TULSIRAMJI GAIKWAD-PATIL COLLEGE OF ENGINEERING & TECHNOLOGY
Wardha Road, Nagpur - 441108
Accredited with NAAC A+ Grade
Approved by AICTE, New Delhi, Govt. of Maharashtra
(An Autonomous Institution Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

DEPARTMENT OF AERONAUTICAL ENGINEERING

Teaching Scheme & Syllabus (As per NEW NEP_2020)

SCHEME OF INSTRUCTION & SYLLABI

Semester -Third

Programme: Aeronautical Engineering

From

Academic Year 2026-27

Institute Vision & Mission

Vision:

- To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission:

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Program Outcomes (POs)

1. Engineering Knowledge
2. Problem Analysis
3. Design/development of solutions
4. Conduct investigations of complex problems
5. Engineering Tool Usage
6. The Engineer and The World
7. Ethics
8. Individual and Collaborative Team work
9. Communication
10. Project management and finance
11. Lifelong learning

Department Vision & Mission

Vision:

- To foster technically skilled Aeronautical Engineers of the utmost academic principles, to convene the needs of academia, industry and society.

Mission:

- Impart quality technical education and unique interdisciplinary experiences.
- Develop the analytical, computational and design capabilities to provide sustainable solutions.
- Expose the students to the current trends and opportunities in the Aerospace industry.
- Inculcate professional responsibility based on an innate ethical value system.

Program Educational Objectives (PEOs)

1. Undergraduate students will acquire knowledge to investigate and solve Aeronautical Engineering problems using basics of applied science and engineering.
2. Undergraduate students will utilize the modern technology and techniques to explore new skills and ideas to satisfy the need of society as well as industry.
3. Undergraduate students will get finest employment opportunities in the field of Aeronautical Engineering.
4. To develop the environment of societal and ethical values to concern with engineering issues.
5. Undergraduate students will contribute in the domain specific and interdisciplinary research through the project based learning.

Program Specific Outcomes (PSO)

- Develop profound working knowledge to solve combination of complex problems in aerodynamics, propulsion, structures, flight mechanics and allied courses.
- Be equipped to use CAE packages, simulation languages and advanced tools to solve practical design and analysis problems.
- Undergraduates will be able to utilize the extensive knowledge of design, manufacturing, testing or maintenance of systems and sub systems to pursue career in aeronautical engineering.

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Department of Basic Sciences and Humanities

Scheme of Instruction for First Year of B. Tech. (UG) Programme

Group-B Semester – I (AE/CE/ME)

SN	Sem	Type	BoS/ Dept	Sub. Code	Subject	T/P	Contact Hours L	P	SL	Hrs	Credits	% Weightage CTE A	CA	ESE	TOTAL	ESE Duration Hours
FIRST SEMESTER (GROUP-B)																
1	1	BSC	S&H	BSH41101	Linear Algebra and Calculus	T	4	0	2	6	4	30	10	60	100	3
2	1	BSC	S&H	BSH41106	Chemical Process in Engineering	T	3	0	2	5	3	30	10	60	100	3
3	1	BSC	S&H	BSH41107	Chemical Process in Engineering-Lab	P	0	2	-	2	1	25	-	25	50	-
4	1	ESC	CE	BCE41101	Engineering Mechanics	T	3	0	2	5	3	30	10	60	100	3
5	1	IKS	S&H	BSH41204	Indian Ancient Technology	T	2	0	2	4	2	15	5	30	50	1
6	1	ESC	ME	BME41101	IDEA-Lab & Engineering Workshop	P	0	4	-	4	2	50	-	-	50	-
7	1	ESC	CE	BCE41102	Environment Sustainability -Lab	P	0	2	-	2	1	25	-	25	50	-
8	1	VSEC	CSE	BCS41104	Fundamentals of Computer-Lab	P	0	2	-	2	1	25	-	25	50	-
9	1	VSEC	S&H	BSH41205	Social Internship	P	0	2	-	2	1	25	-	-	25	-
10	1	PCC	AE/ ME/ CE	BAE41101/ BME41102 BCE41103	Basics of Aircraft Design-Lab / CNC Machine and Programing-Lab / Building Maintenance -Lab	P	0	4	-	4	2	25	-	25	50	-
11	1	CC	S&H	BSH41X01	Liberal Learning Module-I	P	0	4	-	4	2	50	-	-	50	-
TOTAL FIRST SEM							**12**	**20**	**08**	**40**	**22**	**330**	**35**	**310**	**675**	**10**
SECOND SEMESTER (GROUP-B)																
1	2	BSC	S&H	BSH41201	Differential Equation and Statistics	T	4	0	2	6	4	30	10	60	100	3
2	2	BSC	S&H	BSH41206	Solid State Physics & Optics	T	3	0	2	5	3	30	10	60	100	3
3	2	BSC	S&H	BSH41210	Solid State Physics & Optics-Lab	P	0	2	-	2	1	25	-	25	50	-
4	2	ESC	EE	BEE41201	Principle of Electrical Engineering	T	3	0	2	5	3	30	10	60	100	3
5	2	ESC	EE	BEE41202	Principle of Electrical Engineering -Lab	P	0	2	-	2	1	25	-	25	50	-
6	2	ESC	ME	BME41202	Engineering & Computer Graphics	T	2	0	2	4	2	15	5	30	*50	1
7	2	ESC	IT	BIT41205	C' Language -Lab	P	0	2	2	4	1	25	-	25	50	-
8	2	VSEC	CE	BCE41201	Computer Aided Drawing-Lab	P	0	2	-	2	1	25	-	25	50	-
9	2	VSEC	S&H	BSH41105	Professional Etiquette	P	0	2	-	2	1	25	-	-	25	-
10	2	AEC	S&H	BSH41104	Digital Wellness & Basic Communication Lab	P	0	4	-	4	2	50	-	-	50	-
11	2	CC	S&H	BSH41Y01	Liberal Learning Module-II	P	0	4	-	4	2	50	-	-	50	-
TOTAL SECOND SEM							**12**	**18**	**10**	**40**	**21**	**330**	**35**	**310**	**675**	**10**

Course Category	BSC/ESC (Basic Science Course/ Engineering Science Course)	PCC (Programme Core courses)	Multidisciplinary courses	VSEC (Skill Course)	Social Science & Management: AEC (Ability Enhancement Course)	Social Science & Management: IKS (Indian Knowledge System)	Experiential LearningCourses	CC (Co-Curricular Courses)
Credits SEM-I	08 / 06	–	–	02	02	–	–	02
Credits SEM-II	08 / 07	02	–	02	–	02		02
Cumulative Sum	16 / 13	02	–	04	02	02	–	04

PROGRESSIVE TOTAL CREDITS: 22+21=43

Chairperson	Dean Academics	Vice Principal	Principal	July, 2025	4.00	Applicable for AY 2025-26 Onwards
				Date of Release	Version	

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Department of Aeronautical Engineering

Scheme of Instructions: Second Year B. Tech. in Aeronautical Engineering (As Per NEW NEP 2020)

Semester–III

S N.	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration (Hr)	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	III	PCC	AE	BAE42301	Fluid Mechanics	T	3	-	3	3	30	10	60	3	100
2	III	PCC	AE	BAE42302	Introduction to AeronauticalEngineering	T	3	-	3	3	30	10	60	3	100
3	III	PCC	AE	BAE42303	Fluid Mechanics Lab	P	-	2	2	1	-	25	25	2	50
4	III	PCC	AE	BAE42304	Computer Aided Drafting lab	P	-	2	2	1	-	25	25	2	50
5	III	CEP	AE	BAE42305	Micro Project	P	-	4	4	2	-	50	50	2	100
6	III	VEC	AE	BAE42306	Sustainable Development Goals	T	2	-	2	2	14	6	30	2	50
7	III	OEC	AE	BAE42307	Open Elective-I	T	4	-	4	4	30	10	60	3	100
8	III	HSSM	BA	BBA423--	Engineering Economics for Managers	T	2	-	2	2	14	6	30	2	50
9	III	MDM	S&H	BSH423--	Advance Mathematics	T	2	-	2	2	14	6	30	2	50
10	III	AEC	S&H	BSH423--	Liberal Learning Module-III	P	-	2	2	1	-	50		2	50
Total							16	10	26	21	132	198	370	23	700

Course Category	HSSM (Humanities Social Science & Management)	BSC (Basic Science Course)	ESC (Engg. Science Course)	PCC (Programme Core Courses)	PEC (Program Elective Courses)	OEC (Open Elective Courses)	MDM (Multi-disciplinary Courses)	SEC (Skill Course)	ELC/FP/CEP (Experiential Learning Courses)	CC (Liberal Learning Courses)
Credits	2	--	--	08	--	4	2	02	2	01
Cumu.Sum	6	16	13	10	--	4	2	06	2	5

PROGRESSIVETOTALCREDITS:43+21=64

Chairperson	Director Academics/ Vice Principal	Director Administration	Principal	June, 2026 Date of Release	1.00 Version	Applicable For AY2025-26 Onwards

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TGPCET, Nagpur

Director Academics
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College Of Engineering
And Technology, Nagpur

Dr. Premanand Naktode
Principal
TGPCET, Nagpur

Programme: B. Tech. Aeronautical Engineering

List of **Program Electives** offered by Department of Aeronautical Engineering

Program Elective- I	Program Elective-II	Program Elective- III	Program Elective- IV	Program Elective- V
Semester V	**Semester VI**	**Semester VI**	**Semester VII**	**Semester VII**
BAE43508 Aircraft Systems & Instruments	**BAE43607** Aircraft Maintenance & Repair	**BAE43610** Drone Technology	**BAE44704** Aviation Management	**BAE44707** Unmanned Aerial Vehicles & Systems
BAE43509 Space Technology	**BAE43608** Helicopter Engineering	**BAE43611** Boundary Layer Theory	**BAE44705** Rockets and Missiles	**BAE44708** High Speed Aerodynamics
BAE44510 Mechanics of Machines	**BAE43609** Composite Materials & NDT	**BAE43612** Finite Element Methods	**BAE44706** Computational Fluid Dynamics	**BAE44709** Vibrations and Aero elasticity

Program: B. Tech. Aeronautical Engineering

List of **Open Electives** offered by Department of Aeronautical Engineering

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	**Semester-IV**	**Semester-V**
BAE42307: Introduction to Aerospace Engineering	**BAE42406: Avionics**	**BAE43506: Unmanned Arial Systems**

Chairperson	Director Academics/ Vice Principal	Director Administration	Principal	June, 2026	1.00	Applicable For AY2025-26 Onwards
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Principal
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Course Category	HSSM (Humanities Social Science & Manag.)	BSC (Basic Science Course)	ESC (Engineering Science Course.)	PCC (Programme Core Courses	PEC (ProgrammeElective Courses)	OEC (Open Elective Courses)	MDM (Multi-disciplinary Course)	SEC (Skill Course)	ELC/FP/CEP Experien-tial Learning Courses)	CC (Liberal Learning Courses)	Semester Wise Credits
Semester-I	02	08	06	--	--	--	--	02	--	02	20
Semester-II	02	08	07	02	--	--	--	02	--	02	23
Semester-III	2	--	--	08	--	4	2	02	2	01	21
Semester-IV	2	--	--	09	--	2	2	4	--	01	20
Semester-V	--	--	--	12	4	2	4	-	--	--	22
Semester-VI	--	--	--	10	8	--	02	02	01	--	23
Semester-VII	--	--	--	06	08	--	04	--	03	--	21
Semester-VIII	--	--	--	-	04	--	--	--	12	--	16
Cumu. Sum	8	16	13	47	24	8	14	12	18	6	166

Chairperson	Director Academics/ Vice Principal	Director Administration	Principal	June, 2026	1.00	Applicable For AY2025-26 Onwards
				Date of Release	Version	

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Second Year (Semester-III) B. Tech. Aeronautical Engineering

BAE42301: Fluid Mechanics

2nd Year- (3rd Semester)

BAE42301: Fluid Mechanics

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hr / Week		**ESE**	60 Marks
Tutorial	-		**CIE**	40 Marks
Practical	-		**Total**	100 Marks
Theory Credits: 3			**Duration of Exam:** 3 Hours	

Course Objectives

The Objective of this course is:

1.	To introduce the fundamental properties of fluids and principles governing fluid statics and pressure measurement.
2.	To develop understanding of fluid kinematics, including flow visualization and mathematical representation of flow fields.
3.	To impart knowledge of fluid dynamics principles such as Bernoulli's equation, pipe flow, and dimensional analysis.
4.	To provide insight into hydraulic machines, particularly turbines and their performance characteristics.
5.	To familiarize students with pump systems, their working principles, performance, and practical applications.

Course Contents

Unit I	**Introduction to Fluid Mechanics:** Properties of fluids, Newton's law of viscosity and its applications, Pascal's law, Basic equation of fluid statics, Types of fluids. Fluid pressure and its measurement (Manometers and Bourdon's pressure gauge), Pressure variations in compressible and incompressible fluids Incompressible flow. force center of buoyancy, floating body concept met centric height.
Unit II	**Kinematics and Viscous flow:** Types of fluid flow, Stream line, Path line, Streak line, Stream tube, Continuity equation, One- and Two-dimensional flow, Velocity and Acceleration at a point, Stream function, Velocity potential functions, Potential lines, Flow net. Boundary layer, displacement, momentum and energy thicknesses, turbulent boundary layer. Flow separation and its control, Laminar flow vs. turbulent flow.
Unit III	**Dynamics of Fluid Flow:** One-dimensional method for flow analysis, Euler's equation of motion, Derivation of Bernoulli's equation for incompressible flow and its applications. Equation of motion for laminar flow through pipes resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer.
Unit IV	**Dimensional and Model Analysis**: Introduction. Dimensional Homogeneity, Method of Dimensional Analysis, Dimensionless Numbers (Reynolds's Number, Froude's Number, Euler's Number, Weber's Number, Mach's Number)

Unit V	**Impulse and Reaction Turbines:** Introduction to hydrodynamic thrust of jet on a fixed and moving surface, Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel. Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency Selection of water turbines.

Text Books	
1	Introduction to fluid mechanics and Fluid machines by S.K Som, Gautam Biswas, S Chakraborty.
2	Fluid mechanics and machines by R.K Bansal.
3	F.M. White, Fluid Mechanics, 6thEd., Tata McGraw-Hill, 2008.
Reference Books	
1	Fluid Mechanics by Frank M. White, Mc-Graw-Hill, 7th Edition, 2011.
2	Mechanics of Fluids by B. S. Massey, PHI, 7th Edition,2015.
3	Fluid Mechanics by A. K. Jain, Khanna Publishers, 12th Edition, 2004
Useful Links	
1	https://nptel.ac.in/courses/101/106/101106033/
2	https://nptel.ac.in/courses/101/101/101101002/
3	https://nptel.ac.in/courses/101/106/101106082/

BAE42301	**Course Outcomes**	**CL**	**Class Sessions**
CO1	**Describe** fluid properties and pressure measurement systems.	**3**	**9**
CO2	**Analyze** fluid flow using kinematic and boundary layer concepts.	**3**	**9**
CO3	**Solve** fluid flow problems using Bernoulli's equation and dimensional analysis.	**3**	**9**
CO4	**Identify** and interpret important **dimensionless numbers** used in fluid mechanics and aeronautical engineering.	**4**	**9**
CO5	**Compute** performance parameters of hydraulic turbines.	**2**	**9**

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Second Year (Semester-III) B. Tech. Aeronautical Engineering

BAE42302: Introduction to Aeronautical Engineering

2nd Year- (3rd Semester)

BAE42302: Introduction to Aeronautical Engineering

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hr / Week		**ESE**	60 Marks
Tutorial	-		**CIE**	40 Marks
Practical	-		**Total**	100 Marks
Theory Credits :3			**Duration of Exam :**3 Hours	

Course Objectives

The Objectives of this course is:

1.	Understand the historical development and evolution of aircraft and aerospace vehicles.
2.	Gain knowledge of aircraft configurations, components, and onboard systems.
3.	Understand the basic principles of aerodynamics governing lift, drag, and flight.
4.	Study the structural aspects and materials used in aircraft and space vehicles.
5.	Understand the fundamentals of aircraft propulsion systems and engine types.

Course Contents

Unit-I	**Introduction and developments** Pre Wright-Brothers era, Wright Flyer, history and evaluation of aircraft. Conventional airplane, progress in airplane design and application, Current status. Other kinds of heavier than air vehicle, helicopter, VSTOL machines, space vehicles, reusable space vehicles and space shuttle, Developments in aerodynamics, materials, structures and propulsion over the years.
Unit-II	**Aircraft Configurations and Aircraft Systems** Components of an airplane and their functions, Different parts of airplane. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation. **Aircraft Systems:** Elementary studies on hydraulic, pneumatic, pressurizing air- conditioning and oxygen systems. Landing gear and control surface actuating system. Aircraft electrical systems, elementary studies of generation and on-board distribution of electricity.
Unit-III	**Introduction to Aerodynamics** Aerofoil nomenclature; Flow over aerofoil; Lift and generation of lift by Bernoulli's principle; Lift and drag components – generation of lift and drag; lift curve, drag curve, types of drag, factors affecting lift and drag; variation of lift with angle of attack, pressure distribution over aerofoil; centre of pressure and its significance; aerodynamic centre, aspect ratio, velocity of sound, Mach number and supersonic flight effects, wing span, wing area, sweep, tapered ratio, dihedral, anhedral angle.

Unit-IV	**Airplane Structures:** Configuration of fuselage and wings, progress in materials: wooden to all metal airplanes, strength to weight ratio of aircraft materials, importance of weight load factors, factors of safety in aeronautics and aerospace applications. Details of the structural layout of wing, fuselage tail planes. Cockpit and cabin configuration. Different types of materials for airplane and engine application. Materials for space vehicles.
Unit-V	**Introduction to Aircraft Propulsion** Difference between air-breathing and non-air-breathing engines, classification of aircraft based on power plant, location and principle operation, basics of piston engine, classification of aircraft engines, Brayton cycle and its application to the gas turbine engines characteristics of turbofan, turbojet, turbo prop, ramjet and scramjet engines, classification combustion chamber, types of fuel used in commercial aircraft engines, principle operation of aircraft engines.

Text Books	
1	John D. Anderson, Jr., "Introduction to Flight", Mc-Graw Hill, 3rd edition, 1995.
2	Lalit Gupta and O P Sharma, Fundamentals of Flight, Vol-I to Vol-IV, Himalayan Books, 1st edition,2006.
3	John D. Anderson, Jr., "The Airplane - History of its Technology", AIAA Series, 1st edition, 2002.
Reference Books	
1	G. P. Sutton, O.Biblarz,"Rocket Propulsion Elements", John Wiley & Sons, 7th edition, 2001.
2	A. C. Kermode, "Flight without Formulae", Pearson Education, 5th edition, 2004.
3	S. K. Ojha, "Flight Performance of Aircraft", AIAA Series, 1st edition, 1995.
Useful Links	
1	https://nptel.ac.in/courses/101/101/101101079/
2	https://nptel.ac.in/courses/101/105/101105059/
3.	https://nptel.ac.in/courses/101/105/101105031/

BAE42302	**Course Outcomes**	**CL**	**Class Sessions**
CO1	**Describe** the historical development and classification of aircraft.	**2**	**9**
CO2	**Explain** aircraft systems and control mechanisms.	**2**	**9**
CO3	**Analyze** aerodynamic parameters affecting flight.	**3**	**9**
CO4	**Identify** aircraft structures and materials used in aerospace.	**3**	**9**
CO5	**Explain** working principles of various aircraft propulsion systems.	**4**	**9**

Second Year (Semester-III) B. Tech. Aeronautical Engineering

BAE42303: Fluid Mechanics Lab

2nd Year- (3rd Semester)

BAE42303: Fluid Mechanics & Machinery Lab

Teaching Scheme			Examination Scheme	
Practical	**2 Hrs/week**		**CA**	**25 Marks**
Total Credit	**1**		**ESE**	**25 Marks**
			Total	**50 Marks**
			Duration of ESE: 02 Hours	

Course Objectives

The Objectives of this course is to:

1	Study the performance of venturimeter and orifice meter
2	Study the performance of the meta-centric height of a floating body.
3	Study the performance of the Bernoulli's Theorem
4	Study the minor losses due to sudden enlargement, sudden contraction and bends.
5.	Study the performance characteristics of different Turbines and different pumps

Sr. No.	List of Experiment	CO
1	Determine the Metacentric height of given floating vessel	**1**
2	To find critical Reynolds number for a pipe flow	**2**
3	Verify Bernoulli's theorem.	**3**
4	Determine the value of co-efficient discharge of given venture meter fitted in pipe.	**3**
5	Determine the value of co-efficient discharge for a given orifice meter.	**3**
6	Determine Frictional Losses in pipe	**3**
7	Performance characteristics of Pelton wheel	**4**
8	Performance characteristics of Francis turbine	**4**
9	Performance characteristic of Kaplan Turbine	**4**
10	Performance characteristics of variable centrifugal Speed Pump	**5**

Text Books

1	Fluid Mechanics by Frank M. White, Mc graw-Hill, 7th Edition, 2011.
2.	Fluid Mechanics and Fluid Power Engineering by D. S. Kumar, S.K. Kataria & Sons, 9th Edition, 2015.
3.	Fluid Mechanics for Engineers by P.N. Chartterjee, Macmillan Publishers India, 1st Edition,1995.

Reference Books

1.	Fluid Mechanics and hydraulic Machines by R. K. Bansal, Laxmi Publications, 9th Edition,2018.
2.	Mechanics of Fluids by B. S. Massey, PHI, 7th Edition,2015.
3.	Fluid Mechanics by A. K. Jain, Khanna Publishers, 12th Edition, 2004

Useful Links

	https://nptel.ac.in/courses/112/105/112105206/
	https://nptel.ac.in/courses/112/104/112104117/

BAE32303	Course Outcomes	CL	Class Sessions
CO1	**Demonstrate** the concept of Bouncy of floatation and Metacentric height	**3**	**9**
CO2	**Evaluate** the Reynolds number for determining the type of flow	**3**	**9**
CO3	**Demonstrate** the application of Bernoulli's Theorem and Estimate various losses of energy in pipe	**3**	**9**
CO4	**Estimate** performance characteristics of Impulse and Reaction turbine	**3**	**9**
CO5	**Evaluate** performance characteristics of various types of pumps.	**2**	**9**

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Second Year (Semester-IV) B. Tech. Aeronautical Engineering

BAE42304: Computer Aided Drafting Lab

2nd Year- (3rd Semester)

BAE42304: Computer Aided Drafting Lab

Teaching Scheme		Examination Scheme	
Practical	**2 Hrs/week**	**CA**	**25 Marks**
Total Credit	**1**	**ESE**	**25 Marks**
		Total	**50 Marks**
		Duration of ESE: 02 Hours	

Course Objectives

The Objectives of this course are:

1	Draw different components using computer aided design software.
2	Develop a procedure to prepare aircraft structures.
3	Explore different tools and workbenches in CAD software required for preparing different components.
4	Implement the basic CAD knowledge in developing complex structures
5	Develop fuselage, Propeller assembly hub and wing assembly

Sr. No.	List of Experiment	CO
1	Preparing application of common introductory tools in CATIA and common introductory tools in CATIA	1,2
2	Preparing fully constraint two dimensional sketches with basic tools following all the dimensioning rules	1,2
3	Preparing fully constraint two dimensional sketches with advanced tools following all the dimensioning rules	1,2
4	Preparing different three dimensional solid models using basic tools.	1,2,3
5	Preparing different three dimensional solid models using advanced tools.	1,2,3
6	Preparing different three dimensional surface/ wireframe models	1,2,3
7	Exploring CAD software library for fasteners & keys and making similar machine elements	1,2,3
8	Designing and modeling of propeller and hub assembly	4, 5
9	Designing and modeling of wing assembly	4, 5
10	Designing and modeling of landing gear assembly	CO4, CO5

Text Books	
1	Principles of CAD/CAM/CAE by Kunwoo Lee, Pearson, 3rd Ed., 2003.
2	CAD/CAM/CAE by Farazdak Haideri, Tech-Neo Publications, LLP, 1st Ed., 2019.
3	
Reference Books	
1.	Computer Aided Design: A Conceptual Approach by Jayanta Sarkar, CRC Press, 4th Ed., 2017.
2.	
Useful Links	
1	https://nptel.ac.in/courses/l12/104/112104113/
2	

BAE42304	Course Outcomes	CL	Class Sessions
CO1	**Prepare** different components and aircraft structures using computer aided design and modeling software	3	9
CO2	**Utilize** the procedure of preparing different components and aircraft structures	3	9
CO3	**Exploit** different tools and workbenches in CAD software required for preparing different components and aircraft structures	3	9
CO4	**Apply** the knowledge of basic CAD to develop hub and wing assembly	4	9
CO5	**Apply** the knowledge of basic CAD to develop fuselage and propeller assembly	2	9

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Second Year (Semester-III) B. Tech Aeronautical Engineering

BAE42305: Micro Project

2nd Year- (3rd Semester)

BAE42305: Micro Project

Teaching Scheme			Examination Scheme	
Practical	2 Hrs/week		**CA**	50 Marks
Total Credit	1		**ESE**	-
			Total	50 Marks
			Duration of ESE: -	

Course Outcomes (CO)

Students will be able to

1	Work in a team of 4 students to complete the project work.
2	Do the experimentation and/or computational work ethically.
3	Complete the works within the deadline.
4	Prepare neat and neat project report without any errors.
5	Communicate effectively in English during project demonstration, orals and viva-voce.

Instructions:

- The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study.
- Every project work shall have a guide who is the member of the faculty of the institution.
- Sixteen periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
- Each student shall finally produce a comprehensive report covering back ground information, literature survey, problem statement, project work details and conclusion.
- This final report shall be typewritten form as specified in the guidelines.
- The continuous assessment shall be made as prescribed by the regulation TGPECT, Nagpur.

BAE42305	Course Outcomes	CL	Class Sessions
CO1	**Understand** the project managements and team leadership.	**3**	**9**
CO2	**Analyze** Know about the concept of the mini project.	**3**	**9**
CO3	**Understand and analyze** functioning of projects	**3**	**9**
CO4	**Evaluate** the cost and materials of the projects.	**4**	**9**
CO5	**Estimate** the performance of the projects, study their application and classification.	**2**	**9**

Second Year (Semester-III) B. Tech. Aeronautical Engineering

BAE42306 : Sustainable Development Goals

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs./week		**CIE**	20 Marks
Tutorial	-		**ESE**	30 Marks
Total Credit	2		**Total**	50 Marks
			Duration of ESE: 01 Hrs. 00 Min.	

Course Objectives:

1.	To develop a comprehensive understanding of the UN Sustainable Development Goals (SDGs) and their interconnections.
2.	To analyze the global challenges addressed by the SDGs and their impact on various sectors.
3.	To explore innovative solutions and best practices for implementing the SDGs.
4.	To evaluate the progress made towards achieving the SDGs at national and international levels.
5.	To foster a sense of global citizenship and social responsibility among students.

Course Contents		Hours
Unit I	**Introduction to Sustainable Development Goals (SDGs):** Definition of Sustainability, Aspects of sustainability, historical perspective of sustainable development, Climate Change Conferences and Summits, the Brundtland Commission Report, transition from Millennium Development Goals (MDGs) to SDGs, the role of UN and the need for SDGs and Adoption by the World, scope and inclusion of the 2030 Agenda for Sustainable Development.	**(7)**
Unit II	**Framework & Structuring of the 17 SDGs:** SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 4: Quality Education, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 8: Decent Work and Economic Growth, SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequalities, SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action, SDG 14: Life below Water, SDG 15: Life on Land, SDG 16: Peace, Justice and Strong Institutions, SDG 17: Partnerships for the Goal	**(7)**
Unit III	**SDGs Implementation and Future Perspectives:** Interconnections between the SDGs, the role of technology and innovation in SDG implementation, financing the SDGs, measuring SDG progress, future challenges and opportunities, Climate change and its impact on sustainable development, Case studies of successful SDG implementation – India, World	**(7)**

Text Books

1	Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland
2	Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York

Reference Books	
1	Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.
2	OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.

Useful Links
1. https://nptel.ac.in/courses/109106200
2. https://www.un.org/sustainabledevelopment/

BAE42306	Course Outcomes	CL
CO 1	To explore the historical origins and evolution of the UN-SDGs.	2
CO 2	To analyze the 17 SDGs and their interlinkages.	2
CO 3	To analyze the role of technology and innovation in achieving the SDGs along with future challenges and opportunities.	2

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Second Year (Semester-III) B. Tech. Aeronautical Engineering

BAE42307: Introduction to Aeronautical Engineering

2nd Year- (3rd Semester)- Open Elective-I

BAE42307: Introduction to Aerospace Engineering

Teaching Scheme			**Examination Scheme**	
Lectures	4 Hr / Week		**ESE**	60 Marks
Tutorial	-		**CIE**	40 Marks
Practical	-		**Total**	100 Marks
Theory Credits : 4			**Duration of Exam :** 3 Hours	

Course Objectives

The Objectives of this course is:

1.	To make students aware about the aircraft design process and its purpose.
2.	To make the student configuration of fuselage and wings.
3.	To investigate the performance and stability characteristics of airplanes.
4.	To the study different aircrafts engines and their applications.

Course Contents

Unit-I	**Introduction and developments** Pre Wright-Brothers era, Wright Flyer, history and evaluation of aircraft. Conventional airplane, progress in airplane design and application, Current status. Other kinds of heavier than air vehicle, helicopter, VSTOL machines, space vehicles, reusable space vehicles and space shuttle, Developments in aerodynamics, materials, structures and propulsion over the years.
Unit-II	**Aircraft Configurations and Aircraft Systems** Components of an airplane and their functions, Different parts of airplane. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation. **Aircraft Systems:** Elementary studies on hydraulic, pneumatic, pressurizing air- conditioning and oxygen systems. Landing gear and control surface actuating system. Aircraft electrical systems, elementary studies of generation and on-board distribution of electricity.
Unit-III	**Introduction to Aerodynamics** Aerofoil nomenclature; Flow over aerofoil; Lift and generation of lift by Bernoulli's principle; Lift and drag components – generation of lift and drag; lift curve, drag curve, types of drag, factors affecting lift and drag; variation of lift with angle of attack, pressure distribution over aerofoil; centre of pressure and its significance; aerodynamic centre, aspect ratio, velocity of sound, Mach number and supersonic flight effects, wing span, wing area, sweep, tapered ratio, dihedral, anhedral angle.

Unit-IV	**Airplane Structures:** Configuration of fuselage and wings, progress in materials: wooden to all metal airplanes, strength to weight ratio of aircraft materials, importance of weight load factors, factors of safety in aeronautics and aerospace applications. Details of the structural layout of wing, fuselage tail planes. Cockpit and cabin configuration. Different types of materials for airplane and engine application. Materials for space vehicles.
Unit-V	**Introduction to Aircraft Propulsion** Difference between air-breathing and non-air-breathing engines, classification of aircraft based on power plant, location and principle operation, basics of piston engine, classification of aircraft engines, Brayton cycle and its application to the gas turbine engines characteristics of turbofan, turbojet, turbo prop, ramjet and scramjet engines, classification combustion chamber, types of fuel used in commercial aircraft engines, principle operation of aircraft engines.

Text Books	
1	John D. Anderson, Jr., "Introduction to Flight", Mc-Graw Hill, 3rd edition, 1995.
2	Lalit Gupta and O P Sharma, Fundamentals of Flight, Vol-I to Vol-IV, Himalayan Books, 1st edition,2006.
3	John D. Anderson, Jr., "The Airplane - History of its Technology", AIAA Series, 1st edition, 2002.
Reference Books	
1	H. P. Sutton, O.Biblarz,"Rocket Propulsion Elements", John Wiley & Sons, 7th edition, 2001.
2	B. C. Kermode, "Flight without Formulae", Pearson Education, 5th edition, 2004.
3	S. K. Ojha, "Flight Performance of Aircraft", AIAA Series, 1st edition, 1995.
Useful Links	
1	https://nptel.ac.in/courses/101/101/101101079/
2	https://nptel.ac.in/courses/101/105/101105059/
3.	https://nptel.ac.in/courses/101/105/101105031/

BAE42307	**Course Outcomes**	**CL**	**Class Sessions**
CO1	**Understand** history of aviation and basic concepts of aerospace engineering and implement the knowledge acquired in design and development of aircrafts.	**2**	**9**
CO2	**Understand** different components of aircraft, vehicle types and flight instrumentations and develop conceptual design of aircraft systems and subsystems.	**2**	**9**
CO3	**Apply** the knowledge of aerodynamic forces and moments acting on airplane for understanding of different flight parameters.	**3**	**9**
CO4	**Apply** the knowledge of aircraft structures and configurations in solving the problems on airplane layouts, load factor and factor of safety.	**3**	**9**
CO5	**Investigate** the performance and characteristics of the aircraft jet engines and the basic understanding of theirs working principles.	**4**	**9**

Second Year (Semester-III) B. Tech. Aeronautical Engineering

BBA423__: Engineering Economics for Managers

2nd Year- (3rd Semester)

BBA423__: Engineering Economics for Managers

Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr / Week		**ESE**	20 Marks
Tutorial	-		**CIE**	30 Marks
Practical	-		**Total**	50 Marks
Theory Credits: 2			**Duration of Exam:** 2 Hours	

Course Objectives

The Objectives of this course is:

1.	To help students of engineering economics and demand Analysis.
2.	To make the student understand the concept of supply: law of supply, Factors affecting Supply.
3.	To investigate the performance Criteria for good demand Forecasting, demand forecasting of Product.
4.	To know types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships.

Course Contents

Unit-I	**Introduction of Engineering Economics and Demand Analysis:** Meaning and nature of Economics, Relation between science, engineering, technology and economics; Meaning of Demand, Determinants of Demand, Shifts in demand, Law of Demand, Price Elasticity of Demand &Types, Income Elasticity, Cross price Elasticity, Determinants of Elasticity, uses and importance of elasticity.
Unit-II	**Concept of Supply:** Law of Supply, Factors affecting Supply, Elasticity of supply. Demand **Forecasting:** Introduction, Meaning and Forecasting, Methods or Techniques of Demand Forecasting, Criteria for Good Demand Forecasting, Demand Forecasting for a New Product. Market Structure: Market Structure Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.
Unit-III	**Cost Analysis**: Introduction, Types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run; Short run and long run, Break- Even Analysis; Production functions: laws of variable proportions, law of returns; Economies of scale: Internal and external.

Text Books

1	Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)..
2	Salvatore D, “Principles of Microeconomics”, Oxford University Press..
3	Koutsoyiannis A, “Modern Microeconomic”, Macmillan Education Ltd.

Reference Books

1.	Dwivedi DN, “Principles of Microeconomics”, Pearson Education.
2.	Cowell, FA, “Microeconomic Principles and Analysis”, Oxford University Press.

Useful Links

1	https://nptel.ac.in/courses/101/105/101105030/
2	https://nptel.ac.in/courses/101/105/101105083/

BBA423__	Course Outcomes	CL	Class Sessions
CO1	**Understand** the Engineering Economics and Relation between science, engineering, technology and economics.	**3**	**9**
CO2	**Analyze** Know about theconcept of supply: Law of Supply, Factors affecting Supply.	**3**	**9**
CO3	**Understand and analyze** Demand Analysis: Meaning and nature of Economics,	**3**	**9**
CO4	**Evaluate** the cost-output relationship: cost Function and Cost-Output Relationships	**4**	**9**
CO5	**Estimate** the performance of the Economies of scale for Internal and external economics and Production functions	**2**	**9**

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Second Year (Semester-III) B. Tech. Aeronautical Engineering

BSH423__: Advance Mathematics

2nd Year- (3rd Semester)

BSH423__: Advance Mathematics

Teaching Scheme			**Examination Scheme**	
Lectures	2 Hr / Week		**ESE**	30 Marks
Tutorial	-		**CIE**	20 Marks
Practical	-		**Total**	50 Marks
Theory Credits : 2			**Duration of Exam :** 3 Hours	

Course Objectives

The Objectives of this course is:

1.	To help students understand to Numerical solution of ordinary differential equations of first order and first degree.
2.	To the understand the basic concept of Laplace transform and its applications.
3.	To the understand the basic concept of partial differential equation.
4.	To the understand the basic concept of Functions of a Complex Variable.

Course Contents

Unit-I	**Numerical Methods:** Solution of Algebraic and Transcendental Equation: False position method, Newton –Raphson method, Solution of system of simultaneous linear equations: Gauss elimination method, Gauss Seidel method. **Numerical Methods (Differential Equations)** Numerical solution of ordinary differential equation by Taylor series method, Runge-Kutta method of 4th order, Euler modified methods and other aerospace applications.
Unit-II	**Partial Differential equations**: Partial differential equation of first order first degree i. e. Lagrange's form. the Linear homogeneous PDE of nth order with constant coefficient, method of separation of variables. Simple Applications to solve Partial Differential Equations (Wave Equations) **Laplace Transforms**: Laplace transforms and its properties, Inverse Laplace Transform (Convolution Theorem), Partial fraction Method.
Unit-III	**Functions of a Complex Variable**: Function of a complex variable, Analytic functions, Cauchy-Riemann conditions, Conjugate functions, singularities, Cauchy's integral theorem and integral formula, Taylor's and Laurent's theorem, Residue theorem (without proof), contour integration.

Text Books

1	B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2	E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed., 2015.
3	H. K. Dass and Er. RajnishVerma: "Higher Engineering Mathematics", S. Chand publishing, 1st edition, 2011.

Reference Books

1	N. P. Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

2	B. V. Ramana: "Higher Engineering Mathematics" Tata McGraw-Hill, 5th Ed., 2006.
3	Mathematics for Engineers by Chandrika Prasad John Wiley & Sons.
Useful Links	
1	https://nptel.ac.in/courses/122/107/122107037/
2	https://nptel.ac.in/courses/111/105/111105035/
3.	https:// nptel.ac.in/courses/111/107/111107119/

BSH423__	**Course Outcomes**	**CL**	**Class Sessions**
CO1	**Analyze** numerical techniques to find the roots of equations different types of equations	**3**	**9**
CO2	**Apply** solution of ordinary differential equation by different types iterative methods.	**3**	**9**
CO3	**Solve** Partial differential equation arising in flow problems using single step and multi-step numerical methods of nth order with constant coefficient.	**3**	**9**
CO4	**Apply** the concept of Laplace Transform for Solving differential equation.	**4**	**9**
CO5	**Solve** problems on the concepts of analytic functions, residues, poles of complex potentials and conformal and Bilinear transformation arising in field theory and signal processing.	**2**	**9**

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