||Jai Sri Gurudev||
Sri Adichunchanagiri Shikshana Trust (R.)
SJC INSTITUTE OF TECHNOLOGY
An Autonomous Institution under VTU
AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME, CV & AE), Gold Rated by QS I-Gauge
P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka
Estd : 1986

B.E. I / II Semester Courses Syllabus (2025 Scheme)

Physics group Scheme Chemistry group Scheme

Sl. No	Course Code	Course Title	Link
1	1BMATC101	Differential Calculus and Linear Algebra: CV Stream	Syllabus
	1BMATM101	Differential Calculus and Linear Algebra: ME Stream	Syllabus
	1BMATE101	Differential Calculus and Linear Algebra: EC stream	Syllabus
	1BMATS101	Calculus and Linear Algebra: CS Stream	Syllabus
	1BMATC201	Differential Calculus and Numerical Methods: CV Stream	Syllabus
	1BMATM201	Multivariable Calculus and Numerical Methods: ME Stream	Syllabus

Sl. No	Course Code	Course Title	Link
	1BMATE201	Calculus, Laplace Transform and Numerical Techniques: EC stream	Syllabus
	1BMATS201	Numerical Methods: CS Stream	Syllabus
2	1BPHYC102/202	Applied Physics: CV Stream	Syllabus
	1BPHYM102/202	Applied Physics: ME Stream	Syllabus
	1BPHYE102/202	Applied Physics: ECE Stream	Syllabus
	1BPHYS102/202	Applied Physics: CSE Stream	Syllabus
	1BCHEC102/202	Applied Chemistry for Sustainable Structure & Material Design (CV stream)	Syllabus
	1BCHEM102/202	Applied Chemistry for Advanced Metal Protection and Sustainable Energy Systems (ME stream)	Syllabus
	1BCHEE102/202	Applied Chemistry for Emerging Electronics and Futuristic Devices (EC stream)	Syllabus

Sl. No	Course Code	Course Title	Link
	1BCHES102/202	Applied Chemistry for Smart Systems (CS stream)	Syllabus
3	1BCEDC103/203	Computer-Aided Engineering Drawing for CV Stream	Syllabus
	1BCEDM103/203	Computer-Aided Engineering Drawing for ME stream	Syllabus
	1BCEDE103/203	Computer-Aided Engineering Drawing for ECE Stream	Syllabus
	1BCEDS103/203	Computer-Aided Engineering Drawing for CSE stream	Syllabus
	1BAIA203	Introduction to AI and Applications	Syllabus
4	1BESC104A/204A	Building Sciences and Mechanics	Syllabus
	1BESC104B/204B	Fundamentals of Electrical Engineering	Syllabus
	1BESC104C/204C	Introduction to Electronics & Communication	Syllabus
	1BESC104D/204D	Fundamentals of Mechanical Engineering	Syllabus
	1BESC104E/204E	Essentials of Information Technology	Syllabus
5	1BEMC105/205	Engineering Mechanics	Syllabus
	1BEAE105/205	Elements of Aeronautical Engineering	Syllabus

Sl. No	Course Code	Course Title	Link
	1BECE105/205	Fundamentals of Electronics & Communication Engineering	Syllabus
	1BEME105/205	Elements of Mechanical Engineering	Syllabus
	1BPSP105/205	Problem Solving through Programming	Syllabus
6	1BSSK106/206	Soft Skills	Syllabus
	1BENG206	Communication Skills	Syllabus
7	1BMML107/207	Mechanics and Materials Lab	Syllabus
	1BAEL107/207	Elements of Aeronautical Engineering Lab	Syllabus
	1BECL107/207	Fundamentals of Electronics & Communication Engineering Lab	Syllabus
	1BMEL107/207	Elements of Mechanical Engineering Lab	Syllabus
	1BCPL107/207	C Programming Lab	Syllabus

Sl. No	Course Code	Course Title	Link
8	1BIDTL158	Innovation and Design Thinking Lab (Project-based learning)	Syllabus
	1BPRJ258	Interdisciplinary Project-Based Learning	Syllabus
9	1BSKA109/209	Samskrutika Kannada	Syllabus
	1BBKA109/209	Balake Kannada	Syllabus
10	1BPLC105A	Introduction to C Programming (Not for CSE and allied programmes)	Syllabus
	1BPLC105B	Python for Beginners (for all programmes)	Syllabus
11	1BICO207	Indian Constitution & Engineering Ethics	Syllabus

Semester: II						
Elements of Aeronautical Engineering **Stream: ME**						
Course Code	**:**	1BEAE205		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40L		**SEE**	**:**	50 Marks
Course Type	**:**	PSC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Physics, Mathematics**
Knowledge on Fundamental Concepts	**Newtonian mechanics, Properties of fluids, Elementary thermodynamics, Work, energy, and power, Trigonometry, vector algebra.**
Knowledge on Connected Tools (If any)	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the evolution of aircraft and space vehicles and the fundamental principles governing atmospheric flight and space motion.
CLO2	Explain the basic aerodynamic principles governing lift, drag, stall, and aircraft control.
CLO3	Describe the structural components and materials used in aircraft and their response to various loads.
CLO4	Understand the working principles of air-breathing and non-air-breathing propulsion systems.
CLO5	Identify and explain the functioning of aircraft instruments, control systems, and essential onboard systems.

Module – 1: Introduction to Aircrafts	**08 Hrs**
Evolution of aircraft: Evolution from gliders to modern jets and space vehicles, Types of flying machines (airplanes, helicopters, missiles & rockets). Autonomous Aircraft & UAVs, eVTOL & Advanced Air Mobility, Stealth & "Loyal Wingman" UAVs, Supersonic & Hypersonic vehicles overview, Projectile Motion, Orbit types (based on shape), Orbital velocity calculations, orbit Energy Requirements, Simple problems. **The Flight Phases:** The four forces: Lift, Weight, Thrust, Drag, Equilibrium and straight & level flight, Angle of attack, and Stall. Phases of Take-off and landing. Aircraft basic and Aerobatic maneuvers, Airspeed (TAS, IAS, CAS), altitude types (Pressure, density altitudes), Simple problems on airspeed. **Text Book 1: Ch 1,2,3,4,6** **Text Book 2: Ch1,2**	
Module – 2: Aerodynamics	**08 Hrs**
Introduction of Aerodynamics: What is Aerodynamics, The Standard Atmosphere, Flow patterns, Streamlines, and Pressure changes, Wing configurations, Airfoil Nomenclature, Archimedes and application of Bernoulli principle for lift generation, Simple problems on Archimedes and Bernoulli principle **Aerodynamic Forces:** Lift and drag in simple terms, Lift-to-drag ratio and Aerodynamic efficiency, Causes & Prevention of drag, Types of Drags, Aspect Ratio, Stall and prevention. Aircraft Axis of motion. Primary and Secondary control surfaces. Simple problems on Stall speed, Lift and Drag. **Text Book 1: Ch 5,7,8** **Text Book 2: Ch3,4,5,6,7**	
Module – 3: Aircraft Structures	**08 Hrs**

Overview of aircraft layout: Structural components of Wing, Fuselage, Empennage and Landing gear, Forces Acting on Structures, Understanding Stress, Strain, Bending, and Torsion.

Aircraft Materials: Properties required for aerospace application, Advanced Materials (Ceramics, Composites) Strength-to-weight ratio. How engineers test wings and fuselages, Fatigue, cracks, and maintenance.

Text Book 3: Ch 1,2,3,4,6

Module – 4: Propulsion	**08 Hrs**

Air breathing Engines: Newton's third law, Reciprocating engines in early aircraft, Concept of Propeller and its Types, Jet Engines: Types and working principle of Inlets, Compressors, Combustion chambers, Turbine and Nozzles. Basic parts and working principle of Turbojet, Turbofan, Turboprop engines and their comparison, Pros and Cons, Brayton Cycle, Sustainable Aviation Fuels (SAF), Hydrogen & Electric Propulsion, Advanced Engine Concepts (Open Rotor & RISE), AI for Propulsion & Combustion Modeling.

Non Air breathing Engines: How rockets work in space, Classifications, List of Propellants (Solid, Liquid and Cryogenic), Reusable Launch Vehicles and the future space flight programs (SpaceX, ISRO, NASA), Electric and hybrid propulsion for Rockets.

Text Book 4: Ch 1,2,3,4,5,6

Module – 5:Aircraft Systems & Aerospace Ecosystem	**08 Hrs**

Cockpit Instruments, Pitot probes, gyros, GPS, Overview on Glass cockpits and Displays, Basic working principle of Hydraulic control system, FBW control system overview, Basic Fuel systems and its types, Cabin pressurization, Oxygen systems, Anti-icing and De-icing methods.

Emerging Aerospace Ecosystem: Indian Startup & Aerospace Support Programs - IN-SPACe Technology Adoption Fund (Space), Indian Space Policy 2023, iDEX – Innovations for Defence Excellence, Defence Industrial Corridors, Current famous Global Aerospace Giants – ISRO, HAL, Boeing, Airbus, Rolls Royce, SpaceX

Text Book 5: Ch 1,2,3,4,5,6,7

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the evolution of aircraft from early gliders to modern jets, space vehicles, and advanced flying machines such as UAVs, eVTOLs, supersonic and hypersonic vehicles.
CO2	Apply fundamental aerodynamic principles such as Archimedes' principle and Bernoulli's equation to solve simple problems related to lift, drag, stall speed, and aerodynamic efficiency.
CO3	Apply knowledge of aircraft materials and structural behavior to explain strength-to-weight requirements, fatigue, cracking, and testing of wings and fuselages.
CO4	Compare propulsion systems and assess emerging sustainable technologies like SAF, hydrogen, electric, and reusable launch vehicles.
CO5	Assess the impact of aircraft systems and aerospace developments on technology, safety, and industry growth.

Text Books	
1	A C KERMODE, "FLIGHT WITHOUT FORMULAE', 5th Edition, Pearson India, 2004, ISBN-10 : 813171389X.
2	Lalit Gupta & Dr. O.P. Sharma, Fundamentals of Flight (Vol. 1) - Basic Aerodynamics, Himalayan Books, 2015, ISBN : 9788170020752
3	Lalit Gupta & Dr. O.P. Sharma, Fundamentals of Flight (Vol. 2) - Aircraft Structures, Himalayan Books, 2015, ISBN : 9788170020769
4	Lalit Gupta & Dr. O.P. Sharma, Fundamentals of Flight (Vol.3) - Aircraft Propulsion, Himalayan Books, 2015, ISBN : 9788170020776
5	Lalit Gupta & Dr. O.P. Sharma, Fundamentals of Flight (Vol.4) - Aircraft Systems, Himalayan Books, 2015, ISBN : 9788170020974

Reference Books	
1	Fundamental of Aerodynamics, Anderson J.D, 5th edition, 2019 McGraw Hill, International Edition, I- ISBN: 13: 978-0073398105.
2	Mechanics and Thermodynamics of Propulsion, 2nd edition, Hill, P.G. & Peterson, C.R. Addison – Wesley Longman INC, 1991, ISBN-10: 0201146592, ISBN-13: 978- 0201146592.
3	"Aircraft Instrumentation and Systems", S. Nagabhushana , L. K. Sudha, Ist edition IK Books. 2010 ISBN- 13: 978- 9380578354.
4	J.W. Cornelisse, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd, London, 1982.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/playlist?list=PLOzRYVm0a65ey1nPhnbfrz59Hvu-NVob7

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	-	-	-	-	2	-	-	-	2	1
CO2	3	3	-	-	2	-	2	-	-	-	1
CO3	3	3	2	-	2	-	1	-	-	-	1
CO4	3	3	-	2	-	2	3	-	-	-	1
CO5	3	-	-	-	-	3	2	-	-	2	1

COPO Mapping Justification

- **PO1 (Engineering Knowledge)** – All COs map here since all require understanding of fundamental and applied aerospace concepts.
- **PO2 (Problem Analysis)** – Mapped to CO2, CO3, CO4 for analytical understanding of aerodynamics, structures, and propulsion.
- **PO3 (Design/Development)** – CO3 focuses on applying material knowledge for structural solutions.
- **PO4 (Investigation)** – CO4 includes assessing and evaluating emerging propulsion technologies.
- **PO5 (Modern Tool Usage)** – CO2, CO3 involve use of simulation or computational tools for aerodynamic and structural analysis.
- **PO6 (Engineer and Society)** – CO1, CO4, CO5 focus on societal and industrial impact.
- **PO7 (Environment & Sustainability)** – CO2, CO3, CO4, CO5 include sustainable tech like SAF, hydrogen, etc.
- **PO10 (Communication)** – CO1, CO5 require explanation and reporting effectively.

Elements of Aeronautical Engineering Lab		Semester	2
Course Code	**1BAEL207**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	10-12 Lab slots	Total Marks	100
Credits	01	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course objectives: This course will enable students

- To introduce to basic aircraft configurations, structures, and flight concepts through hands-on activities.
- To fabricate simple aerospace models using lightweight materials.
- To understand fundamental aerodynamic principles such as lift, thrust, stability, and control.
- To familiarize with aircraft systems, flight instruments, and unmanned aerial vehicles.
- To develop analytical, observational, and problem-solving skills through experiments and case studies.

PRACTICAL COMPONENTS

Sl.NO	Experiments
1	Sketching the detailed configuration of Aircraft (Fighter and Commercial).
2	Fabrication of wing and semi monocoque Fuselage structure – Foam sheet or Balsa wood.
3	Fabrication of catapult glider using balsa wood/Foam/Coroplast sheets (unpowered).
4	Center of Gravity Estimation and Aerodynamic Performance Analysis of a Modeled Glider.
5	Fabrication of an Ornithopter: Study of Bio-Inspired Flapping Flight.
6	Experimental Demonstration of Lighter-Than-Air Flight using a Hot Air Balloon Model.
7	Hydro Rocket Experiment to understand Thrust and Motion.
8	Identification and Functional Study of Aircraft Flight Instruments.
9	Demonstration of Flight Controls using Model Setup (Aero plane and Helicopter).
10	Assembly, Configuration, and Basic Flight Operations of a Quadcopter Drone.
11	Demonstration of Aircraft Stealth Concept using Embedded Systems (Arduino-Based Model).
12	Case Study and Failure Analysis of Aircraft Crash Investigation.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Identify and sketch detailed configurations of fighter and commercial aircraft.
- Fabricate basic aircraft components and flying models using foam, balsa wood, and similar materials.
- Estimate center of gravity and evaluate basic aerodynamic performance parameters of model aircraft.
- Explain the working of flight instruments, control systems, UAVs, and stealth concepts using demonstrations.
- Analyze real-world aerospace problems through experiments and aircraft accident case studies.