ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

An Empowered Autonomous Institute

(Affiliated to Shivaji University, Kolhapur)

02 Revision Curriculum and Syllabus : IV Year and Semester VII

Bachelor of Technology in Aeronautical Engineering

DOCUMENT NUMBER: ADCET/ACAD/5, Rev:00, 01/01/2020

Annasaheb Dange College of Engineering and Technology Ashta

Department of Aeronautical Engineering

Teaching and Evaluation Scheme

Final Year. B. Tech Semester VII

Course Code	Course Name	Teaching Scheme				THEORY							PRACTICAL						GRAND TOTAL
						ISE		MSE+ ESE			Total	Min	ISE		MSE + ESE		Total	Min	
		L	T	P	Credits	Max	Min	MSE	ESE	Min			Max	Min	Max	Min			
2AEPC401	Vibrations and Structural Dynamics	2	1	2	4	40	16	30	30	24	100	40	50	20	-	-	50	20	150
2AEPC402	Heat Transfer	2	1	-	3	40	16	30	30	24	100	40	-	-	-	-	-	-	100
2AEPE4**	Professional Elective - V	2	-	2	3	40	16	30	30	24	100	40	50	20	-	-	50	20	150
2AEPE4**	Professional Elective - VI	-	-	4	2	-	-	-	-	-	-	-	50	20	50	20	100	40	100
2AEVS411	Aircraft Technical Publication	-	-	2	1	-	-	-	-	-	-	-	50	20	50	20	100	40	100
2AEEL412	Capstone Project	-	-	8	4	-	-	-	-	-	-	-	50	20	50	20	100	40	100
2CCHS413	Project Management and Finance	2	-	-	2	40	16	30	30	24	100	40	-		-	-	-	-	100
2*******	Minor Stream Course 4	3	-	-	3	40	16	30	30	24	100	40	-		-	-	-	-	100
2*******	Open Elective 3	2	-	-	2	100	40	-	-	-	100	40	-		-	-	-	-	100
		13	2	18	24														1000
	Total Contact Hours/Week	33																	

Professional Elective - V	
2AEPE403	Experimental Stress Analysis
2AEPE404	Turbulence Modeling
2AEPE405	Mechatronics for UAV
2AEPE406	Air Traffic Control and Flight Scheduling

Professional Elective - VI	
2AEPE407	Composite Finite Element Analysis
2AEPE408	CFD Analysis using OpenFOAM
2AEPE409	Design of Unmanned Aerial Vehicles
2AEPE410	Repair and Maintenance of Composite Aircraft Structures

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPC401 - Vibrations and Structural Dynamics**
Prerequisite	2AEES103- Engineering Mechanics
Teaching Scheme: Lecture/Tutorial/Practical	02/01/02
Credits	04
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. Students will be equipped with the fundamental knowledge of vibration principles, including basic concepts, classifications, and the analysis of single and multi-degree-of-freedom systems with respect to the behavior due to vibration.
2. Students will be able to formulate and solve problems using various methods for free and forced vibration systems, determine natural frequencies,mode shapes and responses, and apply these skills to real-world engineering problems.
3. Students will develop the ability to utilize computational tools to model, simulate, and analyze vibration systems, considering the visualization and interpretation of results effectively.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPC401_1	Apply the basic principles of vibration to model and simulate single-degree and multi-degree-of-freedom systems.
2AEPC401_2	Execute modal analysis to determine natural frequencies and mode shapes of multi-degree-of-freedom systems using analytical and numerical methods.
2AEPC401_3	Evaluate the vibration characteristics of mechanical and aeroelastic systems using approximate methods.
2AEPC401_4	Analyze the dynamic response of damped and undamped systems under harmonic excitation and base motion.
2AEPC401_5	Investigate aeroelastic phenomena such as divergence, control reversal, and flutter in aircraft structures.

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Course Contents:

Unit 1	**Fundamentals of vibration**	**03 + 02 + 02**
Basic Concepts of Vibration, Classification of Vibration, Vibration Analysis Procedure: Spring Elements, Mass or Inertia Elements, Damping Elements. Harmonic Motion, Solving numerical problems using MATLAB		
Unit 2	**Free & Forced Vibration of Single-Degree-of-Freedom Systems**	**06 + 02 + 08**
Free Vibration of Single-Degree-of-Freedom Systems – Free Vibration of an Undamped Translational & Torsional System, Formulation of the equations of motion, Viscous Damping and Coulomb Damping **Forced Vibration of Single-Degree-of-Freedom Systems** – Response of a Damped System a)Under Harmonic Force, b) Under the Harmonic Motion of the Base, c) Under Rotating Unbalance, Self-Excitation and Stability Analysis. Determination of the Natural frequency and response of each system using MATLAB		
Unit 3	**Two-Degree Freedom Systems**	**04 + 02 + 02**
Two-Degree-of-Freedom Systems - Equations of Motion for Forced Vibration, Free Vibration Analysis of an Undamped System, Torsional System, Coordinate Coupling and Principal Coordinates Determination of the Natural frequency, mode shape of each system using MATLAB		
Unit 4	**Multi-degree-of-Freedom Systems**	**05 + 02 + 04**
Multi-degree-of-Freedom Systems –Modelling of Continuous Systems and Using Newton's Second Law to Derive Equations of Motion, Influence Coefficients, Generalized Coordinates and Generalized Forces, Using Lagrange's Equations to Derive Equations of Motion, Hamilton's principle, Equations of Motion of Undamped Systems in Matrix Form.		
Unit 5	**Approximate Methods to determine the natural frequencies**	**04 + 02 + 04**
Rayleigh's Method- Properties of Rayleigh's Quotient, Computation of the Fundamental Natural Frequency , Fundamental Frequency of Beams and Shafts **Holzer's Method** – Torsional Systems and Spring-Mass Systems **Matrix Iteration Method** - Convergence to the Highest Natural Frequency, Computation of Intermediate Natural Frequencies. Determination of the eigenvalues and eigenvectors of the matrix for the above mentioned systems using MATLAB.		
Unit 6	**Introduction to Aeroelasticity**	**04 + 02 + 00**
Introduction, Classification: Static, Dynamic, Aero-Servo and Aero-Thermo Elasticity, Collar's triangle. **Static Aeroelasticity:** Divergence, Loss, aileron reversal, Control effectiveness for 2d Airfoil. **Dynamic Aeroelasticity:** The phenomenon of flutter of a cantilever wing, buffeting and stall flutter.		

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Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Mechanical Vibrations	V.P.Singh	Dhanpat Rai & Co	5th	2004
2	Introduction to Aircraft and Aeroelasticity and Loads	Jan R. Wright and Jonathan E. Cooper	John Wiley & Sons, Ltd	2nd	2015

Reference Books:

Sl.No	Title	Author	Publisher	Edition	Year
1	Mechanical Vibrations	G.K.Grover	Nem Chand & Bros	8th	2009
2	Mechanical Vibrations	Singiresu.S.Rao	Pearson Education	5th	2004
3	Vibration Problems in Engineering	Timoshenko .S	Wiley and Sons	2nd	1993
4	An Introduction to Theory of Aeroelasticity	Fung Y. C.	Dover Publications, US	Reprint	2008
5	Introduction to structural dynamics and aeroelasticity	Dewey H. Hodges and G. Alvin Pierce	Cambridge University Press	2nd	2011

E-Resources

1. **https://onlinecourses.nptel.ac.in/noc25_ae17**
2. **https://archive.nptel.ac.in/courses/101/105/101105081/**
3. **https://www.youtube.com/watch?v=IRfWDBMN4yU**

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes					Marks		Weightage
		1	2	3	4	5	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	20	16	40 %
2	ISE : TA	☑	☑	☑	☑	☑	20		
3	ISE : PA	☑	☑	☑	☑	☑	50	20	
4	MSE	☑	☑	☐	☑	☐	30	24	60 %
5	ESE	☐	☐	☑	☑	☑	30		

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	2	1	2	-	-	-	2	-	-	-	2	1
2	3	3	2	2	2	-	-	-	2	-	-	-	3	2
3	3	3	2	3	2	-	-	-	2	-	-	-	3	2
4	3	3	2	2	2	-	-	-	2	-	-	-	3	2
5	3	3	3	3	2	-	-	-	1	-	-	-	3	3
Avg	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPC402 - Heat Transfer**
Prerequisite	2AEPC203 - Fluid Mechanics 2AEPC204 - Applied Thermodynamics. 2AEPC213 - Airbreathing Propulsion
Teaching Scheme: Lecture/Tutorial/Practical	02/01/00
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

This course aims to

1. To introduce the fundamental principles of heat transfer (conduction, convection, and radiation) and their relevance in aeronautical engineering.
2. To develop the ability to analyze heat conduction in steady-state and transient conditions and apply it to practical aeronautical systems.
3. To explore convective and radiative heat transfer mechanisms and their applications in aeronautical engineering, focusing on cooling and thermal protection systems.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPC402_1	Explain the basic modes of heat transfer and their significance in aeronautical engineering, including the application of fundamental laws like Fourier's law, Newton's law of cooling, and the Stefan-Boltzmann law.
2AEPC402_2	Analyze and apply principles of thermal resistance concept, steady-state and transient heat conduction in various geometries and systems.
2AEPC402_3	Apply the concepts of convective heat transfer in both forced and natural convection scenarios, understanding empirical correlations, and evaluating different aeronautical applications
2AEPC402_4	Describe and analyze heat transfer during boiling and condensation, and their application in different aeronautical applications
2AEPC402_5	Evaluate radiative heat transfer mechanisms using the Stefan-Boltzmann law, radiative exchange between surfaces, and shape factors, with practical applications in designing thermal protection systems for re-entry vehicles and spacecraft.
2AEPC402_6	Design and optimize heat transfer systems (such as heat exchangers, cooling systems, and insulation) by integrating concepts from conduction, convection, boiling, and radiation for aeronautical engineering applications, considering performance metrics like effectiveness and thermal resistance.

Course Contents:

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Unit 1	**Introduction to Heat Transfer**	**04**
Conduction, convection, and radiation as modes of heat transfer; relevance of heat transfer in aeronautical engineering; Fourier's law of heat conduction; Newton's law of cooling; Stefan-Boltzmann law of radiation;		
Unit 2	**Steady State Heat Conduction**	**04**
One-dimensional heat conduction in plane walls, cylinders, and spheres; concept of thermal resistance; heat conduction in fins for enhanced heat dissipation; applications in turbine blades and thermal insulation in aircraft.		
Unit 3	**Transient Heat Conduction**	**05**
Lumped system analysis for transient heat conduction; time constant and thermal response; one-dimensional transient heat conduction in solids; applications in battery management systems.		
Unit 4	**Convective Heat Transfer**	**04**
Introduction to convective heat transfer; external forced convection: flow over flat plates, cylinders, and spheres; internal forced convection in tubes and ducts; natural convection: vertical plates and cylinders; empirical correlations for convective heat transfer; applications in cooling of avionics, fuel systems, and passenger cabin air conditioning.		
Unit 5	**Boiling, Condensation, and Heat Exchangers**	**05**
Types of boiling: nucleate, film, and transition boiling; condensation mechanisms: filmwise and dropwise condensation; heat exchangers: shell-and-tube, plate heat exchangers; LMTD method and effectiveness-NTU method for heat exchanger analysis; applications in aircraft systems and cryogenic cooling for spacecraft.		
Unit 6	**Radiative Heat Transfer**	**04**
Blackbody radiation and radiative properties; Stefan-Boltzmann law for radiation emission; radiative exchange between surfaces and shape factors; applications in radiation heat shields for re-entry vehicles and thermal protection systems for spacecraft.		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Heat Transfer	R. K. Rajput	S. Chand & Company	4th	2014
2	Fundamentals of Heat Transfer	S. P. Sukhatme	University Press	2nd	2013
3	Fundamentals of Heat and Mass Transfer	Richard E. Incropera, David P. DeWitt	John Wiley & Sons	7th	2011
4	Heat Transfer	J.P. Holman	McGraw-Hill Education	10th	2010

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	☑	20	16	40 %
2	ISE : TA	☑	☑	☑	☑	☑	☑	20		
3	MSE	☑	☑	☑	☐	☐	☐	30	24	60 %
4	ESE	☐	☐	☐	☑	☑	☑	30		

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CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	-	-	-	-	-	-	-	1	2	-
2	3	3	2	-	1	-	-	-	-	-	-	1	3	1
3	3	3	2	-	1	-	-	-	-	-	-	1	3	1
4	3	2	1	-	-	-	-	-	-	-	-	1	2	-
5	3	3	2	-	1	-	-	-	-	-	-	1	3	2
6	3	3	3	2	2	1	1	-	1	1	1	2	3	3
Avg	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**3**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE403 - Experimental Stress Analysis**
Prerequisite	2AEPC212 - Solid Mechanics
Teaching Scheme: Lecture/Tutorial/Practical	02/00/02
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To enable students to select and utilize appropriate experimental methods for stress analysis, considering material properties, loading conditions, and accuracy requirements.
2. To train students in interpreting fringe patterns, calibrating photoelastic materials, and using optical methods like polariscopes to determine stress parameters in two-dimensional models.
3. To equip students with the ability to measure strain using strain gauges and rosettes while addressing sensitivity and environmental factors, and to validate experimental results with computational analyses.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPE403_1	Select appropriate experimental stress analysis techniques based on material properties and loading conditions, ensuring accurate measurement of stress-strain fields under specified constraints.
2AEPE403_2	Apply fringe compensation and thinning methods to calibrate photoelastic materials and evaluate stress parameters for two-dimensional models under specified boundary conditions.
2AEPE403_3	Analyze fringe patterns and stress optic effects using plane and circular polariscope setups under polarized light conditions to determine stress distribution in models.
2AEPE403_4	Evaluate stress-strain relationships using photoelastic coatings by applying correction factors and comparing experimental findings with FEA results under defined testing conditions.
2AEPE403_5	Measure strain at a point using strain gauges and rosettes by considering strain sensitivity, temperature effects, and bonding techniques to ensure accurate strain measurement.

Course Contents:

Unit 1	**Experimental Techniques**	**04 + 02**
Stress analysis - Various experimental techniques - Physical principle of Photoelasticity - Strain gauge - Moire - Brittle coating - Holography - Shearography - TSA - Stress-Strain and Displacement fields. Extensometers - Selection of experimental techniques.		

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Unit 2	**Transmission Photoelasticity**	**04 + 04**
Polarization - Ordinary and extraordinary ray - Light ellipse - passage of light through crystal plate - retardation plate - Fringe patterns - Stress Optic law - Plane Polariscope - Circular polariscope. Arrangement of optical elements to develop circular and plane polariscope.		
Unit 3	**Determination of Photoelastic parameters**	**05 + 04**
Fringe Order & orientation at an arbitrary point - Compensation methods - Fringe Thinning methodologies - Fringe ordering in Photoelasticity. Calibration of Photoelastic materials		
Unit 4	**Stress Visualization**	**03 + 06**
Model to Prototype relation - Similitude equations - Three Dimensional photoelasticity - Visualization of fringe patterns in two dimensional, Determination of stress parameters for circular disc, ring under compression and rod under tension.		
Unit 5	**Reflection Photoelasticity**	**04 + 02**
Principle and Applications - Photoelastic coatings - Stress-strain Optic relation for coating - Evaluation of Coating & specimen thickness - Correction factors for photoelastic coatings - Poisson's ratio mismatch - Coating materials - Maximum fringe order obtainable - Thickness selection. Comparison of experimental results with FEA results for model specimens.		
Unit 6	**Strain Gauges**	**06 + 02**
Strain sensitivity of a strain gauge - Bridge sensitivity - Determination of strain at a point - Rosettes - Strain gauge alloys, carriers and Adhesives - Temperature compensation - Strain gauge selection - Bonding of strain gauge.		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Experimental Stress Analysis	J.W. Dally and W.F. Riley	McGraw Hill	2nd	1991
2	Experimental Stress Analysis	K. Ramesh	IIT Madras	-	-
3	Experimental Stress Analysis	Dr. Sadhu SIngh	Khanna	-	2009

Reference Books:

Sl.No	Title	Authors	Publisher	ISBN	Year
1	E-Book - Experimental Stress Analysis	Dr. K. Ramesh	IIT Madras	978-81-904235-6-4	1991

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes					Marks		Weightage
		1	2	3	4	5	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	40	16	40 %
2	ISE : PA	☑	☑	☑	☑	☑	50	20	
3	MSE	☑	☑	☑	☐	☐	30	24	60 %
4	ESE	☐	☐	☑	☑	☑	30		

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- ABA - Activity Based Assessment, PA - Practical Assessment

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	3	2	-	-	-	-	1	1	2	3	2
2	3	3	-	3	2	-	-	-	-	1	-	1	3	1
3	3	3	-	3	1	-	-	-	-	1	-	1	3	1
4	3	3	1	3	3	-	-	-	-	1	-	2	3	2
5	3	3	1	3	2	-	-	-	-	1	-	2	3	2
Avg	**3**	**3**	**1**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**3**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE404 - Turbulence Modeling**
Prerequisite	2AEPC203 - Fluid Mechanics
Teaching Scheme: Lecture/Tutorial/Practical	02/00/02
Credits	03
Evaluation Scheme : ISE/ESE	40/30/30

Course Objectives:

1. To provide a foundational understanding of turbulence phenomena, its statistical characteristics, and physical significance in engineering flows.
2. To correlate theoretical and computational methods used in turbulence analysis.
3. To develop students' ability to understand turbulence modeling techniques, including DNS, RANS, and LES.
4. To develop an understanding of the impact of turbulence modeling choices on simulation accuracy and computational cost.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPE404_1	*Explain* the nature, characteristics, and statistical treatment of turbulent flows given fluid flow scenarios and turbulence data with maximum accuracy.
2AEPE404_2	Explain the concept of turbulence scales, energy cascade, and Kolmogorov's hypothesis.
2AEPE404_3	Select appropriate turbulence models for a given engineering problem based on flow characteristics and computational constraints.
2AEPE404_4	*Analyze* velocity fields from simulations or experiments to interpret vorticity dynamics, energy spectra, and vortex structures with graphical representation.
2AEPE404_5	*Evaluate* turbulence model predictions by comparing computational results with theoretical/benchmark solutions using quantitative error analysis.
2AEPE404_6	*Conduct* a computational study to predict turbulent flow behavior in a selected engineering application with documented assumptions and boundary conditions.

Course Contents:

Unit 1	**Introduction to Turbulence**	**04**
Nature of Turbulence: Irregularities, Diffusivity, vorticity and swirling strength fluctuations and its characteristics, dissipation; concept of continuum; Statistical Analysis: Random processes, ensemble averaging, time and spatial averaging, probability density functions, single- and multi-point statistics (autocorrelation, cross-correlation), spatial and temporal correlations.		

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Unit 2	**Momentum and Heat Transport**	**04**
Length and Time scales in Turbulence studies:molecular, small and turbulent scales, kolmogorov length scale; temporal and velocity correlations; Reynolds Equations: decomposition, correlations, mean scalar equations and Reynold stress estimations; kinetic theory of gases and turbulent heat transfer; basics of shear and wall flows		
Unit 3	**Turbulence Dynamics**	**05**
Viscosity effects in turbulent flows; vorticity dynamics: tensors, vortices in the equation of motion; vorticity in turbulent flows; Vortex stretching; relation between vortices and reynolds stress, and circulation and vorticity; Concept of spectra: 1D and 2D spectra, energy cascade,time spectra, Fourier series Transport; introduction to numerical simulations		
Unit 4	**Direct Numerical Simulation (DNS)**	**04**
Turbulence modelling in numerical simulations;Zero,single, two and multi equation models; Principles of DNS: Resolving all turbulent scales, Computational requirements and limitations of DNS, Applications of DNS in fundamental research, DNS data analysis and validation; homogeneous and inhomogeneous turbulent flow.		
Unit 5	**Turbulent Kinetic energy-viscosity and Reynolds stress models**	**04**
Boussinesq eddy-viscosity hypothesis and its history; Algebraic model; Spalart-Allmaras model; k–ε, k–ω, mixing-length models; Introduction to RSM and RANS models, Pressure–rate-of-strain models, Limitations of RANS models		
Unit 6	**Large Eddy Simulation (LES)**	**05**
Fundamentals of LES: Filtering operation and sub-grid scale (SGS) models, Smagorinsky model and other SGS models, Advantages and limitations of LES, Applications of LES in engineering problems		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	A First Course in Turbulence	H. Tennekes and J. L. Lumley	MIT press	First	1972
2	An Introduction to CFD: The Finite Volume Method	Versteeg & Malalasekera	Pearson Education	Second	2007
3	Turbulent Flows	S. B. Pope	Cambridge University Press	First	2000

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Reference Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Turbulence Modeling for CFD	David C. Wilcox	DCW industries	Third	2006
2	Turbulence: An Introduction for Scientists and Engineers	P. A. Davidson	Oxford University Press	Second	2015

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	☑	40	16	40 %
2	ISE : PA	☑	☑	☑	☑	☐	☐	50	20	
3	MSE	☑	☑	☑	☑	☐	☐	30	24	60 %
4	ESE	☐	☐	☑	☑	☑	☑	30		

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Practical Assessment

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CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	-	2	1	-	-	-	-	1	-	2	2	1
2	3	2	-	1	-	-	-	-	-	1	-	2	1	-
3	3	3	2	2	3	-	-	-	-	1	1	2	3	2
4	3	3	-	3	3	-	-	-	-	2	-	2	2	1
5	3	3	-	3	3	-	-	-	-	2	-	2	2	2
6	3	3	3	3	3	1	1	1	2	3	2	3	3	3
Avg	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

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Department of Aeronautical Engineering

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE405 - Mechatronics for UAV**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	02/00/02
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To provide students with a comprehensive understanding of mechatronics and its application in UAV systems.
2. To equip students with the skills to design, integrate, and test mechatronic components such as sensors, actuators, and embedded systems for UAVs.
3. To enable students to apply robotics principles and advanced control strategies in developing autonomous UAV systems.

Course Outcomes (CO's):

After successful completion of this course, the student will be able to,

2AEPE405_1	Analyze and design mechatronic systems tailored for UAV applications, integrating mechanical, electronic, and computational components.
2AEPE405_2	Demonstrate proficiency in configuring and testing sensors, actuators, and embedded systems for UAV control and navigation by using any specific sensor/actuator hardware.
2AEPE405_3	Implement robotics-based algorithms, including path planning, obstacle avoidance, and autonomous operation, for Unmanned Aerial Vehicles or Systems by setting any operation condition/mission requirement.
2AEPE405_4	Develop and optimize UAV payload systems, incorporating advanced mechatronics concepts for enhanced functionality and performance.

Course Contents:

Unit 1	**Introduction to Mechatronics and UAV Systems**	**6**
Overview of mechatronics: integration of mechanical, electronic, and computational systems - Introduction to mechatronics applications in UAVs - Key components: actuators, sensors, microcontrollers, and communication systems - Study of UAV mechatronic subsystems using CAD models - Disassembly and identification of components in a UAV system - Simulation of basic mechatronics functions using software tools.		

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Unit 2	Sensors and Actuators for UAV Applications	6
Types of sensors used in UAVs: IMU, GPS, barometers, ultrasonic, and LiDAR - Actuator systems: motors, servos, and their control mechanisms - Sensor calibration and integration techniques - Integration and testing of IMU and GPS sensors with a flight controller - Actuator control: programming servo motors for specific movements - Practical calibration of UAV sensors using ground control software.		
Unit 3	**Microcontrollers and Embedded Systems for UAVs**	**6**
Microcontroller architecture and programming for UAVs - Communication protocols: PWM, UART, I2C, and SPI - Role of embedded systems in UAV flight control and automation - Programming microcontrollers (e.g., Arduino, STM32) for UAV control - Implementing basic communication protocols for sensor data acquisition - Testing real-time control loops on microcontroller platforms.		
Unit 4	**Robotics in UAV Control Systems**	**7**
Fundamentals of robotics and its integration with UAVs - UAV navigation and localization: path planning and obstacle avoidance - Robot Operating System (ROS) for UAV applications - Implementing basic path planning algorithms in simulation - Testing ROS-based UAV simulations for autonomous navigation - Real-world obstacle avoidance using proximity sensors.		
Unit 5	**Mechatronic Design for UAV Payloads**	**7**
Designing mechatronic systems for UAV payloads - Stabilization and gimbal systems for imaging payloads - Power management and energy optimization in UAVs - Assembly and programming of a gimbal stabilization system - Integrating and testing imaging payloads on UAV platforms - Power system testing and optimization for extended UAV operations.		
Unit 6	**Advanced Mechatronics for Autonomous UAV Systems**	**7**
Advanced control strategies for UAV mechatronics: adaptive and robust controls - Swarm robotics and cooperative UAV operations - Future trends in UAV mechatronics: AI and machine learning applications - Implementing adaptive control algorithms for UAV stability - Cooperative control of multiple UAVs in a simulated environment - Experimenting with AI-based UAV behavior for mission-specific tasks.		

Text Books:

Sl.No	Title	Author	Publisher	Edition	Year
1	Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1: Build drones with Ardupilot	Ty Audronis	Packt Publisher	1st	2017
2	Theory, Design, and Applications of Unmanned Aerial Vehicles	A R Jha Ph D	CRC Press	1st	2020
3	Handbook of unmanned aerial vehicles	Valavanis K. P.; Vachtsevanos, G. J., eds	Springer reference	1st	2015
4	A first course in aerial robots and drones	Sebbane, Y. B.	CRC Press	1st	2022

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References:

- https://ros.org/
- https://docs.px4.io/main/en/hardware/reference_design.html
- https://docs.qgroundcontrol.com/master/en/qgc-user-guide/index.html
- https://ardupilot.org/planner/docs/mission-planner-building.html
- https://docs.cubepilot.org/user-guides/herelink/herelink-user-guides

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes				Marks		Weightage
		1	2	3	4	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	40	16	40 %
2	ISE : PA	☑	☑	☑	☑	50	20	
3	MSE	☑	☑	☐	☐	30	24	60 %
4	ESE	☐	☐	☑	☑	30		

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Practical Assessment

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	2	2	1	1	1	2	1	1	2	3	3
2	3	3	2	3	3	1	1	1	2	1	1	2	3	3
3	3	3	3	2	3	2	1	2	3	2	2	3	3	3
4	3	3	3	2	2	1	1	1	2	1	2	2	3	3
Avg	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**3**	**3**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE406 - Air Traffic Control and Flight Scheduling**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	02/00/02
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To provide students with knowledge of airspace classification, ATC services, flight rules, and responsibilities, enabling them to analyze and manage air traffic systems effectively.
2. To equip students with the ability to design airfield layouts, lighting systems, and network flow models, fostering hands-on problem-solving capabilities in aviation operations.
3. To train students in solving complex scheduling, transportation, and fleet assignment problems using mathematical tools and software, ensuring efficient and cost-effective decision-making in aviation management.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPE406_1	**Categorize** ATS airspaces effectively by creating a manual chart, under specified flight rules and responsibilities, to demonstrate a clear understanding of air traffic management principles.
2AEPE406_2	**Calculate** aircraft separations manually under given enroute scenarios, using graph paper and adhering to MOCA and RNAV standards, to ensure safe and efficient air traffic control operations.
2AEPE406_3	**Design and present** a scaled-down airfield layout with accurate markings and lighting components under specified aerodrome requirements, showcasing knowledge of airfield operations and safety.
2AEPE406_4	**Solve** network flow problems like shortest path and minimum cost flow using mathematical models under given conditions, to optimize airline planning processes.
2AEPE406_5	**Develop and implement** scheduling and assignment solutions for fleet, crew, and gate assignments using mathematical tools and software under specified constraints, ensuring efficient resource utilization and operational planning.

Course Contents:

Unit 1	**Airspace and Air traffic management:**	**04 + 02 Hrs**
Objectives of air traffic control systems - Parts of ATC services – Scope and Provision of ATCs – Flight rules – Classification of ATS air spaces - Division and Responsibility of ATC. Create a manual chart that categorizes ATS airspaces		

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Unit 2	Area control service	04 + 02 hrs.
Assignment of Minimum Cruising level, Enroute, MOCA - RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance – ATC clearances - Airport Surveillance Radar. Using graph paper, plot aircraft positions over time to manually calculate vertical, lateral, and longitudinal separations. Include MOCA and RNAV compliance for different scenarios, showcasing the principles of enroute separation.		
Unit 3	**The Airfield**	**05 + 06 Hrs**
Navigational aids (NAVAIDS) located on airfields - Direction indicator – Markings, general requirements – Various markings. Create a scaled-down airfield layout highlighting all essential markings (runway, taxiway, apron) and their general requirements. Airfield Lightning: Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI. Assemble and demonstrate a simplified airport lighting system using LEDs or small electronic components to represent aerodrome beacons, VASI, and PAPI systems		
Unit 4	**Network Flows**	**04 + 04 hrs**
Complexity of airline planning – Network flow models and definitions – Shortest path problems – Minimum cost flow problem – Maximum flow problems. Develop a program to find the shortest path using any programming language.		
Unit 5	**Principle of Flight Scheduling:**	**04 + 04 hrs**
Mission of Scheduling – Hub & Spoke Scheduling – Load Factor and Frequency – Travelling Salesman Problem. Create a program based on a travelling salesman assignment problem to find the feasible route and cost.		
Unit 6	**Fleet assignment and Crew Scheduling**	**05 + 06 Hrs**
Fleet Assignment – Factors in fleet planning – Mathematical formulation - Transportation problems – Minimization and Maximization problems - Manpower planning mathematical modelling case study – Gate Assignment mathematical model for a case study. Prepare a Gate assignment chart using any tool. Using excel solver, solve transportation problems.		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Airline Operation and Scheduling	Massoud Bazargan	Ashgate	2nd	2010
2	International Standards and Recommended Practices	ICAO	ICAO	1st	1951
3	AIP (India) Vol I and II	DGCA	English Book Store	-	2003

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : ABA	☑	☐	☐	☐	☐	☐	40	16	40 %
2	ISE : PA	☑	☑	☑	☑	☑	☑	50	20	
3	MSE	☑	☑	☑	☐	☐	☐	30	24	60 %
4	ESE	☐	☐	☐	☑	☑	☑	30		

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Practical Assessment

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	1	-	-	2	1	1	-	1	3	-	-	-	2
2	1	1	-	-	2	1	1	-	1	3	-	-	-	2
3	1	1	-	-	2	1	1	-	1	3	-	-	-	2
4	3	2	-	-	2	1	1	-	1	3	-	-	2	2
5	3	2	-	-	2	1	1	-	1	3	-	-	2	2
Avg	2.00	1.40			2.00	1.00	1.00		1.00	3.00			2.00	2.00

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE407 - Composite Finite Element Analysis**
Prerequisite	2AEPE304 - Analyzing of Aircraft Structures using FEA 2AEPE319 - Explicit Dynamics Analysis
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04
Credits	02
Evaluation Scheme : ISE/ESE	50/50

Course Objectives:

1. Introduce principles and applications of composite material analysis using finite element methods.
2. Train students in advanced simulation techniques with ANSYS ACP for modeling and performance evaluation of composite structures.
3. Develop expertise in identifying failure mechanisms and optimizing composite designs through hands-on analysis and real-world case studies.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPE407_1	Accurately evaluate stress distribution and deformation behavior of composite components under applied loads using finite element methods, ensuring compliance with industry performance standards.
2AEPE407_2	Effectively define ply configurations, material properties, and simulate composite structures using ANSYS ACP, achieving at least 90% accuracy in comparison to benchmark results.
2AEPE407_3	Identify and interpret critical failure modes such as delamination, buckling, and impact damage in composite laminates, demonstrating a comprehensive understanding through detailed analysis under predefined load conditions.
2AEPE407_4	Optimize the design of composite structures, including T-joints and rocket shells, by reducing stress concentrations and improving load-bearing capacity by at least 20% over baseline models.
2AEPE407_5	Conduct simulations of real-world case studies, such as impact on aircraft structures or failure analysis of marine components, meeting accuracy and performance criteria consistent with industry safety standards.

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List of Experiments:

Sl.No	Title of the Exercises
1	Introduction to ANSYS ACP-Pre: Ply Layup and Material Definition
2	Stress Analysis of a Composite Sandwich Panel
3	Tensile Test Analysis of Unidirectional and Bidirectional Polymer Composites.
4	Delamination Analysis in a Composite Laminates using Bending Test.
5	Modal Analysis of Composite Plate with Symmetric and Unsymmetric Ply Composites
6	Stress Analysis of T-Joint Section Using Unidirectional and Honeycomb Structures
7	Failure Analysis of Class40 Sailboat Using Selection Rules in Ansys ACP-Pre
8	Buckling of Rocket-like Composite Shell Under External Pressure and Temperature.
9	Impact Simulation on Composite Aircraft Structures.

Reference Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Finite Element analysis for Composite Structures	Lazarus Teneketzis Tenek, John Argyris	Springer	1st Edition	1998
2	Finite Element Analysis Of Composite Materials Using Ansys	Ever J. Barbero	CRC Press	2nd Edition	2013
3	Finite Element Analysis Of Composite Laminates	O. O. Ochoa, J. N. Reddy	Springer Netherlands	1st Edition	1992

Online Reference Materials:

Sl.No	Source/Platform	Link to contents
1	Ansys ACP-Pre	https://www.ansys.com/training-center/course-catalog/structures/ansys-mechanical-composite-prepost-acp-advanced#tab1-4

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes					Marks		Weightage
		1	2	3	4	5	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	20	20	50 %
2	ISE : PA	☑	☑	☑	☑	☑	30		
4	ESE : OE	☑	☑	☑	☑	☑	20	20	50 %
5	ESE : PE	☑	☑	☑	☑	☑	30		

- ISE - In-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Pactical Assessment, OE - Oral Examination, PE - Practical Examination

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	1	2	3	2	-	-	-	-	-	-	3	1
2	2	2	1	2	3	-	-	-	-	-	-	-	3	2
3	3	3	-	3	-	2	-	-	-	-	-	-	3	1
4	3	2	3	2	2	-	-	-	-	-	-	-	3	3
5	2	3	2	3	3	3	-	-	-	-	-	-	3	2
Avg	**3**	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE408 - CFD Analysis using OpenFOAM**
Prerequisite	**2AEPE215-Introduction to Computational Fluid Dynamics**
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04
Credits	02
Evaluation Scheme : ISE/ESE	50/50

Course Objectives:

1. To become proficient in using the OpenFOAM software environment, including its command-line interface and graphical user interface
2. To create, modify, and run CFD simulations using OpenFOAM.
3. Master the process of pre-processing, including geometry handling, meshing, and setting boundary conditions.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPE408_1	Demonstrate proficiency in using the OpenFOAM software environment, including its command-line interface and graphical user interface
2AEPE408_2	Create, modify, and run CFD simulations using OpenFOAM for a range of fluid flow problems.
2AEPE408_3	Demonstrate Proficiency in the OpenFOAM pre-processing steps including geometry handling, mesh generation, and choosing appropriate boundary conditions.
2AEPE408_4	Analyze and interpret CFD simulation results effectively, including data visualization and extraction.
2AEPE408_5	Troubleshoot and resolve common issues encountered during CFD simulations using OpenFOAM.
2AEPE408_6	Apply CFD techniques to solve engineering problems in relevant domains, such as aerodynamics, heat transfer, and turbomachinery.

Course Contents:

1. Introduction to CFD and OpenFOAM
2. OpenFOAM Basics: Command Line Interface
3. Geometry Handling & Meshing
4. Meshing & Boundary Conditions
5. Solving and Post-processing
6. Data Analysis & Visualization
7. Case Studies using OpenFOAM

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes					Marks		Weightage
		1	2	3	4	5	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	20	20	50 %
2	ISE : PA	☑	☑	☑	☑	☑	30		
4	ESE : OE	☑	☑	☑	☑	☑	20	20	50 %
5	ESE : PE	☑	☑	☑	☑	☑	30		

- ISE - In-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Pactical Assessment, OE - Oral Examination, PE - Practical Examination

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	-	-	1	-	-	-	-	-	-	-	3	-
2	3	2	-	-	1	-	-	-	-	-	-	-	3	-
3	-	-	-	-	3	-	-	-	-	-	-	1	-	-
4	2	3	-	-	-	-	-	2	3	-	-	-	-	-
5	-	-	-	-	-		-	2	-	3	-	-	-	-
6	3	2	-	-	2	-	-	2	3	3	-	1	3	-
Avg	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**2**	**3**	**3**		**1**	**3**	**-**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE409 - Design of Unmanned Aerial Vehicles**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04
Credits	02
Evaluation Scheme : ISE/MSE/ESE	50/50

Course Objectives:

1. To equip students with the knowledge and skills required to design and develop UAV systems for diverse applications.
2. To provide hands-on experience in integrating and configuring UAV components, including propulsion systems, avionics, and payloads.
3. To enable students to analyze and optimize UAV performance through testing, tuning, and advanced control strategies.

Course Outcomes (CO's):

After successful completion of this course, the student will be able to,

2AEPE409_1	Develop the ability to design UAV systems, including airframe, propulsion, and avionics, tailored to specific mission requirements by using the specific designing tools for engineers.
2AEPE409_2	Apply advanced engineering principles to analyze and optimize UAV performance in terms of aerodynamics, power efficiency, and stability.
2AEPE409_3	Integrate and configure key UAV components, including sensors, controllers, and payloads, for effective real-world drone operations by the experience of basic electronics and workshop practices.
2AEPE409_4	Demonstrate proficiency in autonomous mission planning, system testing, and performance evaluation of Unmanned Aerial Vehicles, i.e., drones through practical flight experiments.

Course Contents:

1. Conceptual & Preliminary UAV Design
2. Weight Estimation and Structural Analysis
3. Propulsion System Design and Evaluation
4. Avionics and Sensor Integration & Circuit diagrams
5. Aerodynamic Performance Analysis
6. Battery and Power System Configuration
7. Simulation on Autonomous Mission Planning and Optimization
8. Flight simulation of Stability and Tuning
9. Payload Integration and Performance Testing
10. Complete System Integration and Flight Test

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Text Books:

Sl.No	Title	Author	Publisher	Edition	Year
1	Unmanned aircraft systems: UAVS design, development and deployment	Austin, R.	John Wiley & Sons.	1st	2011
2	Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1: Build drones with Ardupilot	Ty Audronis	Packt Publisher	1st	2017
3	Introduction to UAV systems	Fahlstrom P, Gleason T	Wiley, UK	4th	2012
4	Handbook of unmanned aerial vehicles	Valavanis K. P.; Vachtsevanos, G. J., eds	Springer reference	1st	2015
5	A first course in aerial robots and drones	Sebbane, Y. B.	CRC Press	1st	2022

Reference Books:

- https://oscarliang.com/flight-controller/
- https://docs.px4.io/main/en/hardware/reference_design.html
- https://ardupilot.org/dev/docs/building-the-code.html
- https://ardupilot.org/mavproxy/index.html#home
- https://ardupilot.org/planner/docs/mission-planner-building.html
- https://docs.cubepilot.org/user-guides/herelink/herelink-user-guides

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes				Marks		Weightage
		1	2	3	4	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	20	20	50 %
2	ISE : PA	☑	☑	☑	☑	30		
4	ESE : OE	☑	☑	☑	☑	20	20	50 %
5	ESE : PE	☑	☑	☑	☑	30		

- ISE - In-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Pactical Assessment, OE - Oral Examination, PE - Practical Examination

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CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	-	3	-	3	-	-	-	-	-	-	-	3	2
2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
3	2	-	2	-	1	-	-	-	1	-	-	-	3	2
4	2	2	-	3	2	-	-	-	-	1	-	-	3	2
Avg	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEPE410 - Repair and Maintenance of Composite Aircraft Structures**
Prerequisite	2AEPE307 - Airframe and Aero Engine Maintenance 2AEPC313 - Composite Materials and Structures
Teaching Scheme: Lecture/Tutorial/Practical	00/00/04
Credits	02
Evaluation Scheme : ISE/ESE	50/50

Course Objectives:

1. Develop a thorough knowledge of composite materials used in aircraft structures and learn to identify their components, failure modes, and inspection techniques.
2. Gain expertise in evaluating damage, selecting appropriate repair methods, and performing hands-on repair procedures to restore composite aircraft structures while adhering to safety and regulatory standards.
3. Learn to design and execute repairs that maintain the aircraft's structural integrity, ensuring compliance with airworthiness standards and optimizing overall performance.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEPE410_1	Explain and apply various composite repair methods, including wet layup, prepreg, and bonded patch repairs, and understand their applications in real-world scenarios.
2AEPE410_2	Demonstrate proficiency in adhering to industry safety practices and regulatory standards during the repair and maintenance of composite structures to ensure a safe working environment.
2AEPE410_3	Use various inspection techniques, including non-destructive testing (NDT), to assess composite structures for damage and determine appropriate repair methods.
2AEPE410_4	Acquire hands-on skills in using the resin injection method to repair delamination in composite structures, ensuring effective bonding and restoring structural integrity.
2AEPE410_5	Understand and apply Structural Health Monitoring (SHM) systems to assess and monitor the ongoing condition of composite aircraft structures, aiding in proactive maintenance and repair decision-making.

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Course Contents:

1. Introduction to Composite Repair
2. Safety Practices and Standards in Composite Repair
3. Inspection Techniques for Composite Structures
4. Wet Layup Repair Method
5. Prepreg Repair Process
6. Bonded Patch Repair
7. Resin Injection Method for Delamination Repair
8. Structural Health Monitoring (SHM) Systems

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Essentials of Advanced Composite Fabrication and Repair	Louis C. Dorworth Ginger L. Gardiner Dr. Greg M. Mellema	Aviation Supplies & Academics Newcastle	2nd Edition	2019
2	Composite Repair - Theory and Design	Cong N. Duong Chun Hui Wang	Elsevier Science	1st Edition	2007
3	Bonded Joints and Repairs to Composite Airframe Structures	Chun Hui Wang, Cong N. Duong	Academic Press	1st Edition	2015

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes					Marks		Weightage
		1	2	3	4	5	Max	Min	
1	ISE : ABA	☑	☑	☐	☐	☐	20	20	50 %
2	ISE : PA	☑	☑	☑	☑	☑	30		
4	ESE : OE	☑	☑	☑	☑	☑	20	20	50 %
5	ESE : PE	☑	☑	☑	☑	☑	30		

- ISE - In-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Pactical Assessment, OE - Oral Examination, PE - Practical Examination

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CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2	-	-	3	-	-	1	2	2	-	-	3	2
2	1	1	-	-	2	-	-	3	2	2	-	-	2	2
3	1	1	-	-	3	-	-	1	2	2	-	-	3	2
4	2	2	-	-	2	-	-	1	2	2	-	-	3	2
5	2	2	-	-	2	-	-	1	2	2	-	-	2	2
Avg	**2**	**2**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**2**	**-**	**-**	**3**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEVS411 - Aircraft Technical Publication**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	00/00/02
Credits	01
Evaluation Scheme : ISE/ESE	50/50

Course Objectives:

1. To introduce students to the fundamental concepts and importance of technical publications in the aerospace industry.
2. To familiarize students with key aerospace technical documentation standards and their application.
3. To enable students to interpret and utilize various types of aircraft technical manuals and engineering drawings for maintenance and operational purposes.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEVS411_1	Understand the role and significance of technical publications in the lifecycle of an aircraft.
2AEVS411_2	Differentiate between and apply the principles of major aerospace technical documentation standards such as ATA 100, iSpec 2200, and S1000D.
2AEVS411_3	Employ Simplified Technical English (ASD-STE100) for clear and unambiguous technical writing.
2AEVS411_4	Interpret and extract information from various aircraft maintenance manuals, including AMM, CMM, IPC, and SRM.
2AEVS411_5	Analyze and comprehend engineering drawings and schematics relevant to aircraft systems and structures.
2AEVS411_6	Utilize basic technical authoring tools and follow best practices for creating and managing technical documentation.

Course Contents:

1. Introduction to Aerospace Technical Publication
2. Aerospace Standards: ATA 100 & iSpec 2200
3. Aerospace Standard: S1000D
4. Aerospace Standard: ASD-STE100 (Simplified Technical English)
5. Aircraft Maintenance Manuals (AMM)
6. Component Maintenance Manuals (CMM)
7. Illustrated Parts Catalogues (IPC)
8. Structural Repair Manuals (SRM)
9. Engineering Drawings and Schematics Interpretation
10. Technical Authoring Tools & Practices

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Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Aircraft Maintenance and Repair	Michael J. Kroes, Ronald Sterkenburg	McGraw-Hill Education	8th	2019
2	Aviation Maintenance Technician Handbook – General	Federal Aviation Administration (FAA)	U.S. Department of Transportation (FAA)	-	-
3	Simplified Technical English (ASD-STE100) Specification	Aerospace and Defence Industries Association of Europe (ASD)	ASD Publications	-	-

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : CAS	☑	☑	☑	☑	☑	☑	25	20	50 %
2	ISE : MP	☑	☑	☑	☑	☑	☑	25		
3	ESE : OE	☑	☑	☑	☑	☑	☑	20	20	50 %
4	ESE : PE	☑	☑	☑	☑	☑	☑	30		

- ISE - In-Semester Examination, ESE - End-Semester Examination
- CAS - Continuous Assessment, MP - Micro Project, OE - Oral Examination, PE - Practical Examination

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	1	-	-	-	2	1	1	-	1	1	2	2	1
2	3	2	1	-	-	1	-	2	1	3	1	2	3	1
3	2	1	-	-	1	1	-	2	1	3	-	1	2	-
4	2	3	-	2	1	1	-	1	-	2	-	2	3	1
5	3	3	-	2	1	1	-	1	-	2	-	2	3	1
6	2	2	2	-	3	1	-	2	2	3	2	2	2	2
Avg	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**2**	**3**	**1**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEEL412 - Capstone Project**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	0/00/08
Credits	04
Evaluation Scheme : ISE/ESE	50/50

Course Objectives:

1. To define and plan a major engineering project.
2. To apply fundamental engineering principles to solve complex problems.
3. To conduct research, analyze data, and interpret results.
4. To develop and implement a project plan effectively.
5. To effectively communicate project goals, methodology, and outcomes through written and oral presentations.
6. To Demonstrate critical thinking, problem-solving, and design skills.
7. To gain experience in working independently and as part of a team.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEEL412_1	Define and plan a major engineering project, considering feasibility, resources, and ethical implications.
2AEEL412_2	Apply fundamental engineering principles and relevant theories to solve complex engineering problems within the project scope.
2AEEL412_3	Conduct thorough research, analyze data effectively, and interpret results to inform project decisions and optimize solutions.
2AEEL412_4	Develop and implement a comprehensive project plan, including timelines, budgets, risk management strategies, and quality control measures.
2AEEL412_5	Communicate project goals, methodology, and outcomes effectively through written reports, presentations, and technical documentation.
2AEEL412_6	Demonstrate critical thinking, problem-solving, and design skills throughout all phases of the project, adapting to challenges and making informed decisions.
2AEEL412_7	Gain practical experience in working independently and collaboratively within a team environment, fostering effective communication and teamwork.

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General Guidelines:

1. **Project Scope**: The major project will involve the development and execution of a significant engineering undertaking. This may encompass a wide range of activities, including:
    - **Design Projects:** Creating novel solutions to engineering problems, such as designing new devices, systems, or processes.
    - **Experimental Studies:** Conducting research through experimentation, collecting and analyzing data, and drawing conclusions.
    - **Computer Simulations:** Utilizing computational models and simulations to investigate and analyze engineering phenomena.

    All projects must focus on topics relevant to the specific Department's specialization, ensuring a strong connection to the core curriculum and industry practices.

2. **Project Components:** The successful completion of the major project necessitates the integration of several critical components:
    - **Problem Identification & Definition:** Clearly identifying and defining an engineering problem or challenge within the project scope.
    - **Literature Review:** Conducting thorough research on existing knowledge, methodologies, and best practices related to the project.
    - **Problem Formulation:** Translating the identified problem into a well-defined set of engineering objectives and constraints.
    - **Design & Development:** Designing, developing, and implementing solutions, which may include:
        - Conceptual design and ideation
        - Detailed design and prototyping
        - System integration and testing
    - **Utilization of Modern Tools & Techniques:** Employing relevant and contemporary engineering tools and techniques throughout the project, such as:
        - Computer-Aided Design (CAD) software
        - Simulation and analysis software (e.g., FEA, CFD)
        - Data acquisition and analysis tools
        - Project management software
3. **Project Synopsis Submission**: Students are required to submit a project synopsis outlining the proposed major project. This synopsis must include the following:
    - **Project Scope:** A clear and concise description of the project, including its objectives, boundaries, and relevance to the chosen area of specialization.
    - **Project Objectives:** Specific, measurable, achievable, relevant, and time-bound (SMART) objectives that the project aims to achieve.
    - **Methodology:** A detailed description of the project approach, including:
        - Research methodology (e.g., literature review, experimental design, simulation methods)
        - Design and development process (if applicable)
        - Data collection and analysis methods
    - **Resources & Tools:** A list of anticipated resources, including:

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- Software (e.g., CAD, simulation, data analysis)
- Equipment and materials
- Access to facilities (e.g., laboratories, workshops)

- **Expected Results:** A clear statement of the anticipated outcomes of the project, including:
  - Measurable results (e.g., performance data, design specifications, research findings)
  - Potential impact and contributions
- **Project Timeline:** A realistic and detailed project schedule, including key milestones and deadlines for completion.

The project synopsis submission serves as a crucial step in the project planning process, ensuring that students have a well-defined plan before commencing their work.

4. **Project Duration**: The project work is structured to be completed over four semesters (6 - 7), with the same group continuing to work under the guidance of the assigned project guide throughout this period.

5. **Group Formation**: Students will typically work in groups of 2 to 4 members to complete the major project. The maximum group size is strictly limited to 4 members.

6. **Assessment**

- **Project Synopsis & Progress Presentations:** The project synopsis and progress presentations will be evaluated using established rubrics.
- **Project Diary & Report -** The project diary, meticulously maintained throughout the project duration, will be a crucial component of the overall assessment.The final project report will be assessed during the End-Semester Examination (ESE).
- **Project Presentations -** Students will make three presentations before the project evaluation committee. These presentations will be collectively assessed.

In Semester Evaluation	
Particulars	**Marks**
Synopsys Presentation	10
Progress Presentation-I	10
Progress Presentation-II	15
Progress Presentation-III	15
End Semester Examinations	
Project Work Report	25
Viva-Voce Examination	25

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7. Submission Requirements

➔ **Project Work Diary**

- ◆ **Maintenance:** Meticulously maintained by the group throughout the project duration.
- ◆ **Entries:** Reflects daily or weekly efforts, including project selection, literature review, experimental work, data analysis, and any other relevant activities.
- ◆ **Countersignature**: Weekly countersigned by the assigned project guide.

➔ **Project Synopsis:**

- ★ Format: Submitted in the prescribed format, including:
  - Project Title
  - Student Names & URNNumbers
  - Guide's Name & Department
  - Project Relevance & Significance
  - Comprehensive Literature Review (minimum 10 peer-reviewed journal articles)
  - Proposed Work: Objectives, Methodology, and Approach
  - Expected Outcomes
  - Detailed Budget Estimate
  - References (in the specified format)
- ★ Approval:
  - Signed by each group member.
  - Approved by the project guide.
  - Endorsed by the Head of the Department.

➔ **Project Report:**

- ◆ Format:
  - Typed report of minimum 50 and maximum 100 pages.
  - Adheres to the standardized format for page size, margins, font, and spacing
  - References: All references (journal articles, books) must be cited correctly in the specified format.

➔ **Project Presentations:**

- **Presentations:** Students must present their project progress to faculty members and review panel members during scheduled reviews.
- **Submission:** Soft copies of all presentation slides (PowerPoint/PPT) must be submitted to the project guide.

➔ **Project Documentation:**

The Project Coordinator shall maintain a separate file with following documents

- Approved Project Synopsis
- Project Review Schedule
- Soft Copies of all presentation slides in Google Drive
- Assessment marks for each review, along with the corresponding rubrics.

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes							Marks		Weightage
		1	2	3	4	5	6	7	Max	Min	
1	ISE : CAS	☑	☑	☑	☑	☑	☑	☑	50	20	50 %
2	ESE : OE	☑	☑	☑	☑	☑	☑	☑	25	20	50 %
3	ESE : PR	☑	☑	☑	☑	☑	☑	☑	25		

- ISE - In-Semester Examination, ESE - End-Semester Examination
- CAS - Continuous Assessment, OE - Oral Examination, PR - Project Report

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	3	1	1	3	2	3	2	1	3	2	2	2
2	3	3	2	2	1	1	1	1	1	1	1	2	3	2
3	2	3	1	3	2	1	1	1	1	2	1	3	2	2
4	1	2	2	1	1	1	1	1	2	2	3	2	1	1
5	1	1	1	1	2	1	1	1	2	3	1	2	1	1
6	3	3	3	3	2	2	1	2	2	2	2	3	3	3
7	1	1	1	1	1	1	1	1	3	2	1	2	1	1
Avg	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**2**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2CCHS413 - Project Management and Finance**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	02/00/00
Credits	02
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To equip students with an understanding of the significance of economics and its related policies.
2. To empower students to manage professional tasks through knowledge of relevant procedures.
3. To inculcate an understanding of the importance of economics in the context of management.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2CCHS413_1	Apply project management principles to initiate, plan, execute, monitor, and control projects.
2CCHS413_2	Analyze project feasibility considering technical, economic, and financial aspects.
2CCHS413_3	Estimate project costs, schedule tasks, and allocate resources effectively.
2CCHS413_4	Identify and mitigate project risks using appropriate techniques.
2CCHS413_5	Apply financial principles to project budgeting, cash flow management, and investment appraisal.
2CCHS413_6	Effectively communicate project plans, progress, and results to stakeholders.

Course Contents:

Unit 1	**Project Fundamentals**	**04**
Definition and characteristics of a project, Project life cycle and its phases, Project management methodologies (e.g., Agile, Waterfall, Scrum), Stakeholder analysis and management, Introduction to Project Management Professional (PMP) framework		
Unit 2	**Project Planning & Scheduling**	**04**
Work Breakdown Structure (WBS) development, Activity definition and sequencing, Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), Resource allocation and leveling, Project scheduling tools (e.g., Gantt charts, MS Project)		

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Unit 3	**Project Cost & Risk Management**	**05**
Cost estimation techniques (e.g., Parametric, Analogous, Bottom-up), Cost budgeting and control, Earned Value Management (EVM), Cost-benefit analysis and return on investment (ROI), Risk identification and assessment, Qualitative and quantitative risk analysis technique, Risk response planning (mitigation, avoidance, transference, acceptance), Contingency planning and reserves		
Unit 4	**Project Execution and Control**	**04**
Activity Planning, Team Building and Management, Stakeholder Engagement, Project Monitoring & Control Performance Measurement, Change Management, Issue Resolution, Quality Management : Quality Planning, Quality Assurance, Continuous Improvement, Project Challenges and Solutions		
Unit 5	**Project Communication & Finance**	**04**
Communication planning and channels, Stakeholder communication strategies, Report writing and presentations, Conflict resolution and negotiation, Time value of money concepts, Capital budgeting techniques (e.g., NPV, IRR, Payback period), Sources of project finance (e.g., loans, equity, grants), Financial statement analysis for project evaluation		
Unit 6	**Project Closure & Review**	**05**
Project completion and handover, Project closure procedures, Post-project evaluation and lessons learned Project audits and reviews, Professional ethics and responsibilities in project management		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	A Guide to the Project Management Body of Knowledge	-	Project Management Institute (PMI)	7th	2021
2	Project Management: The Managerial Process	Erik W. Larson & Clifford F. Gray	McGraw Hill	6th	2017
3	Project Finance: In Theory and Practice	Stefano Gatt	Academic Press	-	2007

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Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : ABA	☑	☑	☑	☑	☑	☑	40	16	40 %
2	MSE	☑	☑	☑	☑	☐	☐	30	24	60 %
3	ESE	☐	☐	☐	☑	☑	☑	30		

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, PA - Practical Assessment

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1	2	2	1	1	1	1	2	2	2	3	2	1	1
2	1	3	2	2	1	2	2	2	1	1	3	2	1	2
3	1	2	2	1	2	1	1	1	2	1	3	2	1	1
4	1	3	2	2	1	1	1	2	2	1	3	2	1	1
5	1	3	1	1	2	1	1	2	1	1	3	2	1	1
6	1	1	1	-	1	1	-	1	2	3	2	1	1	1
Avg	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**3**	**2**	**1**	**1**

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Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEUV401 - UAV Safety and Regulations**
Prerequisite	NIL
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To provide an in-depth understanding of UAV regulations in India, including legal frameworks, operational guidelines, and compliance requirements.
2. To equip students with the knowledge and skills to implement safety protocols, risk management strategies, and advanced safety technologies for UAV operations.
3. To foster awareness of ethical considerations, privacy concerns, and emerging trends in UAV safety and regulatory practices for responsible and secure UAV usage.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEUV401_1	Understand the legal and regulatory framework governing UAV operations in India, including guidelines and Drone Rules with the help of the regulatory bodies like DGCA, ICAO.
2AEUV401_2	Apply UAV safety protocols and risk management strategies to ensure safe and compliant operations in various operating environments.
2AEUV401_3	Analyze the challenges and solutions for operating UAVs in restricted and urban areas, incorporating advanced safety technologies and geo-fencing mechanisms.
2AEUV401_4	Evaluate ethical considerations and future trends in UAV safety and regulations emphasizing privacy, security, and evolving legal standards.

Course Contents:

Unit 1	**Introduction to UAV Safety and Regulations**	**6**
Importance of UAV safety and regulatory compliance - Overview of global UAV regulations: FAA, EASA, and ICAO guidelines - Indian drone regulations: DGCA's Civil Aviation Requirements (CAR) for UAVs - Classification of drones as per Indian regulations (Nano, Micro, Small, Medium, and Large) - Role of Unmanned Aircraft System Traffic Management (UTM) in safe UAV operations.		
Unit 2	**Legal Framework for UAV Operations in India**	**6**
Key provisions of the Drone Rules 2021 - Drone registration and certification process in India - Guidelines for obtaining the Unique Identification Number (UIN) and Operator Permit - No Permission No Takeoff (NPNT) compliance - Airspace categorization: Green, Yellow, and Red zones - Penalties for regulatory violations in India.		

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Unit 3	**UAV Safety Protocols and Risk Management**	**6**
Pre-flight and post-flight safety checks - Risk assessment techniques for UAV operations - Developing and following Standard Operating Procedures (SOPs) for UAVs - Safety considerations during takeoff, flight, and landing phases - Case studies of UAV accidents: causes and preventive measures.		
Unit 4	**Drone Operation in Restricted and Urban Areas**	**7**
Challenges of operating UAVs in urban and restricted environments - Permissions required for flying in restricted zones - Safety measures for operations near airports, highways, and densely populated areas - Handling emergencies: GPS loss, signal jamming, and mid-air collisions - Use of geo-fencing and Return-to-Home (RTH) systems for safe navigation.		
Unit 5	**Advanced UAV Safety Technologies**	**7**
Role of fail-safe mechanisms in ensuring UAV safety - Collision avoidance systems and their implementation in drones - Integration of ADS-B and remote identification systems - Advanced sensor technologies for situational awareness (LiDAR, radar) - Introduction to counter-UAV technologies and their implications.		
Unit 6	**Ethical and Future Perspectives in UAV Operations**	**7**
Ethical considerations in UAV usage: privacy, security, and surveillance concerns - UAV applications with safety implications: delivery, inspection, and search and rescue - Evolving UAV regulatory frameworks and trends in India - International collaboration for UAV safety and standardization - Future challenges in UAV safety and regulation.		

References:

Sl.No	Title	Author	Publisher	Edition	Year
1	The Drone Rules, 2021	Amber Dubey	Ministry of Civil Aviation, Controller of Publications, Delhi	1st	2021
2	Drone (Amendment) Rules, 2022	Amber Dubey	Ministry of Civil Aviation, Controller of Publications, Delhi	1st	2022
3	National Unmanned Aircraft System Traffic Management (UTM) Policy Framework	Amber Dubey	Ministry of Civil Aviation, Controller of Publications, Delhi	1st	2021
4	Certification Scheme for Unmanned Aircraft Systems	Amber Dubey	Ministry of Civil Aviation, Controller of Publications, Delhi	1st	2022

Assessment Modes:

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Sl.No	Method/Technique	CO's				Marks		Weightage
		1	2	3	4	Max	Min	
1	ISE : ABA	☐	☐	☐	☐	40	16	40%
3	MSE	☐	☐	☐	☐	30	24	60%
5	ESE	☐	☐	☐	☐	30		

CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	-	-	-	3	-	2	-	-	-	2	-	-
2	2	3	2	-	-	3	1	3	-	-	-	-	-	-
3	2	3	3	-	2	2	1	-	-	-	-	-	-	-
4	-	2	-	-	-	3	2	3	-	-	-	3	-	-
Avg	2	3	3	-	2	3	1	3	-	-	-	3	-	-

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Sant Dnyaneshwar Shikshan Sanstha's
Annasaheb Dange College of Engineering and Technology, Ashta
(An Empowered Autonomous Institute)
Department of Aeronautical Engineering

Changing Lives.., Enriching Future...

Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEAT401- Aviation Safety and Logistics**
Prerequisite	
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To introduce aviation safety principles and the regulatory frameworks that govern operational and workplace safety in the aviation industry.
2. To develop an understanding of logistical processes, including supply chain management, inventory control, and transportation systems, focusing on the aviation context.
3. To equip students with the skills to analyze and apply risk assessment and mitigation techniques to improve safety and efficiency in aviation operations.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEAT401_2	Apply aviation safety protocols to real-world scenarios by utilizing case studies and regulatory standards to ensure proper implementation and adherence to safety requirements.
2AEAT401_2	Implement aviation logistics strategies by applying knowledge of supply chain processes and operational constraints to optimize resource utilization in practical simulations.
2AEAT401_3	Perform risk assessments by applying risk evaluation tools and techniques to identify hazards and recommend mitigation strategies in various aviation operations.
2AEAT401_4	Utilize inventory management techniques to maintain operational efficiency by applying industry-standard methods and software to manage and track aviation inventory systems.
2AEAT401_5	Demonstrate the application of human factor principles by analyzing real-world incidents and applying corrective measures to minimize human errors in aviation safety practices.

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Course Contents:

Unit 1	**Introduction to Aviation Safety**	**7**
The importance of aviation safety, the evolution of safety standards, the role of regulatory bodies (ICAO, FAA, EASA, DGCA), components of Safety Management Systems (SMS), and safety culture in aviation.		
Unit 2	**Risk Assessment and Hazard Identification**	**7**
Principles of risk assessment, hazard identification and classification, tools and techniques for risk management (FTA, FMEA), case studies of aviation accidents, mitigation strategies.		
Unit 3	**Human Factors in Aviation Safety**	**7**
Role of human factors in aviation, human error and its impact on safety, Crew Resource Management (CRM), fatigue management, stress control, case studies on human factor issues.		
Unit 4	**Aviation Logistics and Supply Chain Management:**	**7**
Overview of aviation logistics, components of aviation supply chain, inventory management techniques (JIT, demand forecasting), transportation systems in aviation logistics, role of technology (RFID, AI, IoT).		
Unit 5	**Emergency Planning and Incident Response**	**04 + 04**
Emergency planning and preparedness, incident reporting systems, investigation procedures, crisis management strategies, communication during emergencies, case studies of successful emergency responses.		
Unit 6	**Safety Audits and Quality Assurance in Aviation**	**04 + 04**
Importance of safety audits, types of audits (internal and external), quality assurance processes in aviation, continuous improvement techniques, implementing audit findings.		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Safety Management Systems in Aviation	Stolzer, A.J., Halford, C.D., & Goglia, J.J.	Ashgate Publishing	2nd Edition	2016
2	Managing the Risks of Organizational Accidents	Reason, J.	Routledge	1st Edition	1997
3	Human Factors in Flight	Hawkins, F.H., & Orlady, H.W.	Routledge	3rd Edition	1993
4	Supply Chain Management: A Logistics Perspective	Coyle, J.J., Langley, C.J., Novack, R.A., & Gibson, B.J.	Cengage Learning	10th Edition	2016

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Sl.No	Title	Authors	Publisher	Edition	Year
5	Aviation and Airport Security: Terrorism and Safety Concerns	Sweet, K.M.	Pearson	2nd Edition	2008
6	Airline Management: Strategies for the 21st Century	Dempsey, P.S., & Goetz, A.R.	Ashgate Publishing	1st Edition	1992

Reference Books:

l. No.	Title	Authors	Publisher	Edition	Year
1	*Aircraft Safety: Accident Investigations, Analyses, and Applications*	Rodrigues, C.C., & Cusick, S.K.	McGraw-Hill Education	2nd Edition	2011
2	Aviation Safety and Security: A Practical Guide	Pruchnicki, S., & Stolzer, A.J.	Routledge	1st Edition	2018
3	Global Logistics and Supply Chain Management	Mangan, J., Lalwani, C., & Butcher, T.	Wiley	3rd Edition	2020
4	Aircraft Maintenance Management	Kinnison, H.A., & Siddiqui, T.	McGraw-Hill Education	2nd Edition	2012
5	Reliability-Centered Maintenance	Moubray, J.	Industrial Press	2nd Edition	2001
6	Logistics Management and Strategy: Competing through the Supply Chain	Harrison, A., & Van Hoek, R.	Pearson	5th Edition	2014

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Changing Lives.., Enriching Future...

Assessment Modes:

Sl. No	Method/ Technique	Course Outcomes						Marks		Weightage
		1	2	3	4	5	6	Max	Min	
1	ISE : ABA	☑	☐	☐	☐	☑	☐	20	16	40 %
2	ISE : PA	☐	☐	☐	☐	☐	☐	50	20	
3	MSE	☑	☑	☑	☐	☐	☐	30	24	60 %
4	ESE	☐	☐	☑	☑	☑	☐	30		

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
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CO's - PO's & PSO's Mapping: (Low - 1, Medium - 2, High -3, No Correlation - "-")

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	–	–	–	–	–	3	–	1	1	1	–	–	–	–
2	–	–	–	–	–	3	-	1	1	1	–	–	–	–
3	–	–	–	–	–	3	2	1	1	1	–	–	–	–
4	–	–	–	–	–	3	2	1	1	1	–	–	–	–
5	–	–	–	–	–	3	2	1	1	1	–	–	–	–
Avg	–	–	–	–	–	3	1.2	1	1	1	–	–	–	–

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Changing Lives.., Enriching Future...

Course Details:

Class	B.Tech., Sem - VII
Course Code and Course Name	**2AEAV401 - Avionics Design and Maintenance**
Prerequisite	2AEPC213 - Airbreathing Propulsion
Teaching Scheme: Lecture/Tutorial/Practical	03/00/00
Credits	03
Evaluation Scheme : ISE/MSE/ESE	40/30/30

Course Objectives:

1. To provide students with a detailed understanding of the principles, components, and design processes of avionics systems used in modern aircraft.
2. To equip students with the skills to troubleshoot, diagnose, and maintain avionics systems to ensure optimal performance and compliance with industry standards.
3. To develop students' ability to analyze and design avionics systems by incorporating technological advancements, adhering to regulatory requirements, and addressing operational constraints.

Course Outcomes (CO's): After successful completion of this course, the student will be able to,

2AEAV401_1	Apply the fundamental principles of avionics systems to analyze and resolve technical challenges in navigation, communication, and flight control systems.
2AEAV401_2	Implement standard troubleshooting techniques to identify and rectify faults in avionics components, ensuring proper functionality in operational settings.
2AEAV401_3	Use appropriate tools and methodologies to perform scheduled maintenance on avionics systems while adhering to industry guidelines and safety standards.
2AEAV401_4	Interpret avionics system diagrams and technical manuals to execute installation and repair tasks accurately adhering to to maintenance practices
2AEAV401_5	Integrate emerging avionics technologies into existing systems by applying compatibility and performance analysis techniques ensuring alignment with existing system requirements

Course Contents:

Unit 1	**Introduction to Avionics Systems**	**7**
Evolution of avionics, components of avionics systems, classification of avionics systems, importance of avionics in modern aircraft, avionics system architecture.		
Unit 2	**Navigation and Communication Systems**	**7**
Principles of navigation systems, GPS and GNSS technologies, VOR and ILS systems, principles of communication systems, HF, VHF, and SATCOM		
Unit 3	**Power and Data Management in Avionics Systems**	**7**

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Power distribution systems in avionics, power converters and inverters, redundancy and fail-safe mechanisms, data buses in avionics (ARINC 429, MIL-STD-1553), integration of power and data systems, fault-tolerant system design.		
Unit 4	**Avionics Maintenance Practices**	**7**
Maintenance procedures for avionics systems, fault diagnosis and troubleshooting techniques, avionics testing equipment, and certification standards for maintenance.		
Unit 5	**Avionics System Design and Integration**	**7**
Design considerations for avionics systems, integration of avionics subsystems, signal processing in avionics, EMI/EMC considerations, and software in avionics.		
Unit 6	**Emerging Trends in Avionics**	**5+2**
Artificial intelligence and machine learning in avionics, advancements in autonomous flight systems, augmented and virtual reality in avionics, next-generation communication systems.		

Text Books:

Sl.No	Title	Authors	Publisher	Edition	Year
1	Introduction to Avionics Systems	Collinson, R.P.G.	Springer	3rd Edition	2011
2	Principles of Avionics	Spitzer, C.R.	Avionics Communications Inc.	6th Edition	2014
3	Avionics: Development and Implementation	Spitzer, C.R.	CRC Press	2nd Edition	2006
4	Aircraft Systems: Mechanical, Electrical, and Avionics Subsystems Integration	Moir, I., & Seabridge, A.	Wiley	3rd Edition	2011
5	Digital Avionics Handbook	Cary R. Spitzer (Editor)	CRC Press	3rd Edition	2014
6	Logistics Management and Strategy: Competing through the Supply Chain	Harrison, A., & Van Hoek, R.	Pearson	5th Edition	2014

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1	Aircraft Electrical and Electronic Systems	Turner, M., & Wass, T.	Routledge	2nd Edition	2018
2	Avionics Navigation Systems	Kayton, M., & Fried, W.R.	Wiley	2nd Edition	1997
3	Understanding Avionics	Helfrick, A.D.	Prentice Hall	4th Edition	2007
4	Modern Aviation Electronics	Helfrick, A.D.	Prentice Hall	2nd Edition	1994
5	Aircraft Digital Electronic and Computer Systems	Jeppesen	Jeppesen Sanderson	1st Edition	2007
6	Advanced Avionics Handbook	FAA (Federal Aviation Administration)	FAA Publications	1st Edition	2009

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1	1	–	–	–	1	–	–	–	1	2	–	–	–	–
2	1	–	–	–	1	–	–	–	1	2	–	–	–	–
3	1	–	–	–	1	–	–	–	1	2	–	–	–	–
4	1	–	–	–	1	–	–	–	1	2	–	–	–	–
5	1	–	–	–	1	–	–	–	1	2	–	–	–	–
Avg	**1**	–	–	–	**1**	–	–	–	**1**	**2**	–	–	–	–

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