



Three-Year Diploma Programme

**Diploma in
Aeronautical
Engineering**

**Faculty of Engineering &
TechnologyParul University
Vadodara, Gujarat, India**

**Faculty of Engineering &
Technology
Diploma in Aeronautical Engineering**

1. Vision of the Department

“The vision of the Diploma Aeronautical Engineering Department at Parul University is to be recognized as a premier institution for aeronautical education, research, and industry collaboration, producing skilled graduates equipped to excel in the dynamic aerospace industry while upholding values of innovation, sustainability, and ethical responsibility.”

2. Mission of the Department

M1: Education and Training Provide comprehensive education and training in aeronautical engineering fundamentals, principles, and practical applications. Equip students with the necessary skills, knowledge, and competencies to excel in various aspects of aeronautical engineering. Foster a learning environment that promotes critical thinking, problem-solving, creativity, and innovation

M2. Research and Development Conduct cutting-edge research and development activities in aeronautical engineering. Explore emerging technologies, methodologies, and solutions to address current and future challenges in the aerospace industry. Collaborate with industry partners, research institutions, and other stakeholders to advance knowledge and contribute to the advancement of the field.

M3: Industry Engagement and Collaboration. Forge strong partnerships and collaborations with industry leaders, organizations, and stakeholders in the aerospace sector. Provide opportunities for students to engage in real-world projects, internships, and industry placements to gain practical experience and exposure to industry practices. Facilitate knowledge transfer, technology exchange, and continuous professional

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the Diploma Aeronautical Engineering curriculum enables graduates to attain.

PEO 1	Preparation: To prepare students to succeed in employment/profession and/or to pursue under graduate educations in Aeronautical Engineering discipline in particular and allied Engineering discipline in general.
PEO 2	Core Competence: To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to formulate, analyses and solve engineering problems requiring knowledge of Aeronautical Engineering. Graduates will exhibit proficiency in applying engineering principles and practices to identify, analyze, and solve technical problems, demonstrating their ability to adapt to evolving

	technologies and contribute effectively to multidisciplinary teams.
PEO 3	Graduates will understand the ethical implications of their work and demonstrate a commitment to social responsibility by engaging in projects and activities that address societal needs, adhere to professional standards, and prioritize health, safety, and environmental considerations.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	Basic and Discipline specific knowledge	Apply knowledge of basic mathematics, science and Engineering fundamentals and Aeronautical engineering specialization to solve the engineering problems.
PLO 2	Problem analysis:	Identify and analyze complex engineering problems systematically, well-defined engineering problems using codified standard methods.
PLO 3	Design/ development of solutions	Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
PLO 4	Engineering Tools, Experimentation and Testing:	Apply modern engineering tools, software, and technologies to aid in analysis and appropriate technique to conduct standard tests and measurements.
PLO 5	Engineering practices for society, sustainability and environment	Apply appropriate technology in context of society, sustainability, environment and ethical practices.
PLO 6	Project Management	Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
PLO 7	Life-long learning	Ability to analyze individual needs and engage in updating in the context of technological changes.

5. Program Specific Learning Outcomes

PSO 1	Demand as per recent development	An ability to apply the principle of core engineering fundamentals of Thermodynamics, Measurement and Instrumentation
--------------	---	---

6. Mapping of Program Educational Objectives and Mission statement

	M1	M2	M3
PEO 1	√		√
PEO 2		√	
PEO 3	√		√

7. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	15
Semester-2	20

Semester-3	20
Semester-4	20
Semester-5	27
Semester-6	25
Total Credits:	127

Category wise Credit distribution of the programme	
Category	Credit
Major Core	70
Minor Stream	19

Multidisciplinary	18
Ability Enhancement Course	3
Skill Enhancement Courses	2
Value added Courses	0
Summer Internship	2
Research Project/Dissertation	13
Total Credits:	127

8. Program Curriculum

Semester 1						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03605101	Environmental Science	0	2	-	0
2	03606102	Introduction to IT Systems Lab	2	-	4	0
3	03609101	Engineering Graphics	1	1	-	0
4	03609102	Engineering Graphics Lab	2	-	4	0
5	03609154	Engineering Workshop Practice	2	-	4	0
6	03691101	Mathematics - I	3	2	-	1
7	03692103	Applied Physics	3	3	-	0
8	03692104	Applied Physics Lab	1	-	2	0
9	03693103	Communication Skills - I	1	1	-	0
Total			15	9	14	1
Semester 2						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03605151	Engineering Mechanics	3	3	-	-
2	03605152	Engineering Mechanics Lab	1	-	2	-
3	03607151	Fundamentals of Electrical and Electronics Engineering	3	2	-	1
4	03607152	Fundamentals of Electrical and Electronics Engineering Lab	1	-	2	-
5	03609151	Fundamentals of Mechanical Engineering	3	2	-	1
6	03609203	Material Science	3	3	-	-
7	03609204	Material Science Lab	1	-	2	-
8	03691151	Mathematics-II	4	3	-	1
9	03693153	Communication Skills - II	1	1	-	-
Total			20	14	6	3
Semester 3						

Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03600201	Entrepreneurship and Start-ups	1	1	-	-
2	03613201	Introduction to Aeronautics	3	3	-	-
3	03613202	Aeromodeling Lab	1	-	2	-

4	03613203	Mechanisms for Machines and Aircrafts	3	3	-	-
5	03613204	Mechanisms for Machines and Aircrafts Lab	1	-	2	-
6	03613205	Aircraft Materials and Manufacturing	3	3	-	-
7	03613206	Aircraft Materials and Manufacturing Lab	1	-	2	-
8	03613207	Basic Engineering Thermodynamics	3	3	-	-
9	03613209	Aircraft Instruments	3	3	-	-
10	03693203	Professional Communication and Critical Thinking	1	1	-	-
Total			20	17	6	-
Semester 4						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03600251	Essence of Indian Knowledge and Tradition	0	2	-	-
2	03613251	Mechanics and Strength of Materials	3	3	-	-
3	03613252	Mechanics and Strength of Materials Lab	1	-	2	-
4	03613253	Computer Aided Modeling and Design-I	2	2	-	-
5	03613254	Computer Aided Modeling and Design-I Lab	2	-	4	-
6	03613255	Fundamentals of Fluid Mechanics	3	3	-	-
7	03613256	Fundamentals of Fluid Mechanics Lab	1	-	2	-
8	03613257	Aircraft Systems	3	3	-	-
9	03613259	Basic Avionics	3	3	-	-
Total			20	17	8	-
Semester 5						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03613301	Aerodynamics	3	3	-	-
2	03613302	Aerodynamics Lab	1	-	2	-
3	03613303	Aircraft Structures	4	4	-	-
4	03613304	Aircraft Structures Lab	1	-	2	-
5	03613305	Aerospace Propulsion	3	3	-	-
6	03613306	Aerospace Propulsion Lab	1	-	2	-
7	03613308	Major Project-I	6	-	12	-
8	03613312	Summer Internship	2	-	-	-
9		Open Elective-I (Compulsory Subjects :1)	3	3	-	-
10		Program Elective - I (Compulsory Subjects :1)	3	3	-	-

Total	27	16	18	-
--------------	-----------	-----------	-----------	----------

Open Elective 01						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03609339	Robotics and Automation Technology	3	3	-	-
2	03609341	Metrology and Instrumentation	3	3	-	-
Program Elective 01						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03613331	Principles of Helicopter Engineering	3	3	-	-
2	03613333	Airport Operations and Management	3	3	-	-
Semester 6						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03600351	Indian Constitution	0	2	-	-
2	03613351	Introduction to Flight Mechanics	4	3	-	1
3	03613353	Aircraft Maintenance	4	4	-	-
4	03613354	Aircraft Maintenance Lab	1	-	2	-
5	03613355	Computer Aided Modelling and Design- II	2	2	-	-
6	03613356	Computer Aided Modelling and Design-II Lab	2	-	4	-
7	03613358	Major Project-II	6	-	12	-
8		Open Elective-II (Compulsory Subjects :1)	3	3	-	-
		Program Elective - II (Compulsory Subjects :1)	3	3	-	-
Total			25	17	18	1
Open Elective-II						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03609381	Principles of Heat Transfer	3	3	-	-
2	03609383	Industrial Engineering	3	3	-	-
Program Elective - II						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	03613381	Rockets and Missiles Technology	3	3	-	-
2	03613383	Lighter than Air Systems	3	3	-	-

ANNEXURE-III

Semester 1

- a. Course Name: Environmental Science**
- b. Course Code: 03605101**
- c. Prerequisite: Zeal to learn the subject**
- d. Rationale:** The course is designed to give developers a general awareness of these and related issues so that every student will start acting as a responsible citizen to make the country and the world a better place to live in.
- e. Course Learning Objective:**

CLOBJ 1	Understanding Ecosystem Structure and Describe the components of an ecosystem, including both biotic and abiotic factors and understand the significance of these cycles in maintaining ecosystem balance.
CLOBJ 2	Evaluate air and noise pollution sources, effects, and control measures, considering both natural and anthropogenic factors. Studying Air and Noise Pollution and Identify common air pollutants and their sources. Evaluate noise pollution sources, measurement techniques, and regulatory measures
CLOBJ 3	Analyze characteristics such as turbidity, pH, BOD, and COD in water. Examine primary, secondary, and tertiary methods of wastewater treatment. Investigate causes, effects, and preventive measures of soil pollution.
CLOBJ 4	Explore the basics of solar energy and different solar technologies and Evaluate biomass as an energy source, including its thermal characteristics and biogas production. Investigate new energy sources like hydrogen, ocean energy, tidal energy, and geothermal energy.
CLOBJ 5	Understand the principles of the 3Rs (Reduce, Reuse, Recycle) in solid waste management. Evaluate methods of energy recovery and disposal, including sanitary landfill for municipal solid waste.

f. Course Learning Outcomes:

CLO 1	Understand the ecosystem and terminology and solve various engineering problems applying
CLO 2	Ecosystem knowledge to produce eco – friendly products.
CLO 3	Understand the suitable air, the extent of noise pollution, and control measures and acts.
CLO 4	Understand the water and soil pollution, and control measures and acts.
CLO 5	Understand different renewable energy resources and efficient process of harvesting.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Understand the ecosystem and terminology and solve various engineering

	problems applying
CLO 2	Ecosystem knowledge to produce eco – friendly products.
CLO 3	Understand the suitable air, the extent of noise pollution, and control measures and acts.
CLO 4	Understand the water and soil pollution, and control measures and acts.
CLO 5	Understand different renewable energy resources and efficient process of harvesting.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	0	20	20	-	-	-	40

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Ecosystem: Structure of ecosystem, Biotic & Abiotic components, Food chain and food web Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global warming -Causes, effects, process, Green House Effect, Ozone depletion.	15%	3
2	Air and Noise Pollution: Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator). Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler, Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.	22%	6
3	Water and Soil Pollution: Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation. Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO	24%	8

	(reverse osmosis), Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.		
4	Renewable Sources of energy: Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy. New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.	24%	8
5	Solid Waste management: Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.	15%	3

j. Text Book and Reference Book:

1. "Principles of Solar Engineering" By Yogi Goswami D., Frank Kreith, Jan F. Kreider | Taylor & Francis, 2003 | Second.
2. "Environmental Studies" By M.P. Poonia, S.C. Sharma | Khanna Publishing House, NewDelhi | 2017.
3. "Renewable Energy Sources" By Twidell J.W. and Weir. A | EFN Spon Ltd"Linear Systems and Signals" by B.P. Lathi.
4. "Environmental Sciences", By Daniel B Botkin & Edward A Keller, | John Wiley & Sons
5. "Air Pollution", By M. N. Rao and H. V. N. Rao | Tata McGraw-Hill Publishing Company
6. "Environmental Pollution Control Engineering", By Rao C.S | 2nd edition
7. "Solid Waste Treatment and Disposal", By G. Tchabanoglous | McGraw Hill Pub.

a. Course Name: Introduction to IT Systems Lab

b. Course Code: 03606102

c. Prerequisite: Basic knowledge of Computer.

d. Rationale: This course aims to teach students basics of computer including hardware and software.

e. Course Learning Objective:

CLOBJ 1	Understand functional units and components of computer
----------------	--

CLOBJ 2	Familiarize the students with basic functions Internet applications.
CLOBJ 3	Enable the students in preparing documents and presentations.
CLOBJ 4	Students can create HTML pages

f. Course Learning Outcomes:

CLO 1	Know about different computer components& different types of memory.
CLO 2	Create excel sheet, power point, word, access database etc.
CLO 3	Use internet effectively.
CLO 4	Create dynamic webpages including style sheet.
CLO 5	Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Know about different computer components& different types of memory.
CLO 2	Create excel sheet, power point, word, access database etc.
CLO 3	Use internet effectively.
CLO 4	Create dynamic webpages including style sheet.
CLO 5	Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. "Basic Computer Course Made Simple", by Satish Jain | BPB Publication
2. "Basic Computer Engineering" By Sanjay Silakari and Rajesh K Shukla | Wiley India Pvt. Limited, Pub. Year 2011
3. "Computer Fundamentals", By P.K. Sinha | BPB Publications.
4. "HTML & CSS: The Complete Reference", By Thomas A. Powell | McGraw Hill

j. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Study practical of computer components.
2	Study practical of different OS installation (Windows, Linux, Ubuntu).
3	Write a script for basic OS commands.
4	Write a script for basic operators in OS.
5	Study practical of Internal structure and components of storage devices (Hard disk components).
6	Study practical of input working devices (Keyboard, Mouse, scanner).
7	Study practical of output working devices (Monitor, Printer).
8	Write a HTML code to display Hello world
9	Write a HTML code to create a table for student marksheet.
10	Write a HTML code to create a simple registration form.
11	Write a CSS to create user define tag.
12	Write an HTML code to create static website using CSS
13	Study practical of evolution and working of internet.
14	Study practical of surfing techniques in internet
15	Create your Gmail account and use different services provided by Google like Google drive, sharable sheet etc.
16	Perform various DOS commands
17	Develop an excel sheet which has record of 50 students result of 5 subjects and make following analysis 1) Fetch the data of the student who has distinction 2) Fetch the data of students with minimum marks in each subject. 3) Sort the data based on percentage
18	Create a presentation of your favourite movie using animation
19	Create a word file for your resume
20	Create library management database in access with minimum 5 tables in it.

a. Course Name: Engineering Graphics

b. Course Code: 03609101

c. Prerequisite: Drawing basic knowledge

d. Rationale: Engineering drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. It is the transmitting link between ideas and realization. It is an attempt to develop fundamental Understanding and application of engineering drawing. It covers knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian standards.

e. Course Learning Objective:

CLOBJ 1	Understand the specifications and proper usage methods of drawing equipment and instruments.
CLOBJ 2	Understand standard practices for planning and layout in engineering

	graphics and apply orthographic projection techniques to convert pictorial views into orthographic views.
CLOBJ 3	Understand various dimensioning methods and their applications.
CLOBJ 4	Understand the process of constructing polygons and apply isometric projection techniques to create isometric drawings of objects containing lines, circles, and arcs.
CLOBJ 5	Understand the concepts of conic sections and their construction methods.

f. Course Learning Outcomes:

CLO 1	Students should be able to demonstrate a solid understanding of the fundamental principles of engineering drawing, including line types, dimensioning, scale, and projection methods.
CLO 2	Students should be proficient in manual drafting techniques as well as computer-aided drafting (CAD) software, such as AutoCAD or SolidWorks, to create accurate and detailed engineering drawings.
CLO 3	Develop the ability to visualize three-dimensional objects from two-dimensional representations and vice versa, enabling students to interpret engineering drawings effectively.
CLO 4	Students should be able to interpret complex engineering drawings, including orthographic projections, isometric drawings, sectional views, and assembly drawings, to understand the design intent and manufacturing specifications.
CLO 5	Gain proficiency in geometric construction techniques, such as creating polygons, circles, and tangents, as well as understanding geometric relationships and constraints in engineering design.

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Students should be able to demonstrate a solid understanding of the fundamental principles of engineering drawing, including line types, dimensioning, scale, and projection methods.
CLO 2	Students should be proficient in manual drafting techniques as well as computer-aided drafting (CAD) software, such as AutoCAD or SolidWorks, to create accurate and detailed engineering drawings.
CLO 3	Develop the ability to visualize three-dimensional objects from two-dimensional representations and vice versa, enabling students to interpret engineering drawings effectively.
CLO 4	Students should be able to interpret complex engineering drawings, including orthographic projections, isometric drawings, sectional views, and assembly drawings, to understand the design intent and manufacturing specifications.
CLO 5	Gain proficiency in geometric construction techniques, such as creating polygons, circles, and tangents, as well as understanding geometric relationships and constraints in engineering design.

Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	0	1	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Drawing equipment's, instruments and materials. Equipment's-types, specifications, method to use them, applications. Instruments-types, specifications, methods to use them and applications. Pencils-grades, applications, types of points and applications. Other materials-types and applications.	4	1
2	Planning, Layout And Scaling Of Drawing Follow and apply standard practice as per bureau of I.S. for planning and layout, Choose appropriate scale factor for the drawing as per given situation	4	0
3	Lines, Lettering and dimensioning: Different types of lines. Vertical capital and lower-case letters. Inclined capital and lower-case letters. Numerals and Greek alphabets. Dimensioning methods. Aligned method. Unilateral with chain, parallel, progressive and combined dimensioning.	4	0
4	Geometric Construction: Geometric construction related with line like bisecting a line, to draw perpendicular with a given line, divide a line, etc. Geometric construction related with angle like bisect an angle, trisect an angle, etc. To construct polygon. Triangle, Square / Rectangle, Pentagon with special method. d: Hexagon with special method. To draw tangents. Geometric construction related with circle & arc.	7	2
5	Engineering Curves: Conic sections: Concept and understanding of focus, directory, vertex and eccentricity and drawing of conic sections. Using various methods, understand construction of: Ellipse. Parabola. Hyperbola. Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid) Involute. Involute of a circle, Involute of a polygon, Spiral (Archimedean spiral only).	22	3
6	Projection Of Points, Lines And Planes Reference planes, orthographic projections. Concept of quadrant. 1st angle and	25	2

	3rd angle projection and their symbols. Projection of points. 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 plane. Line inclined to one plane and parallel to another. Line inclined to both the planes. 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.		
7	Orthographic Projections: Types of projections-orthographic, perspective, isometric and oblique: concept and applications. Various term associated with orthographic projections. Theory of projection, Methods of projection, Orthographic projection, Planes of projection. Conversion of simple pictorial views into Orthographic views. Illustrative problems on orthographic projection B.I.S. code of practice	22	3
8	Isometric Projections: Isometric axis, lines and planes. Isometric scales. Isometric view and isometric drawing. Difference between isometric projection and isometric drawing. Illustrative problems limited to objects containing lines, circles and arcs shape only.	12	3

i. Text Book and Reference Book:

1. “ENGINEERING GRAPHICS” By P. J. Shah | S. Chand & Co., New Delhi Publications.
2. “A Text Book of Engineering Graphics” By P.J.Shah | S.Chand & Company Ltd., New Delhi
3. “Engineering Drawing” By P.J.Shah. | S.Chand, New Delhi

a. Course Name: Engineering Graphics Lab

b. Course Code: 03609102

c. Prerequisite: Zeal to learn the subject

d. Rationale: Engineering Drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link between ideas and realization.

e. Course Learning Objective:

CLOBJ 1	Gain proficiency in creating technical drawings using manual drafting tools such as drawing boards, T-squares, triangles, and drafting pencils, as well as computer-aided drafting (CAD) software.
CLOBJ 2	Develop the ability to visualize three-dimensional objects from two-dimensional drawings and vice versa. This includes understanding orthographic projection, isometric projection, and other projection methods.
CLOBJ 3	Acquire the ability to interpret engineering drawings accurately, identifying various features, dimensions, and tolerances represented in the drawings.

CLOBJ 4	Apply engineering graphics principles to solve design problems, including visualization of complex geometries, interference detection, and tolerance analysis.
----------------	--

f. Course Learning Outcomes:

CLO 1	Students will demonstrate the ability to use engineering graphics principles to solve design problems, including visualization of complex geometries, interference detection, and tolerance analysis.
CLO 2	Students will be able to create assembly drawings that depict the relationships between components and detail drawings that provide precise information about individual parts.
CLO 3	Students will demonstrate the ability to visualize three-dimensional objects from two-dimensional drawings and vice versa, effectively communicating design concepts through sketches and drawings.
CLO 4	Students will be able to apply GD&T symbols and practices to specify geometric characteristics, ensuring proper fit, form, and function of mechanical components.

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Students will demonstrate the ability to use engineering graphics principles to solve design problems, including visualization of complex geometries, interference detection, and tolerance analysis.
CLO 2	Students will be able to create assembly drawings that depict the relationships between components and detail drawings that provide precise information about individual parts.
CLO 3	Students will demonstrate the ability to visualize three-dimensional objects from two-dimensional drawings and vice versa, effectively communicating design concepts through sketches and drawings.
CLO 4	Students will be able to apply GD&T symbols and practices to specify geometric characteristics, ensuring proper fit, form, and function of mechanical components.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	4	2	-	-	100	-	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. Engineering Drawing Practice for Schools and Colleges By Bureau of Indian Standards | Government of India, Pub. Year 1998
2. Engineering Drawing By N. D. Bhatt | Charotar Publishing House, Pub. Year 2010
3. Engineering Graphics & Design By Jain & Gautam | Khanna Publishing House
4. Engineering Drawing By D. A. Jolhe | Tata McGraw Hill Edu
5. Engineering Drawing By R. K. Dhawan | S. Chand and Company

j. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Use of drawing instruments
2	Geometric construction
3	Engineering curves – i
4	Engineering curves – ii
5	Projections of points and line
6	Projections of plane
7	Orthographic projections
8	Isometric drawings

a. Course Name: Engineering Workshop Practice

b. Course Code: 03609154

c. Prerequisite: Learn about fundamental of mechanical and electrical engineering

d. Rationale: Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems. The workshop experiences would help to build the understanding of the complexity of the industrial job, along with time and skills requirements of the job. Workshop curricula build the hands on experiences which would help to learn manufacturing processes and production technology courses in successive semesters. Workshop practice is also important since only practice can make the man perfect

e. Course Learning Objective:

CLOBJ 1	To develop general machining skills in the students.
CLOBJ 2	To develop a skill in dignity of labour, precision, safety at work place, team Working and development of right attitude.
CLOBJ 3	To Apply the Engineering Workshop Practice for engineers is a training lab course spread over entire semester. The modules include training on different trades like Fitting, Carpentry, Black smithy etc... which makes the

	students to learn how various joints are made using wood and other metal pieces
--	---

f. Course Learning Outcomes:

CLO 1	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines.
CLO 2	Understand job drawing and complete jobs as per specifications in allotted time.
CLO 3	Inspect the job for the desired dimensions and shape.
CLO 4	Operate, control different machines and equipment's adopting safety practices.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines.
CLO 2	Understand job drawing and complete jobs as per specifications in allotted time.
CLO 3	Inspect the job for the desired dimensions and shape.
CLO 4	Operate, control different machines and equipment's adopting safety practices.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. Mechanical workshop practice By K.C. John
2. A Textbook of Electrical Workshop Practices By Dr. Umesh Rathore | S.K. Kataria & Sons
3. A Course in Workshop Technology By Raghuwamsi B S | Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi., Pub. Year 1982
4. Workshop Practice Manual By K. Venkat Reddy | BS Publications
5. Elements of Workshop Technology Vol. I By Hajra Chaudhary S.K. | Asia Publishing House

j. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	To A Perform a Job in Carpentry Shop.
2	To A Perform a Job in Tim Smithy.
3	To Perform a Job on Fitting Practice.
4	To Perform a Job on Soldering.
5	To Perform a Job on Welding.
6	To Perform a Job on plumbing.
7	To Perform a Job on Sheet Metal Practice.
8	Identify Different symbol used in electrical installation and prepare sheet.
9	Identify the different tools used in electrical installation.
10	Demonstration of measuring instrument Voltmeter, Ammeter, Wattmeter.
11	Demonstration of testing instruments: Multi meter, Clip-on meter, Megger, Line tester.
12	Demonstration of different cables used in electrical installation.
13	Demonstration of different switches used in electrical installation.
14	Demonstration of protective devices: fuse, MCB, ELCB.
15	Identify different types of domestic wirings.

a. Course Name: Mathematics - I

b. Course Code: 03691101

c. Prerequisite: Knowledge of basic concept studied till 10th std.

d. Rationale: The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects

e. Course Learning Objective:

CLOBJ 1	Evaluate logarithms by converting between logarithmic and exponential forms. Find unknown bases or arguments in simple logarithmic equations, solve word problems involving evaluating logarithms, Differentiate types of partial fractions
CLOBJ 2	Understand the concept of angles, Calculate T-Ratios of Allied angles, utilize product formulae for transforming product to sum, difference, and vice versa, Calculate T-Ratios of multiple angles and sub-multiple angles, Graph all trigonometric functions
CLOBJ 3	Define complex numbers, represent complex numbers in Polar and Cartesian forms, Understand the geometric representation of complex numbers and their operations, Apply De Moivre's Theorem for roots of complex numbers

	and simplifying mathematical expressions
CLOBJ 4	Define functions and limits, calculate derivatives using the first principle and differentiation rules, differentiate standard functions including algebraic, trigonometric, exponential, logarithmic, implicit, and composite functions
CLOBJ 5	Calculate higher-order derivatives

f. Course Learning Outcomes

CLO 1	Use Logarithms in engineering calculations.
CLO 2	Represent Complex numbers in various forms like modulus-amplitude (polar) form, Exponential (Euler) form – illustrate with examples.
CLO 3	Resolve Rational Fraction into sum of Partial Fractions in engineering problems
CLO 4	Understand Trigonometric Ratios and solve problems using the formulae for Multiple and Sub multiple Angles
CLO 5	Use the concepts of Limit and Continuity for solving the problems, Appreciate Differentiation and its meaning in engineering situations

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Use Logarithms in engineering calculations.
CLO 2	Represent Complex numbers in various forms like modulus-amplitude (polar) form, Exponential (Euler) form – illustrate with examples.
CLO 3	Resolve Rational Fraction into sum of Partial Fractions in engineering problems
CLO 4	Understand Trigonometric Ratios and solve problems using the formulae for Multiple and Sub multiple Angles
CLO 5	Use the concepts of Limit and Continuity for solving the problems, Appreciate Differentiation and its meaning in engineering situations

h) Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	-	3	20	20	-	60	-	100

Lect - Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** – Continuous Evaluation, **T** - Theory, **P** – Practical

Contents:

Sr. No.	Topic	Weightage	Teaching Hrs.
1.	Unit I: Logarithms: Definition, Logarithm as a transformation, Antilogarithm, Rules of Logarithms and examples, use logarithmic functions for simplifying arithmetic computations. Partial fractions: Definition of partial fractions. Types of partial fraction (Denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors).	17%	4
2.	Unit II: Trigonometry: Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Trigonometric identities, Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2). Graphs of all trigonometric functions	23%	7
3.	Unit III: Complex Numbers: Definition of a complex number, real and imaginary parts of a complex number, Polar and Cartesian representation of complex number, Conjugate of complex number, Geometric representation of complex numbers and their operations, Modules and Amplitude form, De Moivre's Theorem, Root of Complex Number, Use of De Moivre's Theorem to simplify mathematical expressions.	17%	4
4.	Unit IV: Function and Limit: Definition and concept of function, Concept of limits and standard forms of limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}, \lim_{x \rightarrow 0} \frac{\sin x}{x}, \lim_{x \rightarrow a} \left(\frac{a^x - 1}{x} \right) \text{ and } \lim_{x \rightarrow a} (1 + x)^{\frac{1}{x}}$	9%	3

5.	Unit V: Calculus: Definition of derivative, differentiation of standard function by first principle, Rule of Differentiation, Differentiation of algebraic, trigonometric, Exponential, Logarithmic, Implicit functions and Composite functions, Higher order derivatives.	34%	10
----	--	-----	----

REFERENCE BOOKS:

1. Advanced Mathematics for Polytechnic, Pandya N R , Macmillan Publishers India Ltd.
2. Engineering Mathematics (Diploma Stream), H.K. Dass, S. Chand Publishing
3. Mathematics for Polytechnic, S.P. Deshpande, Pune Vidyarthi Griha Prakashan
4. Polytechnic Mathematics (Made Easy)(Applied Mathematics) , Manjeet Singh, Dhanpat Rai & Co. (P) Ltd (Publisher)

a. Course Name: Applied Physics

b. Course Code:03692103

c. Prerequisite: Understanding of fundamental physics principles such as mechanics, thermodynamics, Knowledge of key physical laws and theories, such as Newton's laws of motion.

d. Rationale: It fuels technological advancements by providing the scientific foundation for the development of new materials, devices, and systems. Applied physics underpins innovations in areas such as electronics, renewable energy, telecommunications, and healthcare. Applied physics serves as a practical problem-solving tool by utilizing fundamental physical principles to address real-world issues encountered in engineering, technology, medicine, and other fields

e. Course Learning Objective:

CLOBJ 1	Understand the concept of physical quantities, distinguishing between fundamental and derived quantities. Learn about measurements, measuring instruments, errors in measurements, and the significance of significant figures.
CLOBJ 2	Differentiate between scalar and vector quantities, and perform operations like addition and subtraction of vectors. Understand force, momentum, and the principle of conservation of linear momentum.
CLOBJ 3	Define work and power and calculate them in numerical problems. Examine the conservation of mechanical energy and its applications. Study friction, including types, laws of limiting friction, and its engineering applications.
CLOBJ 4	Understand the concepts of elasticity, stress, and strain, including Hooke's law. Explore surface tension, viscosity, and their effects, including applications in hydraulic systems. Study fluid motion, stream line and

	turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and its applications.
CLOBJ 5	Learn about heat and temperature, modes of heat transfer, and specific heats. Explore various types of thermometers and their uses in temperature measurement.

f. Course Learning Outcomes:

CLO 1	Demonstrate understanding of fundamental physical principles. Apply units and measurements effectively. Utilize dimensional analysis for problem-solving. Analyze experimental data accurately.
CLO 2	Define force and Newton's laws. Apply Newton's laws to analyze motion. Calculate net force and predict motion. Understand concepts of inertia, momentum, and friction.
CLO 3	Define work, power, and energy. Calculate work, power, and energy transformations. Analyze simple machines and mechanical advantage. Apply conservation of energy principles.
CLO 4	Describe matter's atomic and molecular structure. Identify states of matter and explain properties. Investigate behavior under different conditions. Explore properties like density, viscosity, and elasticity.
CLO 5	Define heat, temperature, and heat transfer methods. Measure temperature using thermometric scales. Apply laws of thermodynamics to analyze systems.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Demonstrate understanding of fundamental physical principles. Apply units and measurements effectively. Utilize dimensional analysis for problem-solving. Analyze experimental data accurately.
CLO 2	Define force and Newton's laws. Apply Newton's laws to analyze motion. Calculate net force and predict motion. Understand concepts of inertia, momentum, and friction.
CLO 3	Define work, power, and energy. Calculate work, power, and energy transformations. Analyze simple machines and mechanical advantage. Apply conservation of energy principles.
CLO 4	Describe matter's atomic and molecular structure. Identify states of matter and explain properties. Investigate behaviour under different conditions. Explore properties like density, viscosity, and elasticity.
CLO 5	Define heat, temperature, and heat transfer methods. Measure temperature using thermometric scales. Apply laws of thermodynamics to analyze systems.

h. Teaching & Examination Scheme:

a) Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-		3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

Sr. No.	Topic	Weightage	Teaching Hrs.
1.	Unit 1: Physical world, Units and Measurements Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis. Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.	15 %	6
2.	Unit 2: Force and Motion Scalar and Vector quantities – examples, representation of vector, types of vectors. Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product, Resolution of a Vector and its application to inclined plane and lawn roller. Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, rockets, Impulse and its applications.	20%	9
3	Unit 3: Work, Power and Energy Work: Concept and units, examples of zero work, positive work and negative work Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane for rough and plane surfaces and related applications. Energy and its units, kinetic energy, gravitational potential energy with examples and derivations, mechanical energy, conservation of mechanical energy for freely falling bodies, transformation of energy (examples). Power and its units, power and work relationship, calculation of power (numerical problems).	25%	9

4.	Unit 5: Properties of Matter Elasticity: definition of stress and strain, moduli of elasticity, Hooke's law, significance of stress-strain curve. Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications. Surface tension: concept, units, cohesive and adhesive forces, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension. Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems. Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula and numerical) and its applications.	25%	12
5.	Unit 6: Heat and Thermometry Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with examples), specific heats, scales of temperature and their relationship, Types of Thermometer (Mercury thermometer, Bimetallic thermometer, Platinum resistance thermometer, Pyrometer) and their uses. Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Co-efficient of thermal conductivity, engineering applications.	15%	6

References Book:-

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
5. Engineering Physics by DK Bhattacharya & PoonamTandan; Oxford University Press, New Delhi.
6. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
7. Practical Physics by C. L. Arora, S. Chand Publication.
8. e-books/e-tools/ learning physics software/websites etc.

a. Course Name: Applied Physics Lab

b. Course Code:03692104

c. Prerequisite: The ability to think critically, identify potential sources of error, and troubleshoot experimental setups is crucial in a physics lab.

d. Rationale: Physics involves quantitative analysis and mathematical modeling to describe physical phenomena. Applied physics education helps students develop

quantitative and analytical skills that are valuable in a wide range of academic and professional settings.

e. Course Learning Objective:

CLOBJ 1	Students will learn to make accurate measurements using precision instruments such as Vernier calipers and screw gauges, and apply mathematical concepts to calculate physical quantities such as volume and diameter.
CLOBJ 2	Students will develop practical laboratory skills through hands-on experimentation, including the use of equipment such as Fly wheel, Red wood Viscometer and Searl's apparatus
CLOBJ 3	Students will gain an understanding of capillary rise method
CLOBJ 4	Students will apply physics principles to real-world situations, such as measuring spring constant and frequency of tuning fork of with a sonometer.
CLOBJ 5	Students will be able to determine Force constant with the help of periodic time of oscillations of spring and verify triangle and parallelogram law of forces.

f. Course Learning Outcomes:

CLO 1	Measure objects' dimensions accurately and calculate their volumes using Vernier calipers, enhancing precision in experimental techniques.
CLO 2	Determine diameters of various objects using a screw gauge, refining skills in measuring small dimensions.
CLO 3	Calculate the moment of inertia of a flywheel, demonstrating understanding of rotational dynamics principles.
CLO 4	Measure viscosity using a Redwood viscometer, developing proficiency in experimental methods for fluid mechanics.
CLO 5	Determine material properties such as the coefficient of linear expansion and Young's modulus, fostering understanding of material behavior under thermal and mechanical stress.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Measure objects' dimensions accurately and calculate their volumes using Vernier calipers, enhancing precision in experimental techniques.
CLO 2	Determine diameters of various objects using a screw gauge, refining skills in measuring small dimensions.
CLO 3	Calculate the moment of inertia of a flywheel, demonstrating understanding of rotational dynamics principles.

CLO 4	Measure viscosity using a Redwood viscometer, developing proficiency in experimental methods for fluid mechanics.
CLO 5	Determine material properties such as the coefficient of linear expansion and Young's modulus, fostering understanding of material behavior under thermal and mechanical stress.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination.

Experiment List with Course

i. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier calliper and find volume of each object.
2	To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.
3	To find the moment of inertia of a flywheel.
4	Measurement of Viscosity by Redwood Viscometer
5	To find the coefficient of linear expansion of the material of a rod. (Young's Modulus)
6	To find the co-efficient of friction between wood and glass using a horizontal board.
7	To find surface tension of a liquid using capillary rise method
8	To find frequency of given tuning fork with the help of a sonometer.
9	To determine radius of curvature of a convex and a concave mirror/surface using a spherometer.
10	To determine Force constant with the help of periodic time of oscillations of spring

11	To verify triangle and parallelogram law of forces
12	To determine force constant of a spring using Hook's Law.

j. List of Practical/Activities:

1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier calliper and find volume of each object.
2. To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.
3. To find the moment of inertia of a flywheel.
4. Measurement of Viscosity by Redwood Viscometer
5. To find the coefficient of linear expansion of the material of a rod.(Young's Modulus)
6. To find the co-efficient of friction between wood and glass using a horizontal board.
7. To find surface tension of a liquid using capillary rise method
8. To find frequency of given tuning fork with the help of a sonometer.
9. To determine radius of curvature of a convex and a concave mirror/surface using a spherometer.
10. To determine Force constant with the help of periodic time of oscillations of spring
11. To verify triangle and parallelogram law of forces.
12. To determine force constant of a spring using Hook's Law.

Course Name: Communication Skills-I

a. Course Code: 03693103

b. Prerequisite: Basic Knowledge of English

c. Rationale: Communication confidence laced with knowledge of English grammar is essential for all engineers.

d. Course Learning Objective:

CLOBJ 1	Encourage students to analyze information, evaluate arguments, and develop reasoned conclusions.
CLOBJ 2	Foster the ability to identify and solve complex problems through logical reasoning and creativity.
CLOBJ 3	Develop effective written, verbal, and non-verbal communication skills to express ideas clearly and persuasively.
CLOBJ 4	Teach students to work effectively in teams, valuing diverse perspectives and contributing positively to group efforts.
CLOBJ 5	Cultivate imaginative thinking and the ability to generate original ideas and solutions.

e. Course Learning Outcomes:

CLO 1	Analyze complex issues, evaluate evidence, and develop reasoned arguments to support their conclusions.
CLO 2	Identify problems, explore potential solutions, and implement strategies to address challenges effectively.
CLO 3	Articulate ideas clearly and persuasively in written, verbal, and non-verbal forms, adapting their communication style to different audiences and purposes.
CLO 4	Locate and critically evaluate information from various sources, demonstrating information literacy skills to support their learning and decision-making.
CLO 5	Create coherent and persuasive written and oral messages.

f. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Analyze complex issues, evaluate evidence, and develop reasoned arguments to support their conclusions.
CLO 2	Identify problems, explore potential solutions, and implement strategies to address challenges effectively.
CLO 3	Articulate ideas clearly and persuasively in written, verbal, and non-verbal forms, adapting their communication style to different audiences and purposes.
CLO 4	Locate and critically evaluate information from various sources, demonstrating information literacy skills to support their learning and decision-making.
CLO 5	Create coherent and persuasive written and oral messages.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	1	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination.

Note: 15 Hours of additional sessions will be taken (within the semester) to match up 30 hours content.

h. Course Content:

Sr. No	Content	Weightage	Teaching Hours
1	Ice breaker + Introducing your friend: This is one activity which will build the bond between the students in the class and work as a		

	team in the task given to them. The students will be asked to introduce their new best friend in the class. This will ensure that the bond being created here will stay strong and also breaks the ice between them.	05%	01
2	Picture connector: - In this class the students will be trained to form a logical connection between a set of pictures which will be shared with them. - This geared towards building creativity and presentation skills.	05%	01
3	Crazy Scientist: The students will be taught the importance of invention and innovation using some examples that changed the world the way it worked.	05%	01
4	Shopping role play: - This activity topic gears towards making students do role play based on shopping scenarios. - It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on to enact it.	05%	01
5	Grammar Parts of speech, Active and Passive voice, Tenses	20%	10
6	Communication: Theory & Practice Basics of communication: Introduction, meaning, definition, Process of communication Types of communication: Formal, Informal, Verbal / Non verbal and Written barriers to effective communication 7 Cs of effective communication: (considerate , concrete concise , clear, complete , correct and courteous) Technical Communication :	12%	05
7	Soft Skills for Professional excellence Introduction: Soft skills and hard skills, Importance of Soft Skills	12%	02
8	Debate: - Students are trained to let go of inhibitions and come forward and speak openly on passionate topics. - The students will be divided into teams and made to share their ideas and views on the topics.	05%	01
9	Extempore: - To change the average speakers in the class to some of the best Orator. - This will be done by making the students give variety of impromptu speeches in front of the class.	05%	01
10	Letter Writing Types of letters-Inquiry letter, Order letter,		

	Complaint letter,Adjustment, Request letter, Recommendation letter • Format of letters	12%	02
11	Reading Comprehension: • Dabbawalahs • A Snake in the grass • Internet – Dr. Jagdish Joshi	14%	05
	Total	100	30

***Continuous Evaluation:**

It consists of

1. Phase I Exam-35 Marks(Hybrid or Offline Mode)
2. Phase II Exam -35 Marks (Hybrid or Offline Mode)
3. Activities – (Listening and Speaking) -10+10=20 Marks
4. Attendance -10 Marks

The passing marks for Continuous Evaluation will be 40 out of 100. There will not be any re-test.

References Book/ Text Book

1. Active English –Almas Juneja and Vaseem Qureshi-Macmillan Publishers India Ltd
2. English- Prof. Pradyuman Raj, Prof. Rakhi Moghe, Ms. Anisha Modi
3. Technical Communication –Principles & Practice-IIInd Edition by Meenakshi Raman & Sangeeta Sharma.
4. Effective Technical Communication by Dr.Bharti Kukreja & Dr. Anupama Jain
5. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
6. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London:Wilson & Sons, 1908.
7. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi (Re-visedEdition 2018)
8. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
9. M.Ashraf Rizvi. Effective Communication. Mc-Graw Hill: Delhi, 2002.
10. A Ready Reckoner –Dineshbhai J. Shah, Dr.Janakbhai I. Shah,Bhartiben P. Shah.
11. Oxford Dictionary
12. Roget's Theasaurus of English Words and Phrases.

SEMESTER 2

- a. **Course Name: Engineering Mechanics**
- b. **Course Code: 03605151**
- c. **Prerequisite:** Knowledge of Applied science.

d. Rationale: Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.

e. Course Learning Objective:

CLOBJ 1	Identify force systems in diverse engineering scenarios through the application of fundamental mechanics principles.
CLOBJ 2	To impart knowledge about calculate the centroid and center of gravity for various components within engineering systems.
CLOBJ 3	To impart knowledge about force systems and methods to determine resultant.
CLOBJ 4	To impart knowledge about force systems and methods to determine resultant.
CLOBJ 5	Apply the principles of friction across various conditions to achieve practical objectives. Select appropriate eco-friendly lifting machines for specific purposes

f. Course Learning Outcomes:

CLO 1	Identify the force systems for given conditions by applying the basics of mechanics.
CLO 2	Find out the centroid and center of gravity of various components in engineering systems.
CLO 3	Determine unknown force(s) of different engineering systems.
CLO 4	Determine unknown force(s) of different engineering systems.
CLO 5	Apply the principles of friction in various conditions for useful purposes, Select the eco-friendly relevant simple lifting machine(s) for given purposes

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No	Content	Weightage	Teaching Hours
1	Basics of Mechanics: Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.	10%	2
2	Centroid and Centre of Gravity: Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle) Centroid of composite figures composed of not more than three geometrical figures. Centre of Gravity of simple solids (Cube, cuboids, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids.	10%	6
3	Coplanar Concurrent Forces: Force – Unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Newton's first, second and third Law of motion Principle of transmissibility of force, Principle of superposition of force, Force system and its classification. Lami's Theorem – statement and explanation, Application for various engineering problems. Resolution of a force .Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.	25%	10
4	Equilibrium and Coplanar Non-Concurrent Forces: Types of Equilibrium, Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium. Moment and couple, Varignon's Theorem. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load. Beam reaction graphically for simply supported beam subjected to vertical point loads only	25%	10
5	Friction: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Ladder Friction, Engineering Problems.	10%	6
6	Simple Lifting Machine: Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, Work – work done ,	20%	8

	force displacement diagram, Power , Engineering Problems Energy – Kinetic & Potential energy and Engineering Problems. Law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines.		
--	--	--	--

i. Text Book and Reference Book:

1. "Applied Mechanics" by H. J. Shah and S. B. Junarkar.
2. "A Text Book of Engineering Mechanics" by Bansal R K.
3. "Engineering Mechanics" by J.L. Meriam, and L.G.Kraige.
4. "Engineering Mechanics" by S.S. Bhavikatti and K. G. Rajashekarappa.

a. Course Name: Engineering Mechanics Lab

b. Course Code: 03605152

c. Prerequisite: Knowledge of Applied science

d. Rationale: Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.

e. Course Learning Objective:

CLOBJ 1	Identify force systems in diverse engineering scenarios through the application of fundamental mechanics principles.
CLOBJ 2	To impart knowledge about calculate the centroid and center of gravity for various components within engineering systems.
CLOBJ 3	To impart knowledge about force systems and methods to determine resultant.
CLOBJ 4	To impart knowledge about force systems and methods to determine resultant.
CLOBJ 5	Apply the principles of friction across various conditions to achieve practical objectives.

f. Course Learning Outcomes:

CLO 1	Identify the force systems for given conditions by applying the basics of mechanics.
CLO 2	Find out the centroid and center of gravity of various components in engineering systems.
CLO 3	Determine unknown force(s) of different engineering systems.
CLO 4	Determine unknown force(s) of different engineering systems.
CLO 5	Apply the principles of friction in various conditions for useful purposes

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes

CLO 1	Identify the force systems for given conditions by applying the basics of mechanics.
CLO 2	Find the centroid and center of gravity of various components in engineering systems.
CLO 3	Determine unknown force(s) of different engineering systems.
CLO 4	Determine unknown force(s) of different engineering systems.
CLO 5	Apply the principles of friction in various conditions for useful purposes

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. "Applied Mechanics" by H. J. Shah and S. B. Junarkar.
2. "A Text Book of Engineering Mechanics" by Bansal R K.
3. "Engineering Mechanics" by J.L. Meriam, and L.G.Kraige.
4. "Engineering Mechanics" by S.S. Bhavikatti and K. G. Rajashekarappa

j. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Law of Parallelogram: Verify and calculate resultant force through Law of Parallelogram.
2	Triangle Law of Forces: Verify and calculate resultant force through triangle Law of Forces.
3	Lami's Theorem: Verify and calculate resultant force through Lami's Theorem.
4	Polygon Law of Forces: Verify and calculate resultant force through Polygon Law of Forces.
5	Reactions in beam through Graphical & analytical method: Verify reactions in beam through Graphical & analytical method
6	Co efficient of Sliding Friction and angle of repose: Calculate Co efficient of Sliding Friction and angle of repose for different surfaces – Wood, Glass
7	Simple machines: To find out efficiency, velocity ratio and M.A for differential wheel and axle
8	Simple screw jack: To find out efficiency, velocity ratio and M.A for simple lifting machine using simple screw jack.
9	Centroid and Centre of Gravity: Solve numerical problems on Centroid and Centre of Gravity.

a. Course Name: Fundamentals of Mechanical Engineering

b. Course Code: 03609151

c. Prerequisite: Learn about fundamental of mechanical

d. Rationale: This course mainly encompasses the major and general areas of mechanical engineering which are being used by common man to large industrial sectors. A technician has to know many times the implications and knowledge of other disciplines so as to conclude the solution of his/her own branch tasks.

e. Course Learning Objective:

CLOBJ 1	1. Gain fundamental knowledge of Thermodynamics, Fluid Mechanics and I.C. Engines.
CLOBJ 2	Develop skills for material selection for different devices/ components.
CLOBJ 3	Gain knowledge of steam formation and properties of steam.

f. Course Learning Outcomes:

CLO 1	Enhancement of fundamental knowledge of mechanical engineering.
CLO 2	Enhancement of fundamental knowledge of Power Transmission & Safety.
CLO 3	Acquiring knowledge of materials and their properties for engineering applications
CLO 4	Evaluate properties of steam. Demonstrate various types of boilers and their relative merits and demerits.
CLO 5	Enhancement of fundamental knowledge of I.C. Engines.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Enhancement of fundamental knowledge of mechanical engineering.
CLO 2	Enhancement of fundamental knowledge of Power Transmission & Safety.
CLO 3	Acquiring knowledge of materials and their properties for engineering applications
CLO 4	Evaluate properties of steam. Demonstrate various types of boilers and their relative merits and demerits.
CLO 5	Enhancement of fundamental knowledge of I.C. Engines.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**

Continuous Evaluation, **ESE- End Semester Examination**

i. Course Content:

Sr. No	Content	Weightage	Teaching Hours
1	Introduction: Introduction of mechanical engineering. Use of mechanical engineering: In day to day life, Interdisciplinary use. Items in general use- identification criteria, major types, specifications and uses : such as bolts, nuts, washers, bearings, bushes, belts, springs, levers, couplings, brakes, screws, rivets, keys' rings, oil seals, gears, pulleys, shafts, axles, etc. Hand and power tools: Types, specifications and uses of spanners (such as fix, ring, box, pipe, allen, adjustable, etc.). Types, specifications and uses of hand tools (such as pliers, screw drivers, saws, hammers, chisels, cutters, planes, etc.). Types, specifications and uses of power tools (drill, chipper, etc.)	10	14
2	Power Transmission & Safety: Power transmission: Importance, Modes (belt drives, rope drives, chain drives and gear trains). Types of belts, Gear train-concept, transmission ratio, Applications. Types and applications of couplings in power transmission. Causes and remedies of general accidents in power transmission. Safety norms to be followed for preventing accidents and damage in power transmission. Safety norms to be followed in mechanical based industries.	20	8
3	Processes On Material: Welding: Types, Working setup of arc and gas welding, accessories and consumables, Types of work carried out by welding, Precautions and safety during arc and gas welding. Brazing and Soldering: General setup, Applications. Gas cutting: Working setup, accessories and consumables, Types of work carried out, Precautions and safety during Gas cutting. Foundry: Concept, Process of getting cast material, Applications. Other metal forming and cutting Operations - bending, shearing- concept and applications. Basic machine tools: Working principle of hacksaw, lathe, Drill and milling machines, Types of operations / jobs which can be performed on machine tools listed above.	20	8
4	Steam Generation & Prime Movers: Steam: Generation process, Properties. Boilers: Classification, Working, Accessories and mountings-types and applications, Regulations and safety requirements, Common troubles and remedies. Prime movers: Meaning, Classification, Working, Steam turbine-working, Gas turbine-types and applications. Common troubles and remedies.	10	4
5	Internal Combustion Engines: Internal combustion engines: Meaning, Classification. Main parts and functions. Applications.	13	6

6	Hydraulic & Pneumatic Devices: Concept of theory of fluid flow. General properties of fluids. Pump: Working principle, Types, Working of centrifugal and reciprocating pumps, Performance parameters, Main parts of pumps and their functions, Common troubles and remedies. Water turbines-working principle, types and applications. Common troubles and remedies of water turbine. Air compressor: Working principle, Types, Performance parameters, Applications. Other hydraulic/pneumatic/hydro-pneumatic equipment's: Principle of working-hydraulic lift, hydraulic pump, hydraulic power pack, hydraulic jack, Applications of above.	13	6
7	Material Handling Need of material handling: Types, principle of working and applications of material handling equipment's, Hoisting equipment's, Conveying equipment's, Surface & overhead equipment's, Earth moving machineries, Construction machineries. Criteria for selection of material handling equipment's. Factors affecting selection of material handling equipment's. Selection of suitable material handling equipment for the given situation. Common troubles and remedies.	14	6

j. Text Book and Reference Book:

1. "Theory of Machine" By R. S. Khurmi and J. K. Gupta | S. Chand
2. "Hydraulic Machines" By Jagdish Lal | S.K. Kataria & Sons
3. "Elements of Workshop Technology" By Hajra Choudhary | Media Promoters and Publishers Pvt. Ltd.
4. "Heat engines" By N C Pandya, C S Shah, S S Khandare | Charotar Publishing House | 10th edition, Pub. Year 2005

a. Course Name: Fundamentals of Electrical and Electronics Engineering

b. Course Code: 03607151

c. Prerequisite: Knowledge of Physics and Mathematics up to 10th Standard Level

d. Rationale: Electrical and electronics engineering equipment is widely used in mechanical/ metallurgy/mining /Auto mobile / Aeronautical engineering applications and a diploma engineer from any of these disciplines have to identify the related equipment being used in the industry with respect to their working and major faults that could occur. Electronics is an integral part of computers; hence students of computer engineering and information technology need to know the fundamental of electronics. This course has been designed to provide the needful inputs to handle simple electronic components and circuits. Students after studying this course will be able to understand the basics of analog electronics, various electronics components and develop skills to use simple electronic instruments needed for computer-based working environment.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental principles of basic circuit elements, including
----------------	--

	resistors, capacitors, and inductors, and analyze their behavior in electrical circuits.
CLOBJ 2	Apply knowledge of logic gates to design and implement various electronic circuits, demonstrating proficiency in Boolean algebra and logic gate operations.
CLOBJ 3	Demonstrate comprehension of the basic concepts of operational amplifiers (op-amps), including their characteristics, configurations, and common applications in electronic circuits.
CLOBJ 4	Solve basic problems related to electrical circuits and machines, utilizing appropriate mathematical techniques and analytical methods to analyze circuit behavior, troubleshoot issues, and optimize performance.

f. Course Learning Outcomes:

CLO 1	Understand the basic circuit elements.
CLO 2	Understand logic gates and apply them in various electronic circuits.
CLO 3	Understand the basic concepts of op-amps, and their applications.
CLO 4	Solve basic problems related to electrical circuits and machines.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Understand the basic circuit elements.
CLO 2	Understand logic gates and apply them in various electronic circuits.
CLO 3	Understand the basic concepts of op-amps, and their applications.
CLO 4	Solve basic problems related to electrical circuits and machines.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	1	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Overview of Electronic Components & Signals Passive Active Components: Resistances, Capacitors,	15%	6

	Inductors, Diodes, Transistors, FET, MOS and CMOS and their Applications. Signals: DC/AC, voltage/current, periodic/non-periodic signals, average, rms, peak values, different types of signal waveforms, Ideal/non-ideal voltage/current source, independent/dependent voltage current sources.		
2	Introduction of Semiconductor Components P-N junction diode, V-I Characteristics of P-N junction Diode, Zener Diode, Classification of Transistor, Transistor construction, Types of transistors (NPN & PNP)	10%	5
3	Overview of Digital Electronics Number systems, Base Conversion -BINARY -DECIMAL -HEX -OCTAL, Complements - 2' and 10's Complement -1's and 9's Complement, Binary addition, subtraction, multiplication and division Logic Gates -Basic Gates (AND, OR, Not), Universal Gates (NAND and NOR Gate), Complementary Gates-(EX-OR, EX-NOR), De-Morgan's Theorems, Adder and Subtractor, Multiplexer and De-multiplexer.	25%	10
4	Electric Circuit Generation of electricity, Different terms related to electric circuit, Concept of AC and DC, Concept of 1-phase and 3-phase supply, Electrical circuit elements – Resistor Inductor and Capacitor, Resistor in series and parallel, Ohm's law and its limitations, Factors affecting the value of resistance	20%	8
5	Magnetic Circuit Terms Related to magnetic circuit, Terms Related to AC circuit, Faraday's Law, Fleming's law, Lenz's Law, Hysteresis loop (B/H Curve), Types of Induced EMF, Comparison between Electric and Magnetic Circuit	20%	8
6	Transformer and Machines General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and Working principle of motors; Basic equations of motors.	10%	5

j. Text Book and Reference Book:

- 1. Basic Electrical Engineering** By Ritu Sahdev | Khanna Publishing House
- 2. Fundamentals of Electrical Engineering** By Saxena, S. B. Lal | Cambridge University Press
- 3. Electrical Technology Vol-1** By Theraja, B. L. | S. Chand, New Delhi

a. Course Name: Fundamentals of Electrical and Electronics Engineering Lab

b. Course Code: 03607152

c. Prerequisite: Knowledge of Physics and Mathematics up to 10th Standard Level.

d. Rationale: Electrical and electronics engineering equipment is widely used in mechanical/ metallurgy/mining /Auto mobile / Aeronautical engineering applications and a diploma engineer from any of these disciplines have to identify the related equipment being used in the industry with respect to their working and major faults that could occur. Electronics is an integral part of computers; hence students of computer engineering and information technology need to know the fundamental of electronics. This course has been designed to provide the needful inputs to handle simple electronic components and circuits. Students after studying this course will be able to understand the basics of analog electronics, various electronics components and develop skills to use simple electronic instruments needed for computer-based working environment.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental principles of basic circuit elements, including resistors, capacitors, and inductors, and analyze their behavior in electrical circuits.
CLOBJ 2	Apply knowledge of logic gates to design and implement various electronic circuits, demonstrating proficiency in Boolean algebra and logic gate operations.
CLOBJ 3	Demonstrate comprehension of the basic concepts of operational amplifiers (op-amps), including their characteristics, configurations, and common applications in electronic circuits.
CLOBJ 4	Solve basic problems related to electrical circuits and machines, utilizing appropriate mathematical techniques and analytical methods to analyze circuit behavior, troubleshoot issues, and optimize performance.

f. Course Learning Outcomes:

CLO 1	Understand the basic circuit elements.
CLO 2	Understand logic gates and apply them in various electronic circuits.
CLO 3	Understand the basic concepts of op-amps, and their applications.
CLO 4	Solve basic problems related to electrical circuits and machines.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Understand the basic circuit elements.
CLO 2	Understand logic gates and apply them in various electronic circuits.
CLO 3	Understand the basic concepts of op-amps, and their applications.
CLO 4	Solve basic problems related to electrical circuits and machines.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	30	-	20	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Mapping of Experiment List with Course Learning Outcomes:

Sr. NO.	Experiment List
1	Determine the permeability of magnetic material by plotting its B-H curve
2	Measure voltage, current and power in 1-phase circuit with resistive load.
3	Measure voltage, current and power in R-L series circuit.
4	Determine the transformation ratio (K) of 1-phase transformer.
5	Connect single phase transformer and measure input and output quantities.
6	Identify various active and passive electronic components.
7	Connect resistors in series and parallel combination on bread board and measure its value using digital multimeter.
8	Use multimeter to measure the value of given resistor. Determine the value of given resistor using digital multimeter to confirm with colour code.
9	Test the performance of PN-junction diode.
10	Test the half wave rectifier using CRO.
11.	Test the Bridge rectifier and capacitor filter using CRO.
12	Test the performance of Zener diode.
13	Identify the pins of IC 741.
14	Test the performance of CE NPN transistor.
15	Test the performance of transistor amplifier circuit.

a. Course Name: Material Science

b. Course Code: 03609203

c. Prerequisite: Zeal to learn the Subject

d. Rationale: Subject is concerned with the changes in structure and properties of matter. Many of the processes which are involved to bring out these changes, forms the basis of engineering activities. The study of basic concepts of material science and metallurgy will help the students understanding engineering subjects where the emphasis is laid on the application of these materials.

e. Course Learning Objective:

CLOBJ 1	Know the fundamental science and engineering principles relevant to materials.
CLOBJ 2	Understand the relationship between properties and processing and design of materials.
CLOBJ 3	Have the experimental skills for a professional career or graduate study in materials.

CLOBJ 4	Be able to communicate effectively, to work in teams and to assume positions as leaders.
----------------	--

f. Course Learning Outcomes:

CLO 1	Interpret Crystal structure, BCC, FCC, HCP in materials. Categorize different types of bonds in materials.
CLO 2	Pivot phase diagrams for materials, Explain properties of different metals and alloys.
CLO 3	Relate Nonferrous and Nonmetallic materials with metallic materials
CLO 4	Describe Metallurgical microscope with sample specimen and NDT methods.
CLO5	Classify different types of corrosion takes place in materials and methods to prevent them

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Interpret Crystal structure, BCC, FCC, HCP in materials. Categorize different types of bonds in materials.
CLO 2	Pivot phase diagrams for materials, Explain properties of different metals and alloys.
CLO 3	Relate Nonferrous and Nonmetallic materials with metallic materials
CLO 4	Describe Metallurgical microscope with sample specimen and NDT methods.
CLO5	Classify different types of corrosion takes place in materials and methods to prevent them

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Crystal Structures and Bonds: Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC;	25%	8

	Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell. Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond		
2	Phase Diagrams: Ferrous Metals and its Alloys Isomorphs, eutectic and eutectoid systems; Iron-Carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores – Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses.	25%	09
3	Non-ferrous Metals and Non-Metallic Material Classification of Nonferrous metals; Properties and applications of aluminum, copper, tin, lead, zinc, magnesium and nickel; Standard commercial grades as per BIS/ASME. Introduction and classification of non-metallic materials. Classification of Polymers on basis of Thermal behavior (Thermoplastics & Thermosetting); Other non-metallic materials-types, properties and applications of rubber, ceramics, refractories, insulators, abrasives, adhesives	25%	09
4	Metallurgical Microscope and Non-Destructive Testing: Metallographic examination and microstructures-need and importance; Principle & working of metallurgical microscope; Preparation of specimen for microscopic examinations Non-destructive testing: Visual Inspection; magnetic particle inspection; liquid penetrate test; ultrasonic inspection; radiography.	15%	7
5	Corrosion and Surface Engineering: Nature of corrosion and its causes; Electrochemical reactions; Electrolytes; Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control. Surface engineering processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching	20%	09

j. Text Book and Reference Book:

1. "Material Science & Metallurgy" By O.P. Khanna | Dhanpath Rai and Sons
2. "Material Science & Engineering" By R.K. Rajput | S.K. Kataria & Sons
3. "Material Science" By R.S. Khurmi | S. Chand & Co. Ltd

a. Course Name: Material Science lab

b. Course Code: 03609204

c. Prerequisite: Zeal to learn the subject.

d. Rationale: -Basic principles of science are used to study the structure-properties relationships of various materials for their proper applications in this subject. Especially study of different types of ferrous and non-ferrous metals and alloys, in terms of their composition, structure, properties and applications; nondestructive testing are included in this course to understand the basic concept of selection and processing of metals and materials for their applications.

e. Course Learning Objective:

CLOBJ 1	Know the fundamental science and engineering principles relevant to materials
CLOBJ 2	Understand the relationship between properties and processing and design of materials.
CLOBJ 3	Acquainting the experimental skills for a professional career or graduate study in materials
CLOBJ 4	Be able to communicate effectively, to work in teams and to assume positions as leaders.

f. Course Learning Outcomes:

CLO 1	To apply core concepts in Materials Science to solve engineering problems
CLO 2	Be knowledgeable of contemporary issues relevant to Materials Science and Engineering.
CLO 3	Be able to select materials for design and construction.
CLO 4	Possess the skills and techniques necessary for modern materials engineering practice

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Be able to apply core concepts in Materials Science to solve engineering problems
CLO 2	Be knowledgeable of contemporary issues relevant to Materials Science and Engineering.
CLO 3	Be able to select materials for design and construction.
CLO 4	Possess the skills and techniques necessary for modern materials

	engineering practice
--	----------------------

h. i. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Text Book and Reference Book:

1. Material Science & Metallurgy By O.P. Khanna | Dhanpath Rai and Sons
2. Material Science & Engineering By R.K. Rajput | S.K. Kataria & Sons
3. Material Science By R.S. Khurmi | S. Chand & Co. Ltd

k. . Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	To study crystal structures of a given specimen
2	To study the metallurgical microscope.
3	Prepare a report of microstructure of ferrous metals based on microscopic examination.
4	Prepare a report of micro structure of non-ferrous metals based on microscopic examination.
5	Detail Study of Non-Destructive testing of welded component
6	Study corrosive materials to identify different types of corrosion of metals.

a. Course Name: Mathematics - II

b. Course Code: 03691151

c. Prerequisite: Knowledge of Basic concept of mathematics studied till first semester

d. Rationale: This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, Integral Calculus coordinate geometry, Basic elements of vector algebra and First Order Differential Equations.

e. Course Learning Objective:

CLOBJ 1	Understand elementary properties of determinants up to 3rd order, Apply Cramer's rule to solve equations, learn algebra of matrices and matrix inverse method for solving linear equations
CLOBJ 2	Define vectors and their notation, perform vector addition and

	subtraction, calculate scalar and vector products, solve problems related to work, moment, and angular velocity using vectors.
CLOBJ 3	Determine inclination and slope of a line, Express equations of a straight line in various forms, Understand the general equation of a straight line and conditions for concurrency of lines, Define and work with circles, including equations and properties.
CLOBJ 4	Learn integration as the inverse operation of differentiation, integrate simple functions using various methods, apply definite integrals and understand their properties. Solve problems related to area bounded by curves and volume of solids using integration.
CLOBJ 5	Solve first-order and first-degree differential equations using variable separation method, Work with exact and linear differential equations, gain a simple introduction to MATLAB for solving differential equations.

f. Course Learning Outcomes:

CLO 1	Students will be able to understand the elementary properties of determinants up to 3rd order, consistency of equations, and Cramer's rule. They will also learn the algebra of matrices, inverse of a matrix, and matrix inverse method for solving a system of linear equations in 3 variables.
CLO 2	Students will be able to define and notate vectors, resolve vectors in rectangular form, add and subtract vectors, and calculate scalar and vector products. They will also learn to apply vector algebra to simple problems related to work, moment, and angular velocity.
CLO 3	Students will be able to understand the properties of lines and circles, including slope, intercepts, equations, and conditions for concurrency. They will also learn to calculate equations of chords and tangents for circles
CLO 4	Students will be able to understand integration as the inverse operation of differentiation, integrate simple functions, and apply integration by substitution, by parts, and by partial fractions. They will also learn to solve problems related to area and volume using definite integrals.
CLO 5	Students will be able to solve first-order and first-degree differential equations using variable separation method, exact differential equations, and linear differential equations. They will also gain a simple introduction to MATLAB for solving differential equations.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Students will be able to understand the elementary properties of determinants up to 3rd order, consistency of equations, and Cramer's rule. They will also learn the algebra of matrices, inverse of a matrix, and matrix inverse method for solving a system of linear equations in 3 variables.
CLO 2	Students will be able to define and notate vectors, resolve vectors in rectangular form, add and subtract vectors, and calculate scalar and vector products. They will also learn to apply vector algebra to simple problems related to work, moment, and angular velocity.
CLO 3	Students will be able to understand the properties of lines and circles, including slope, intercepts, equations, and conditions for concurrency. They will also learn to calculate equations of chords and tangents for circles
CLO 4	Students will be able to understand integration as the inverse operation of differentiation, integrate simple functions, and apply integration by substitution, by parts, and by partial fractions. They will also learn to solve problems related to area and volume using definite integrals.
CLO 5	Students will be able to solve first-order and first-degree differential equations using variable separation method, exact differential equations, and linear differential equations. They will also gain a simple introduction to MATLAB for solving differential equations.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	1	-	4	20	20	-	60	-	100

L - Lecture, T - Tutorial, P - Lab, C - Credit T - Theory, P - Practical, CE – Continuous Evaluation, T - Theory, P – Practical, ESE - End Semester Exam

i. Contents:

Sr.	Topic	Weightage	Teaching Hrs.
1.	Unit I: Determinants and Matrices Elementary properties of determinants up to 3rd order, consistency of equations, Cramer's rule. Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.	22%	8

2.	Unit II: Vector Algebra Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.	13%	5
3	Unit III: Co-Ordinate Geometry Straight line Inclination and slope of a line, different forms of equations to a straight line (i) Slope-intercept form (ii) Point-slope form (iii) Two-point form (iv) Intercept form. General equation of a Straight line, Family of lines. Conditions for concurrency of lines. Circle Definition, Equation of a circle with given center and radius, General form of equation of circle, Equation of a circle when intercepts are given, circle passing through three points, Equation of chord, Equations of tangents and normal at a point on a circle.	15%	7
4.	Unit IV: Integral Calculus Integration as inverse operation of differentiation, Integration of simple functions, Integration by substitution, by parts and by partial fractions (for linear factors only). Definite integral: Definition, Properties of Definite integral, Odd and Even functions, Use of formulas $\int_0^{\frac{\pi}{2}} \sin^n x \, dx$, and $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx$ for solving problems Where m and n are positive integers. Applications of integration for i. Simple problem on evaluation of area bounded by a curve and axes. ii. Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems).	37 %	14
5.	Unit V: Differential Equations Solution of first order and first-degree differential equation by variable separation method (simple problems), Exact differential equations (simple problems), Linear differential equations (simple problems), MATLAB – Simple Introduction.	13%	5

REFERENCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics (Diploma Stream), H.K. Dass, S. Chand Publishing
3. Mathematics for Polytechnic, S.P. Deshpande, Pune Vidyarthi Griha Prakashan.
4. Polytechnic Mathematics (Made Easy)(Applied Mathematics) , Manjeet Singh

a. Course Name: COMMUNICATION SKILLS-II

b. Course Code: 03693153

c. Prerequisite: Inclination to improve speaking & listening skills .Basic speaking & writing skills

d. Rationale: Communication skills are essential for all Diploma Engineers

e. Course Learning Objective:

CLOBJ 1	Develop learning & establish a platform for the students that they can easily learn through various life skills required in the organization for becoming an asset for the organization.
CLOBJ 2	Analyze new words are formed, role of syllable, vowel, consonant in pronunciation of word.
CLOBJ 3	Enhance formal communication as well as to participate in events like debate, extempore etc, and to introduce them to various international Language testing systems
CLOBJ 4	Encourage them to overcome stage fear through classroom activities.
CLOBJ 5	Cultivate Reading Skill through the usage of comprehensions.

f. Course Learning Outcomes:

CLO 1	Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
CLO 2	Apply and analyses the right kind of pronunciation with regards to speech sounds and able to get different types of pronunciations.
CLO 3	Competent to read, understand, and interpret a text intrinsically as well as extrinsically. The learner can browse a text quickly to come-up with a gist and personal interpretation. One is able to create a healthy work-environment and prove to be an asset or one of the most reliable resources to the Organization. As a professional, one is mature to bridge the gulf between the existing behavior/ lifestyle and the expected corporate behavior cum lifestyle with the help of learning life skills.
CLO 4	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.
CLO 5	Enhanced ability to understand and interpret written texts, leading to better grasp of subject matter across disciplines.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes

CLO 1	Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
CLO 2	Apply and analyses the right kind of pronunciation with regards to speech sounds and able to get different types of pronunciations.
CLO 3	Competent to read, understand, and interpret a text intrinsically as well as extrinsically. The learner can browse a text quickly to come-up with a gist and personal interpretation. One is able to create a healthy work-environment and prove to be an asset or one of the most reliable resources to the Organization. As a professional, one is mature to bridge the gulf between the existing behavior/ lifestyle and the expected corporate behavior cum lifestyle with the help of learning life skills.
CLO 4	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.
CLO 5	Enhanced ability to understand and interpret written texts, leading to better grasp of subject matter across disciplines.

i. Teaching & Examination Scheme:

Teaching & Examination Scheme:									
Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	0	-	1	-	100	-	-	-	100

L - Lecture, **T** - Tutorial, **P** - Lab,C-Credit **T** - Theory, **P** - Practical, **CE** – Continuous Evaluation, **T** - Theory, **P** – Practical ,**ESE**-End Semester Exam

Note: 15 Hours of additional sessions will be taken (within the semester) to match up 30 hours content.

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Listening skills: Listening Process and Practice : Introduction, importance of good Listening skills, difference between listening and hearing, types of listening, Barriers to effective listening, traits of a good listener.	10%	6
2	Listening Skills – Questions: With audio aids, students will be able to listen to dialogues, Improve in gathering information and to summarize the content. To listen and understand day-to-day conversations and to solve questions based on audio files.	2%	1
3	Building Vocabulary Synonyms, Antonyms, Homophones, Homonyms,	2%	1

	Homographs, Phrasal verbs, idioms & phrases, One word substitution		
4	Introduction to Phonetics Sounds: Consonant, Vowel, Diphthongs, transcription of words(IPA) weak forms, syllable division, word stress, intonation and voice	10%	6
5	Speaking Skill Building Introduction: To enable students to eliminate stage fright and engage in conversation with others.	3%	2
6	Speaking Skill Building Activity: Enables students to engage in formal communication as well as to participate in events like debate, extempore etc, and to introduce them to various international Language testing systems	2%	1
7	Tourism Pitch: Classroom activity which helps students to express their feelings and experiences in English. Encouraging students to overcome stage fear.	2%	1
8	Lifeboat: Classroom Activity to encourage Communication and Convincing Skills	5%	1
9	Reporter: Classroom Activity to encourage Communication and Convincing Skills.	5%	1
10	Paragraph jumble: Enhance the skill of writing by completing the paragraph in appropriate and sensible form	5%	4
11	Life skills: Self-Awareness, Empathy, Sympathy, Emotional Intelligence	5%	4
12	Reading Comprehension : A Day's Wait – Ernest Hemingway, My Lost Dollar- Stephen Leacock	10%	2

****Continuous Evaluation:**

It consists of

1. Phase I Exam-35 Marks(Hybrid or Offline Mode)
2. Phase II Exam -35 Marks (Hybrid or Offline Mode)
3. Activities – (Listening and Speaking) -10+10=20 Marks
4. Attendance -10 Marks

The passing marks for Continuous Evaluation will be 40 out of 100. There will not be any re-test.

j. Text Book and Reference Book:

1. Technical Communication –Principles & Practice-IInd Edition by Meenakshi Raman & Sangeeta Sharma.
2. Effective Technical Communication by Dr. Bharti Kukreja & Dr. Anupama Jain
3. Daniel Johns : The Pronunciation of English. Cambridge: Cambridge University

Press, 1956

4. James Hartman & et al. Ed. English Pronouncing Dictionary. Cambridge University Press, 2006.
5. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi 00 (Revised Ed. 2018)
6. Active English – Almas Juneja and Vaseem Qureshi-Macmillan Publishers India Ltd
7. English- Prof. Pradyuman Raj, Prof. Rakhi Moghe, Ms. Anisha Modi
8. J.D.O's Connor. Better English Pronunciation Cambridge University Press, 1980
9. Lindley Murry. An English Grammar: Comprehending Principles and Rules. London: Wison and sons, 1908.
10. Margaret M. Maison. Examine your English Orient Longman: New Delhi, 1964
11. J.Sethi & et al. A Practice Course in English Pronunciation, New Delhi: Prentice Hall, 2004
12. Pfeiffer, William Sanborn and T.V.S. Padmaja. Technical Communication: A Practical Approach 6th ed Delhi: Pearson, 2007.

Semester 3

- a. **Course Name:** Introduction to Aeronautics
- b. **Course Code:** 03613201
- c. **Prerequisite:** Zeal to Learn the Subject.
- d. **Rationale:** The subject gives basic principles and understanding of Aircraft Science, Airplane structure & operation of engines used in Aeronautics.
- e. **Course Learning Objective:**

CLOBJ 1	The key objective of the controller is to reduce the error between the estimated and desired states. UAVs refer to controlled aerial vehicles, which perform several missions without human assistance.
CLOBJ 2	Explain the structure of the atmosphere and its impact on aircraft flight.
CLOBJ 3	Describe the structure of different parts of an aircraft, including the fuselage, wings, empennage, and landing gear. Identify materials used in aircraft construction and discuss future trends in aircraft design.
CLOBJ 4	Explain the function and operation of primary and secondary flight controls. Describe various flight control systems and their roles in aircraft maneuverability. Understand the mixing of control surfaces and their impact on aircraft behavior.
CLOBJ 5	Trace the history of aircraft propulsion and classify different types of power plants. Define thrust and discuss the operation of reciprocating engines, propellers, and turbine engines. Explain the principles of operation for ramjet engines, rocket engines, and their propellant types.

f. Course Learning Outcomes:

CLO 1	Make familiar with the configuration and history of aircraft.
CLO 2	Acquainted with the various principles used for aircrafts.
CLO 3	Understand the various control system of an airplane.
CLO 4	Understand the various types of structure an airplane. Understand the fundamentals of aerodynamics involved in airplane performance.
CLO 5	To know the various components used for the propulsion of airplane. Understand the basic principles of flight take off, stability and control.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with the configuration and history of aircraft.
CLO 2	Acquainted with the various principles used for aircrafts.
CLO 3	Understand the various control system of an airplane.
CLO 4	Understand the various types of structure an airplane. Understand the fundamentals of aerodynamics involved in airplane performance.
CLO 5	To know the various components used for the propulsion of airplane. Understand the basic principles of flight take off, stability and control.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	0	60	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**Continuous Evaluation, **ESE-** End Semester Examination.

i. Course Content:

Unit No.	Topic	Weightage	Teaching Hrs.
-----------------	--------------	------------------	----------------------

1.	History & Background History of Flight, Different types of flight vehicles, Types of Aircraft Systems and Instruments, UAVs and its application.	12%	5
2.	Introduction to Aerodynamics Structure of the Atmosphere, Airfoil, Airfoil Nomenclature, Types of Airfoil, NACA Series, Theories in the Production of Lift, Newton's Basic Laws of Motion, Forces Acting on the Aircraft, Coefficients of lift and drag at various angles of attack, Lift/Drag Ratio, Types of Drag, Types Wings, Aspect Ratio, Taper Ratio, Wingtip Vortices, Axes of an Aircraft, Moment and Moment Arm, Speed Ranges, Stalls, Boundary Layer, Shock Waves, Stability and its types.	30%	12
3.	Introduction to Aircraft Structures Introduction, Nomenclature of Aircraft, Fuselage and its types, Wings, Empennage, Landing Gear, Powerplant, Subcomponents, Structural components of Helicopter, Rocket and RLV, Aircraft Materials, Construction of Future Aircraft.	20%	8
4.	Flight Controls Introduction, Flight Control Systems Primary Flight Controls- Ailerons, Elevator, Rudder, Mixing of control surfaces. Secondary Flight Controls- Flaps, Leading Edge Devices, Spoilers, Trim Tabs, Balance Tabs, Servo Tabs, Antiservo Tabs, Ground Adjustable Tabs, Adjustable Stabilizer, Canard and Autopilot, Helicopter Flight Controls.	18%	7
5.	Introduction to Aircraft Propulsion History, Classification of Powerplant, Thrust, Reciprocating Engines, Propeller, Turbine Engines, Ramjet Engine, Rocket Engines (Solid, Liquid and Hybrid Propellant)	20%	8

j. Text Book and Reference Book:

1. Introduction to Flight by John D Anderson, Tata Mc Graw Hill Book Company
2. Flight without Formula by A C Kermode, Pearson Education
3. Pilot's Handbook of Aeronautical Knowledge by Federal Aviation Administration
4. Fundamentals of Flight by R S Shevell, Pearson Education

a. Course Name: Introduction to Aeronautics Lab

b. Course Code: 03613202

c. Prerequisite: Zeal to learn the subject.

d. Rationale: The main objective of this course is to understand the aircraft components. This subject addresses the basic concept of aeromodelling,

design, building and flying of model airplanes or helicopters.

e. Course Learning Objective:

CLOBJ 1	Gain an understanding of aeromodeling, including its purpose, scope, and relevance in aviation. Learn about the history and development of aeromodeling as a hobby and a tool for education and research.
CLOBJ 2	Identify various types of model aircraft and practical skills related to building various models of aircraft, including scale models, radio-controlled models, and UAVs. Understand the differences between different types of model aircraft in terms of design and operation.
CLOBJ 3	Explore the various components of an airplane, including the fuselage, wings, empennage, and landing gear. Identify the purpose and function of each component in the overall operation of the aircraft. The importance of proper model construction for achieving desired performance characteristics.
CLOBJ 4	Examine the various forces acting on an airplane during flight, including lift, weight, thrust, and drag. Understand how these forces interact to affect the aircraft's performance and stability.
CLOBJ 5	Study the principles of flight, including aerodynamics, Newton's laws of motion, and Bernoulli's principle. Gain insight into how these principles govern the behavior of aircraft in the air.

f. Course Learning Outcomes:

CLO 1	To know about the basic principle of flight that how an aircraft actually flies in the air.
CLO 2	To understand what types of forces act upon an aircraft while flying.
CLO 3	To understand how a sheet metal work is performed over an aircraft and how parts are joined.
CLO 4	Know about the components and materials which are widely used in small airplane production i.e Glider etc.
CLO 5	To develop skills in aircraft manufacturing.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	To know about the basic principle of flight that how an aircraft actually flies

	in the air.
CLO 2	To understand what types of forces act upon an aircraft while flying.
CLO 3	To understand how a sheet metal work is performed over an aircraft and how parts are joined.
CLO 4	Know about the components and materials which are widely used in small airplane production i.e Glider etc.
CLO 5	To develop skills in aircraft manufacturing.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. Aeromodelling Made Easy by Siddharth M. Sharma.
2. Basic Aeromodelling by R. H. Warring
3. How to Build and Fly Electric Model Aircraft by Robert Schleicher.
4. Building and Detailing Model Aircraft by Pat Hawkey

j. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Study the overview of Aeromodeling.
2	Study the model aircraft and their different types.
3	Study the various components of an Airplane.
4	Study the various forces acting on an Airplane
5	Study the principles of flight.
6	Building the various models of an Aircraft. operation in time domain.

- a. **Course Name: Mechanisms for Machines and Aircrafts**
- b. **Course Code: 03613203**
- c. **Prerequisite:** Ease of learning and having interest in learning of different mechanism of machines.
- d. **Rationale:** This course is included in the curriculum to provide such necessary knowledge and skills in the area of aeronautical equipment and devices to help in understanding of kinematics & dynamics of different equipment being used in industry.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the introduction, need, scope, and importance of design and analysis in engineering. Define and differentiate between kinematics, kinetics, and dynamics, providing examples to illustrate each concept.
CLOBJ 2	Analyze velocity and acceleration in mechanisms, including absolute and relative motion, using vector analysis. Understand the mechanisms involved in aircraft components such as landing gear, flaps, rudder, ailerons, elevator, and trim tabs Perform velocity analysis for four-link mechanisms and slider-crank mechanisms.
CLOBJ 3	Understand the concept of cams and cam profiles, including their functions, types, and motion characteristics.
CLOBJ 4	Explain the concept of the turning moment diagram and its application in various machines. Calculate fluctuations of energy and coefficients of fluctuation of speed and energy.
CLOBJ 5	Explain the concept of friction and the laws governing it. Identify the functions, types, and working principles of clutches, brakes, and dynamometers.

f. Course Learning Outcomes:

CLO 1	Define link, pairs, mechanisms, inversion, structure and machines.
CLO 2	Explain various terminology associated with theory of machine. Draw inversions of different mechanisms in aircraft components
CLO 3	Explain different types of cams and cam followers and their motions. Construct different types of cam profile from given data
CLO 4	Draw velocity and acceleration diagram for a given mechanism.
CLO 5	Calculate velocity and acceleration from a given mechanism. Construct Turning moment diagram.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes

CLO 1	Define link, pairs, mechanisms, inversion, structure and machines.
CLO 2	Explain various terminology associated with theory of machine. Draw inversions of different mechanisms in aircraft components
CLO 3	Explain different types of cams and cam followers and their motions. Construct different types of cam profile from given data
CLO 4	Draw velocity and acceleration diagram for a given mechanism.
CLO 5	Calculate velocity and acceleration from a given mechanism. Construct Turning moment diagram.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction: Introduction, need, scope and importance of design and analysis; Kinematics, kinetics and dynamics - concept and examples; Link, kinematic pair, degrees of freedom. Classification of kinematic pairs, Inversions of four bar chain, slide crank mechanism & double slider crank mechanism.	15%	5
2	Velocity And Acceleration Analysis: Absolute & relative motion, vectors, motion of a link; Velocity analysis of four-link mechanism & slider crank mechanism; Acceleration, Acceleration analysis of four-link mechanism & slider crank mechanism; Klein's construction for single slider Cranks mechanism.	15%	6
3	Cam And Cam Profile: Introduction; Functions and types of cams; Types of motions and displacement for different types of cam and cam followers; Construction of different types of cam profiles	15%	5

4	Flywheel And Governor: Turning moment diagram: Concept & Its use for different machines. Fluctuations of energy; Co-efficient of fluctuation of speed and energy; Method to construct turning moment diagram, numerical examples; Fly wheel: functions and types; Governors: terminology, type & functions.	15%	6
5	Friction: Concept and laws of friction; Clutch: Functions. Types with sketches and working; Brake: Functions. Types with sketches and working; Dynamometers- types and operational Working principles	20%	6
6	Aircraft Mechanism: Landing gear mechanism; Flaps mechanism; Rudder mechanism; Aileron mechanism; Elevator mechanism, Trim Tab Mechanism.	20%	6

j. Text Book and Reference Book:

1. Theory of Machines (TextBook) R.S.Khurmi; S.Chand.
2. Theory of Machine, S S Ratan; Tata McGraw Hill Publishing
3. Understanding the flight, J.D. Anderson; McGraw Hill, Inc
4. Theory of Machine -Jagdish Lal- Metro Politan Books, New Delhi.
5. Theory of Machine – P.L. Ballaney – Khanna Publishers, New Delhi

a. Course Name: Mechanisms for Machines and Aircrafts Lab

b. Course Code: 03613204

c. Prerequisite: Ease of learning and having interest in learning of different mechanism of machines.

d. Rationale: This course is included in the curriculum to provide such necessary knowledge and skills in the area of aeronautical equipment and devices to help in understanding of kinematics & dynamics of different equipment being used in industry.

e. Course Learning Objective:

CLOBJ 1	Learn the principles of four-bar and slider-crank mechanisms, their configurations, and applications. Gain skills in velocity and acceleration analysis using suitable mathematical methods.
CLOBJ 2	Acquire skills in constructing cam profiles for various types of cams, understanding the design considerations and motion characteristics.
CLOBJ 3	Gain insight into the working principles of governors and flywheels, including their roles in controlling speed fluctuations in machinery.
CLOBJ 4	Study the functions, types, and working principles of brakes, clutches, and dynamometers, and their applications in engineering systems.

CLOBJ 5	Utilize animated videos to visualize and understand various mechanisms used in aircraft, and create educational resources for better comprehension.
----------------	---

f. Course Learning Outcomes:

CLO 1	Define link, pairs, mechanisms, inversion, structure and machines.
CLO 2	Draw velocity and acceleration diagram for a given mechanism.
CLO 3	Calculate velocity and acceleration from a given mechanism.
CLO 4	Explain different types of cams and cam followers and their motions.
CLO 5	Construct different types of cam profile from given data

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Define link, pairs, mechanisms, inversion, structure and machines.
CLO 2	Draw velocity and acceleration diagram for a given mechanism.
CLO 3	Calculate velocity and acceleration from a given mechanism.
CLO 4	Explain different types of cams and cam followers and their motions.
CLO 5	Construct different types of cam profile from given data

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. Understanding the flight ,J.D. Anderson; McGraw Hill, Inc
2. Theory of Machines,S.S. Rattan; Tata McGraw Hill

j. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
-----------------	-------------------------------

1	To study about various mechanisms four bar and slider crank mechanism.
2	Prepare a sheet for velocity and acceleration analysis.
3	Prepare a sheet for construction of cam profile.
4	To study about working principle of governor and flywheel.
5	To study about brakes, clutches and dynamometer
6	To provide Animated Videos and prepare a sheet for various mechanisms of aircraft

- a. **Course Name: Aircraft Materials and Manufacturing**
- b. **Course Code:** 03613205
- c. **Prerequisite:** Zeal to learn Subject
- d. **Rationale:** The course is designed to give the detailed understanding of various system of conventional & unconventional machining process. Also the subject gives details about the production machines & different tools.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the classification, composition, properties, heat treatment, and applications of aerospace materials such as plastic, wood, plywood, glue, dopes, and rubber used in aircraft manufacturing.
CLOBJ 2	Define composite materials and their components, including fibers and matrices. Recognize the advantages of composite materials and structures, and identify their applications in the present world. Understand the mechanical behavior of composite materials.
CLOBJ 3	Learn various manufacturing techniques for advanced composites, including contact molding, spray-up, hand lay-up, compression molding, matched die molding, forming methods employing gas pressure, pultrusion, and filament winding.
CLOBJ 4	Gain knowledge of general principles and processes for casting, including sand casting, die-casting, centrifugal casting, and investment casting. Understand welding techniques such as arc welding, gas welding, friction welding, laser welding, electron beam welding, TIG welding, MIG welding, soldering, and brazing techniques.
CLOBJ 5	Understand the general principles and types of machines used in aerospace manufacturing, including lathes, shapers, milling machines, grinding machines, and drilling machines. Learn about sheet metal operations such as shearing, punching, bending, forming, spinning, and drawing. Identify types of rivets and their operations, as well as grinding operations. applications of unconventional machining techniques such as EDM, ultrasonic machining

f. Course Learning Outcomes:

CLO 1	To define different types of Engineering Materials
CLO 2	To study about composition & heat treatment of materials, types of composites materials & behaviour of composites materials.
CLO 3	To study about different types of casting processes principle
CLO 4	To understand methods of Casting and principle of different types of welding processes

CLO 5	To study about principle of different types unconventional processes
--------------	--

g. Mapping of Course Learning Outcomes :

Course Learning Outcomes	
CLO 1	To define different types of Engineering Materials
CLO 2	To study about composition & heat treatment of materials, types of composites materials & behaviour of composites materials.
CLO 3	To study about different types of casting processes principle
CLO 4	To understand methods of Casting and principle of different types of welding processes
CLO 5	To study about principle of different types unconventional processes

k. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

l. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction To Aerospace Materials Classification. Composition, properties, heat treatment & application of materials. Plastic, wood, plywood, glue, dopes and rubber used in aircraft manufacturing.	10%	04
2	Introduction To Composite Materials Composite material, Fibers, Matrix, Advantages of Composite Materials and Structures, Applications of Composite materials in Present world, Mechanical Behaviour of Composite Materials.	10%	05
3	Manufacturing Of Advanced Composites Contact moulding: Mould preparation, Spray-up, Hand lay-up, Compression moulding methods: Matched die moulding, Forming methods employing gas pressure, Pultrusion, Filament Winding	10%	07

4	Casting & Welding General principles of various Casting Processes: Sand casting, die-casting, centrifugal casting, Investment casting, Welding Techniques: Arc welding, Gas welding, Friction welding, Laser welding, Electron Beam welding, TIG welding, MIG welding, Soldering and brazing techniques.	25%	8
5	Machines , Sheet Metal , Grinding & Rivet Operation General Principles (with schematic diagram only) of working and types of Lathe, Shaper, Milling machines, Grinding, Drilling m/c, Sheet metal operations Shearing, Punching, Bending, Forming, Spinning, Drawing etc. Types of rivets & its operations, Grinding Operations	30%	8
6	Unconventional Machining Principles of working and applications of EDM, Abrasive jet machining, Ultrasonic machining, Electron beam and Plasma arc machining.	15%	07

h. Text Book and Reference Book:

1. Manufacturing Technology P.N.Rao; Tata McGraw Hill publication
2. Production Technology R.K. Jain; Khanna Pub.
3. Aircraft Materials C G K Nair; Interline
4. Mechanics of Composite Materials and Structures Madhujit Mukhopadhyay; University Press
5. Production Technology, P. C. Sharma; S Chand

a. Course Name: Aircraft Materials and Manufacturing Lab

b. Course Code: 03613206

c. Prerequisite: Knowledge of Aircraft Materials & Manufacturing

d. Rationale: Aircraft Materials & Processes is the main subject of aeronautical engineering which gives a basic base of the subject that materials & manufacturing process. The goal of this course is to expose students to Aircraft Materials & Processes problems in mechanics as applied to plausibly real-world scenarios.

e. Course Learning Objective:

CLOBJ 1	Understand the process of metal melting, pouring, casting, and finishing, including the equipment used and safety precautions.
CLOBJ 2	Gain practical experience in preparing at least one job using arc welding processes, including electrode selection, welding technique, and safety measures.
CLOBJ 3	Acquire skills in preparing two jobs, one using soldering and another using brazing techniques, understanding the differences between the two processes and their applications.

CLOBJ 4	Demonstrate proficiency in operating a lathe machine, shaper machine, milling machine, grinding machine a drilling machine including basic turning operations, tool selection, and safety procedures.
CLOBJ 5	Demonstrate and perform riveting operations, including rivet selection, drilling, rivet installation, and safety procedures, the operation of EDM

f. Course Learning Outcomes:

CLO 1	Knowledge of metal casting processes, Ability to operate casting equipment and finishing tools
CLO 2	To understand principle of different types of welding processes.
CLO 3	To study about classification and working of basic machine tools.
CLO 4	To understand principle lathe machine, shaper machine, milling machine, grinding machine a drilling machine
CLO 5	Skill in performing perform riveting operations

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Knowledge of metal casting processes, Ability to operate casting equipment and finishing tools
CLO 2	To understand principle of different types of welding processes.
CLO 3	To study about classification and working of basic machine tools.
CLO 4	To understand principle lathe machine, shaper machine, milling machine, grinding machine a drilling machine
CLO 5	Skill in performing perform riveting operations

k. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
0	-	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

l. Text Book and Reference Book:

1. Workshop Technology, B.S.Raghuwanshi; Dhanpat Rai Publishing Company
2. Production Technology, P. C. Sharma; S Chand

3. Manufacturing Technology, P.N.Rao; Tata McGraw Hill publication

m. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Demonstration of metal melting, metal pouring, metal casting and casting finishing
2	Prepare at least one jobs using arc welding processes
3	Prepare two jobs, one using soldering and another using brazing
4	Demonstration of lathe machine operations
5	Demonstration of shaper machine operations
6	Demonstration of drilling machine operations
7	Demonstration of milling machine operations
8	Demonstration of grinding machine operations
9	Demonstration of sheet metal operations
10	Demonstration and perform riveting operations
11	Demonstration of EDM operations.

a. Course Name: Basic Engineering Thermodynamics

b. Course Code: 03613207

c. Prerequisite: Zeal to Learn the Subject.

d. Rationale: The course is designed to give the detailed understanding of various systems of Thermodynamics, its different laws. Also the subject gives details about the properties of thermodynamics.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamentals of thermodynamics, including thermodynamic systems, properties, and energy concepts such as heat, work, and power. Learn about the Zeroth Law of Thermodynamics and various temperature measurement devices/instruments used in thermodynamics.
CLOBJ 2	Explore Joule's experiment and its significance in establishing the First Law of Thermodynamics. Understand the law of conservation of energy and its application to closed systems, systems undergoing a change of state, and open systems. Apply the energy equation to various scenarios, including non-flow processes, open systems, and steady flow using the Steady Flow Energy Equation (SFEE). Understand the limitations of the First Law of Thermodynamics through simple numerical examples.
CLOBJ 3	Learn about various ideal gas laws, the characteristic gas equation, universal gas constant, specific heats, and different thermodynamic processes. Represent thermodynamic processes on P-V (Pressure-Volume) and T-s (Temperature-Entropy) diagrams. Apply equations for PVT relationships, work transfer, heat transfer, and internal energy to solve simple numerical examples.
CLOBJ 4	Understand the concepts of heat source, heat sink, heat engine, heat pump, and refrigerator.

	Explore the Kelvin-Plank statement, Clausius statement, and the equivalence of these statements. Understand thermal efficiency, COP (Coefficient of Performance), and entropy. Learn about the concepts of reversibility and irreversibility of thermodynamic processes and their causes. Explore the Carnot cycle and its representation on P-V and T-s diagrams.
CLOBJ 5	Understand the concept of air standard efficiency and analyze Otto, Diesel, and Dual Combustion cycles, including their limitations, applications, and comparison based on different parameters. Explore refrigeration cycles, including the Reversed Carnot cycle and Reversed Brayton cycle, and understand their representation on P-V and T-s diagrams. Calculate COP (Coefficient of Performance) for these cycles.

f. Course Learning Outcomes:

CLO 1	Apply the knowledge of thermodynamics to temperature scales.
CLO 2	Solve the practical thermodynamic problems by applying first law and steady flow energy equation
CLO 3	Analyze the problems on heat engines, refrigeration and entropy by applying second law of thermodynamics.
CLO 4	Evaluate the properties of gases.
CLO 5	Evaluate the performance of cycles.

k. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Apply the knowledge of thermodynamics to temperature scales.
CLO 2	Solve the practical thermodynamic problems by applying first law and steady flow energy equation
CLO 3	Analyze the problems on heat engines, refrigeration and entropy by applying second law of thermodynamics.
CLO 4	Evaluate the properties of gases.
CLO 5	Evaluate the performance of cycles.

l. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	0	60	0	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; **MSE**- Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE**- End Semester Examination.

m. Course Content:

Unit No.	Topic	Weightage	Teaching Hrs.
1.	Introduction to Thermodynamics Introduction, Thermodynamic systems-concept, terminology associated, classification, concept of continuum. Thermodynamics properties & their units. Concept of energy, heat, work and power- types & simple numerical examples. Zeroth law of thermodynamics and its application. Name of various Temperature measurement devices/instruments used with related units.	15%	06
2.	First Law Of Thermodynamics Joule's experiment-set up & significance. Law of conservation of energy. First law of thermodynamics with reference to: i. Closed system. ii. System undergoing a change of state. iii. Open system. Energy equation & its application to: Non flow process, Open system, Steady flow (Steady flow energy equation – SFEE), Limitations of first law of thermodynamics, Simple numerical examples based on above.	20%	08
3.	Properties of Gases Various ideal gas laws, Characteristic gas equation and Universal gas constant, Specific heats & their relationship, Different thermodynamic processes, their representation on P-V (Pressure-Volume) and T-s (Temperature-Entropy) diagram, Equations for PVT relationship, work transfer, heat transfer internal energy (without derivations), Simple numerical examples based on above.	20%	08
4.	Second Law Of Thermodynamics Concept and real life examples of heat source, heat sink (reservoir), heat engine, heat pump and refrigerator. Second law of thermodynamics. i. Kelvin-Planck statement. Clausius statement, iii. Equivalence of above two statements, iv. Corollary. Concept of thermal efficiency and COP (Coefficient of Performance), Concept, importance and examples of entropy, Concept of reversibility and irreversibility of thermodynamic processes causes of irreversibility, Carnot cycle, representation on P-V, T-s diagrams, derivation, examples.	25%	10

5.	Thermodynamic Cycles Concept of air standard efficiency. Otto, Diesel & Dual Combustion cycle: i. Representation on P-V & T-s diagram, derivation for air standard efficiency & simple examples. ii. Limitations, applications & comparison of above cycles based on different parameters. Refrigeration cycles: Reversed Carnot cycle, Reversed Brayton cycle: i. Representation on P-V & T-s diagram & expression for COP (without derivation).	20%	10
----	--	-----	----

n. Text Book and Reference Book:

1. Engineering Thermodynamics, R K Rajput; Laxmi Publication
2. Engineering Thermodynamics (TextBook), P K Nag; Tata McGraw-Hill
3. Thermodynamics, R. Yadav; CPH
4. Engineering Thermodynamics, Khurmi R S.
5. Thermodynamics for Engineers, M.L. Mathur; Dhanpatrai & sons

a. Course Name: Aircraft Instruments

b. Course Code: 03613209

c. Prerequisite: Zeal to Learn the Subject.

d. Rationale: The course is designed to give the detailed understanding of various instruments of aircraft, its measurement techniques. Also the subject gives details about the situation of aircraft in the sky.

e. Course Learning Objective:

CLOBJ 1	Understand the classification of aircraft instruments and instrument panels, including the importance of aircraft instruments and their categorization according to usage. Recognize the importance of navigational instruments and Electronic Flight Displays (EFDs), such as Primary Flight Displays (PFDs) and Multi-Function Displays (MFDs).
CLOBJ 2	Study pitot static instruments, including the working principles of the pitot static system, common errors, and their remedies. Learn about various instruments like airspeed indicators, vertical speed indicators, and altimeters and how to interpret their readings.
CLOBJ 3	Explore gyro instruments, their importance, properties of gyroscopes, and their role in various instruments. Understand gyro system sources and working principles of instruments like attitude indicators, directional gyros, turn coordinators, turn and slip indicators, heading indicators, and inclinometers. Identify errors in gyro instruments and their remedies.
CLOBJ 4	Understand the importance and working principles of various engine instruments, including engine performance parameters and condition parameters. Study pressure and temperature instruments inside the engine and learn about instruments such as tachometers, engine pressure ratio indicators, cylinder head temperature gauges, manifold pressure gauges,

	EGT (Exhaust Gas Temperature) indicators, TIT (Turbine Inlet Temperature) indicators, TOT (Turbine Outlet Temperature) indicators, and fuel flow indicators.
CLOBJ 5	Learn about miscellaneous instruments such as Air Data Computers (ADCs), primary controls of aircraft, trim tab indicators, flap position indicators, angle of attack indicators, magnetic compasses, Outside Air Temperature (OAT) gauges, and Machmeters. Understand their roles, importance, and working principles.

g. Course Learning Outcomes:

CLO 1	Make familiar with the working and operating characteristic of flight instruments.
CLO 2	Acquainted with the various Instruments used in aircraft.
CLO 3	Develop skills to understand and solve the errors of instruments.
CLO 4	Understand the importance of six pack instruments
CLO5	Learn about miscellaneous instruments

h. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with the working and operating characteristic of flight instruments.
CLO 2	Acquainted with the various Instruments used in aircraft.
CLO 3	Develop skills to understand and solve the errors of instruments.
CLO 4	Understand the importance of six pack instruments
CLO5	Learn about miscellaneous instruments

o. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	0	0	3	20	20	0	60	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**Continuous Evaluation, **ESE-** End Semester Examination.

i. Course Content:

Unit No.	Topic	Weightage	Teaching Hrs.
1.	Introduction Classification of the various instruments and instruments panels, six pack instruments, types of instruments panels, Importance of aircraft instrument and its classification according to its usage, Importance of navigational instruments, Electronic Flight Display (EFD)-PFD, MFD.	18%	04
2.	Pneumatic Instruments Study about the pitot static Instruments, working of pitot static system, Errors and its remedies of Pitot static system, study of various instruments like Air speed indicator, Vertical speed indicator and Altimeter and how to read this instrument.	21%	08
3.	Gyro Instruments Important of gyro instruments and its application area, properties of gyroscope and its role in various instruments, Gyro system and its sources for the working, working of various gyro instruments like Attitude indicator, Directional gyro, Turn coordinator, Turn and slip indicator and Heading Indicator, Inclinator, Errors in instruments and its remedies.	22%	07
4.	Engine Instruments Importance of various engine instruments and its working, study about engine performance parameters, study of engine condition parameters, working concept of pressure and temperature instruments inside engine, working of various instruments like Tachometer, Engine pressure ratio indicator, Cylinder head temperature gauge, manifold pressure gauge, EGT, TIT, TOT and Fuel flow indicator.	24%	06
5.	Miscellaneous Instruments Air Data Computer (ADC), To study the role and importance of various primary controls of aircraft, Trim tab indicators, Flap position indicators. Angle of Attack Indicators, Magnetic Compass, Outside Air Temperature (OAT) Gauge, Machmeter	15%	04

j. Text Book and Reference Book:

1. Aircraft Instruments (TextBook), E H Pallet; Pearson Education
2. Aircraft Instrumentation and Systems ,S. Nagabhushana; I K International publishing house
3. Aircraft Instruments
C A Williams; Galgotia Publication

a. Course Name: Entrepreneurship and Start-ups

b. Course Code: 03600201

- c. **Prerequisite:** Zeal to Learn the Subject.
- d. **Rationale:** The main objective of this course is to understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation and learning the process and skills of creation. This subject provides detail information about Acquiring Entrepreneurial spirit and resourcefulness, Familiarization with various uses of human resource for earning dignified means of living, Acquiring entrepreneurial quality, competency, and motivation and management of entrepreneurial venture.
- e. **Course Learning Objective:**

CLOBJ 1	Define entrepreneurship and startups, understand the traits of an entrepreneur, and explore the motivation behind starting a business. Identify different types of business structures and analyze the similarities and differences between entrepreneurs and managers.
CLOBJ 2	Discover business ideas, visualize business concepts, and create activity maps. Develop a comprehensive business plan that outlines the vision, goals, and strategies for the startup venture.
CLOBJ 3	Conduct market analysis to identify the target market and evaluate competition. Develop strategies for marketing, accounting, and risk management to ensure the success of the startup.
CLOBJ 4	Understand the importance of company organization structure in startup management. Learn techniques for recruitment and management of talent, as well as financial organization and management.
CLOBJ 5	Explore financing methods available for startups in India and learn to effectively communicate ideas to potential investors through investor pitches. Understand the process of patenting and obtaining licenses to protect intellectual property.

f. **Course Learning Outcomes:**

CLO 1	Understanding the dynamic role of entrepreneurship and small businesses
CLO 2	Organizing and Managing a Small Business
CLO 3	Financial Planning and Control
CLO 4	Forms of Ownership for Small Business
CLO 5	Strategic Marketing Planning, New Product or Service Development, Business Plan Creation

g. **Mapping of Course Learning Outcomes and Bloom's Taxonomy:**

Course Learning Outcomes	
CLO 1	Understanding the dynamic role of entrepreneurship and small businesses
CLO 2	Organizing and Managing a Small Business
CLO 3	Financial Planning and Control

CLO 4	Forms of Ownership for Small Business
CLO 5	Strategic Marketing Planning, New Product or Service Development, Business Plan Creation

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
1	0	0	1	20	20	0	60	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**Continuous Evaluation, **ESE-** End Semester Examination.

i. Course Content:

Unit No.	Topic	Weightage	Teaching Hrs.
1.	Introduction to Entrepreneurship and Start Ups Definitions, Traits of an entrepreneur, Entrepreneurship, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers.	20%	06
2.	Business Ideas and their implementation Discovering ideas and visualizing the business, Activity map, Business Plan.	15%	04
3.	Idea to Start-up Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis	15%	04
4.	Management Company's Organization Structure, Recruitment and management of talent, Financial organization and management	20%	04
5.	Financing and Protection of Ideas Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses	15%	04
6.	Exit strategies for entrepreneurs Bankruptcy, and succession and harvesting strategy	15%	04

j. Text Book and Reference Book:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company by Steve Blank and Bob Dorf, K & S Ranch
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Business by Eric Ries, Penguin UK
- 3 Demand: Creating What People Love Before They Know They Want It by Adrian J. Slywotzky with Karl Weber, Headline Book Publishing
4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business by Clayton M. Christensen, Harvard business

a. Course Name: Professional Communication and Critical Thinking

b. Course Code: 03693203

c. Prerequisite: Knowledge of English Language

d. Rationale: Advance level of communication and personality development is crucial for and after placement,

e. Course Learning Objective:

CLOBJ 1	Develop basic speaking and writing skills including proper use of language & vocabulary so that they become highly confident & skilled speakers & writers
CLOBJ 2	Define the latest trends in basic verbal activities such as presentations, facing interviews & other forms of oral communication.
CLOBJ 3	Engage in professional Development Activities through presentation & enhance communication skills in team.
CLOBJ 4	Enhance non-verbal communication skills such as proper use of body language & gestures.
CLOBJ 5	Identify format & basic to write professionally through emails & reports

f. Course Learning Outcomes:

CLO 1	Develop their Personality
CLO 2	Analyze various concepts included in competitive exams.
CLO 3	Imply their knowledge for appearing in Interview
CLO 4	Writing & Communication is improved by their efforts.
CLO 5	Analyze the effectiveness of emails and reports in terms of clarity, conciseness, and tone.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understand the concepts of Body language, verbal & nonverbal communication for understanding the basic psychology behind a person's

	behavior.
CLO 2	Use their knowledge & learn more about different competitive exams, patterns, content asked in it.
CLO 3	Develop personality & learn presentation skills
CLO 4	Understand types of formal communication & speaking skills through different activities.
CLO 5	Interpret the effectiveness of emails and reports in terms of clarity, conciseness, and tone.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
1	0	0	1	0	10 0	0	0	0	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**Continuous Evaluation, **ESE-** End Semester Examination.

i. Course Content:

Unit No.	Topic	Weightage	Teaching Hrs.
1.	Story Mason: Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	5%	01
2.	Determiners, Articles, Prepositions and Interrogatives This session will enable students to understand proper usage of Determiners and Articles. It will also enhance their daily speaking conversational/ communication skills. Preparation of verbal section in company's aptitude exam	10%	06
3.	Subject-Verb Agreement: This will enable students to understand the formation of sentence with the usage of subject-verb agreement	10%	03
4.	Reading-Skill Building: Types of Reading – reading for different purposes Reading General Articles, Reading Essay, Reading Journal Articles, Novel & Story discussion Enhance reading skills by collecting information, know the importance of reading	10%	02

5.	Reading Comprehension: Learn to solve the reading comprehension questions in an easy manner and also in less amount of time Introduction, Factual & Inferential comprehension, Reasons for Poor Comprehension Able to solve reading comprehension in less amount of Time by practicing	10%	02
6.	Mafia The art of observation and convincing: The interesting activity is targeted toward improving observation And convincing skills. A team activity in which every single. Individual is a very important person of his team to win.	5%	01
7.	Forms and Speech and Voice: Able to solve aptitude questions on forms and voices and Speeches	10%	3
8.	Industry Expectation: In this class the students will be made to understand what will be the world after their college life will be, how they should prepare themselves from that competitive world with full of challenges for them	5%	1
9	Mirror & Water Images Reflection of an object into a mirror and water It is obtained by inverting an object laterally (mirror) & vertically (water).	10%	3
10	Paper Folding In this section of non verbal reasoning a figure is obtained by folding a piece of paper containing same design along the dotted line.	5%	2
11	Play Teacher: Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	5%	1
12	Social Networking: This session will provide knowledge about the importance of Social Networking sites in their Professional life.	5%	3
13	Group Discussion It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members of a group who share some common objectives.	10%	2

j. Text Book and Reference Book:

Reference Books:

1. Active English by Juneja & Qureshi | Macmillan
2. Verbal and Non-verbal reasoning by B.S.Sijvali and Indu Sijvali | Arihant Publication
3. Competitive English by Azhar Siddiqui | Macmillan

Semester 4

- a. **Course Name: Mechanics and Strength of Materials**
- b. **Course Code:** 03613251
- c. **Prerequisite:** Engineering Mechanics
- d. **Rationale:** All Aircraft components are subjected to different loadings and behave in a specific way. In this course, analysis of determinate structures under various kinds of loadings will be taught. Also, strength and properties of the cross-section and its response in terms of stress and strain will also be focused. This course will lay sound foundation to analysis & design of Aircraft Structure.

e. Course Learning Objective

CLOBJ 1	Recognize different loads and their effects on structures, discerning resulting stresses and strains.
CLOBJ 2	Calculate moment of inertia for various structural shapes, symmetric and asymmetric, for bending and torsion analysis.
CLOBJ 3	Construct diagrams for beams, visualizing internal forces and moments under different loads.
CLOBJ 4	Apply bending theory to determine stresses induced in beams for design and safety evaluation and assess structural elements subjected to eccentric axial loads, considering implications for design and stability.
CLOBJ 5	Calculate deflection in beams under various loads, understanding its significance in structural integrity and Determine load capacity of columns and struts considering buckling and material failure.

f. Course Learning Outcomes:

CLO 1	Student will capable to Identify Loads, stresses and strains acting on structure.
CLO 2	Student will capable to Compute Moment of Inertia of Symmetric asymmetric structure.
CLO 3	Student will capable to Illustrate Shear Force & Bending Moment Diagram for Statically Determinate Beams.
CLO 4	Student will capable to Use 'Theory of Bending' to compute stresses in Beams and Calculate Load carrying capacity of Column & Strut.
CLO 5	Student will capable to Determine deflection induced in Statically Determinate Beams and Analyze Structural components subjected to Axial Eccentric Loads.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Student will capable to Identify Loads, stresses and strains acting on structure.
CLO 2	Student will capable to Compute Moment of Inertia of Symmetric asymmetric structure.
CLO 3	Student will capable to Illustrate Shear Force & Bending Moment Diagram for Statically Determinate Beams.
CLO 4	Student will capable to Use 'Theory of Bending' to compute stresses in Beams and Calculate Load carrying capacity of Column & Strut.
CLO 5	Student will capable to Determine deflection induced in Statically Determinate Beams and Analyze Structural components subjected to Axial Eccentric Loads.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Course Content:

Sr.	Topics	Weightage	Teaching Hrs.
1	Introduction to Direct Stress and Strain: Different types of Structures and Loads, Direct Stress, linear Strain, Hook's Law, Calculate Numerical on Direct Stress & Linear Strain, Stress Strain curve of Mild Steel, Modulus of Elasticity, Yield Breaking & Ultimate Stress and factor of Safety; Lateral Strain and Poisson's ratio; Shear Stress, Shear Strain & Shear Modulus	15	6
2	Moment of Inertia: Moment of Inertia & its Importance. Parallel & Perpendicular Axis Theorem, Formula of Moment of Inertia of solid & Hollow sections like Rectangle, Triangle, Moment of Inertia about C.G for I section, H section, Channel Section, Angle Section, T Section.	10	5
3	S.F and B.M in Beam: Statically Determinate Beams Like Cantilever, Simply Supported & Over Hang Beam, Relation between Shear Force and Bending Moment, Sagging & Hogging Bending Moment and its importance, Point of Contra flexure & its importance; S.F & B.M Diagram for Cantilever, Simply Supported & Over Hang Beam	20	6

4	Bending Stresses in Beam: Bending Theory Equation Bending stress; Sectional Modulus, Neutral Axis; Application of Bending theory to Statically determinate beams elements like shaft, axle, and spindle, pulley arm having rectangular or circular section to find out stresses.	30	10
5	Deflection of Beams: Slope & Deflection; Formulae for Cantilever Beam subjected to Point Load at free end and with full UDL; Formulae for S.S Beam subjected to Point; Load at MID SPAN and with full UDL; Numerical problems on Slope and Deflection.	15	4
6	Columns and Struts: Column & Strut; Short & Long Column; End Condition of Column and effective Length of Column & Modes of Failure in Column; Radius of Gyration, Slenderness Ratio; Euler's Crippling Load & its numerical	15	4
7	Combined Direct and Bending Stresses: Eccentricity; Formula for combined Direct & Bending Stresses; Limit of Eccentricity; Core section for Rectangular & Circular (Hollow & Solid); Numerical on Combined Stresses for Rectangle & Circular Section.	15	6

k. Text Book and Reference Book:

1. A textbook Strength of Materials (TextBook)
By R.K.Bansal; Laxmi Publications (P) LTD
2. Strength of Materials
By R S Khurmi; S. Chand & Company Limited
3. Strength of Materials
S. Ramamrutham; Dhanpat Rai Publishing Company (P) Limited.
4. Strength of Material
B.C. punmia; laxmi publication

a. Course Name: Mechanics and Strength of Materials Lab

b. Course Code: 03613252

c. Prerequisite: Knowledge of Applied science

d. Rationale: All Aircraft components are subjected to different loadings and behave in a specific way. In this course, analysis of determinate structures under various kinds of loadings will be taught. Also, strength and properties of the cross-section and its response in terms of stress and strain will also be focused. This course will lay sound foundation to analysis & design of Aircraft Structure.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamentals of material properties, stress, and
----------------	---

	strain.
CLOBJ 2	Apply mathematical and scientific principles to solve engineering problems effectively.
CLOBJ 3	Identify, formulate, and solve engineering and real-life problems using appropriate methodologies.
CLOBJ 4	Design and conduct experiments, analyze data, and interpret results to inform engineering decisions.
CLOBJ 5	To Draw SFD and BMD for different situation.

f. Course Learning Outcomes:

CLO 1	To understand the basics of material properties, stress and strain.
CLO 2	To apply knowledge of mathematics, science, for engineering applications.
CLO 3	Ability to identify, formulate, and solve engineering & real-life problems.
CLO 4	Ability to design and conduct experiments, as well as to analyze and interpret data.
CLO 5	Students are capable of calculating end moments for different cases.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	To understand the basics of material properties, stress and strain.
CLO 2	To apply knowledge of mathematics, science, for engineering applications.
CLO 3	Ability to identify, formulate, and solve engineering & real-life problems.
CLO 4	Ability to design and conduct experiments, as well as to analyze and interpret data.
CLO 5	Students are capable of calculating end moments for different cases.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
-	-	2	1	-	-	-	-	50	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester

Evaluation, **CE-**
Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr.	Topics
1	Draw Stress Strain Curve for Tension Test on Ductile Materials like Mild Steel, Aluminum.
2	Determine Young's Modulus of wire of Given Material.
3	Calculate Moment of Inertia of Fly Wheel.
4	Demonstrate End Conditions of Column.
5	To Solve numerical on Moment of Inertia about C.G for different section.
6	To draw S.F & B.M Diagram for Cantilever, Simply Supported & over Hang Beam
7	Numerical problems on Slope and Deflection.
8	Numerical on Combined Stresses for Rectangle & Circular Section.

j. Text Book and Reference Book:

1. A textbook Strength of Materials (TextBook)
By R.K.Bansal; Laxmi Publications (P) LTD
2. Strength of Materials,
By R.S Khurmi; S. Chand
3. Strength of Materials
S. Ramamurtham, R. Narayan; Dhanpat Rai Publishing company (P) Limited

L. Mapping of Experiment List with Course Learning Outcomes:

Sr. NO.	Experiment List
1	Draw Stress Strain Curve for Tension Test on Ductile Materials like Mild Steel, Aluminum.
2	Determine Young's Modulus of wire of Given Material.
3	Calculate Moment of Inertia of Fly Wheel.
4	Demonstrate End Conditions of Column.
5	To Solve numerical on Moment of Inertia about C.G for different section.
6	To draw S.F & B.M Diagram for Cantilever, Simply Supported & over Hang Beam
7	Numerical problems on Slope and Deflection.

8	Numerical on Combined Stresses for Rectangle & Circular Section.
---	--

- a. **Course Name:** Computer Aided Modeling and Design-I
- b. **Course Code:** 03613253
- c. **Prerequisite:** Zeal to learn the Subject
- d. **Rationale:** The course is designed to give the detailed understanding of designing process & basic of computer knowledge. Also, the subject gives details about how draw different types of objects with help of AutoCAD software.
- e. **Course Learning Objective:**

CLOBJ 1	Understand computer graphics terminology, define CAD and explain its concept and need.
CLOBJ 2	Describe the CAD process and its functional areas, explain coordinate systems and their importance.
CLOBJ 3	Identify different types of CAD workstations and their configurations, Describe geometric modeling concepts, types, features, and applications.
CLOBJ 4	Introduce AutoCAD and provide an overview of its 2D commands.
CLOBJ 5	Explain 2D modify and editing commands in AutoCAD, dimensioning objects in AutoCAD, 3D modeling using AutoCAD.

f. Course Learning Outcomes:

CLO 1	Appreciate the need of CAD and its application and performance of Geometric 2D transformation.
CLO 2	Description of the functions of CAD Workstation, its types, and configuration and Use input/output CAD devices.
CLO 3	To explain types of solid modeling and Description of characteristics of features-based CAD packages.
CLO 4	Differentiate graphics packages used for modeling and application of appropriate UCS for the given situation.
CLO 5	Creating solid model of industrial parts and its assembly using Auto CAD and prepare simple surface model using AutoCAD.

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Understand the need of CAD and its application and performance of Geometric 2D transformation.
CLO 2	Description of the functions of CAD Workstation, its types, and configuration and Use input/output CAD devices.
CLO 3	To explain types of solid modeling and Description of characteristics of features-based CAD packages.
CLO 4	Differentiate graphics packages used for modeling and application of appropriate UCS for the given situation.
CLO 5	Creating solid model of industrial parts and its assembly using Auto CAD and prepare simple surface model using AutoCAD.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to CAD: Computer graphics & its terminology, CAD definition, concept & need, CAD process, Functional areas of CAD, Coordinate systems, Geometric transformation-concept and types, 2 dimensional (2D) geometric transformation- translation, scaling, rotation and mirror with numeric examples.	20%	4
2	Cad Hardware: CAD Workstation-types, functions and configuration, Input and output devices (including voice, gesture, 3-dimensional (3D) printer, etc)- types, configuration and applications.	15%	4

3	Geometric Modelling: Difference between 2D & 3D models, Geometric modeling concept, types, features and applications, Solid modeling methods like Constructive Solid Geometry, Pure primitives & Boundary Representation, Feature base modeling-concept, illustrative examples, Parametric & non parametric modeling- concept, differences and illustration.	20%	6
4	2D Modelling using AutoCAD: Introduction to AutoCAD-2D commands overview, 2D Draw Command, 2D Modify & Editing Command, Dimension of Object.	20%	4
5	3D Modeling using AutoCAD: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries.	25%	6

j. Text Book and Reference Book:

1. CAD/CAM (TextBook)
By Groover; Pearson
2. Computer aided design: A conceptual approach
By Jayanta Sarkar; CRC press
3. Computer-Aided Graphics and Design,
By D. L. Ryan; Marcel Dekker Inc, 1994
4. AutoCAD 2013 for Engineers and Designers
By Sham Tickoo; Dream tech press, New Delhi, Latest edition

a. Course Name: Computer Aided Modeling and Design-I Lab

b. Course Code: 03613254

c. Prerequisite: Zeal to learn the Subject

d. Rationale: Computer Aided Drafting is the main subject of aeronautical engineering which gives an idea of design process & design software of AutoCAD. The goal of this Computer Aided Drafting course is to expose students to problems in designing as applied to plausibly real-world scenarios.

e. Course Learning Objective:

CLOBJ 1	Provide an overview of AutoCAD software, its features, and applications in engineering and design.
CLOBJ 2	Develop proficiency in creating 2D drawings, including basic shapes, lines,

	dimensions, and annotations, using AutoCAD software.
CLOBJ 3	Gain skills in creating 3D solid models, including extrusions, rotations, and sweeps, using AutoCAD software.
CLOBJ 4	Learn techniques for creating simple surface models, such as lofting and surface editing, using AutoCAD software.
CLOBJ 5	Apply knowledge and skills acquired in AutoCAD to conceptualize, design, and create a mini project demonstrating proficiency in both 2D and 3D modeling.

f. Course Learning Outcomes:

CLO 1	Appreciate the need of CAD and its application and performance of Geometric 2D transformation.
CLO 2	Description of the functions of CAD Workstation, its types, and configuration and Use input/output CAD devices.
CLO 3	To explain types of solid modeling and Description of characteristics of features-based CAD packages.
CLO 4	Differentiate graphics packages used for modeling and application of appropriate UCS for the given situation.
CLO 5	Creating solid model of industrial parts and its assembly using Auto CAD and prepare simple surface model using AutoCAD.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Understand the need of CAD and its application and performance of Geometric 2D transformation.
CLO 2	Description of the functions of CAD Workstation, its types, and configuration and Use input/output CAD devices.
CLO 3	To explain types of solid modeling and Description of characteristics of features-based CAD packages.
CLO 4	Differentiate graphics packages used for modeling and application of appropriate UCS for the given situation.
CLO 5	Creating solid model of industrial parts and its assembly using Auto CAD and prepare simple surface model using AutoCAD.

h. Teaching & Examination Scheme:

Teaching Scheme	Evaluation Scheme
------------------------	--------------------------

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content
1	Introduction of AutoCAD
2	To prepare 2D drawing using AutoCAD.
3	To prepare 3D solid models using AutoCAD.
4	To prepare a simple surface model using AutoCAD
5	To prepare a mini project using AutoCAD

j. Text Book and Reference Book:

1. "AutoCAD 2016 For Beginners" (Textbook) CADFolks;; CreateSpace Independent Publishing Platform
2. AutoCAD 2015 for Engineers & Designers by Bhatt; WILE.
3. AutoCAD 2013 for Engineers and Designers by Sham Tickoo; Dream tech press, New Delhi, Latest edition.

k. Mapping of Experiment List with Course Learning Outcomes:

Sr. NO.	Experiment List
1	Introduction of AutoCAD
2	To prepare 2D drawing using AutoCAD.
3	To prepare 3D solid models using AutoCAD.
4	To prepare a simple surface model using AutoCAD
5	To prepare a mini project using AutoCAD

a. Course Name: Fundamentals of Fluid Mechanics

b. Course Code: 03613255

c. Prerequisite: Ease of learning and having interest in fluid behavior and flow properties

d. Rationale: The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behavior at rest and in motion and fundamental equations like mass, energy

and momentum conservation of the fluid flow thereby developing an understanding of fluid dynamics in variety of fields. Applications of these basic equations have been highlighted for flow measurements. This course will lay sound foundation for aerodynamics.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental concepts and properties of fluids, including classification, viscosity, and basic numerical problem-solving.
CLOBJ 2	Gain knowledge about fluid statics principles, pressure measuring devices, their applications, and selection criteria through theoretical understanding and numerical problem-solving.
CLOBJ 3	Develop skills in analyzing fluid flow behavior, understanding equations governing fluid motion, and solving numerical problems related to fluid kinematics.
CLOBJ 4	Understand the principles of fluid dynamics, including Euler's and Bernoulli's equations, flow measurement devices, and their applications, along with solving numerical problems related to flow dynamics.
CLOBJ 5	Acquire knowledge about pipe flow characteristics, factors affecting flow through pipes, selection criteria for pipes, and solving numerical problems related to pipe flow.

f. Course Learning Outcomes:

CLO 1	Understand the effect of fluid properties on a flow system.
CLO 2	Selection and use of pressure measuring devices
CLO 3	Identify type of fluid flow pattern.
CLO 4	Use of Continuity equation to one dimensional fluid flow situations.
CLO 5	Selection and use of flow measuring devices based on given situation and Study different types of flow from Reynolds Experiment.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understand the effect of fluid properties on a flow system.
CLO 2	Selection and use of pressure measuring devices
CLO 3	Identify type of fluid flow pattern.

CLO 4	Use of Continuity equation to one dimensional fluid flow situations.
CLO 5	Selection and use of flow measuring devices based on given situation and Study different types of flow from Reynolds Experiment.

I. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

J. Course Content:

Sr.	Topics	W	T
1	Introduction: Concept and classification of fluid; Properties of fluid; Newton's law viscosity; Simple numerical examples	10	3
2	Fluid Statics and its Applications: Law of fluid statics; Type working and applications of pressure measuring devices (Manometers and mechanical gauges) with simple numerical examples; Selection criteria for pressure measuring devices	20	6
3	Fluid Kinematics: Concept of control volume; Fluid flow; Continuity and energy equation; Momentum equations; Types of fluid flow; Flow patterns for ideal, laminar, turbulent and compressible fluid, flow of one dimension; Simple numerical problems.	20	6
4	Fluid Dynamics and Flow Measurement: Fluid energy-types, interrelations; Euler's equation: Concept and definition, understanding various terms in Euler's equation, Bernoulli's equation: Concept and definition, Derivation from Euler's equation, Assumptions and Limitations, Applications; Flow measurement Devices, classifications, principle, working, applications; Selection criteria for flow measuring device; Simple numerical examples.	30	10
5	Flow through Pipes: Introduction to pipe and pipe flow; Reynolds's experiment; friction factor; Darcy's equation; Moody's chart; Water hammer effect; Selection criteria for pipes and pipe size; Simple numerical examples.	20	7

k. Text Book and Reference Book:

1. Fluid mechanics & hydraulic Machines (TextBook)
By R.K.Bansal; Lakshmi publication
2. Fluid mechanics & hydraulic machines
By S.C. Gupta; PERSON Education
3. Fluid Mechanics & Hydraulics Machines
By Dr. R K Rajput; S Chand & Company Limited
4. Engineering Fluid Mechanics
By D. S. Kumar; S K KATARIA & SONS-NEW DELHI
5. Fluid Mechanics
By F. M. White; Tata McGraw - Hill Publishing Co. Ltd

a. Course Name: Fundamentals of Fluid Mechanics Lab

b. Course Code: 03613256

c. Prerequisite: Ease of learning and having interest in fluid behavior and flow properties

d. Rationale: The main objective of this course is to understand the fundamentals of the fluid mechanics such as fluid and flow properties, fluid behavior at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow thereby developing an understanding of fluid dynamics in variety of fields. Applications of these basic equations have been highlighted for flow measurements. This course will lay sound foundation for aerodynamics

e. Course Learning Objective:

CLOBJ 1	Describe and experimentally determine different properties of fluids, such as density, viscosity, surface tension, and specific gravity.
CLOBJ 2	Understand set up and use various types of manometers to measure pressure accurately in different fluid systems.
CLOBJ 3	Conduct experiments to demonstrate and verify Bernoulli's theorem, comparing the total energy at different points along a streamline in a fluid flow.
CLOBJ 4	Understand process of measuring fluid flow rates using Venturi meters and nozzles, including calibration and accuracy, and use Orifice meters while considering head loss, discharge coefficient, and flow conditions.
CLOBJ 5	Determine the Reynolds number for a given flow situation using appropriate flow visualization techniques and calculations.

f. Course Learning Outcomes:

CLO 1	The effect of fluid properties on a flow system.
--------------	--

CLO 2	Select and use of pressure measuring devices
CLO 3	Identify type of fluid flow pattern and Use of Continuity equation to one dimensional fluid flow situations
CLO 4	Select and use flow measuring devices based on given situation.
CLO 5	To study different types of flow from Reynolds Experiment.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	The effect of fluid properties on a flow system.
CLO 2	Select and use of pressure measuring devices
CLO 3	Identify type of fluid flow pattern and Use of Continuity equation to one dimensional fluid flow situations
CLO 4	Select and use flow measuring devices based on given situation.
CLO 5	To study different types of flow from Reynolds Experiment.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content
1	To study various fluid properties
2	Demonstrate and Measure pressure using: i. various manometers ii. Various Pressure gauges
3	Verify Bernoulli's theorem.

4	Measure fluid flow by Venturimeter and Nozzle.
5	Measure fluid flow by Orifice meter.
6	Estimate Reynolds number using given test rig

j. Text Book and Reference Book:

1. Fluid Mechanics & Hydraulics Machines
By R. K. Bansal; Laxmi Publications
2. Fluid Mechanics & Hydraulics Machines
By Dr.R K Rajput; S Chand & Company Limited
3. Engineering Fluid Mechanics
by K.L. Kumar; Eurasia Publication House
4. Fluid Mechanics
By V. L. Streeter; McGraw-Hill

k. Mapping of Experiment List with Course Learning Outcomes:

Sr. NO.	Experiment List
1	To study various fluid properties
2	Demonstrate and Measure pressure using: i. various manometers ii. Various Press gauges
3	Verify Bernoulli's theorem.
4	Measure fluid flow by Venturimeter and Nozzle.
5	Measure fluid flow by Orifice meter.
6	Estimate Reynolds number using given test rig

a. Course Name: Aircraft Systems

b. Course Code: 03613257

c. Prerequisite: Introduction to Aeronautics

d. Rationale: The main objective of this course is to understand the working of the aircraft systems. This subject addresses the understanding and functioning of hydraulic system and associated parts, the pneumatic system, lubrication system, and the cabin pressurization system.

e. Course Learning Objective:

CLOBJ 1	Explain the principles of engine lubrication, identify different types of friction, describe the functions of engine oil, and analyze lubrication system requirements for both reciprocating and turbine engines.
----------------	---

CLOBJ 2	Understand basic fuel system requirements, types of aviation fuel, fuel tank configurations, and the functioning of reciprocating and turbine engine fuel systems and ignition systems.
CLOBJ 3	Understand the characteristics of hydraulic fluids, types of hydraulic systems, and the main components of hydraulic systems in large commercial aircraft. They will also understand aircraft pneumatic systems and their components.
CLOBJ 4	Learn about various auxiliary systems in aircraft, including ice and rain protection, fire protection, induction and exhaust systems, cabin environmental control, landing gear, and air conditioning systems.
CLOBJ 5	Evaluate the requirements, characteristics, and operational aspects of different aircraft systems, considering safety, efficiency, and reliability aspects.

f. Course Learning Outcomes:

CLO 1	Make familiar with the systems of aircraft various principles used for systems.
CLO 2	Understand lubrication and cooling system of an airplane.
CLO 3	Understand hydraulic and pneumatic system of an airplane and Fuel & Ignition System of an airplane.
CLO 4	Understand types of operating systems are used to conduct successful operation.
CLO 5	Understand the fundamentals of rain and ice protection system, Fire protection system etc.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with the systems of aircraft various principles used for systems.
CLO 2	Understand lubrication and cooling system of an airplane.
CLO 3	Understand hydraulic and pneumatic system of an airplane and Fuel & Ignition System of an airplane.
CLO 4	Understand types of operating systems are used to conduct successful operation.
CLO 5	Understand the fundamentals of rain and ice protection system, Fire protection system etc.

h. Teaching Scheme:

Teaching Scheme				Evaluation Scheme		
				Internal Evaluation	ESE	

L	T	P	C	MSE	CE	P	Theor y	P	Total
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr.	Topics	W	T
1	Introduction: Introduction, Classification of Systems	5	2
2	Lubrication and Cooling System: Principles of Engine Lubrication, Types of Friction, Functions of Engine Oil, Requirements and Characteristics of Reciprocating Engine Lubricants, Reciprocating Engine Lubrication Systems, Requirements for Turbine Engine Lubricants, Turbine Engine Lubrication Systems. Engine Cooling Systems.	25	8
3	Fuel and Ignition System: Basic Fuel System Requirements, Types of Aviation Fuel, Types fuel Tanks, Reciprocating Engine Fuel System, Turbine Engine Fuel system, Ignition Systems, Engine Starting Systems.	20	6
4	Hydraulic and Pneumatic Power Systems: Hydraulic Fluid Characteristic, Types of Hydraulic Fluids, Basic Hydraulic Systems, Large Commercial Aircraft, Main Components of Hydraulic System Aircraft Pneumatic Systems & Components.	25	6
5	Miscellaneous Systems: Ice & Rain protection System, Fire Protection Systems, Induction and Exhaust Systems, Cabin Environmental Control Systems, Landing Gear System, Air Conditioning System.	25	8

Reference Books:

1. Aircraft Systems (TextBook)
By Ian Moir, Allan Seabridge; John Wiley & Sons
2. Aircraft Systems
By David Lombardo; McGraw Hill
3. Aircraft Maintenance and Repair
by Michael J. Kroes and William A Watkins; McGraw Hill

a. Course Name: Basic Avionics

b. Course Code: 03613259

c. Prerequisite: Zeal to learn Subject

d. Rationale: The course is designed to give the detailed understanding of various navigational instruments of aircraft, its operating techniques. Also the subject gives details about the situation of aircraft in the sky.

e. Course Learning Objective:

CLOBJ 1	Knowledge of various navigational instruments and avionics equipment used in aircraft, including their classification, principles, and significance in ensuring safe and efficient navigation.
CLOBJ 2	Learn about various navigation systems such as VOR, NDB, ADF, ILS, and MLS, including their working principles, types, applications, equipment involved, and common errors encountered in navigation.
CLOBJ 3	Understand the importance of radar in navigation and communication with Air Traffic Control (ATC). They will study the concept, application, and working principles of Primary Surveillance Radar, Secondary Surveillance Radar, Doppler Radar, and other radar systems used in aviation.
CLOBJ 4	Study different types of flight displays, including their classification and working principles. They will also learn about advanced display technologies such as Head-Up Displays (HUDs) and Head-Mounted Displays (HMDs) and their significance in enhancing situational awareness.
CLOBJ 5	Knowledge of concepts related to electronic warfare, including noise jamming, deception jamming, and defensive aids. They will also study the basics of Unmanned Aerial Vehicles (UAVs), including their types, avionics systems, and their role in modern warfare.

f. Course Learning Outcomes:

CLO 1	Understanding the working and operating characteristic of avionics instruments
CLO 2	Acquainted with the various Navigation system used in aircraft
CLO 3	Develop skills to understand and solve the errors of navigation.
CLO 4	Understand the importance of radar in navigation and communication with Air Traffic Control (ATC).
CLO 5	Understand the importance of warfare and UAVs.

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Understanding the working and operating characteristic of avionics instruments
CLO 2	Acquainted with the various Navigation system used in aircraft
CLO 3	Develop skills to understand and solve the errors of navigation.
CLO 4	Understand the importance of radar in navigation and communication with Air Traffic Control (ATC).
CLO 5	Understand the importance of warfare and UAVs.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

i. Course Content:

Sr.	Topic	Weightage	Teaching Hrs.
1	Introduction: Classification of various navigational instruments and introduction, principles of avionics, learn about various avionics equipment, and understanding the navigation part of aircraft and its importance.	15	4
2	Navigation System: Study about the various navigational system and its importance, Working of VOR, types of VOR, NDB, ADF, ILS, MLS and its principles, applications, equipment and its errors.	24	10
3	Radars: Understanding the importance of radar in navigation and communicating with ATC, concept, application and working of Radar, To study about Primary Surveillance Radar, To study about secondary surveillance Radar, Radar display and data processing unit, Radio altimeter, study about GPWS, Doppler Radar, working of airborne weather radar, Working of TCAS.	28	12
4	Displays: To study the types and classification of flight displays, working of flight displays, To study about Head up displays and its working with importance, To study about Head mounted displays and its importance in military aircraft, concept of reflective optical system.	15	6
5	Introduction to the electronic warfare & UAVs: To study about noise jamming and deception jamming, working of jamming technology, Importance and application of jamming, Defensive aids, Key players in warfare, Importance of anti-aircraft artillery and its usage, study about types of UAVs, study about basic avionics of UAVs.	18	8

j. Reference Books:

1. Avionics Handbook (TextBook)
By CARY R. SPITZER; AvioniCon, Inc
2. Military Avionics Systems
By Ian Moir and Allan G. Seabridge; John wiley & sons, ltd.
3. Avionics Systems
By D H Middleton
4. Manual of Avionics
By Brian Kendal
5. Principles of Avionics
By Albert Helfric

a. Course Name: Minor Project

b. Course Code: 03613262

c. Prerequisite: Zeal to learn the subject.

d. Rationale: The main aim of this subject is to transform theoretical knowledge into practical.

e. Course Learning Objective:

CLOBJ 1	Demonstrate the ability to apply theoretical concepts and methodologies learned throughout the course to solve real-world problems or undertake a small-scale project.
CLOBJ 2	Acquire skills in project planning, organization, execution, and documentation, enhancing their ability to manage small-scale projects effectively.
CLOBJ 3	Participants will collaborate effectively with peers, demonstrate effective communication skills, and contribute positively to team dynamics during project implementation.

f. Course Learning Outcomes:

CLO 1	Makes Transformation of Theoretical Knowledge and its Applications.
CLO 2	Improves Innovative Spirit.
CLO 3	Boosts Curiosity and Liking for Studies and improves Team Leading and Problem-Solving Skills.

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Makes Transformation of Theoretical Knowledge and its Applications.
CLO 2	Improves Innovative Spirit.
CLO 3	Boosts Curiosity and Liking for Studies and improves Team Leading and Problem-Solving Skills.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	-	-	50	50

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

a. **Course Name: Essence of Indian Knowledge and Tradition**

b. **Course Code:** 03600251

c. **Prerequisite:** Zeal to learn Subject

d. **Rationale:** The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature is also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

e. **Course Learning Objective:**

CLOBJ 1	Gain knowledge about the Vedas and Unvedas, including Ayurveda, Dhanurveda, Gandharvaveda, and Sthanya, and their significance in the Indian knowledge system.
CLOBJ 2	Learn about Vedangas such as Education, Kalpa, Nirukta, Grammar, and Jyotisha, and their importance in supporting and enriching the understanding of Vedic texts.
CLOBJ 3	Understand the purpose and relevance of Upangas such as Dharma Shastras, Itihasas, Puranas, and Tantras in providing supplementary knowledge and guidance in various aspects of life.
CLOBJ 4	Examine how modern scientific approaches are applied to ancient Indian practices like Yoga and Holistic Healthcare, exploring their effectiveness and potential benefits.
CLOBJ 5	Analyze real-world case studies demonstrating the practical implementation and outcomes of Yoga and Holistic Healthcare practices, including their effects on physical, mental, and emotional well-being.

f. **Course Learning Outcomes:**

CLO 1	Analyze the significance of rituals, practices, and traditions within the context of Indian culture and spirituality.
CLO 2	Utilize traditional Indian practices or methods in creative or problem-solving contexts.
CLO 3	Compare and contrast different schools of thought within Indian philosophy and their approaches to various concepts.
CLO 4	Evaluate the influence of Indian knowledge and tradition on other cultures and vice versa.
CLO 5	Critically evaluate the ethical implications of certain practices or beliefs within Indian traditions.

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Analyze the significance of rituals, practices, and traditions within the context of Indian culture and spirituality.
CLO 2	Utilize traditional Indian practices or methods in creative or problem-solving contexts.
CLO 3	Compare and contrast different schools of thought within Indian philosophy and their approaches to various concepts.
CLO 4	Evaluate the influence of Indian knowledge and tradition on other cultures and vice versa.
CLO 5	Critically evaluate the ethical implications of certain practices or beliefs within Indian traditions.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	0	20	20	-	-	-	40

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr.	Topics	W	T
1	Basic Structure of Indian Knowledge System: i) Vedas, (ii) Unveda (Ayurveda, Dhanurveda, Gandhveda, Sthanya etc.) (iii) Vedanga (Education, Kalna, Nanrut, Grammar, Jyotish verses), (iv) Upaayaga (Dharma level, Vivamsa, Purana, Takma level)	60	12

2	Modern Science and Indian Knowledge System	15	5
3	Yoga and Holistic Health care	15	5
4	Case Studies	10	4

- a. **Course Name: Employability Skills**
- b. **Course Code: 03693251**
- c. **Prerequisite:** Knowledge of English Language.
- d. **Rationale:** Cracking aptitude is the first step towards cracking placements and competitive exams.
- e. **Course Learning Objective:**

CLOBJ 1	Understand and apply pure logical thinking to solve critical reasoning questions effectively.
CLOBJ 2	Learn various strategies and techniques for coding & decoding, alphabetical series, analogy, and odd man out.
CLOBJ 3	Improve skills in paper folding, completion of figures, and completion of series through practice and application.
CLOBJ 4	Develop effective communication and interpersonal skills through group discussions, resume building, and interview preparation.
CLOBJ 5	Acquire knowledge and skills necessary for entrepreneurship, including concept selling, resume building, and interview techniques tailored for entrepreneurship roles.

- f. **Course Learning Outcomes:**

CLO 1	Improve their critical thinking
CLO 2	Prepare them for Campus Placement and Competitive Exams.
CLO 3	Builds up their confidence level.

- g. **Mapping of Course Learning Outcomes**

Course Learning Outcomes	
CLO 1	Improve their critical thinking
CLO 2	Prepare them for Campus Placement and Competitive Exams.
CLO 3	Builds up their confidence level.

- h. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
1	-	-	1	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Critical Thinking - Case Studies: Critical thinking is based on pure logical thinking. Solving a critical reasoning question requires nothing but reasoning ability of the candidate. This session deals with the basic logic involved in critical reasoning questions and covers all the type of questions in CT. Worksheets would be provided to students for further practice.	8	2
2	Coding & Decoding, Alphabetical Series: Understand various types of questions which they can come across in the given topic. Tips and tricks to solve questions on the above-mentioned topics.	8	3
3	Analogy and Odd Man Out: Understand various types of questions which they can come across in the given topic. Tips and tricks to solve questions on the above-mentioned topics.	8	3
4	Direction Sense: Able to solve all the direction sense question in competitive exams and aptitude exams of different Companies.	8	3
5	Blood Relations: Able to solve all the Blood Relation questions in competitive exams and aptitude exams of different companies.	8	3
6	Paper Folding: In this section of non-verbal reasoning a figure is obtained by folding a piece of paper containing same design along the dotted line.	6	1
7	Seating Arrangement: Candidates are required to arrange the objects either in a row or circle on the basis of information. Questions are presented in distorted form to create confusion and to taste the candidate's ability to analyze the information step by step in order to answer the question.	8	2

8	Completion of Figure: In each of the following figure, a part of figure is missing. Find out from the given options, the right figure to fit in the missing figure.	6	2
9	Completion of Series: In these questions a series of figures is given as problem figure & the candidate are asked to select one of the figures from the set of answer figure which will continue the given sequence.	8	3
10	Entrepreneurship Skills (Selling the Concept): This topic will help students develop the skills necessary to develop into Self- Sufficient business leaders through Entrepreneurship studies.	8	2
11	Resume Building: The students will have a proper understanding of the content and how it is to be presented in resume	8	2
12	Group Discussion: It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members of a group who share some common objectives.	8	2
13	Interview Skills: Students are prepared for their interviews, question and answers, how to react on some unique questions, body language & grooming is taken into account	8	2

j. Text Book and Reference Book:

1. Non-Verbal Reasoning
By B S Sijwali and Indu Sijwali; Arihant
2. Develop Your Contributor Personality
By i-become Publishers, Mumba

SEMESTER-5

a. Course Name: Aerodynamics

b. Course Code: 03613301

c. Prerequisite: Basic knowledge of principles of flight.

d. Rationale: This course is specially designed with a view to impart basic knowledge of aerodynamics and it encompasses the major and general areas of aerodynamics. Aerodynamics is one of the core areas of Aeronautical discipline. The concepts of aerodynamics are vitally important to an aeronautical engineer.

e. Course Learning Objective:

CLOBJ 1	Understand the forces acting on an airplane during flight. - Explain the principle of lift generation and the role of wingtip vortices. - Discuss ground effect. - Identify the axes of an airplane and explain moments and stability. - Introduce the basics of wind tunnel operation.
----------------	---

CLOBJ 2	Derive forces involved in turns, climbs, and descents. - Explain stalls and stalling conditions.
CLOBJ 3	Describe airfoil nomenclature and characteristics. - Classify types of airfoils. - Explain low-speed flow over an airfoil including vortex sheet and circulation. - Introduce classical thin airfoil theory.
CLOBJ 4	Introduce high-speed flight. - Differentiate between supersonic and subsonic flow. - Understand Mach number and its relationship with airspeed. - Describe boundary layers, shock waves, and sweepback.

f. Course Learning Outcomes:

CLO 1	Knowledge of various forces acting on aircraft.
CLO 2	Understanding flight forces acting during operation of flights.
CLO 3	To study about various airfoils and flow characteristics.
CLO 4	To get the idea about various speeds of aircraft, Mach number & flight controls

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Knowledge of various forces acting on aircraft.
CLO 2	Understanding flight forces acting during operation of flights.
CLO 3	To study about various airfoils and flow characteristics
CLO 4	To get the idea about various speeds of aircraft, Mach number & flight controls.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	-	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Aerodynamics of Flight: Forces Acting on the Airplane; Principle of lift generation; Wingtip Vortices; Ground Effect; Axes of an Airplane; Moments and Moment, Fundamentals of stability and Introduction to wind tunnel.	20%	8
2	Aerodynamic Forces in Flight Maneuvers: Forces in Turns and its derivation; Forces in Climbs and its derivation; Forces in Descents and its derivation; Stalls and Stalling Conditions.	25%	8
3	Incompressible Flow over an Airfoil: Airfoil Nomenclature and Characteristics; Types of Airfoils; Low speed flow over an Airfoil- Vortex Sheet; Circulation, Kelvin's Circulation Theorem; Kutta Conditions; Classical Thin Airfoil Theory-The Symmetrical Airfoil, The Cambered Airfoil, The Vortex Panel Numerical Method for Lifting flow over bodies.	30%	10
4	High Speed Flight: Introduction; Supersonic vs. Subsonic Flow; Speed Ranges; Mach Number vs. Airspeed; Boundary Layer, Types of Boundary layer Thickness; Shock Waves, Types of shockwaves; Sweepback.	25%	8

j. Text Book and Reference Book:

1. Fundamentals of Aerodynamics J D Anderson; Tata McGraw Hill
2. Aerodynamics L J Clancy; Sterling Book House Indian Edition
3. Aerodynamics for Engineering Students E L Houghton and P W Carpen

a. Course Name: Aerodynamics Lab

b. Course Code: 03613302

c. Prerequisite: Ease of learning and having interest in fluid behavior and flow properties.

d. Rationale: The main objective of this course is to understand the fundamentals of the Aerodynamics such as air behavior at rest and in motion. The flow behavior and pressure distribution of air over different air bodies is studied.

e. Course Learning Objective:

CLOBJ 1	Understand the principles and methods of wind tunnel calibration.
CLOBJ 2	Learn techniques for determining aerodynamic forces and moments
CLOBJ 3	Analyze incompressible flow over a flat plate.
CLOBJ 4	Calculate pressure distribution, lift, and drag over a symmetric airfoil.
CLOBJ 5	Calculate pressure distribution, lift, and drag over a cambered airfoil.

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to calibrate a subsonic wind tunnel
CLO 2	Apply methods for determining aerodynamic forces and moments
CLO 3	Understand the effect of airflow on the aircraft performance.
CLO 4	Understand the effect of flow on the Aircraft of 2-D and Finite wing.
CLO 5	To visualize different flow patterns over different Air bodies with the help of Smoke Generator

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Demonstrate the ability to calibrate a subsonic wind tunnel
CLO 2	Apply methods for determining aerodynamic forces and moments
CLO 3	Understand the effect of airflow on the aircraft performance.
CLO 4	Understand the effect of flow on the Aircraft of 2-D and Finite wing.
CLO 5	To visualize different flow patterns over different Air bodies with the help of Smoke Generator

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	30	-	20	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Text Book and Reference Book:

1. "Fundamentals of Aerodynamics" by John D Anderson
2. "Aerodynamics for Engineering Students" by E L Houghton and P W Carpenter
3. "Aerodynamics" by L J Clancy | Sterling Book House
Indian Edition

k. Mapping of Experiment List with Course Learning Outcomes:

Exp No.	Name of the Experiment
1	Calibration of a subsonic Wind tunnel.
2	Determination of Aerodynamic Forces and Moments.

3	Incompressible flow over a flat plate.
4	Pressure distribution and Lift and Drag calculation over a symmetric Aerofoil.
5	Pressure distribution and Lift and Drag calculation over a cambered Aerofoil.
6	Flow visualization using smoke in subsonic flows

- a. **Course Name: Aircraft Structures**
- b. **Course Code: 03613303**
- c. **Prerequisite:** Basic Knowledge of aircraft parts.
- d. **Rationale:** The main objective of this course is to understand the structure of aircraft. This subject addresses the understanding and load associated with aircraft parts.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the history, components, major stresses, types of loads, load factors, and aerodynamic loads in aircraft structures.
CLOBJ 2	Identify metallic and non-metallic materials used in aircraft structures, comprehend properties of various materials, and analyze case studies of materials in different aircraft.
CLOBJ 3	Describe the structure of fuselage, wing, empennage, flight control surfaces, landing gear, and helicopter structures.
CLOBJ 4	Define stress, strains, equations of equilibrium, plane stress and strain, principal stresses and strains, Mohr's circle of stress, and stress-strain relationship.
CLOBJ 5	Differentiate between statically determinate and indeterminate structures, Understand principles of superposition, Maxwell's Reciprocal Theorem, strain energy, and kinematic indeterminacy.

- f. **Course Learning Outcomes:**

CLO 1	Make familiar with basic structure of aircraft and its properties.
CLO 2	Study about material for aircraft structure and its properties.
CLO 3	To Understand about fixed wing aircraft structure and Rotor Aircraft Structure.
CLO 4	To study about principle of stress, strains and Equilibrium Conditions.
CLO 5	To Understand about statically determinate & indeterminate structure.

- g. **Mapping of Course Learning Outcomes and Bloom's Taxonomy:**

Course Learning Outcomes

CLO 1	Make familiar with basic structure of aircraft and its properties.
CLO 2	Study about material for aircraft structure and its properties.
CLO 3	To Understand about fixed wing aircraft structure and Rotor Aircraft Structure.
CLO 4	To study about principle of stress, strains and Equilibrium Conditions.
CLO 5	To Understand about statically determinate & indeterminate structure.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	T	P	
3	1	0	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Contet	Weightage	Teaching Hours
1	Introduction: History of aircraft structures; Component of aircraft structure; Major structural stresses; Types of loads; Load factors; Aerodynamics loads.	10%	5
2	Materials for Aircraft Structures: Metallic and non-metallic materials; Aluminum Alloys, Steel, Titanium, Plastics, Glass, Composite Materials, Properties of Materials, Case studies of materials used in different Aircrafts	20%	7
3	Aircraft Components Structure: Fuselage Structure; Wing Structure; Empennage Structure; Flight Control Surface Structure; Landing Gear Structure; Helicopter Structures	25%	9
4	Basic Elasticity: Stress; Strains; Notation for Forces and Stresses; Equations of Equilibrium; Plane Stress and its boundary conditions; Plane strain and its boundary conditions; Determination of Stresses on Inclined Planes; Principal Stresses; Principle Strains; Mohr's Circle of Stress; Stress±Strain Relationship.	30%	10

5	Determinate and Indeterminate Structures: Concept of statically Determinate and Indeterminate structure; Principal of super position; Maxwell's Reciprocal Theorem; Strain Energy, Introduction to concept of Kinematic Indeterminacy.	15%	6
---	---	-----	---

j. Text Book and Reference Book:

1. "Aircraft Structure for Engineering Students" by THM Megson & Edward Arnold.
2. "Aircraft Structures" by David J Peery and J J Azar.
3. "Analysis of Structure Vol. 1" by S S Bhavikatti.
"Mechanics of structure Vol. 1" by S B Junarkar

a. Course Name: Aircraft Structures Lab

b. Course Code: 03613304

c. Prerequisite: Basic concepts of Engineering Mechanics.

d. Rationale: The main objective of this course is to understand the structure of aircraft. This subject addresses the understanding and load associated with aircraft parts

e. Course Learning Objective:

CLOBJ 1	Learn to use Mechanical Extensometers to measure Young's Modulus, a fundamental property of steel, essential for structural analysis.
CLOBJ 2	Explore materials commonly used in aircraft construction, considering factors like strength-to-weight ratio, durability, and fatigue resistance.
CLOBJ 3	Understand and apply the superposition theorem in structural analysis to simplify complex systems by breaking them down into simpler components.
CLOBJ 4	Explore and confirm Maxwell's reciprocal theorem, which states that the displacement at a point due to a force is equal to the displacement at another point due to the force applied at the original point.
CLOBJ 5	Differentiate between determinate and indeterminate structures, understanding their behavior under load and the implications for structural design and analysis.

f. Course Learning Outcomes:

CLO 1	Understand the principles and techniques involved in using mechanical extensometers to measure Young's Modulus of steel materials.
CLO 2	Explore various materials commonly used in aircraft structures, including their properties, advantages, and limitations, to ensure optimal design and performance.
CLO 3	Understand and demonstrate the superposition theorem in the context of structural analysis, including its application to solve complex structural problems efficiently.

CLO 4	Explore and confirm the validity of Maxwell's reciprocal theorem in structural mechanics, demonstrating its application to analyze and design structural systems.
CLO 5	Differentiate between determinate and indeterminate structures, analyze their behavior under various loads, and understand their implications in structural design.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understand the principles and techniques involved in using mechanical extensometers to measure Young's Modulus of steel materials.
CLO 2	Explore various materials commonly used in aircraft structures, including their properties, advantages, and limitations, to ensure optimal design and performance.
CLO 3	Understand and demonstrate the superposition theorem in the context of structural analysis, including its application to solve complex structural problems efficiently.
CLO 4	Explore and confirm the validity of Maxwell's reciprocal theorem in structural mechanics, demonstrating its application to analyze and design structural systems.
CLO 5	Differentiate between determinate and indeterminate structures, analyze their behavior under various loads, and understand their implications in structural design.

b. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	30	-	20	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

c. Text Book and Reference Book:

1. "Aircraft Structure for Engineering Students" by THM Megson & Edward Arnold.
2. "Aircraft Structures" by David J Peery and J J Azar.
3. "Analysis of Structure Vol. 1" by S S Bhavikatti.

d. Mapping of Experiment List with Course Learning Outcomes:

Exp No.	Name of the Experiment
1	Determination of Youngs Modulus of steel using Mechanical Extensometers.
2	To study about materials for aircraft structures
3	Verification of superposition theorem.
4	Verification of Maxwells reciprocal theorem.
5	To study about determinate and indeterminate structure

a. Course Name: Aerospace Propulsion

b. Course Code: 03613305

c. Prerequisite: Fundamental knowledge of Thermodynamics.

d. Rationale: The main objective of this course is to understand the working of the aircraft power plant. This subject addresses the understanding and functioning of different propulsion system of an aircraft and associated components like compressor, diffuser, combustion chamber & nozzles.

e. Course Learning Objective:

CLOBJ 1	Understand the history and principles of thermodynamics in relation to propulsion systems. Identify and classify different types of propulsion systems. Explore the components and functions of various engines and propulsion systems. Evaluate methods for thrust augmentation and noise reduction.
CLOBJ 2	Define the purpose and function of inlet, compressor, and diffuser components. Examine different types of compressors and their efficiencies. Understand compressor design parameters and techniques for optimization. Analyze bleed air utilization and the theory behind dual compressor systems. Assess the role and operation of variable inlet vanes and stators.
CLOBJ 3	Explore the design factors and performance considerations of combustion chambers. Identify various types of combustion chambers and their stability characteristics. Understand the principles behind fuel injection systems. Examine different types of nozzles and their efficiencies. Analyze thrust reversal mechanisms and their applications.
CLOBJ 4	Understand the operating principles of impulse and reaction turbines. Analyze the velocity triangle and its significance in turbine operation. Examine blade design and its impact on turbine performance. Evaluate velocity and pressure compounding in multistage turbines. Understand the concept of degree of reaction in turbine operation.
CLOBJ 5	Explore the historical development and classification of rocket engines. Differentiate between air-breathing engines and rocket engines. Understand the principles underlying rocket propulsion, including the thrust equation. Examine the operation and components of solid propellant and liquid propellant rocket engines. Analyze the design and function of rocket nozzles and staging mechanisms. Evaluate the principles and applications of electric

	pump and ion engine thrusters in rocket propulsion systems.
--	---

f. Course Learning Outcomes:

CLO 1	Understanding the historical development and reviews of thermodynamic principles in the context of propulsion systems.
CLO 2	Understanding the function, types, efficiency, and design parameters of inlet, compressor, and diffuser in propulsion systems.
CLO 3	Study of combustion chamber design, stability, fuel injection, and requirements. Examination of nozzle types, efficiency, throat conditions, and thrust reversal.
CLO 4	Understanding the operating principles of impulse and reaction turbines. Study of blades, velocity triangles, and pressure compounding in multistage turbines.
CLO 5	Overview of the historical development and classification of rocket engines. Understanding the principles and thrust equation of rocket propulsion. Examination of rocket nozzle types, staging techniques, and modern propulsion technologies like electric pumps and ion thrusters.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understanding the historical development and reviews of thermodynamic principles in the context of propulsion systems.
CLO 2	Understanding the function, types, efficiency, and design parameters of inlet, compressor, and diffuser in propulsion systems.
CLO 3	Study of combustion chamber design, stability, fuel injection, and requirements. Examination of nozzle types, efficiency, throat conditions, and thrust reversal.
CLO 4	Understanding the operating principles of impulse and reaction turbines. Study of blades, velocity triangles, and pressure compounding in multistage turbines.
CLO 5	Overview of the historical development and classification of rocket engines. Understanding the principles and thrust equation of rocket propulsion. Examination of rocket nozzle types, staging techniques, and modern propulsion technologies like electric pumps and ion thrusters.

i. Teaching & Examination Scheme:

Teaching Scheme	Evaluation Scheme
------------------------	--------------------------

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

j. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction: History, Reviews of thermodynamic principle, Classification of propulsion system, Internal combustion engines, Gas turbine engine, Ramjet engine, Scramjet Engine, Pulse Detonation Engine, Rocket engine, Turbojet engine, Turboprop engine, Turboshift engine, Turbofan engines, Thrust augmentation, Diffusion mass transfer, Accessory section, Auxiliary power unit, Noise, Propeller.	30%	12
2	Inlet, Compressor and Diffuser: Inlet, Compressor (Types of compressors, Efficiency of compressor, Compressor design parameters, Bleed air utilization, Dual compressor theory, Variable inlet vane & stator) Diffuser	15%	4
3	Combustion Chamber and Nozzle: Combustion chamber, Factors affecting combustion chamber design, process & performance, Requirements of combustion chamber, Combustion chamber process, Types of combustion chamber, Combustion chamber stability & instability, Fuel injection system, Nozzle, Types of nozzles, Throat condition for supersonic nozzle, Nozzle efficiency, under expanding & over-expanding nozzle, Variable area nozzle, Thrust reversal	20%	8
4	Turbines: Operating principle of impulse Turbines, Operating principle of Reaction turbines, Velocity Triangle, Blades, Velocity & Pressure compounding of multistage impulse turbine, Degree of Reaction.	15%	4
5	Fundamentals of Rocket Propulsion: History, Classification of Rocket Engines, Difference between air breathing engines and rocket engines, Principle of rocket propulsion, Thrust equation, Principle of Rocket Propulsion, Solid propellant rocket engine, Liquid propellant rocket engine, Rocket nozzle and Rocket staging, Electric pump and Electric ion Engine Thruster.	20%	6

k. Text Book and Reference Book:

1. Aircraft Propulsion Mayur R Anvekar; Phi Learning Pvt Ltd
2. Compressors Turbines and Fans S M Yahya; Tata Mcgraw Hill
3. Elements of Gas Turbine Propulsion Mattingly; Tata McGraw Hill

4. Steam & Gas turbines R Yadav
5. Aircraft Propulsion, System Technology & Design Gordon C Oates; AIAA Publications

- a. **Course Name: Aerospace Propulsion Lab**
- b. **Course Code:** 03613306
- c. **Prerequisite:** Ease of learning and having interest in aerospace propulsion.
- d. **Rationale:** The main objective of this course is to understand the fundamentals & principles of the aerospace propulsion.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and types of turbo machines.
CLOBJ 2	Analyze the factors affecting propeller performance.
CLOBJ 3	Examine the performance characteristics of axial flow compressors.
CLOBJ 4	Explore the design and operation of combustion chambers.
CLOBJ 5	Learn the principles and procedures of water rocket experiments and Evaluate the performance parameters of nozzles.

f. Course Learning Outcomes:

CLO 1	Understand working principles of turbo machines
CLO 2	Understand working and performance of propeller.
CLO 3	Understand working and performance of axial flow compressor.
CLO 4	Study about Flame characteristics.
CLO 5	Study different types of operation of ramjet combustion system and working and performance of nozzle

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Understand working principles of turbo machines
CLO 2	Understand working and performance of propeller.
CLO 3	Understand working and performance of axial flow compressor.
CLO 4	Study about Flame characteristics.
CLO 5	Study different types of operation of ramjet combustion system and working and performance of nozzle

e. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor	P	

							y		
0	-	2	1	-	-	30	-	20	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Text Book and Reference Book:

1. Aircraft Propulsion Mayur R Anvekar; Phi Learning Pvt Ltd
2. Compressors Turbines and Fans S M Yahya; Tata Mcgraw Hill
3. Elements of Gas Turbine Propulsion Mattingly; Tata McGraw Hill
4. Steam & Gas turbines R Yadav
5. Aircraft Propulsion, System Technology & Design Gordon C Oates; AIAA Publications

j. Mapping of Experiment List with Course Learning Outcomes:

Exp No.	Name of the Experiment
1	To study about the Turbo machines.
2	To study about the performance of propeller
3	To study about the performance of Axial Flow Compressor.
4	To study about the Combustion Chamber.
5	To study the functioning and operation of Water Rocket Experiment
6	To study about the Performance of nozzle.

- a. Course Name:** Major Project-I
- b. Course Code:** 03613308
- c. Prerequisite:** Minor Project.
- d. Rationale:** The main aim of this subject is to transform theoretical knowledge into practical.
- e. Course Learning Objective:**

CLOBJ 1	Understand Project Management Principles
CLOBJ 2	Apply Engineering Design Techniques.
CLOBJ 3	Enhance Technical Communication Skills.
CLOBJ 4	Demonstrate Problem-Solving Abilities

f. Course Learning Outcomes:

CLO 1	Makes Transformation of Theoretical Knowledge and its Applications
CLO 2	Improves Innovative Spirit.
CLO 3	Boosts Curiosity and Liking for Studies

CLO 4	Improves Team Leading and Problem Solving Skills.
--------------	---

g. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

Course Learning Outcomes	
CLO 1	Makes Transformation of Theoretical Knowledge and its Applications
CLO 2	Improves Innovative Spirit.
CLO 3	Boosts Curiosity and Liking for Studies
CLO 4	Improves Team Leading and Problem Solving Skills.

a. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	8	4	-	-	60	-	40	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

- a. Course Name: Robotics and Automation Technology**
- b. Course Code:** 03609339
- c. Prerequisite:** Zeal to learn subject
- d. Rationale:** The main objective of this course is to understand the working of robotics and material handling process carried out in aircraft industries. This subject addresses the understanding and functioning of robotics and Advance manufacturing system and automated material handling system.
- e. Course Learning Objective:**

CLOBJ 1	Understanding Historical Context and Influences
CLOBJ 2	Mastery of Basic Robotics Concepts
CLOBJ 3	Proficiency in Robot End Effectors
CLOBJ 4	Knowledge of Advanced Manufacturing Systems
CLOBJ 5	Understanding Automated Material Handling and Storage Systems

f. Course Learning Outcomes:

CLO 1	Make familiar with the robotics and automation technology.
CLO 2	Acquainted with the various principles used for robotics and automation technology
CLO 3	To understand the importance of robotics in industry
CLO 4	Identify the applications of various advance techniques used in manufacturing.
CLO 5	To understand about material handling system

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with the robotics and automation technology.
CLO 2	Acquainted with the various principles used for robotics and automation technology
CLO 3	To understand the importance of robotics in industry
CLO 4	Identify the applications of various advance techniques used in manufacturing.
CLO 5	To understand about material handling system

i. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction: History, Influence of mythology, Influence of motion pictures, Inventions leading to robotics, First use of the world robotics, Birth of industrial robot, Robotics in research laboratories, Robotics in industry, Space exploration, Military and law enforcement application, medical application.	15%	4

2	Robotics: Basic concepts and definition, Robot anatomy and terminology used in robotics, Robot configurations, Axes nomenclature & Basic robot Motions, Work Volume, Robot drive system, Sensors in Robotics, Control System, Applications & benefits, Application of robotics in Industries, Overview of robot programming Methods & languages.	20%	8
3	Robot End Effectors: Introduction to End effectors, Types of end effectors, Mechanical Grippers, Vacuum Cups, Magnetic Grippers, Adhesive Grippers, Hooks, Scoops and other miscellaneous devices, Tools as end effectors, The robot end effectors interface, Consideration in gripper selection and design.	15%	4
4	Advance Manufacturing System: GT - concept, definition, need, scope, & benefit, Flexible Manufacturing System, (FMS)-concept, definition and comparison with other manufacturing systems, Computer Aided Process Planning (CAPP) - concept, types, features, methods and importance, Computer Integrated Manufacturing (CIM): need, block diagram, functional areas covered and their importance	30%	10
5	Automated Material Handling and Storage Systems: Introduction & Definition, Principle of material handling, Classification of Material handling equipment, Conveyor and AGV system, AS/RS System, Carousel storage system.	20%	8

k. Text Book and Reference Book:

1. Handbook of Industrial Robotics
Shimon Y. Nof; John Wiley & Sons
2. Industrial robotics Technology, programming and applications
Groover M.P.; McGraw-Hill Book Co.
3. Robotics and Control
R K Mittal, I. J. Nagrath; Tata Mc Graw-Hill
4. Material handling equipment
P.Rudenko; MIR Publication
5. Automation, Production Systems & Computer Aided manufacturing
M. P. Grover; Prentice Hall.
6. Industrial Automation & Robotics
A K Gupta & S K Arora; Laxmi Publication Ltd.

a. Course Name: Metrology and Instrumentation

b. Course Code: 03609341

c. Prerequisite: Zeal to learn the subject.

d. Rationale: The course is designed to use appropriate analog and digital measuring and gauging instruments for a given manufacturing situation. The course provides required knowledge and skills and creates self confidence in students so that they can work on Industry independently for accurate and precise measurements and manufacturing.

e. Course Learning Objective:

CLOBJ 1	Inspection, quality control definitions and differences - Accuracy, precision, error definitions - Vernier scale principle, least count - Surface plates types, features, applications, precautions
CLOBJ 2	Dial indicators, types, applications - Straightness, flatness, squareness, parallelism, perpendicularity definitions - Roundness, concentricity, cylindricity, run out, ovality definitions, Surface finish terminology - Comparison methods - Instrument measurement methods - Talysurf, Tomlinson tester construction, working, applications
CLOBJ 3	Gear types, forms of gear teeth, tooth terminology - Gear tooth vernier, measurement methods - Thread classification, specifications, forms - Thread micrometer, pitch measurement methods
CLOBJ 4	Limit gauges, comparators - Instrumentation, transducers classifications, working principles, applications - Electrical transducers types, applications - Sensors classifications, applications.
CLOBJ 5	Temperature measuring devices classifications, working principles, constructions, advantages, limitations, applications

f. Course Learning Outcomes:

CLO 1	Measure the given mechanical elements and assemblies using linear and angular analog /digital measuring instruments
CLO 2	Check geometrical accuracy of given application and Understand working principles of surface roughness checking instruments.
CLO 3	Measure and derive important dimensions of various thread forms and gears.
CLO 4	Check the dimensions using the gauges.
CLO 5	Select and measure variables using appropriate sensors and transducers

g. Mapping of Course Learning Outcomes

Course Learning Outcomes	
CLO 1	Measure the given mechanical elements and assemblies using linear and angular analog /digital measuring instruments
CLO 2	Check geometrical accuracy of given application and Understand working principles of surface roughness checking instruments.
CLO 3	Measure and derive important dimensions of various thread forms and gears.
CLO 4	Check the dimensions using the gauges.
CLO 5	Select and measure variables using appropriate sensors and transducers

i. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Linear and Angular Measurement: Inspection, quality and quality control-definitions and differences, Define accuracy, precision and error, Principle of Vernier scale and least count, Surface plates-types, important features, standards/important sizes, applications and precautions in use. Types, constructional sketch, major parts and their functions, least count, measuring methods and measurement illustration of: i. Vernier caliper. ii. Micrometer. iii. Telescopic gauge. iv. Height gauge. v. Depth gauge, Slip gauge-types, applications and wringing method. Sketch, major parts and their functions, least count, measuring methods and measurement illustration of: i. Bevel Protector. ii. Sine bar. iii. Angle gauges. iv. Angle Dekkor. v. Spirit level. vi. Clinometers. vii. Auto collimator. Calibration concept and need	25%	8
2	Measurement of Geometrical Tolerances: Dial indicators/gauge-types, constructional sketch and applications. Definition, symbol and measuring methods of: i. Straightness. ii. Flatness. iii. Squareness. iv. Parallelism. v. Perpendicularity. vi. Roundness. vii. Concentricity. viii. Cylindricity. ix. Run out and ovality	15%	4
3	Measurement of Surface Roughness: Terminology used in connection with surface finish, Comparison methods to inspect surface finish-concept and applications, Direct instrument measurement methods-types and concepts, Construction, working and applications of Talysurf surface roughness tester and Tomlinson tester	10%	4
4	Gear and Thread Measurement: Types of gears, Forms of gear teeth-types and concept, Gear tooth Terminology, Sketch, major parts and their functions, least count, measuring methods and measurement illustration of gear tooth vernier, Derivation and numerical example to measure gear tooth thickness using: i Gear tooth vernier. ii Constant chord method. iii Base tangent method. Gear tooth profile measurement. Threads-classification, elements, specifications and forms, Measurement of major	20%	8

	and minor diameters, Thread micrometer-sketch, method to use and determination of dimension, Pitch measurement methods.		
5	Limit Gauges, Transducers and Sensors: Limit gauges- classification, sketch and applications, Comparators concept, types and applications. Instrumentation- introduction, performance characteristics, Static characteristics of instruments. Transducers-concept, classifications, physical quantities which can be measured, advantages and disadvantages, Electrical transducers types, working principles and applications. i Linear Variable Differential Transformer (LVDT) type pressure gauge. ii Resistance type. iii Capacitance type. iv Inductance type (LVDT). v Piezo-electric, Sensors- classification and applications.	20%	6
6	Temperature Measurement: Introduction, Classification, working principle, construction, working, advantages, limitations and applications of temperature measuring devices: i. Mercury in glass thermometer. ii. Bimetallic thermometer. iii. Resistance thermometer. iv. Thermister. v. Thermocouple. vi. Radiation pyrometers. vii. Optical pyrometers.	15%	4

k. Text Book and Reference Book:

1. Mechanical Measurements D.S.Kumar
2. Engineering Metrology and Instrumentation R.K.Rajput
3. Engineering Metrology and Measurement N V Raghavendra and Krishnamurthy; Oxford University Press

a. Course Name: Principles of Helicopter Engineering

b. Course Code: 03613331

c. Prerequisite: Basic knowledge Aircraft Science

d. Rationale: The aerodynamics of a rotary wing aircraft differs significantly from that of a fixed wing aircraft and it is important to study this variation to understand the working of a helicopter. The physics and underlying theories required to be studied before actually embarking upon the design of a helicopter are included within this content.

e. Course Learning Objective:

CLOBJ 1	Understand the historical context of helicopter development, its uses, rotor system, and flight control mechanisms.
CLOBJ 2	Grasp the fundamental principles governing helicopter flight including forces, airfoil dynamics, and various flight maneuvers.
CLOBJ 3	Comprehend the function and operation of collective pitch, throttle, cyclic pitch, and anti-torque pedals in controlling helicopter flight.

CLOBJ 4	Identify and describe the various components, systems, and sections of a helicopter including airframe, rotor system, engines, and avionics.
CLOBJ 5	Gain proficiency in preflight checks, engine start procedures, rotor engagement, and safety protocols associated with helicopter operations.

f. Course Learning Outcomes:

CLO 1	Make familiar with the configuration and history of rotorcraft.
CLO 2	Acquainted with the various principles used for rotorcrafts.
CLO 3	Understand the various control system of Helicopter.
CLO 4	Understand the basic principles of flight take off, stability and control.
CLO 5	Understand the fundamentals of aerodynamics involved in Helicopter.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with the configuration and history of rotorcraft.
CLO 2	Acquainted with the various principles used for rotorcrafts.
CLO 3	Understand the various control system of Helicopter.
CLO 4	Understand the basic principles of flight take off, stability and control.
CLO 5	Understand the fundamentals of aerodynamics involved in Helicopter.

i. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction to the Helicopter: Introduction, Turbine Age, Uses, Rotor System, Tail Rotor, Controlling Flight, Flight Conditions.	15%	4

2	Aerodynamics of Flight: Introduction, Forces Acting on the Aircraft, Airfoil, Blade Twist, Airflow and Reactions in the Rotor Disk, Powered Flight, Hovering Flight, Vertical Flight, Forward Flight, Sideward Flight, Rearward Flight, Turning Flight, Autorotation.	25%	10
3	Helicopter Flight Controls: Introduction, Collective Pitch Control, Throttle Control, Governor/Correlator, Cyclic Pitch Control, Anti-torque Pedals.	15%	6
4	Helicopter Components, Sections and Systems: Introduction, Airframe, Fuselage, Main Rotor System, Swash Plate Assembly, Freewheeling Unit, Antitorque System, Antitorque Drive Systems Engines, Transmission System, Fuel Systems, Electrical Systems, Hydraulics, Stability Augmentations Systems, Environmental Systems, Anti-Icing Systems.	30%	8
5	Ground Procedures and Flight: Introduction, Preflight, Engine Start and Rotor Engagement, Safety in and Around Helicopters.	15%	4

k. Text Book and Reference Book:

1. Helicopter Performance, Stability, and Control
Raymond Prouty; Krieger Publishing Company
2. Principles of Helicopter Aerodynamics
J. Gordon Leishman; Cambridge University Press

a. Course Name: Airport Operations and Management

b. Course Code: 03613333

c. Prerequisite: Basic aviation knowledge

d. Rationale: The main objective of this course is to understand the airport operations. This subject addresses the understanding and functioning of air traffic control, radio system and runways markings.

e. Course Learning Objective:

CLOBJ 1	Define an airport and its functions - Identify customers and stakeholders - Differentiate airside and landside operations - Understand airport certification and regulations - Recognize types and categories of airports - Explain the role of regulating authorities - Interpret airport data sources like ATIS, aeronautical charts, and NOTAMs
CLOBJ 2	Recognize and interpret runway markings and signs - Understand thresholds, RSA, holding positions, and distance remaining signs - Identify LAHSO markings - Interpret taxiway markings and signs - Distinguish between temporary and permanent closures - Understand other airport markings and signs
CLOBJ 3	Describe various airport lighting systems - Understand the purpose of airport beacons, approach lighting, runway, and taxiway lighting - Explain wind direction indicators and traffic pattern lights
CLOBJ 4	Understand the importance of radio communication in aviation - Explain the workings of ATC services - Recognize the role of TCAS in collision avoidance

	- Interpret ATC instructions and manage wake turbulence
CLOBJ 5	Describe airport ownership and operation models - Explore airport management as a career option - Understand the need for standardization in airport operations - Analyze the economic impact of airport businesses - Explain airport master planning and land use compatibility

f. Course Learning Outcomes:

CLO 1	Make familiar with the working culture of airport.
CLO 2	Acquainted with the various Operations of airport and its management.
CLO 3	Develop skills to understand and solve the emergency situation of airport.
CLO 4	Understand the importance of ATC and its working culture.
CLO 5	Understand the fundamentals of Airport management.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with the working culture of airport.
CLO 2	Acquainted with the various Operations of airport and its management.
CLO 3	Develop skills to understand and solve the emergency situation of airport.
CLO 4	Understand the importance of ATC and its working culture.
CLO 5	Understand the fundamentals of Airport management.

i. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

j. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
----------------	----------------	------------------	-----------------------

1	Understanding the Airport: Definition, function, customers, airside, components of the airside, the terminal area, the landside, airport certification, the overall airport operation, Types of airport, regulating authorities, categories of airport, towered and non-towered airport, sources of airport data, ATIS, aeronautical charts, NOTAMs, importance and understanding of sources.	20%	6
2	Airport markings and signs: Runway markings and signs, relocated runway threshold, displaced threshold, RSA, Holding position sign and markings, distance remaining signs, LAHSO and other marking and signs, taxiway marking and signs, enhanced taxiway marking and signs, Hold position, ILS area, temporary and permanent close runway and taxiway, other markings and airport signs.	26%	8
3	Airport Lighting and Indicators: Airport beacons, approach light system, runway and taxiway lighting system, control of airport lighting, wind direction indicators, Traffic pattern and other airport lights and its importance	20%	6
4	Radio and ATC: Radio communication system and its importance, working of Radio, ATC and radio communication, ATC services, wake turbulence, collision avoidance and role of TCAS, ATC instructions.	14%	4
5	Airport management: Ownership and operation, airport management as a career, the need for standardization, airport business and its economic impact, the airport business cost, airport master planning, land use compatibility, the planning process.	20%	6

k. Text Book and Reference Book:

1. Airport Operations

Norman Ashford, Pierre Coutu, John Beasley; McGraw Hill Professional

2. Planning and Design of Airports

R. Horenjeff and F McKelvey

a. Course Name: Summer Internship

b. Course Code: 03613312

c. Prerequisite: Zeal to learn the Subject.

d. Rationale: The main objective of this course is students will do the internship in private/ Govt. Industries or organization. The aim of this Internship programme is to develop practical knowledge and understand the structure of industry and develop the practical skill.

e. Course Learning Objective:

CLOBJ 1	Gain Practical Experience in Aeronautical Engineering
----------------	---

CLOBJ 2	Develop Professional Skills
CLOBJ 3	Understand Industry Practices and Standards
CLOBJ 4	Network and Establish Professional Connections

f. Course Learning Outcomes:

CLO 1	Demonstrate the ability to apply concepts learned in classroom settings to real-world aeronautical engineering projects.
CLO 2	Analyze and solve engineering challenges encountered during the internship, fostering critical thinking and innovation.
CLO 3	Effectively convey ideas, project progress, and results through oral presentations, written reports, and technical documentation.
CLO 4	Work collaboratively with peers, supervisors, and professionals from diverse backgrounds to achieve common project goals.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Demonstrate the ability to apply concepts learned in classroom settings to real-world aeronautical engineering projects.
CLO 2	Analyze and solve engineering challenges encountered during the internship, fostering critical thinking and innovation.
CLO 3	Effectively convey ideas, project progress, and results through oral presentations, written reports, and technical documentation.
CLO 4	Work collaboratively with peers, supervisors, and professionals from diverse backgrounds to achieve common project goals.

a. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	-	2	-	-	100	-		100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

- a. **Course Name:** Introduction to Flight Mechanics
- b. **Course Code:** 03613351
- c. **Prerequisite:** Basic Flight motions
- d. **Rationale:** The main objective of this course is to understand the working of an aircraft performance and stability. This subject addresses the understanding of standard atmosphere, performance parameters, flight maneuvering and concept of aircraft stability.
- e. **Course Learning Objective**

CLOBJ 1	Understand fundamental concepts of airplane axis systems, airspeed types, critical Mach numbers, drag divergence Mach numbers, and swept-back wing aerodynamics.
CLOBJ 2	Define and distinguish between types of altitude, describe the layers of the atmosphere, explain the concept of the International Standard Atmosphere.
CLOBJ 3	Analyze and calculate key performance parameters including thrust, power, rate of climb, and range for various aircraft configurations.
CLOBJ 4	Understand and apply principles of various flight maneuvers including gliding, horizontal turning, vertical pull-up and pull-down turns, spiral turns, and interpretation of V-n diagrams.
CLOBJ 5	Grasp the principles and criteria governing aircraft stability, including static and dynamic aspects, moment analysis, and canard configuration stability.

- f. **Course Learning Outcomes:**

CLO 1	Develop understanding about different types of altitude.
CLO 2	Acquainted about standard atmosphere.
CLO 3	Knowledge about aircraft performance parameters.
CLO 4	Understand about various Flight maneuvering conditions.
CLO 5	Understand V-n diagram for flight and study about static stability and Dynamic Stability conditions.

- g. **Mapping of Course Learning Outcomes:**

Course Learning Outcomes	
CLO 1	Develop understanding about different types of altitude.
CLO 2	Acquainted about standard atmosphere.
CLO 3	Knowledge about aircraft performance parameters.
CLO 4	Understand about various Flight maneuvering conditions.
CLO 5	Understand V-n diagram for flight and study about static stability and Dynamic Stability conditions.

- h. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
3	1	0	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr.	Topics	W	T
1	Introduction to Flight: Airplane Axis System and Moment; Types of Airspeed; Critical Mach number and Drag Divergence Mach number; Swept Back Wing.	10	4
2	Standard Atmosphere: Types of Altitude; Relation between local gravitational constant and universal gravitational constant; Relation between Geometric Altitude (g) and Geopotential Altitude (g0); Layers of Atmosphere; International Standard Atmosphere; Numerical on standard Atmosphere.	20	8
3	Aircraft Performance: Drag Polar; Thrust Required for steady level flight; Minimum power required for cruise flight; Minimum Thrust and Minimum Power Required condition; Power available for aircraft engine; Rate of Climb for Steady flight; Absolute ceiling and service ceiling; Breguet formula for propeller driven Aircraft; Range and Endurance for Jet Powered aircraft.	30	10
4	Maneuvering Flight: Gliding Flight; Horizontal Turning Flight; Vertical Pull Up turn; Vertical Pull down turn; Spiral Turn Flight; V-n diagram	20	6
5	Aircraft Stability: Static Stability; Dynamic Stability; Criteria for longitudinal static Stability; Moment and Moment Coefficient about C.G. for Wing alone Configuration; Neutral point and Static Margin; Canard: Types and Stability	20	6

j. Text Book and Reference Book:

1. Introduction to Flight
John D Anderson; Tata Mc Graw Hill Book Company
2. Aircraft Performance and Stability Control
C D Perkins R E Hage; John Wiley & Sons
3. Flight Stability and Automatic Control
Robert C Nelson; Mcgraw Hill Education
4. Aircraft Performance and Design
J D Anderson; Mcgraw Hill Education

a. Course Name: Aircraft Maintenance

b. Course Code: 03613353

c. Prerequisite: Introduction to Aeronautics and Aircraft Systems

d. Rationale: The main objective of this course is to understand the maintenance and inspection of aircraft components. This subject addresses the understanding and maintenance of wood and welded structures and other structural components.

e. Course Learning Objective:

CLOBJ 1	Understand the importance of aircraft maintenance and the roles of AMEs and Mechanics in ensuring compliance with Indian aviation regulations.
CLOBJ 2	Develop an understanding of hazardous materials, OSHA standards, and protocols for safe handling, disposal, and managing accidental releases.
CLOBJ 3	Gain expertise in sheet-metal construction and repair, covering design principles, calculations, fabrication techniques, and riveting methods for effective maintenance practices.
CLOBJ 4	Acquire proficiency in constructing and repairing welded aircraft structures, focusing on steel-tube assemblies, inspection protocols, and soldering/brazing techniques.
CLOBJ 5	Develop proficiency in aircraft assembly, rigging, and maintenance inspections, while mastering both destructive and non-destructive testing techniques to ensure optimal performance and safety.

f. Course Learning Outcomes:

CLO 1	Understand the importance of maintenance in aviation.
CLO 2	Recognize hazardous materials commonly found in aviation.
CLO 3	Understand the Sheet-Metal Inspection and Repair and Perform fundamental calculations for sheet-metal structures.
CLO 4	Identify construction techniques for steel-tube assemblies in aircraft structures.
CLO 5	Demonstrate proficiency in aircraft assembly procedures and Understand the fundamentals of destructive and non-destructive testing methods.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understand the importance of maintenance in aviation.
CLO 2	Recognize hazardous materials commonly found in aviation.
CLO 3	Understand the Sheet-Metal Inspection and Repair and Perform fundamental calculations for sheet-metal structures.
CLO 4	Identify construction techniques for steel-tube assemblies in aircraft structures.
CLO 5	Demonstrate proficiency in aircraft assembly procedures and Understand the fundamentals of destructive and non-destructive testing methods.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr.	Topics	Weightage	Teaching Hours
1	Introduction: Importance of maintenance, The role of an AME, The role of a Mechanic, Types of Maintenance, Indian aircraft rules, Civil aviation requirements.	15%	6
2	Hazardous Materials and Safety Practices: Hazardous Materials, OSHA's Hazardous Communications Standards, Disposal and Accidental Releases of Hazardous Materials	10%	3
3	Sheet-Metal Construction and Repair: Design Philosophies, Factors Affecting Sheet-Metal Part and Joint Design, Fundamental Calculations for Structures, Preparation for Layout Work, Hand Tools for Sheet-Metal Work, Floor and Bench Machinery for Sheet-Metal Work, Fabrication of Sheet-Metal Parts, Riveting, Sheet-Metal Repair, Repair Practice, Rivet-Repair Design.	20%	6
4	Welded Aircraft Structures and Repair: Construction of Steel-Tube Assemblies by Welding, Inspection of Steel-Tube Structures, Aircraft Tubing Repair, Special Welding Repairs, Soldering and Brazing.	20%	6
5	Aircraft Assembly and Rigging: Aircraft Assembly, Aircraft Rigging, Fixed Surface Alignment, Control Surface Rigging, Balancing Control Surfaces, Inspection and Maintenance.	15%	6
6	Inspection and Testing: Fundamentals of Destructive and Non-destructive Testing, Scope and limitations of NDT, Visual Examination Methods, and Different Visual Examination aids, NDT Inspection Methods.	20%	6

j. Text Book and Reference Book:

1. AIRCRAFT MAINTENANCE & REPAIR
Michael j. kores; Mc Graw Hill Publication

2. Aviation Maintenance Technician Handbook-Powerplant
U.S. Department of Transportation; Federal Aviation Administration

- a. **Course Name: Aircraft Maintenance Lab**
- b. **Course Code:** 03613354
- c. **Prerequisite:** Introduction to Aeronautics and Aircraft Systems.
- d. **Rationale:** The main objective of this course is to understand the maintenance and inspection of aircraft components. This subject addresses the understanding and working of different types of inspection methods in aircraft.
- e. **Course Learning Objective:**

CLOBJ 1	To understand the necessity and significance of nondestructive testing (NDT) methods in ensuring structural integrity and safety of materials and components in various industries.
CLOBJ 2	To apply visual testing techniques using appropriate visual aids to detect surface defects and anomalies in materials or components.
CLOBJ 3	To demonstrate the ability to perform liquid penetration testing effectively to detect surface-breaking defects in non-porous materials.
CLOBJ 4	To analyze and conduct ultrasonic testing procedures, magnetic particle testing methods proficiently for flaw detection and thickness measurement and detecting surface and near-surface defects in materials.
CLOBJ 5	To comprehend the principles and applications of eddy current testing and X-ray testing for internal inspection and defect detection in materials and components.

f. **Course Learning Outcomes:**

CLO 1	Understand the importance and rationale behind nondestructive testing (NDT) methods in various industries to ensure material integrity and safety.
CLO 2	Apply visual testing techniques with the aid of appropriate tools to effectively examine and identify surface defects in given samples.
CLO 3	Perform liquid penetration tests and magnetic particle testing proficiently, demonstrating the ability to detect and evaluate surface-breaking defects in materials.
CLO 4	Apply magnetic particle testing methods effectively to identify surface and near-surface defects in ferromagnetic materials.
CLO 5	Understand the principles and applications of eddy current testing and X-ray testing for internal inspection and defect detection in materials and components

g. **Mapping of Course Learning Outcomes:**

Course Learning Outcomes	
CLO 1	Understand the importance and rationale behind nondestructive testing (NDT) methods in various industries to ensure material integrity and safety.
CLO 2	Apply visual testing techniques with the aid of appropriate tools to effectively examine and identify surface defects in given samples.
CLO 3	Perform liquid penetration tests and magnetic particle testing proficiently, demonstrating the ability to detect and evaluate surface-breaking defects in materials.
CLO 4	Apply magnetic particle testing methods effectively to identify surface and near-surface defects in ferromagnetic materials.
CLO 5	Understand the principles and applications of eddy current testing and X-ray testing for internal inspection and defect detection in materials and components

h Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
-	-	2	1	-	-	30	-	20	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content
1	To study about need of nondestructive testing (NDT)
2	To study and perform visual test for given sample using visual aid.
3	To study and perform liquid penetration test.
4	To study and perform ultrasonic test.
5	To study and perform magnetic particle test.
6	To study about eddy current test.
7	To study about x-ray test.

8	To study and perform engine overhauling & cleaning of IC engine.
---	--

j. Mapping of Experiment List with Course Learning Outcomes:

Sr. NO.	Experiment List
1	To study about need of nondestructive testing (NDT)
2	To study and perform visual test for given sample using visual aid.
3	To study and perform liquid penetration test.
4	To study and perform ultrasonic test.
5	To study and perform magnetic particle test.
6	To study about eddy current test.
7	To study about x-ray test.
8	To study and perform engine overhauling & cleaning of IC engine.

a. Course Name: Computer Aided Modelling and Design- II

b. Course Code: 03613355

c. Prerequisite: Basic computer geometrical modelling

d. Rationale: The course is designed to give the detailed understanding of designing process, geometric modelling & basic of computer knowledge. Also, the subject gives details about how draw different types of objects with help of CREO software.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamentals of parametric design software, including differences between 2D and 3D models, geometric modeling concepts, and the distinction between parametric and non-parametric modeling.
CLOBJ 2	Master 2D modeling techniques using CAD software, including sketching interfaces, draw commands, modify commands, and applying dimensions and constraints to objects.
CLOBJ 3	Develop proficiency in 3D modeling using CAD software, covering aspects such as sketching parts, creating various shapes, engineering models, and editing 3D models.
CLOBJ 4	Gain competence in assembly modeling with CAD software, including assembly techniques, applying constraints, and generating views of assembled components.

f. Course Learning Outcomes:

CLO 1	Develop computer aided drawings and models using codes, norms, standards and CAD software.
CLO 2	Learning about CREO software of 2D & 3D drawing with different command.
CLO 3	Design, develop and model the given part using CREO
CLO 4	Develop Assemble using CREO

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Develop computer aided drawings and models using codes, norms, standards and CAD software.
CLO 2	Learning about CREO software of 2D & 3D drawing with different command.
CLO 3	Design, develop and model the given part using CREO
CLO 4	Develop Assemble using CREO

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Introduction about Parametric Design Software: Difference between 2D & 3D Models, Geometric modeling concept, types, Introduction about Parametric & non parametric modeling concept, difference between Parametric & Non parametric, and example of Parametric & Non parametric software, CREO Software, CATIA Software, Solid Work Software, NX Software.	20%	5
2	2d Modelling by CAD Modelling Software: Introduction to parametric modeling CAD Modelling software, sketching interfacing overview, Draw Command, Modify Command, Dimensions of Object, Sketch Constraints.	25%	6

3	3D Modelling by CAD Modelling Software: Sketch of Part, Model Shapes, Model Engineering, Model Editing	35%	9
4	Assembly Modelling by CAD Modelling Software: Assembly modeling, Assembly Constrain, Views generation	20%	4

j. Text Book and Reference Book:

1. Computer aided design: A conceptual approach Jayanta Sarkar; CRC press.
2. CAD/CAM
By Groover; Pearson
3. Computer-Aided Graphics and Design
D. L. Ryan; Marcel Dekker Inc, 1994

a. Course Name: Computer Aided Modelling and Design-II Lab

b. Course Code: 03613356

c. Prerequisite: Computer Aided Modeling and Design -I Lab

d. Rationale: Computer Aided Drafting is the main subject of aeronautical engineering which gives an idea of design process & design software of CREO. The goal of this Computer Aided Drafting course is to expose students to problems in designing as applied to plausibly real-world scenarios.

e. Course Learning Objective:

CLOBJ 1	Demonstrate proficiency in creating accurate 2D drawings of aircraft components using CAD modeling software.
CLOBJ 2	Develop competence in generating detailed 3D solid models of aircraft components using CAD modeling software.
CLOBJ 3	Acquire skills in creating solid models of dismantled parts from assemblies of aircraft components using CAD modeling software.
CLOBJ 4	Master the technique of assembling solid models of aircraft components to construct an integrated assembly using CAD software.
CLOBJ 5	Gain proficiency in generating comprehensive bills of materials (BOMs) for assembly models of aircraft components using CAD software.

f. Course Learning Outcomes:

CLO 1	Develop computer aided drawings and models using codes, norms, standards and CAD software.
CLO 2	Learning about CREO software of 2D & 3D drawing with different tool.

CLO 3	Design, develop and model the given part using CREO.
CLO 4	Create assembly of solid models of Aircraft Components.
CLO 5	Create the bill of material (BOM) of Assembly Model of Aircraft Components

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Develop computer aided drawings and models using codes, norms, standards and CAD software.
CLO 2	Learning about CREO software of 2D & 3D drawing with different tool.
CLO 3	Design, develop and model the given part using CREO.
CLO 4	Create assembly of solid models of Aircraft Components.
CLO 5	Create the bill of material (BOM) of Assembly Model of Aircraft Components

I. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
-	-	4	2	-	-	60	-	40	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-**Continuous Evaluation, **ESE-** End Semester Examination

J. Course Content:

Sr.	Topics
1	Prepare a 2D drawing using CAD Modelling Software of Aircraft Components.
2	Prepare 3D solid model using from CAD Modelling Software of Aircraft Components
3	Prepare solid models of dismantled parts of an assembly with CAD Modelling Software of Aircraft Components.
4	Prepare assembly of solid models of Aircraft Components.
5	Prepare the bill of material (BOM) of Assembly Model of Aircraft Components
6	Case study of Aircraft Components.

K. Mapping of Experiment List with Course Learning Outcomes:

Sr. NO.	Experiment List
1	Prepare a 2D drawing using CAD Modelling Software of Aircraft Components.
2	Prepare 3D solid model using from CAD Modelling Software of Aircraft Components
3.	Prepare solid models of dismantled parts of an assembly with CAD Modelling Software of Aircraft Components.
4.	Prepare assembly of solid models of Aircraft Components.
5.	Prepare the bill of material (BOM) of Assembly Model of Aircraft Components
6.	Case study of Aircraft Components.

a. Course Name: Major Project-II

b. Course Code: 03613358

c. Prerequisite: Major Project-I.

d. Rationale: The main aim of this subject is to transform theoretical knowledge into practical. Students have to submit the project with report.

e. Course Learning Objective:

CLOBJ 1	Apply principles of aeronautical engineering to conceptualize, design, and execute a major project, demonstrating understanding of aerodynamics, propulsion systems, structures, and other relevant areas.
CLOBJ 2	Utilize CAD software and other engineering tools to develop detailed designs, schematics, and simulations for the major project, ensuring accuracy and adherence to industry standards.
CLOBJ 3	Conduct comprehensive research and analysis to identify challenges, opportunities, and innovative solutions relevant to the chosen project topic within the aeronautical field.
CLOBJ 4	Collaborate effectively within multidisciplinary teams to plan, coordinate, and execute various stages of the project, fostering communication, leadership, and teamwork skills.
CLOBJ 5	Present the major project outcomes through written reports, technical documentation, and oral presentations, showcasing critical thinking, problem-solving abilities, and project management capabilities.

f. Course Learning Outcomes:

CLO 1	Makes Transformation of Theoretical Knowledge and its Applications.
CLO 2	Improves Innovative Spirit.
CLO 3	Boosts Curiosity and Liking for Studies.

CLO 4	Improves Team Leading and Problem-Solving Skills.
--------------	---

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Makes Transformation of Theoretical Knowledge and its Applications.
CLO 2	Improves Innovative Spirit.
CLO 3	Boosts Curiosity and Liking for Studies.
CLO 4	Improves Team Leading and Problem-Solving Skills.

h. Teaching Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
-	-	8	4	-	-	60	-	40	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

- Course Name: Rockets and Missiles Technology**
- Course Code:** 03613381
- Prerequisite:** Basic knowledge of rocket science and aerodynamics
- Rationale:** The course is designed to give the basic understanding of Rockets and Missiles, performances and its propellants. Also, the subject gives details about the launching and testing criteria of rockets and missiles.
- Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of rocket science, including its history, terminology, classifications, and aerodynamic principles.
CLOBJ 2	Identify the components and characteristics of solid rocket motors and propellants, as well as the advantages and design considerations of liquid propulsion systems.
CLOBJ 3	Analyze the various factors affecting missile performance, including drag types, trajectory types, and maneuvering flight techniques.
CLOBJ 4	Gain insight into the design considerations and materials used in rocket manufacturing, along with safety provisions for testing and flight.

f. Course Learning Outcomes:

CLO 1	Understand the importance of creative and critical thinking.
CLO 2	Expand vocabulary with proper pronunciation.
CLO 3	Comprehend the basics of English grammar.
CLO 4	Read & write effectively for a variety of contexts. Develop confidence in speaking skills.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understand the importance of creative and critical thinking.
CLO 2	Expand vocabulary with proper pronunciation.
CLO 3	Comprehend the basics of English grammar.
CLO 4	Read & write effectively for a variety of contexts. Develop confidence in speaking skills.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

i. Course Content:

Sr.	Topic	Weightage	Teaching Hrs.
1	Introduction: Introduction, History, Terminology: Rockets, Missiles and Motors, Rocket Science, Classifications of Rockets, Airframe components of a Rocket, Gimbling Phenomenon for Rockets, Aerodynamic Forces on a Rocket, Rocket Performance parameters, General Thrust Equation, Guidance phases of flight Classification of Guidance Systems, Multistage Rocket. Applications of Rockets, Missile, Types of Missiles, differentiate between tactical and strategic, Guided missiles, Launch Mode, Range, Inertia and Non-Inertia Reference frames, Aerodynamic control systems of missiles, Applications of missiles.	30%	9

2	Rocket Engines and Propellants: Solid Propulsion Introduction; Solid Motor Components, Classification, Burning Process, Internal Ballistics, Igniter Design, Igniter Hardware, Pyrotechnics, Thrust vector Control, Main Failure Modes, Important parameters, Desirable Properties of Solid Rocket Motor, Solid Rocket Motor Performance, Classification of Nozzles, Solid Propellant; Characteristics of Solid Propellants. Liquid Propulsion Introduction, Classification, Advantages of Liquid Propellant Engines Over Solid Propellant Engines, Design Considerations of Bi-propellant systems, Engine Cycles, Valve, Combustion Instabilities, Thrust vector control, Characteristics of Bi-propellant systems, Advantages, Cooling of Combustion Chamber and Nozzles. Miscellaneous Hybrid Rocket Engines, Electric Rocket Engines, Nuclear Rocket Engines, Solar Rocket Engines, Photon-Based Engines.	35%	12
3	Missile Performance: Introduction, Friction drag, Pressure drags, induced drag, Interference drag, Boost- Glide Trajectory, Boost -Sustain Trajectory, Long range Cruise Trajectory, Long range Ballistic Trajectory, Maneuvering Flight: Flat turns, Pull-ups & Relation, between Maneuverability & Static stability margin.	20%	7
4	Design, Materials and Testing of Rockets: Design considerations in the selection of liquid rocket combustion chamber volume and shape, Materials used for manufacturing case of rockets, Criteria for the selection of materials for Aerospace applications, Metal Cases, Selection of materials, Rocket testing, Safety provisions in a modern test facility, Terminology for the study of atmospheric diffusion of exhaust, Flight testing.	15%	6

j. Reference Books:

1. Missile configuration Design
S S Chin; McGraw Hill
2. Exterior Ballistics of Rockets
Davis Follin & Blitzler Van; Nostrand
3. Rocket Propulsion and Space flight dynamics
Cornelisse JW, Schoyer HFR, and Wakker KF, Pitma

a. Course Name: Lighter than Air Systems

b. Course Code: 03613383

c. Prerequisite: Zeal to learn the subject.

d. Rationale: This course is designed to provide students an overview of Lighter-than-Air (LTA) systems, a subject of Aerospace Engineering that was once at the forefront of technological developments. The subject involves the study of systems for long endurance applications with low fuel

consumption. An increased focus on green aerial vehicles, especially for large volume cargo transportation to remote areas has led to a revival of sorts of Lighter-than-Air (LTA) systems. Several research and development projects in this area have been launched all over the world for various applications, and it has become a hot topic of research.

e. Course Learning Objective:

CLOBJ 1	Gain understanding of the history, types, components, and applications of lighter-than-air (LTA) systems, including airships and aerostats.
CLOBJ 2	Master the principles of aerostatics, including buoyancy, ballasting, and static lift prediction, and their application to various LTA systems.
CLOBJ 3	Acquire knowledge of envelope materials, structural design, operational issues, aerodynamics, and flight mechanics related to LTA systems.
CLOBJ 4	Develop skills in aerostat and airship sizing, conceptual design, and addressing challenges in the design of LTA systems.
CLOBJ 5	Stay updated on current trends, recent developments, and emerging technologies in the field of LTA systems, including hybrid and solar-powered airships.

f. Course Learning Outcomes:

CLO 1	Make familiar with green aerial vehicles used for large volume cargo transport.
CLO 2	Able to understand the application of LTA in today's world.
CLO 3	Study used for the application like long duration aerial surveillance at a specific location, or the ability to take-off and land vertically, and hover without massive amount of fuel consumption.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Make familiar with green aerial vehicles used for large volume cargo transport.
CLO 2	Able to understand the application of LTA in today's world.
CLO 3	Study used for the application like long duration aerial surveillance at a specific location, or the ability to take-off and land vertically, and hover without massive amount of fuel consumption.

h. Teaching & Examination Scheme:

ii. Teaching & Examination Scheme:									
Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor	P	

							y		
3	-	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation,
CE- Continuous Evaluation, ESE- End Semester Examination

i. Course Content:

Sr.	Topic	Weightage	Teaching Hrs.
1	Introduction and Historical Perspectives: Background and Introduction to Lighter-than-Air systems, Differences between LTA and HTA systems, The three conventional LTA systems, LTA gases, Types of Airships and their components, Introduction of Skyship 600 and USP of Airships, Applications of Airships, Tethered Aerostat systems, Why use Aerostats. Historical developments of LTA systems, Overview of PADD, Remote Controlled Airships, Autonomous Airships, Indoor Blimp Projects by students, Biomimetic Airships	25%	8
2	Principles of Aerostatics: Introduction to Buoyancy, Basic Concepts of Aerostatics, Ballasting, Weigh off and Fuel weight recovery, In flight Ballast Collection methods, Static Lift Prediction, :Effect of Humidity & Vapour Pressure, Calculation of Ambient Air Density, Effect of Lifting Gas Purity, Super pressure and Superheat, Ballonet Air Weight Estimation, Net Static Lift of non-rigid airships, Net Static Lift for other LTA systems, Parameters affecting Static Lift, Effect of change in Atmospheric Pressure, Effect of Super-pressure, Effect of Slow change in Atmospheric Temperature and Superheat, Effect of Rapid change in Atmospheric Temperature, Effect of change in Relative Humidity, Effect of change in Lifting Gas Purity, Effect of change in Lifting Gas Volume, Determination of Inflation Fraction, Flight To Lower Ground Elevation, Outdoor Hot Air Balloon. Pressure Height, Level Inflation Fraction, Flight above Pressure Height, Effect of Change in Operating Altitude, Descent Following Exceedance, Pressure Height for other LTA Vehicles	35%	12
3	Miscellaneous: Envelope materials and structural design, Operational issues and ground handling, aerodynamics and flight mechanics, Aerostat sizing and conceptual design, Airship sizing and conceptual design, High altitude airships, Challenges in design of LTA systems, Hybrid LTA systems, Stratospheric airships, Current trends and recent developments, features of hybrid airships, Solar powered airships, Hybrid LTA systems.	40%	15

- a. Course Name: Principles of Heat Transfer
- b. Course Code: 03609381

- c. **Prerequisite:** To have the basic knowledge of thermodynamics
- d. **Rationale:** The course is designed to give the detailed understanding of various modes of heat transfer, its measurement and applications of heat transfer principles.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the definition and significance of heat transfer in process industries, distinguishing between thermodynamics and heat transfer principles.
CLOBJ 2	Comprehend Fourier's law of heat conduction and key concepts such as heat transfer rate, heat flux, and temperature gradient, along with the variation of thermal conductivity with temperature.
CLOBJ 3	Identify different types of convection and Newton's Law of convective heat transfer, and calculate individual and overall heat transfer coefficients.
CLOBJ 4	Explain the principles of radiation heat transfer, including surface emission properties, laws of radiation, and radiation exchange between surfaces.
CLOBJ 5	Gain proficiency in heat exchanger analysis, including classification, LMTD method, overall heat transfer coefficient calculation, and evaluation of effectiveness and number of transfer units for various heat exchanger configurations.

f. **Course Learning Outcomes:**

CLO 1	Understand basic concept of heat transfer
CLO 2	Able to do basic calculations involving heat transfer which includes conduction, convection and radiation Heat transfer as well as heat exchanger design.
CLO 3	Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer
CLO 4	Evaluation of heat exchanger analysis
CLO 5	Understand the definition and significance of heat transfer in process industries, distinguishing between thermodynamics and heat transfer principles.

g. **Mapping of Course Learning Outcomes:**

Course Learning Outcomes	
CLO 1	Understand basic concept of heat transfer
CLO 2	Able to do basic calculations involving heat transfer which includes conduction, convection and radiation Heat transfer as well as heat

	exchanger design.
CLO 3	Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to conduction, convection and radiation heat transfer
CLO 4	Evaluation of heat exchanger analysis
CLO 5	Understand the definition and significance of heat transfer in process industries, distinguishing between thermodynamics and heat transfer principles.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

i. Course Content:

Sr.	Topics	W	T
1	INTRODUCTION: Definition and importance of heat transfer in process Industries, Heat, Difference between thermodynamics and heat transfer Thermodynamics, Modes of heat transfer (a) Conduction (b) Convection (c) Radiation, Steady state and unsteady state heat transfer	15%	6
2	CONDUCTION: Fourier's law of heat conduction with Concepts of (a) Heat transfer rate (b) Heat flux (c) Temperature gradient, Thermal conductivity and its variation with temperature, conduction through plane and composite walls, cylinders and spheres, Thermal Conductivity of solids, liquids and gases, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient	25%	8
3	CONVECTION: Types of Convection-Free convection, Force convection, Newton's Law of convective heat transfer, Individual and Overall heat transfer coefficient	15%	6
4	RADIATION: Introduction, Surface Emission Properties, Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power and emissivity, laws of radiation -Planck, Stefan-Boltzmann, Wien's displacement, Kirchhoff's law, intensity of radiation and Lambert's Cosine law, Radiation exchange between surfaces, Error in temperature measurement due to radiation, Radiation shield Radiation from gases, vapors and flames	25%	8

5	HEAT EXCHANGERS: Introduction, Classification, heat exchanger analysis, LMTD, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness and number of transfer unit for parallel and counter flow heat exchanger, Pressure drop and Pumping power, Evaporators	20%	6
---	--	-----	---

j. Text Book and Reference Book:

1. Heat & Mass Transfer
PK. Nag; Tata McGraw Hill New Delhi
2. Heat and Mass Transfer
R. K. Rajput; S. Chand Publication
3. Basics of Heat and Mass transfer
Dr. D. S. Kumar; S. K. Kataria and Sons Publishers.

a. Course Name: Industrial Engineering

b. Course Code: 03609383

c. Prerequisite: Zeal to learn the subject

d. Rationale: Main aim of this subject is to understand the Industrial sector.

Prosperity of nation in general depends on the productivity of industries and quality of production. Technical managers, engineers, plant operators, machine operators, supervisors and workers working in industries have to compulsorily meet set standards of production in terms of quality, quantity and productivity so as to compete domestic and international market.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamentals, objectives, and techniques of industrial engineering, including productivity enhancement methods and the basics of work study.
CLOBJ 2	Develop proficiency in work study techniques, such as method study, data recording, process charting, and motion economy principles, to analyze and improve work processes.
CLOBJ 3	Gain knowledge of quality assurance concepts, including quality control, statistical quality control (SQC), reliability, and the fundamentals of statistics for quality analysis.
CLOBJ 4	Learn statistical quality control (SQC) tools and techniques, including control charts for variable and attribute quality types, and their applications in quality management.
CLOBJ 5	Acquire understanding of plant layout concepts, types, applications, advantages, and limitations, and explore recent trends in industrial engineering, including ISO standards, Total Quality Management (TQM), Six Sigma, and Kaizen.

f. Course Learning Outcomes:

CLO 1	Appreciate importance of industrial engineering, productivity and work study
CLO 2	Apply Statistical Quality Control tools in a given situation.
CLO 3	Apply Ergonomics for human comfort at work place.
CLO 4	Appreciate the emerging trends in industrial engineering.
CLO 5	Define work study, method study and work measurement.

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Appreciate importance of industrial engineering, productivity and work study
CLO 2	Apply Statistical Quality Control tools in a given situation.
CLO 3	Apply Ergonomics for human comfort at work place.
CLO 4	Appreciate the emerging trends in industrial engineering.
CLO 5	Define work study, method study and work measurement.

h. Teaching & Examination Scheme:

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs / Week	Hrs/ Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
3	-	-	3	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr.	Topics	W	T
1	INTRODUCTION TO INDUSTRIAL ENGINEERING: Industrial engineering-definition, objectives and techniques, Scope, importance and applications of industrial engineering, Methodology and approach of Industrial engineering. Productivity -concept, definition, importance and ways to enhance it, numeric examples, Introduction to work study, Introduction to statistical quality control (SQC).	10%	4
2	WORK STUDY: Work study-Definition, techniques and role to enhance productivity, Importance of human factors in application of work study techniques, Basic procedure of method study, Methods of recording data for method study	30%	12

	using standard symbols, process charts and diagrams, Preparation of operation (outline) process chart for given mechanical assembly having 6-8 components, Preparation of flow process chart and flow diagram for given mechanical components having at least 6-8 major operations, Given the process plan, operation process chart and flow diagram, develop questioning techniques in analyzing data for method study, Also develop and improve the method, based on analysis of given data, Principles of motion economy applied in (a) use of human body, (b) design of work place layout. Principles of micro motion study, Therbligs and SIMO chart, Man and machine chart, Basic procedure of work measurement, Equipment used in time study, Job elements and their types, Methods of measuring time cumulative and fly back timing, Allowances-types, normal values and applications, Calculation of basic time, standard time and work content.		
3	QUALITY ASSURANCE: Definition of quality, quality control (QC), quality assurance (QA), statistical quality control (SQC) and reliability, Importance of quality., Difference between reliability and quality control, Factors affecting and improving reliability, QA tools, Concept of total quality cycle, quality of design, quality of performance, quality of conformity and total quality, Difference between inspection and quality control, Fundamentals of statistics-types of variations, frequency, class boundary and midpoint, frequency distribution, frequency histogram, frequency bar chart and polygon chart, Frequency distribution curve, central tendency, spread or dispersion and range, mode, median and mean, standard deviation and variance with numeric examples	20%	6
4	STATISTICAL QUALITY CONTROL (SQC): Concept of variability, SQC tools and statistical fundamentals, Concept and differences between variables and attributes, Control charts for variable quality types, objectives, applications, calculations of control limits and range/mean, methods to plot and interpretations (X bar-R chart) and examples, Control charts for attribute quality types, objectives, applications, calculations of control limits and range/mean, methods to plot and interpretations and examples	20%	6
5	PLANT LAYOUT: Plant layout: Definition and concept, Types of plant layout, their applications, advantages and limitations.	5%	2
6	RECENT TRENDS IN INDUSTRIAL ENGINEERING: International Organization for standardization and its role, ISO standard series and quality managements system, Total Quality Control (TQC) and Total Quality Management (TQM)- philosophical concepts Concept of six sigma and its applications, Concept and applications of Kaizen, Definition, Normal and maximum work area, Environmental requirements of work place.	15%	5

j. Text Book and Reference Book:

1. Industrial Engineering and Management by M Mahajan
DhanpatRai Publications, New Delhi.

2. Industrial Engineering and Management Dr. B.Kumar, Khanna Publishers
3. Industrial Engineering and Production Management -M. Mahajan, Dhanpat Rai & Co

a. Course Name: Indian Constitution

b. Course Code: 03600351

c. Prerequisite: Zeal to learn Subject

d. Rationale: The course aims to give brief knowledge of Indian Constitution and administration of different bodies of India. To make governance better an engineer must conduce to E-governance through computers and knowledge of cyber laws. An engineer must know the limits of state action and regulations by acquainting himself with the laws that applied by the bureaucrats. Since an engineer works at different places and sights, he must have the basic knowledge of centre -state relations with reference to policy of financing the key projects. The knowledge of Constitution is necessary for him in order to ensure that the rules and regulations under which public and private sector works, do not violate the provisions of the Constitution. Knowledge of corporate culture is necessary for him. He must understand the compulsions of the public private partnership and philosophy of state ownership of key industries.

e. Course Learning Objective:

CLOBJ 1	Understand the historical context and significance of the Indian Constitution, including the Preamble and its interpretation.
CLOBJ 2	Comprehend the structure and roles of the Union Government, including the President, Prime Minister, and Parliament.
CLOBJ 3	Gain insight into the functions and powers of State Governments, including the roles of Governors, Chief Ministers, and State Legislatures.
CLOBJ 4	Familiarize with the structure and functions of local administration, including District Administration, Municipal Corporations, and Zila Panchayats.
CLOBJ 5	Understand the role and functioning of the Election Commission, including the Chief Election Commissioner and State Election Commissions, in conducting free and fair elections in India.

f. Course Learning Outcomes:

CLO 1	Understanding the Constitution.
CLO 2	Ability to understand, Union Government State Government, Local Administration and Election Commission.
CLO 3	Understand powers of State Governments, including the roles of Governors, Chief Ministers, and State Legislatures.
CLO 4	Understand Familiarize with the structure and functions of local administration, including District Administration, Municipal Corporations, and Zila Panchayats.

CLO 5	Understand the role and functioning of the Election Commission, including the Chief Election Commissioner and State Election Commissions, in conducting free and fair elections in India.
--------------	---

g. Mapping of Course Learning Outcomes:

Course Learning Outcomes	
CLO 1	Understanding the Constitution.
CLO 2	Ability to understand, Union Government State Government, Local Administration and Election Commission.
CLO 3	Understand powers of State Governments, including the roles of Governors, Chief Ministers, and State Legislatures.
CLO 4	Understand Familiarize with the structure and functions of local administration, including District Administration, Municipal Corporations, and Zila Panchayats.
CLO 5	Understand the role and functioning of the Election Commission, including the Chief Election Commissioner and State Election Commissions, in conducting free and fair elections in India.

h. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theor y	P	
2	-	-	-	20	20	-	-	-	40

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

i. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	THE CONSTITUTION -INTRODUCTION: The History of the Making of the Indian Constitution Preamble and the Basic Structure, and its interpretation Fundamental Rights and Duties and their interpretation, State Policy Principles.	25%	7
2	UNION GOVERNMENT: Structure of the Indian Union, President -Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha	20%	5
3	STATE GOVERNMENT: Governor Role and Power, Chief Minister and Council of Ministers, State Secretariat.	20%	4

4	LOCAL ADMINISTRATION: District Administration, Municipal Corporation, Zila Panchayat	15%	4
5	ELECTION COMMISSION: Role and Functioning, Chief Election Commissioner, State Election Commission	20%	4

j. Text Book and Reference Book:

1. An Introduction to the Constitution of India
D.D. Basu; Prentice Hall, New Delhi
2. An Introduction to the Constitution of India
M. V. Pylee; Vikas New Delhi