basic knowledge of angles, polygons and geometrical shapes.

3. Rationale

- ✓ The subject mainly focuses on the use of drawing instruments, developing imagination and translating ideas. Developing the sense of drawing sequence and use of drawing instruments effectively yields not only with productive preparation of computer-aided graphics but also the yields of effective industrial applications ranging from marking to performance of operations.
- ✓ The fundamentals of engineering drawing present technical information to all individual who works as a manager, suppliers, designers, planners, supervisors and technician. Engineering drawing is the graphical language to express thoughts, ideas and concepts. The expression by drawing is very accurate, precise and brief.
- ✓ This course is aimed at providing basic understanding of the fundamentals of Engineering Drawing; mainly visualization, graphics theory, standards & conventions of drawing, the tools of drawing and the use of Drawings in engineering applications. At a glance, one can understand a detailed description of any part to be manufactured or an electric circuit detail.

4. Objectives

- ✓ To provide knowledge of drawing standards, reading & construction of technical drawings.
- ✓ To know and understand the conventions and the methods of engineering drawing.
- ✓ Interpret engineering drawings using fundamental technical mathematics.
- ✓ Construct basic and intermediate geometry.
- ✓ To improve their visualization skills so that they can apply these skills in developing new products.
- ✓ To improve their technical communication skill in the form of communicative drawings.
- ✓ To comprehend the theory of projection.

- ✓ To prepare engineering drawings manually with given geometrical dimensions using prevailing drawing standards and drafting instruments.
- ✓ To Visualize the shape of the simple object from orthographic views and vice versa.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours
1.	**Engineering Drawing Aids**	1.1. Drawing Equipment, Instruments and Materials, Equipment-Types, Specifications, Method to use them, Applications 1.2. Instruments and Materials 1.3. Equipment-Types, Specifications, Method to use them, Applications 1.4. Instruments-Types 1.5. Pencils-Grades, Applications 1.6. Types of Points and Applications	• Able to use drawing equipment, instruments and materials effectively.	5	02
	Planning, Layout and Scaling of Drawing	2.1. I.S. Codes for Planning and Layout 2.2. Scaling Technique used in Drawing 2.3. Representative Fraction 2.4. Types of Scale: Plain Scale, Diagonal Scale	• Able to follow and apply standard practice as per bureau of I.S. for planning and layout. • Able to choose appropriate scale factor for the drawing as per given situation.	5	03
	Lines, Lettering and Dimensioning	3.1. Different Types of Lines 3.2. Vertical Capital and Lower-Case Letters 3.3. Inclined Capital and Lower-Case Letters 3.4. Numerals and Greek Alphabets 3.5. Dimensioning Methods: Aligned Method & Unilateral with Chain, Parallel and Combined Dimensioning	• Able to write annotations on a drawing where ever necessary. • Able to choose appropriate line and dimensioning style for a given geometrical entity.	5	03
	Geometric Construction	4.1. Geometric Construction Related with Line like, bisecting a Line, To Draw Perpendicular with a Given Line, Divide a Line etc.	• Able to develop the ability to draw polygons, circles and lines with	5	04

		4.2. Geometric Construction Related with Angle like Bisect an angle, Trisect an Angle, etc. 4.3. To Construct Polygon, Triangle, Square, Rectangle, Pentagon with Special Method, Hexagon with Special Method, To Draw Tangents 4.4. Geometric Construction Related with Circle & Arc	different geometric conditions.		
2.	**Engineering Curves**	5.1. Conic sections. Concept and Understanding of Focus and Eccentricity and Drawing of Conic Sections 5.2. Using Various Methods Understand Construction of: Ellipse, Parabola, Hyperbola 5.3. Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid) 5.4. Involutes: Involutes of a Circle, Involutes of a Polygon 5.5. Spiral (Archimedean Spiral only)	• Able to draw engineering curves with proficiency and speed as per given dimensions.	10	04
3.	**Projection of Points, Lines and Planes**	6.1. Reference Planes 6.2. Projection of Points 6.3. Projection of Lines: Determination of True Length and Inclinations for Following cases: Line Parallel to One or Both the Plane, Line Perpendicular to One of the Planes, Line Inclined to One Plane and Parallel to Another, Line Inclined to Both the Planes 6.4. Projection of Planes: Types of Planes Projection of Planes Parallel to One of the Reference Planes, Projection of Plane Inclined to One Reference Plane and Perpendicular to Another, Projection of Planes Inclined to Both Reference Planes. [Triangle, Square /	• Able to draw the projection of points, lines and planes with different conditions. • Able to find out true shape and size of an inclined line or plane.	30	08

		Rectangle, Pentagon, Hexagon and Circle Shape Should be Included.]			
4.	**Orthographic Projections**	7.1. Concept of Quadrant: 1st Angle and 3rd Angle projection Methods and Symbols 7.2. Types of Projections- Orthographic, Perspective, Isometric and Oblique: Concept and Applications 7.3. Theory of Projection 7.4. Methods of Projection 7.5. Orthographic Projection 7.6. Planes of Projection 7.7. Various Term Associated with Orthographic Projections 7.8. Theory of Projection 7.9. Methods of Projection 7.10. Orthographic Projection 7.11. Planes of Projection 7.12. Conversion of Simple Pictorial Views into Orthographic Views 7.13. Illustrative Problems on Orthographic Projection	• Able to draw the orthographic views of object containing lines, circles and arc geometry. • Able to interpret given orthographic views and to imagine the component.	25	02
5.	**Isometric Projections**	8.1. Isometric Axis 8.2. Lines and Planes 8.3. Isometric Scales 8.4. Isometric View and Isometric Drawing 8.5. Difference between Isometric Projection and Isometric Drawing 8.6. Illustrative Problems Limited to Objects Containing lines, Circles and Arcs Shape only	• Able to draw the isometric view from orthographic views of objects containing lines, circles and arcs. • Able to draw the 3D Views of any object from 2D.	15	02
				Total Hours	**28**

6. List of Practical's / Exercises

Sr. No	Practical / Exercises	Key Competency	Hours
1.	Use of Drawing Instruments	• Use of drawing instruments. • Planning and layout as per IS. • Scaling technique. • Drawing horizontal, vertical, 30º, 45º, 60º & 75º lines using Tee and Set squares/ drafter. • Types of lines • Types of dimensioning • Alphabets & numerical (Vertical & Inclined as Per I.S.)	14
2.	Geometric Construction	• Drawing of the set of lines with different conditions. • Drawing Polygons. • Drawing circles and arcs with different geometric conditions and with line constraints.	06
3.	Engineering Curves – I	• Construction of ellipse using two Methods from the arc of circle method, four center method, rectangular method, eccentricity method and concentric circle method. • Construction of parabola with any one method from the rectangular method, tangent method and eccentricity method. • Construction of hyperbola with any one method from eccentricity method and rectangular method. • Construction of spiral.	04
4.	Engineering Curves – II	• Construction of cycloid. • Construction of hypocycloid & epicycloids. • Construction of involute (circle).	04
5.	Projections of Points and Lines	• Draw projection of points-For 10 various conditions. • Draw projection of lines with different conditions.	04
6.	Projections of Plane	• Draw projection of different planes with different conditions. (triangle, square / rectangular, pentagonal / hexagonal, and circular -one for each)	02
7.	Orthographic Projections	• Draw Orthographic projections of different objects. (Draw four views of each object)	06
8.	Isometric Drawings	• Draw isometric drawings from given orthographic views.	09

9.	Problem Based Learning	• Given the orthographic views of at least three objects with few missing lines, the student will try to imagine the corresponding objects, complete the views and draw these views in sketchbook.	02
10.	AutoCAD 2D Drafting Exercise	• Students have to draft the sheet of projections of lines, planes and orthographic projections by using drafting software like AutoCAD 2D. • Students have to generate at-least four drafting sheets in PDF format or print-outs per industry standard using AutoCAD 2D.	05
		Total Hours	**56**

Notes:

- Theory & practice should be in First Angle Projections and IS codes should be followed wherever applicable.
- The dimensions of line, axes, distances, angle, side of the polygon, diameter, etc. must be varied for each student in batch so that each student will have same problems, but with different dimensions.
- The sketchbook has to contain data of all problems, solutions of all problems and student activities performed. Students' activities are compulsory to be performed.
- A handout containing applicable standards from IS codes including title block as per IS standard should be given to each student by the concerned teacher.
- Students have to generate given problems using drafting software like Autodesk AutoCAD 2D and export the sheets in PDF format or print-outs per industry standards.

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	App %	C %	E %	An %
1.	Engineering Drawing Aids Planning, Layout and Scaling of Drawing Lines, Lettering and Dimensioning Geometric Construction	20	40	40	0	0	0
2.	Engineering Curves	20	25	25	30	0	0
3.	Projection of Points, Lines and Planes	15	30	20	25	5	5
4.	Orthographic Projections	0	30	30	30	5	5
5.	Isometric Projections	0	30	30	30	5	5

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. List of Major Equipment / Instruments:

- ✓ Models- full and cut
- ✓ Set of various industrial drawings being used by industries-up dated.
- ✓ Drawing equipment and instruments for class room teaching-large size.
- ✓ Drawing board-half imperial size
- ✓ T-square or drafter (Drafting Machine).
- ✓ Set squires (45^o and 30^o-60^o)
- ✓ Protector
- ✓ Drawing instrument box (containing set of compasses and dividers).
- ✓ Drawing sheets
- ✓ Sheet Container
- ✓ Drawing pencils
- ✓ Eraser
- ✓ Drawing pins / clips
- ✓ Roller scale

9. List of Student Activities

Activity No.	Details of Student Activities
1.	Sketch the combinations of set squares to draw angles in step of 15^o (15^o, 30^o, 45^o, 60^o, 75^o, 90^o, 105^o, 120^o, 135^o, 150^o, 165^o, 180^o).
2.	Solve all problems for all sheets number 1 to 8 in sketch book (with dimensions).
3.	List the shapes you are observing around you in real life with place/item. (For ellipse, parabola and hyperbola).
4.	Take two simple objects. Sketch isometric of them. Also draw orthographic projections of them (all views).
5.	Take one circular shape. Assume one point on circumference and mark it. Roll that shape on flat and circular surface. Observe the path of point.
6.	List at least two questions individually which you would like to ask for followings: • Ellipse • Involute of circle • Perspective projections • Use of geometric constructions • Quadrants

10. Textbooks

1) Elements of Engineering Drawing, N.D. Bhatt, Charotar Publishing House, Anand.
2) Engineering Drawing, P.J. Shah, S. Chand, New Delhi.

11. Reference Books

1) Fundamentals of Engineering Drawing, French & Vierck, McGraw-Hill
2) Fundamentals of Drawing, K.R. Gopalkrishna, Subhash Publications, Bangalore.
3) Fundamentals of Engineering Drawing, W.J. Luzzadar, Prentice-hall of India Pvt. Ltd.-New Delhi
4) Engineering Drawing, M.B. Shah, B.C. Rana, Pearsons.
5) Machine Drawing., V. Laxminarayan & M.L. Mathur, Jain Brother, New Delhi.
6) Engineering Drawing, N.S Parthasarathy & Vela Murali, Oxford University Press
7) Engineering Drawing, Principles & Applications, Lakhwinder Pal Singh, Cambridge University Press
8) Engineering Drawing and Descriptive Geometry, Charles James Walsh, Harvard University Press
9) Engineering Drawing + AutoCAD, K. Venugopal, New Age International Publishers
10) Engineering Graphics Using Autodesk Inventor, Jobin Joy, J.J. Publications
11) Bureau of Indian Standards, Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint.
12) Engineering Graphics & Design, Jain & Gautam, Khanna Publishing House, New Delhi
13) Engineering Drawing, D.A. Jolhe, Tata McGraw Hill Edu, New Delhi
14) Engineering Drawing, R. K. Dhawan, S. Chand and Company, New Delhi
15) Engineering Graphics with AutoCAD, D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, PHI Learning Private Limited, New Delhi
16) Essentials of Engineering Drawing and Graphics using AutoCAD, T. Jeyapoovan, Vikas Publishing House Pvt. Ltd, Noida
17) An Introduction to AutoCAD for Beginners, Autodesk Press, San Rafael, California, USA.

12. Open Sources (Website, Video, Movie)

1) https://nptel.ac.in/courses/112/103/112103019/
2) https://nptel.ac.in/courses/112/104/112104172/
3) https://nptel.ac.in/courses/112/105/112105294/
4) http://web.iitd.ac.in/~hirani/mel110-part3.pdf
5) https://www.coursera.org/
6) http://www.technologystudent.com/designpro/drawdex.htm
7) http://ljku.edu.in/
8) https://www.youtube.com/playlist?list=PLSQj2zZx2KxcWCv4IFMrCBm9e21nb0Mzu
9) https://rgpv-ed.blogspot.com/2009/02/engineering-curves.html
10) http://www.slideshare.net/sahilsahil992/conic-section-1819818
11) http://www.technologystudent.com/designpro/drawdex.htm
12) http://web.iitd.ac.in/~hirani/mel110-part3.pdf
13) http://www.youtube.com/watch?v=a703_xNeDao
14) http://www.youtube.com/watch?v=TCxTP_8ggNc
15) http://www.youtube.com/watch?v=o1YPja2wCYQ
16) http://www.youtube.com/watch?v=dJyKV3Ay7vM
17) E-learning package from KOROS
18) E-learning package from Cognifront
19) CD with book-Engineering drawing, M.B. Shah-B.S. Rana (Pearson)
20) Computer based learning material published by KOROS