

Annasaheb Dange College of Engineering and Technology, Ashta

Department of Aeronautical Engineering



Structure and Curriculum Contents

B.Tech (Second Year)

Revision - 3

SEMESTER - 4

(ACADEMIC YEAR 2026-2027)



Annasaheb Dange College of Engineering and Technology
 Ashta - 416301, Dist. : Sangli, Maharashtra
 (An Empowered Autonomous Institute)
 Department of Aeronautical Engineering

**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - IV					Category	PC	
Course Code, Course Title:	3AEPC211, Low Speed Aerodynamics					Type	LIT1	
Prerequisites	3AEPC203, Fluid Mechanics 3AEPC205, Introduction to Aeronautical Engineering							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	2	1	2		3	4		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	50

Course Outcomes (COs) :

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

CO1	Explain the concepts of potential flow and apply basic flow elements such as uniform flow, source, sink, doublet and vortex to analyse ideal flow patterns.
CO2	Determine the pressure and velocity distribution around circular cylinders in lifting and non lifting conditions using principles of circulation.
CO3	Apply thin airfoil theory, the Kutta condition and circulation concepts to analyse lift generation for symmetric and cambered airfoils.
CO4	Analyse finite wing behaviour using downwash, induced drag and lifting line theory to understand general lift distribution.
CO5	Apply conformal transformations and boundary layer concepts to study aerodynamic flow over bodies, including flat plate solutions and separation behaviour.

Syllabus:

Module	Contents	Lecture Hours
I	Potential Flow: Introduction-Velocity potential and Stream function; Uniform Flow; Source Flow; Doublet Flow; Vortex Flow; Flow Combination of a Uniform Flow with a Source and Sink;	05
II	Flow Over A Cylinder: Non-lifting and Lifting flow over a Circular Cylinder; Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows.	05
III	Flow Over Airfoil: The Kutta Condition, Kelvin's Circulation Theorem and the Starting Vortex, Thin Airfoil Theory: The Symmetric and cambered Airfoil	05

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IV	Flow Over Finite Wings: Introduction: Downwash and Induced Drag; The Vortex Filament, the Biot-Savart Law, and Helmholtz's Theorems; Lifting-Line Theory-Elliptical and general lift distribution	05
V	Conformal Transformation: Introduction-Transformation, conformal mapping, Joukowski transformation and its application to fluid flow problems – Schwartz-Christoffel transformation	05
VI	Boundary Layer Theory: Introduction- Boundary-Layer Properties; Boundary-Layer Equations, Displacement, Momentum and Energy thickness; Shape parameter, Flow over a flat plate- Blasius solution; Boundary layer separation concepts	05
Total Lecture Hours		30

List of Tutorials with CO Mapping:

S. No.	Title of Tutorial	CO Mapped
1	Basic potential flow elements, including uniform flow, source, sink, doublet, and vortex flow.	CO1
2	Superposition of flow elements to construct combined potential flow fields and identify stagnation points.	CO1
3	Pressure and velocity distribution on a non-lifting circular cylinder using the Bernoulli equation.	CO2
4	Effect of circulation on circular cylinder flow, including lift, stagnation point shift, and surface pressure	CO2
5	Application of thin airfoil theory to symmetric and cambered airfoils for lift and moment calculations.	CO3
6	Use of the Kutta condition and Kelvin's circulation concepts for airfoil flow analysis.	CO3
7	Downwash, induced angle of attack, and induced drag for finite wings.	CO4
8	Lifting line theory calculations of circulation distribution and lift for finite wings.	CO4
9	Comparison of elliptical and general lift distributions and their influence on induced drag.	CO4
10	Conformal mapping and Joukowski transformation from a cylinder to an airfoil.	CO5
11	Introduction to the Schwartz-Christoffel transformation with simple mapping examples.	CO5
12	Boundary layer flow over a flat plate, including displacement thickness, momentum thickness, shape parameter, and separation concepts.	CO5
Total tutorial Sessions		15
Total Tutorial Hours		15

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List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment	CO Mapped
1	Introduction of Wind Tunnel	CO1
2	Calibration of Wind Tunnel	CO5
3	Pressure distribution over a cylinder	CO2
4	Estimation of force coefficients over a symmetrical airfoil from the pressure distribution curves for various instances of velocity and AOA	CO3
5	Estimation of force coefficients over a cambered airfoil from the pressure distribution curves for various instances of velocity and AOA	CO3
6	Boundary layer measurement using a wind tunnel	CO5
7	Flow visualization over aerodynamic profiles	CO4
Total Sessions		15
Total Hours		30

Text Books:

1. Anderson, J. D. (2023). Fundamentals of aerodynamics (7th ed.). McGraw-Hill Education.
2. Kundu, P. K., Cohen, I. M., & Dowling, D. R. (2016). Fluid mechanics (6th ed.). Academic Press.
3. White, F. M. (2021). Fluid mechanics (9th ed.). McGraw-Hill Education.

References:

1. Katz, J., & Plotkin, A. (2001). Low-speed aerodynamics (2nd ed.). Cambridge University Press.
2. Schlichting, H., & Gersten, K. (2017). Boundary-layer theory (9th ed.). Springer.
3. Bertin, J. J., & Smith, M. L. (2014). Aerodynamics for engineers (6th ed.). Pearson.


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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	PC	
Course Code, Course Title:	3AEPC212, Aircraft Structures					Type	LIT2	
Prerequisites	3AEPC202 - Solid Mechanics, 3AEPC111 - Engineering Mechanics							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	2	1	2		3	4		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	-

Course Outcomes (COs) :

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

CO1	Implement the concepts of unsymmetrical bending to determine stress distribution and neutral axis position in beams, and validate the results using experimental data.
CO2	Locate the shear center of thin-walled open and closed section beams using shear flow principles, and validate the analytical results through experimental investigation.
CO3	Evaluate the buckling behavior of columns and plates under compressive loads using stability theories, analytical calculations, and experimental testing.
CO4	Determine the load distribution and stress distribution in fuselage structures subjected to combined loading using theoretical formulations and experimental validation.
CO5	Analyze wing structural components subjected to bending, shear, and torsion using analytical methods and validate the results through experimental investigation.

Syllabus:

Module	Contents	Lecture Hours
I	Unsymmetrical Bending Of Beams: Symmetrical bending, Anticlastic bending - Unsymmetrical bending - Generalized 'K' method - Position of Neutral axis - Direct stress on thin walled section - Principal axes for beam cross section	04
II	Shear Of Open Section Beams: Shear of thin walled open section beams - Shear center of open section beams - Structural Idealization - Symmetrical and Unsymmetrical beam cross section.	05
III	Shear Of Box Beams: Shear of thin walled closed section - Torsion of thin walled box beam structures - Beams having variable stringer areas	06
IV	Structural Stability: Euler's Buckling of Columns - Buckling of isotropic flat plates in compression - Ultimate compressive strength of isotropic flat sheet (effective width) - Needham and Gerard's method.	06


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V	Stress Analysis Of Fuselage And Its Components: Loads acting on aircraft components and its functions - Fuselage frames - Bending of a fuselage - Torsion of a fuselage.	06
VI	Stress Analysis Of Wing And Its Components: Tension field beam - Tapered wing spar - Bending of wing – Torsion of wing – Shear of wing	05
Total Lecture Hours		30

List of Tutorials with CO Mapping:

S. No.	Title of Tutorial	CO Mapped
1	Calculation of Non-homogenous section properties	CO1
2	Bending of unsymmetrical composite beam cross section	CO1
3	Shear flow of anti-symmetrical section	CO2
4	Shear of composite beam cross section	CO2
5	Multicell structure due to torsion	CO2
6	Combined bending and torsion	CO2
7	Crippling strength estimation	CO3
8	Skin-Stringer panel	CO3
9	Stress developed in fuselage	CO4
10	Shear of cut-out in the fuselage	CO4
11	Wing ribs	CO5
12	Shear of wing cut-outs	CO5
Total tutorial Sessions		15
Total Tutorial Hours		15

List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment	CO Mapped
1	Maxwell's Reciprocal Theorem	CO1
2	Principal angle of unsymmetrical section	CO1
3	Shear centre of open section	CO2
4	Shear centre of closed section	CO2
5	Buckling of column	

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6	Wagner beam	CO3
7	Combined bending and torsion	CO4
8	Fabrication of Composite Lamina	CO5
9	Determination of material constants using polariscope for photoelastic specimen	CO5
10	Design of Aircraft Structural components	CO5
Total Sessions		15
		Total Hours
		30

Text Books:

1. Megson T. M. G., Aircraft Structures for Engineering Students, Elsevier Ltd., 6th Edition, 2021
2. Bruhn E. H., Analysis and Design of Flight Vehicle Structures, Tri-State Offset Company, USA, 1973

References:

1. Peery, D. J., and Azar, J. J., Aircraft Structures, 2nd edition, McGraw-Hill, N.Y., 1999

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**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - IV					Category	VSEC	
Course Code, Course Title:	3AEVS213, Grid Generation Techniques					Type	L1	
Prerequisites	3AEVS206, Parametric Modelling and Assembly							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	-	-	2		-	1		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	50

Course Outcomes (COs) :

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

CO1	Independently generate high-quality meshes for various geometries using HyperMesh.
CO2	Choose the appropriate meshing techniques based on the specific FEA application.
CO3	Apply advanced meshing techniques for complex geometries and optimize meshes for efficiency and accuracy.
CO4	Use mesh controls to refine specific areas of the mesh for improved accuracy.

Syllabus:

Module	Title of the Exercises
I	Introduction: - Overview of Finite Element Analysis (FEA) and the role of meshing - Introduction to HyperMesh as a pre-processing tool for FEA - User interface and basic navigation
II	Geometry Preparation: - Geometry Clean-up - Importing and Repairing CAD Geometry - Generating a Midsurface - Simplifying Geometry
III	1D Meshing: - Creating beams and rods - Assigning material properties
IV	2D Meshing: - Shell meshing techniques (quads, tris, mapped meshing) - Setting element size and quality parameters - Mesh refinement and cleanup
V	3D Meshing: Tetrahedral and hexahedral meshing techniques

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	• Automatic and manual meshing • Advanced meshing options (sweeping, morphing) • Mesh quality checks and improvement
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Online Reference Materials:

Sl.No	Source/Platform	Link to contents
1	Altair HyperMesh	https://2021.help.altair.com/2021/hwdesktop/hm/topics/tutorials/hm/meshing_r.htm
2	Skill-Lync	https://skill-lync.com/student-projects/3d-meshing-using-hypermesh-3
3	IFS Academy	https://ifsacademy.org/assets/images/pdf/Finite-Element-Analysis-using-Hypermesh-ANSYS.pdf


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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	PE	
Course Code, Course Title:	3AEPE214, Introduction to Applied Finite Element Analysis					Type	T1	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	-		3	3		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-

Course Outcomes (COs) :

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

CO1	Explain the principles of the Finite Element Method (FEM) and perform the basic steps, such as discretization, meshing, and the application of boundary conditions.
CO2	Formulate FEA problems using mathematical approaches including stiffness method, energy principles, and Galerkin techniques.
CO3	Analyze 1D and 2D engineering problems (structural and thermal) using appropriate finite element formulations and interpret the results.
CO4	Apply FEA tools to solve real-world engineering problems, evaluate results, and assess structural behavior such as stress, deformation, and stability

Syllabus:

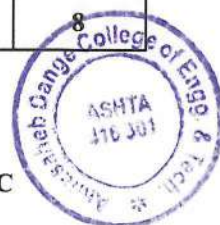
Module	Contents	Lecture Hours
I	Introduction To Finite Element Analysis (FEA) And Finite Element Method (FEM): Introduction, Discretization (meshing), Pre-processing, Solving, and Post-processing. Applications: Structural Analysis, Thermal Analysis, Fluid Flow, and Multiphysics simulations. Advantages & Limitations: Benefits of virtual prototyping versus risks of inaccurate data.	5
II	Mathematical Foundations (The Theory): Numerical Methods: Overview of approximation techniques, Direct Stiffness Method: Understanding assembly of stiffness matrices, Variational Methods/Energy Principles: Principle of Minimum Potential Energy, Weighted Residual Methods: Galerkin formulation	8
III	One-Dimensional Analysis (1D): Bars/Truss Elements: Formulation of linear bar elements, Beam Elements: Euler-Bernoulli beam theory, stiffness matrices, and loads, Assembly of Matrices: Global stiffness matrix construction. Boundary Conditions: Treatment of constrained vs. free nodes	8
IV	Two-Dimensional Analysis (2D):	8

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	Element Types: Constant Strain Triangles (CST), 4-node/8-node Quadrilateral Elements, Isoparametric Mapping: Mapping irregular shapes to master elements, Numerical Integration: Gauss Quadrature techniques, Plane Stress & Plane Strain Problems: Applications in thin-walled structures. Axisymmetric Analysis: Modeling solid of revolution problems (e.g., pipes, discs)	
V	Specialized Analysis Topics: Steady-State Heat Transfer: Conduction and convection problems, heat fins, Dynamic Analysis: Modal analysis (natural frequencies) and harmonic analysis, Buckling Analysis: Predicting structural instability.	7
VI	Applied FEA & Modeling Techniques: Meshing Strategies: High-stress area refinements and element quality checking, Interpretation of Results: Evaluating stress concentrations, displacements, and factor of safety, Software Practice: Examples using commercial software (e.g., <u>ANSYS</u> , NASTRAN, ABAQUS)	6
Total Lecture Hours		45

Text Books:

1. Chandrapatla, T. R., & Belegundu, A. D. (2012). Introduction to Finite Elements in Engineering (3rd ed.). PHI Learning Private Limited.
2. Seshu, P. (2012). Textbook of Finite Element Analysis. PHI Learning Private Limited.
3. Reddy, J. N. (2019). An Introduction to the Finite Element Method (3rd ed.). McGraw-Hill Education.

References:

1. Rao, S. S. (2018). The Finite Element Method in Engineering (6th ed.). Butterworth-Heinemann.

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Course Information:								
Class, Semester	S.Y. B.Tech, Semester - IV					Category	PE	
Course Code, Course Title:	3AEPE215, Advanced Heat & Mass Transfer					Type	T1	
Prerequisites	3AEPC203, Fluid Mechanics 3AEPC204, Applied Thermodynamics & Heat Transfer							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	-		3	3		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-

Course Outcomes (COs) :

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

CO1	Solve heat conduction problems involving heat generation, extended surfaces, multidimensional conduction, and insulation using analytical methods with correct formulation and logically consistent solutions.
CO2	Predict temperature variation in transient heat transfer systems including lumped systems and semi-infinite solids using lumped system analysis and Heisler charts with appropriate assumptions and accurate estimation of thermal response.
CO3	Evaluate convection heat transfer in internal and external flows including developing flow conditions using empirical correlations and dimensionless parameters with correct selection of correlations and reliable engineering calculations.
CO4	Determine heat transfer characteristics during boiling and condensation processes using standard correlations and simplified approaches with correct identification of regimes and consistent interpretation of results.
CO5	Calculate radiative heat exchange between surfaces using radiation properties, fundamental laws, and simplified network approach with physically meaningful interpretation of results.
CO6	Assess heat exchanger performance and basic mass transfer processes using LMTD method, NTU concept, and Fick's law with appropriate method selection and consistent engineering interpretation.

Syllabus:

Module	Contents	Lecture Hours
I	Advanced Heat Conduction: Heat conduction with internal heat generation (plane wall and cylinder), extended surfaces (straight fins – temperature distribution, efficiency and effectiveness), concept of two-dimensional conduction, insulation in engineering systems.	08
II	Transient Heat Transfer: Lumped system analysis, Biot number significance, Heisler charts (use for slabs and cylinders), semi-infinite solids, thermal penetration depth.	07

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III	Applied Convection: External flow over flat plate (laminar), internal flow in pipes (laminar and turbulent correlations), hydrodynamic and thermal entry length, Reynolds, Prandtl and Nusselt numbers, use of empirical correlations.	08
IV	Phase Change Heat Transfer: Boiling (pool boiling curve and regimes), condensation (film and dropwise), critical heat flux (concept), basic correlations (concept only).	07
V	Radiation Heat Transfer: Blackbody radiation, emissivity and absorptivity, Stefan-Boltzmann law, radiation exchange between two surfaces, shape factor (basic use), radiation shields (concept).	08
VI	Heat Exchangers & Mass Transfer: Heat exchanger types, LMTD method (applications), NTU-effectiveness method (concept), introduction to mass transfer: Fick's law, steady-state diffusion through plane wall, heat and mass transfer analogy, simple applications.	07
Total Lecture Hours		45

Text Books:

1. Rajput, R. K. (2021). Heat and Mass Transfer. New Delhi, India: S. Chand Publishing.
2. Incropera, F. P., DeWitt, D. P., Bergman, T. L., & Lavine, A. S. (2020). Fundamentals of Heat and Mass Transfer (8th ed.). Hoboken, NJ, USA: John Wiley & Sons.
3. Çengel, Y. A., & Ghajar, A. J. (2020). Heat and Mass Transfer: Fundamentals and Applications (6th ed.). New York, NY, USA: McGraw Hill Education.
4. Holman, J. P. (2020). Heat Transfer (11th ed.). New York, NY, USA: McGraw-Hill.

References:

1. Bejan, A. (2013). Convection Heat Transfer (4th ed.). Hoboken, NJ, USA: John Wiley & Sons.
2. Kakac, S., & Yener, Y. (2013). Heat Conduction (3rd ed.). Boca Raton, FL, USA: CRC Press.
3. Sparrow, E. M., & Cess, R. D. (1978). Radiation Heat Transfer. Washington, DC, USA: Hemisphere Publishing.
4. Welty, J. R., Wicks, C. E., Wilson, R. E., & Rorrer, G. L. (2008). Fundamentals of Momentum, Heat and Mass Transfer (5th ed.). Hoboken, NJ, USA: John Wiley & Sons.

Online Learning Resources

1. NPTEL – Heat Transfer (IIT Kharagpur)
2. NPTEL – Convective Heat Transfer (IIT Kanpur)
3. MIT OpenCourseWare – Heat Transfer


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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	PE	
Course Code, Course Title:	3AEPE216, Fundamentals of Experimental Aerodynamics					Type	T1	
Prerequisites	3AEPC203- Fluid Mechanics							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	-		3	3		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-

Course Outcomes (COs) :

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

CO1	Explain the fundamental concepts of aerodynamics, fluid flow characteristics, and the generation of aerodynamic forces and moments acting on aircraft and airfoils using the principles of aerodynamics with correct engineering terminology and scientific reasoning.
CO2	Analyze aerodynamic fluid motion using Eulerian and Lagrangian descriptions, conservation laws, Bernoulli's equation, potential flow theory, and boundary layer concepts with appropriate analytical methods and engineering assumptions.
CO3	Evaluate subsonic and supersonic wind tunnel configurations using design principles, similarity laws, scaling requirements, and safety guidelines for appropriate aerodynamic testing applications.
CO4	Apply flow visualization and aerodynamic measurement techniques using Schlieren, Shadowgraph, Particle Image Velocimetry (PIV), Pitot tubes, and drag measurement methods to obtain accurate experimental observations and measurements.
CO5	Assess aerodynamic force, moment, and pressure measurement systems using strain-gauge balances, pressure sensors, data acquisition systems, and uncertainty analysis to interpret experimental data with acceptable accuracy..

Syllabus:

Module	Contents	Lecture Hours
I	Introduction: Introduction on Aerodynamics-its relevance and applications , Flow velocity, pressure, skin friction ,Generation of aerodynamic forces and moments on an aircraft	07
II	Eulerian and Lagrangian perspectives of flow: Fluid element trajectories, Fluid element trajectories, Angular velocity, and vorticity, Irrotational and Rotational flow, Strain of a fluid element, Line Surface and Volume Integrals, Circulation, Conservation equations of mass, momentum and energy, Inviscid and viscous flows ,Bernoulli's equation applications; Potential flow; Boundary layer flow Laminar and turbulent flow ,Airfoil Geometry, forces and moments acting on an airfoil	08


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III	Classification of Subsonic tunnel: Wind tunnel-an experimental tool in aerodynamics; Types of wind tunnels , Wind Tunnel design basics- Subsonic Wind Tunnels ,Smoke and Tuft grid techniques,Dye injection special techniques,Calibration of wind tunnel	07
IV	Supersonic Wind Tunnel: Supersonic wind tunnels,Helium and gun tunnels, Shock tubes High Speed WindTunnel-converted Continuous closed circuit supersonic wind tunnel, Scaling of wind tunnel models; Safety issues in wind tunnel handling ,	08
V	Flow visualization techniques and Pitot tubes: Optical methods of flow visualization,Schlieren and Shadowgraph techniques, Velocity measurement using Particle Image Velocimetry, Measurement of Pressure using mechanical instruments,Rayleigh Pitot tube; laser Doppler anemometer, Rotameters and ultrasonic flow meters	08
VI	Flow Sensors and Measurements: Mechanical balance Electronic transducers, Wheatstone bridge circuits for force and moment measurement,Strain gauge based balances; Claw yaw meter, Yaw sphere, Wire balance, Strut-type, Platform-type , Yoke-type -Pyramid typeElectronic pressure gauges, Absolute-Gauge- Differential pressure sensors; Data Acquisition System, Measurement error and uncertainty	07
Total Lecture Hours		45

Text Books:

1. Rathakrishnan. E "Instrumentation, Measurement and Experiments in Fluids", CRC Press, London, 2007
2. Rae, W.H. Jr. and Pope, A., Low-Speed Wind Tunnel Testing, 3rd Edition, John Wiley & Sons, 1999.
3. Dobrev, I., Massouh, F., and Tropea, C., Experimental Aerodynamics, 1st Edition, CRC Press, 2023.

References:

1. Pope, A. and Goin, K.L., High-Speed Wind Tunnel Testing, Krieger Publishing Company, 1978.
2. Goldstein, R.J. (Ed.), Fluid Mechanics Measurements, 2nd Edition, Taylor & Francis, 1996.
3. Tropea, C., Yarin, A.L., and Foss, J.F. (Eds.), Springer Handbook of Experimental Fluid Mechanics, Springer, 2007.

Online Learning Resources

1. NPTEL – Fundamentals of Theoretical and Experimental Aerodynamics, IIT Kharagpur


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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	PE	
Course Code, Course Title:	3AEPE217, Fundamentals of Unmanned Aerial Vehicles					Type	T1	
Prerequisites	3AEPC205 – Introduction to Aeronautical Engineering							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	-		3	3		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-

Course Outcomes (COs) :

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

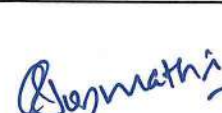
CO1	Explain the classification, components, and applications of UAV systems using standard materials, ensuring correct identification of UAV types and system elements.
CO2	Describe principles of flight, rotorcraft dynamics, sensors, communication systems, and autopilot concepts using diagrams and given data, ensuring correct interpretation of UAV behavior and subsystem functions.
CO3	Apply basic flight dynamics, sensor data, and autopilot functionalities using simulation tools / case scenarios to interpret UAV motion and flight modes with acceptable accuracy.
CO4	Apply design considerations, material selection, assembly procedures, and regulatory guidelines under frameworks of DGCA, FAA, and EASA to ensure compliant and balanced UAV system configuration.

Syllabus:

Module	Contents	Lecture Hours
I	Introduction To UAV Systems & Classification: History of UAS - Types of UAVs : Fixed-wing, Rotary-wing, Hybrid VTOL - Classification, Category and Sub-category of UAS - System Composition : Airframe, Propulsion, Avionics, Payload, GCS - Applications : Survey, Agri, Logistics, Inspection, and Defense etc.,	07
II	Rotorcraft And Hybrid Dynamics: Principles of Flight : Lift, Drag, Thrust, Weight - 6-DOF Dynamics & Coordinate Frames - Attitude : Roll, Pitch, Yaw - Propulsion Systems : BLDC Motors, ESCs, Li-Po/Li-Ion Batteries	08
III	UAS Sensors & Communication: Sensors: IMU, Magnetometer, Barometer, GPS - Payload Types: RGB, Multispectral, LiDAR, Thermal - Data Links : Remote Control, Telemetry, FPV; Introduction to MAVLink Protocol - Ground Control Software	07
IV	Autopilot Hardware & Firmware: Role of Flight Controllers - Introduction to Open-Source Ecosystems : PX4 and ArduPilot - Flight Modes : Stabilize, AltHold, Loiter, Auto - Basic Navigation Algorithms and Firmwares	07


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Module	Contents	Lecture Hours
V	Design, Materials & Assembly: Airframe Design Considerations - Material Selection : Composites, Foams, 3D Printed Plastics - Weight and Balance Calculations - Hands-on Quadcopter Component Identification and Assembly Process	08
VI	Regulatory Framework: Global Regulatory Bodies : DGCA, FAA, EASA - DGCA Rules and Regulations - Guidelines for UTM - Airspace Classifications - Drone Training Circulars - Certification Scheme for Unmanned Aerial Systems	08
Total Lecture Hours		45

Text Books:

1. Unmanned Aircraft Systems: UAVS Design, Development and Deployment, Reg Austin, John Wiley & Sons Inc., 2nd Edition, 2022
2. Design of Unmanned Aerial Systems, Dr. Mohammad H. Sadraey, John Wiley & Sons Inc., 2nd Edition, 2020
3. Handbook of Unmanned Aerial Vehicles, Kimon P. Valavanis and George J. Vachtsevanos, Springer, 2nd Edition, 2023

References:

1. Building Your Own Drones - A Beginner's Guide to Drones, UAVs, and ROVs, John Baichtal, Que Publishing, 2nd Edition, 2019
2. Small Unmanned Fixed-Wing Aircraft Design: A Practical Approach, Andrew J. Keane, András Sóbester, James P. Scanlan, John Wiley & Sons Ltd., 2nd Edition, 2023

Online Learning Resources

1. www.dgca.gov.in - Drones and AAM
2. www.ardupilot.com - Documentation
3. www.px4.io - Documentation

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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	PE	
Course Code, Course Title:	3AEPE218, Introduction to Air Transportation					Type	T1	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	-		3	3		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-

Course Outcomes (COs) :

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

CO1	Explain the characteristics and economic profile of the aerospace and air transportation industry, given course materials and case discussions, by outlining key features, types of airlines, and network structures.
CO2	Summarize the concepts of air cargo and logistics, given industry data and examples, by identifying operational characteristics, challenges and opportunities.
CO3	Describe the principles of international air law and aviation regulations, given relevant conventions and regulatory frameworks, by classifying key laws, freedoms of air, and roles of major organizations.
CO4	Interpret airline management and organizational concepts, given organizational scenarios and models, by relating functions of management, market dynamics of demand and supply.
CO5	Discuss air transport marketing concepts, deregulation impacts, and environmental issues given real-world aviation contexts with appropriate explanation of the key factors involved.

Syllabus:

Module	Contents	Lecture Hours
I	Aerospace And Air Transportation Industry: Characteristics of the industry - Economic profile of the Industry - Civil Aviation market - Factors affecting commercial transport sales - General Aviation - Characteristics of the commercial air transport industry -Economic and social benefits and impacts - Types of airlines - Basis scheduling and network structures	08
II	Air Cargo And Logistics: Business case for Air cargo - Characteristics of Air cargo - The air cargo Industry - Global & Specialized air cargo operation - Challenges and Opportunities.	07
III	International Law, Regulators And Associations: Air law and Aviation law - International Air law - Sovereignty of territorial Airspace - Chicago Convention - Freedom of Air - Warsaw convention - Montreal Convention - ICAO - FAA - NTSB - IATA - EASA - DGCA - AAI - other International Associations.	07
IV	Management & Organization: Airline Partnership - Organizational structure - Functions of management - Types of Airline Personnel - Organizational culture - Aviation Value chain - Airline Markets: Demand, Supply	07


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V	Marketing For Air Transportation: Deregulation and impact in airline industry - Airline business model - Principles of air transport marketing - Stages in the Application of Marketing Principles - Principles of engagement marketing – Market segmentation – PESTE Analysis.	08
VI	Air Transport And The Environment: Introduction - Limiting Aviation's Environmental Impact: The role of Regulatory bodies - Airport Water Quality Control - Noise - Surface Air Quality - Impact of Aviation on Climate.	06
Total Lecture Hours		45

Text Books:

1. Air Transportation - A Management Perspective - John G. Wensveen, Routledge Publisher, 8th Edition, 2018
2. Air Transport Management - An International Perspective - Lucy Budd & Stephen Ison, Routledge Publisher, 2nd Edition, 2020

References:

1. The Global Airline Industry - Peter Belobaba, Amedeo Odoni, Cynthia Barnhart, Wiley Publisher, 2nd Edition, 2015
2. Airline Marketing and Management - Stephen Shaw, Routledge Publisher, 8th Edition, 2021


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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	MM	
Course Code, Course Title:	3AEAA219, Fundamentals of Aeronautical					Type	LIT2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	2		3	4		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	-

Course Outcomes (COs) :

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

CO1	Classify aerial vehicles by distinguishing major types using basic historical and system information.
CO2	Describe the major components of an airplane and control systems by identifying their key functions with the help of standard diagrams or visuals.
CO3	Summarize cockpit flight instruments by stating their working principles using instrument panel visuals.
CO4	Explain fundamental aerodynamic concepts by identifying key features using definitions and diagrams.
CO5	Discuss propulsion systems using engine schematics by comparing principles.
CO6	Outline aircraft structural concepts and materials by identifying loads, major components & applications

Syllabus:

Module	Contents	Lecture Hours
I	Evolution And Classification Of Aerial Vehicles: History of Flight - Types of aircrafts - Lighter than air systems - Heavier than air systems: Power driven & Non-power driven vehicles - Launch and Re-entry vehicles - Unmanned Aerial vehicle.	07
II	Airplane Configurations: Components of airplanes and their functions - Control surfaces: Primary & Secondary - Conventional control - Powered control - Fly-by-wire system.	08
III	Flight Instruments: Introduction to cockpit and basic instruments - Working of Airspeed Indicator - Altimeter - Vertical speed indicator - Attitude indicator - Turn indicator - Heading indicator - Navigation Instruments: VOR, Magnetic Compass, GPS - Engine control systems - Autopilot Systems.	08
IV	Aerodynamics: International standard Atmosphere - Steady level Flight - Types of drag - Aerofoil: Types and Nomenclature - Lift generation - Centre of pressure & Aerodynamic centre - Types of aircraft wings	07

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	with comparative merits - Mach number.	
V	Propulsion: Basic Principle of Gas turbine engine - Types of Airbreathing and Non-airbreathing engine - Piston, Turboprop, Turbojet, Turbofan, Turboshift, Ramjet and Scramjet engines components and functions - Comparative merits - Principle of operation of rocket, types of rocket and typical applications.	08
VI	Aircraft Material And Components: Monocoque and Semi-monocoque constructions - Load acting on Aircraft structures - Wing, Fuselage, Landing gear structure - Materials used in aircraft structures: Aluminium alloy, titanium, stainless steel and composite materials properties and applications.	07
Total Lecture Hours		45

List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment (Any 10)	CO Mapped
1	Lighter than Air System (Lanterns or air balloons)	CO1
2	Heavier than air systems (making of Ornithopter)	CO1
3	Anatomy of Aircraft	CO2
4	Create a paper plane with Control surface	CO2
5	Study of Basic Instruments from the Cockpit	CO3
6	Create different wing shapes	CO4
7	Flow visualization on different shapes	CO4
8	Water rocketry	CO5
9	Study of Piston / Gas Turbine Engine Components (Cut-section)	CO5
10	Study of Aircraft Structural Elements (Wing, Fuselage, LG)	CO6
11	Build a cardboard wing	CO6
12	Build a Fuselage from scraps	CO6
Total Sessions		15
Total Hours		30

Text Books:

- Anderson, J. D. (2021). Introduction to flight (10th ed.). McGraw-Hill Education.
- Kermode, A. C. (2012). Mechanics of flight (12th ed.). Pearson Education.
- Houghton, E. L., & Carpenter, P. W. (2021). Aerodynamics for engineering students (8th ed.). Butterworth-Heinemann.
- Gupta, S. C. (2017). Fundamentals of aerodynamics. New Age International Publishers.

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5. Newman, S. (2018). The foundations of aerodynamics: Bases of aerodynamic design (6th ed.). McGraw-Hill.

References:

1. Kroes, M., Wild, T., & Watkins, F. (2019). Aircraft maintenance and repair (8th ed.). McGraw-Hill Education.
2. Jeppesen Sanderson. (2018). Aircraft systems for pilots. Jeppesen Training Systems.
3. Lahiri, S. (2014). Applied aerodynamics. Tata McGraw-Hill.
4. Nagaraja, M. S., & Sudha, G. (2018). Aerospace engineering: Principles and practice. I.K. International Publishing House.

Online Learning Resources

1. Introduction to Aerospace Engineering - By Prof. Rajkumar S. Pant, IIT Bombay - Swayam
<https://nptel.ac.in/courses/101101079>

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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	MM	
Course Code, Course Title:	3AEAM220, Aircraft System and Components					Type	LIT2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	2		3	4		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	-

Course Outcomes (COs) :

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

CO1	Describe the basic components, terminology, and functions of major aircraft systems, including control systems, hydraulic, pneumatic, and engine systems.
CO2	Explain the working principles of aircraft subsystems such as flight control mechanisms, fuel systems, landing gear, and auxiliary systems using schematic representations
CO3	Illustrate the operation and significance of key aircraft instruments and avionics used for flight and engine monitoring.
CO4	Apply fundamental concepts to interpret aircraft system layouts, cockpit instrument panels, and basic wiring diagrams during lab and hangar demonstrations.
CO5	Analyze basic maintenance procedures and troubleshooting practices for aircraft systems such as hydraulic, fuel, and control systems based on observed demonstrations.

Syllabus:

Module	Contents	Lecture Hours
I	Airplane Control Systems Assembly And Rigging: Aircraft assembly and Rigging- Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – operating principles – Control surface Rigging Modern control systems – Digital fly by wire systems – Auto pilot system, Active Control Technology.	08
II	Aircraft Systems: Hydraulic systems – Study of typical systems – components – Hydraulic systems controllers – Modes of operation – Pneumatic systems – Working principles – Typical Pneumatic Power system – Brake system – Components, Landing Gear Systems – Classification – Shock absorbers – Retractive mechanism.	07
III	Engine Systems:	07

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	Piston and Jet Engines- Fuel systems – Components - Multi-engine fuel systems, lubricating systems – Starting and Ignition systems.	
IV	Auxiliary Systems: Basic Air Cycle systems – Vapor Cycle Systems, Boot-strap air cycle system – Evaporative vapor cycle systems – Evaporation air cycle systems – Oxygen systems – Fire extinguishing system and smoke detection system, De-icing and anti-icing system	08
V	Aircraft Instruments: Flight Instruments and Navigation Instruments – Accelerometers, Air speed Indicators – Mach Meters – Altimeters - Gyroscopic Instruments– Principles and operation – Study of various types of engine instruments – Tachometers – Temperature and Pressure gauges.	08
VI	General Maintenance And Trouble Shooting: Aircraft control system inspection and maintenance, Hydraulic and pneumatic system maintenance practices, Inspection and maintenance of landing gear and break maintenance, inspection, maintenance and repair of fuel systems, Installation and maintenance of instruments, troubleshooting theory and practices	07
Total Lecture Hours		45

List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment	CO Mapped
1	Aircraft “Jacking Up” procedure	CO4&5
2	Aircraft “Levelling” procedure	CO4&5
3	Control system “Rigging Check” procedure	CO1,2,4 &5
4	Aircraft “Symmetry Check” procedure	CO2,4&5
5	Altimeter calibration procedure	CO3,4&5
6	Aircraft walk around inspection, 50 hrs and 100 hrs maintenance check- fuelling and defuelling procedures	CO1,2,4 &5
7	Maintenance and rectification of snags in hydraulic and fuel systems	CO1,2,4 &5
8	Sketch the layout of the cockpit flight instrument for Airbus A 380, Boeing 747 with acronyms as per the FAA/DGCA/EASA standards	CO2,3&4
9	Draw a schematic of an autopilot system of an aircraft with description of its components, functions, operations	CO2,3&4
10	Prepare an avionics planning worksheet with reference to manuals, diagrams and installation drawings	CO2,3,4 &5
11	Sketch the various symbols/ Call signs used in aircraft instrumentation with detailing about the	CO1,2,3

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	associated components and FAA/DGCA/EASA regulations	&4
12	Read and comprehend the wiring diagram of an aircraft and suggest effective changes to improve space utilization	CO2,4&5
Tostal Sessions		15
Total Hours		30

Text Books:

1. Aircraft Maintenance and Repair, Michael J. Kroes et al., McGraw Hill Education, 8th Edition, 2019
2. Aviation Maintenance Technician Handbook – Airframe & Powerplant Mechanics, U.S. Department of Transportation, Federal Aviation Administration (FAA), Latest Edition, 2023

References:

1. Aircraft Power Plants, J. L. McKinley & R. D. Bent, McGraw Hill, 5th Edition, 1993
2. Aircraft Instruments and Principles, E. H. J. Pallett, Pearson Education, 3rd Edition, 2012
3. Aircraft Gas Turbine Technology, Irwin E. Treager, McGraw Hill Education, 3rd Edition, 2017

Online Learning Resources

1. Introduction to Aircraft Systems Definition and Terminology - By Prof. Dr. Yagya Dutta Dwivedhi, <https://youtu.be/-7KDC7yYhGY?si=v68kNxVzcNBkKcZI>
2. Airframes & Aircraft Systems- <https://youtu.be/JltYcdVvzXE?si=I4CHlgs6B7YX4RZE>
3. Introduction to Aerospace Engineering - By Prof. Rajkumar S. Pant, IIT Bombay - Swayam <https://nptel.ac.in/courses/101101079>


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**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - IV					Category	MM	
Course Code, Course Title:	3AEDT221, Fundamentals of Unmanned Aerial Vehicles and Flight Operations					Type	LIT2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	3	-	2		3	4		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	-

Course Outcomes (COs) :

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

CO1	Explain the classification, components, and applications of UAV systems using standard materials, ensuring correct identification of UAV types and system elements.
CO2	Describe principles of flight, rotorcraft dynamics, sensors, communication systems, and autopilot concepts using diagrams and experimental / given data, ensuring correct interpretation of UAV behavior and subsystem functions.
CO3	Apply UAV simulation tools and ground control software to establish communication, perform sensor calibration, and configure flight parameters using platforms like PX4 and ArduPilot (in laboratory/simulator environment) ensuring successful execution of calibration and communication setup.
CO4	Apply autopilot functionalities and flight modes to execute manual and autonomous flight operations using drone simulators and demonstration setups ensuring safe and correct execution of flight maneuvers and emergency procedures.
CO5	Discuss UAV design considerations, material selection, assembly processes, and regulatory requirements under DGCA, FAA, and EASA using design data and regulatory documents ensuring proper interpretation of design constraints and compliance standards.

Syllabus:

Module	Contents	Lecture Hours
I	Introduction To UAV Systems & Classification: History of UAS - Types of UAVs : Fixed-wing, Rotary-wing, Hybrid VTOL - Classification, Category and Sub-category of UAS - System Composition : Airframe, Propulsion, Avionics, Payload, GCS - Applications : Survey, Agri, Logistics, Inspection, and Defense etc.,	07
II	Rotorcraft And Hybrid Dynamics: Principles of Flight : Lift, Drag, Thrust, Weight - 6-DOF Dynamics & Coordinate Frames - Attitude: Roll, Pitch, Yaw - Propulsion Systems : BLDC Motors, ESCs, Li-Po/Li-Ion Batteries	08

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Module	Contents	Lecture Hours
III	UAS Sensors & Communication: Sensors: IMU, Magnetometer, Barometer, GPS - Payload Types: RGB, Multispectral, LiDAR, Thermal - Data Links : Remote Control, Telemetry, FPV; Introduction to MAVLink Protocol - Ground Control Software	07
IV	Autopilot Hardware & Firmware: Role of Flight Controllers - Introduction to Open-Source Ecosystems : PX4 and ArduPilot - Flight Modes : Stabilize, AltHold, Loiter, Auto - Basic Navigation Algorithms and Firmwares	07
V	Design, Materials & Assembly: Airframe Design Considerations - Material Selection : Composites, Foams, 3D Printed Plastics - Weight and Balance Calculations - Hands-on Quadcopter Component Identification and Assembly Process	08
VI	Regulatory Framework: Global Regulatory Bodies : DGCA, FAA, EASA - DGCA Rules and Regulations - Guidelines for UTM - Airspace Classifications - Drone Training Circulars - Certification Scheme for Unmanned Aerial Systems	08
Total Lecture Hours		45

List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment	CO Mapped
1	Study on Ground Equipment Handling	CO1
2	Drone simulator configuration and Controller Calibration	CO3
3	Establishing Connection between Drone and Ground Control Software	CO3
4	Calibration of Accelerometer and Level Horizon via GCS	CO3
5	Calibration of Gyroscope and Compass via GCS	CO3
6	Study of Flight Modes for Rotorcraft, Aeroplane and Hybrid	CO4
7	Manual Flight using Drone Simulators - Control Checks, Basic Flight	CO4
8	Manual Flight using Drone Simulators - Circuit Flying	CO4
9	Manual Flight using Drone Simulators - Abnormal/Emergency Procedures	CO4
10	Execution of Preflight Checklist for Drone Flying	CO4
11	Demonstration of Drone Flying - Manual Flight	CO4
12	Demonstration of Drone Flying - Autonomous Flight	CO4
Total Sessions		15
Total Hours		30

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**Text Books:**

1. Unmanned Aircraft Systems: UAVS Design, Development and Deployment, Reg Austin, John Wiley & Sons Inc., 2nd Edition, 2022
2. Design of Unmanned Aerial Systems, Dr. Mohammad H. Sadraey, John Wiley & Sons Inc., 2nd Edition, 2020
3. Handbook of Unmanned Aerial Vehicles, Kimon P. Valavanis and George J. Vachtsevanos, Springer, 2nd Edition, 2023

References:

1. Building Your Own Drones - A Beginner's Guide to Drones, UAVs, and ROVs, John Baichtal, Que Publishing, 2nd Edition, 2019
2. Small Unmanned Fixed-Wing Aircraft Design: A Practical Approach, Andrew J. Keane, András Sóbester, James P. Scanlan, John Wiley & Sons Ltd., 2nd Edition, 2023

Online Learning Resources

1. www.dgca.gov.in - Drones and AAM
2. www.ardupilot.com - Documentation
3. www.px4.io - Documentation


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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	HS	
Course Code, Course Title:	3AEHS224, Psychology					Type	T2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	1	-	-		1	1		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-

Course Outcomes (COs) :

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

CO1	Identify the basic concepts of decision making, emotional intelligence, and procrastination from given real-life situations with appropriate accuracy.
CO2	Differentiate between effective and ineffective thinking patterns, emotional responses, and time-management behaviors in structured scenarios with logical reasoning.
CO3	Apply suitable psychological strategies for decision making, emotional regulation, and task management in case-based scenarios.
CO4	Analyze the influence of cognitive biases, emotions, distractions, and mindset on personal and academic performance.
CO5	Select appropriate behavioral and self-management techniques from given practical situations to effectively improve focus, interpersonal understanding, and productivity

Syllabus:

Module	Contents	Lecture Hours
I	Smart Thinking & Decision Making: - What is decision making - Importance in engineering/management - Common mistakes (3 biases only) - Fast vs Slow thinking - Good enough vs perfect decision - Six Thinking Hats (application) - Individual vs group decision making - Growth Mindset vs Fixed Mindset - Decision making in real-life situations	05
II	Understanding Emotional Intelligence:	03


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Module	Contents	Lecture Hours
	- Understanding emotions and importance - EI vs IQ 5 Domains of EI - Emotional Intelligence and Personality	
III	Emotional Regulation & Interpersonal Skills: - Impulse control (self-regulation) - Handling criticism (self-management) - Empathy and altruism (social awareness) - Assertiveness (relationship management)	03
IV	Procrastination: - Introduction and definition of procrastination - Why do we procrastinate - Time management myths - Distractions and attention - Techniques to beat procrastination	04
Total Lecture Hours		15

Reference Books:

1. "Thinking, Fast and Slow", Daniel Kahneman, Penguin Books, 2011.
2. Emotional Intelligence: Why It Can Matter More Than IQ", Daniel Goleman, Bantam Books, 1995.
3. "Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones", James Clear, Avery, 2018
4. "Deep Work: Rules for Focused Success in a Distracted World", Cal Newport, Grand Central Publishing, 2016
5. "The Power of Habit: Why We Do What We Do in Life and Business", Charles Duhigg, Random House, 2012
6. "Nudge: Improving Decisions About Health, Wealth, and Happiness", Richard H. Thaler & Cass R. Sunstein, Penguin Books, 2008
7. "The 7 Habits of Highly Effective People", Stephen R. Covey, Free Press, 1989

Online Learning Resources

1. <https://www.youtube.com/watch?v=O2y1OGCIzMw>
2. <https://www.youtube.com/watch?v=33d61cpRfog>
3. <https://www.youtube.com/watch?v=b6FpfGiENPo>
4. <https://www.youtube.com/watch?v=YLhGgef7SvA>
5. <https://www.youtube.com/watch?v=TOFjyi0tg5w>

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Course Information:

Class, Semester	S.Y. (B.Tech), Semester - IV					Category	HS	
Course Code, Course Title:	3AEHS225- Foreign Language - German					Type	T2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	2	-	-		2	2		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-

Course Outcomes (COs) :

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

CO1	Introduce themselves and others in German during structured oral interactions using appropriate greetings and personal information.
CO2	Communicate information related to family, hobbies, studies, and daily routines in simple German conversations and written exercises.
CO3	Apply basic German grammar rules, vocabulary, and common phrases to construct simple sentences in speaking and writing activities.
CO4	Read, interpret, and compose simple emails and short written texts in German using appropriate vocabulary and sentence structures.
CO5	Formulate and respond to questions related to everyday situations in German through conversations and role-play activities.
CO6	Demonstrate foundational German language skills in listening, speaking, reading, and writing required for progression to the A2 level.

Syllabus:

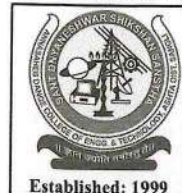
Unit	Contents	Lecture Hours
MODULE 1 - PRE-TERM		
I	Introduction to German Language: • Introduction to German language and culture • German alphabets • Pronunciation and phonetics • Greetings and farewells • Classroom expressions • Basic vocabulary	10
II	Self-Introduction and Basic Communication: • Personal pronouns	10


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	- Verbs Haben and Sein - Verb conjugation - Introducing oneself and others - Numbers (0-1000) - Days of the week - Basic sentence structure - W-Fragen (Question Words)	
III	Countries, Languages and Daily Communication: - Countries and nationalities - Languages - Asking and answering simple questions - Yes/No questions - Articles (Definite and Indefinite) - Simple conversations	10
MODULE 2 - IN-TERM		
IV	Friends, Family and Hobbies: - Talking about friends and colleagues - Family members - Hobbies and interests - Daily routine - Possessive articles Describing people	10
V	Time, Dates and Appointments: - Days, months and seasons - Telling time - Dates and birthdays - Making appointments - Invitations - Apologizing - Modal verbs	10
VI	Work and Workplace Communication: - Occupations and professions - Workplace vocabulary - Talking about studies and work - Telephone conversations - Job advertisements - Expressing opinions about jobs	10
VI	City, Transport and Directions: - Places in a city - Means of transport - Asking for and giving directions - Enquiring information - Imperative forms - Negation - Definite and indefinite articles	10
MODULE 3 - SELF STUDY		
VIII	Food, Shopping and Restaurants:	10


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	• Food and beverages • Shopping conversations • Ordering food • Paying bills • Akkusativ case • Verbs with Akkusativ • Restaurant communication	
IX	Home, Communication and Writing Skills • Describing home and surroundings • Understanding advertisements • Likes and dislikes • Letters and emails • Understanding texts • Dativ case • Dativ prepositions • Wechselprepositionen	10
X	Social Life, Past Events and Fashion • Planning activities with friends • Event information and radio announcements • Separable verbs • Personal pronouns • Präteritum of Haben and Sein • Perfekt tense and Partizip II • Conjunctions (und, oder, aber) • Clothes and fashion • Demonstrative and interrogative articles • Verbs with Dativ	10
Total Lecture Hours		100

Text Books:

1. Netzwerk neu A1 Kursbuch Goyal publishers & Distributors Pvt. Ltd. First Indian reprint 2020 Reprinted 2023
2. Netzwerk neu A1 Übungsbuch Goyal publishers & Distributors Pvt. Ltd. First Indian reprint 2020 Reprinted 2023

References:

1. Fit fürs Goethe -Zertifikat A1 Start Deutsch 1 Hübner


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Course Information:

Class, Semester	S.Y. (B.Tech), Semester - IV					Category	HS	
Course Code, Course Title:	3AEHS226 - Foreign Language - Japanese					Type	T2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial		Practical		Self Study	Credits	
	2	-		-		2	2	
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-

Course Outcomes (COs) :

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

CO1	Communicate in basic scenarios using familiar everyday expressions to make greetings, introduce themselves and others, and ask or answer questions about personal details.
CO2	Navigate daily life situations by ordering food, asking for simple directions, using public transportation, and making basic purchases at stores.
CO3	Discuss routines and interests by talking simply about daily schedules, hobbies, past weekend activities, and future desires such as travel plans.
CO4	Read and write basic Japanese by recognizing and reading Hiragana, Katakana, and a few high-frequency Kanji used in daily life.
CO5	Demonstrate understanding of Japanese cultural context by applying basic Japanese social etiquette in workplaces, public spaces, and casual settings.

Syllabus:

Unit	Contents	Lecture Hours
MODULE 1 - PRE-TERM		
I	Introduction to Japanese Language and Culture: - Overview of Japanese language and culture - Japanese writing systems: Hiragana, Katakana, Kanji - Basic pronunciation and phonetics - Greetings according to time of day - Classroom and workplace expressions - Asking for repetition and clarification - Basic etiquette and manners	10
II	Self-Introduction and Personal Information: - Introducing oneself and others - Name, nationality, occupation, and residence	10

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	- Family members - Languages spoken - Basic sentence patterns - Introduction to Hiragana writing practice	
III	Hiragana and Katakana Mastery: - Complete Hiragana characters - Complete Katakana characters - Reading and writing practice - Simple words and phrases - Listening and pronunciation exercises - Everyday vocabulary development	10
MODULE 2 - IN-TERM		
IV	Food and Dining: - Food and beverage vocabulary - Expressing likes and dislikes - Reading simple menus - Ordering food and drinks - Restaurant conversations - Japanese dining etiquette	10
V	Home, Family and Surroundings: - Describing houses and rooms - Household objects and furniture - Family relationships - Location expressions - Counting objects and people - Describing surroundings	10
VI	Daily Life and Time Expressions: - Telling time - Days, dates, and months - Daily routines - Operating hours and schedules - Borrowing and lending items - Making simple appointments	10
VII	Hobbies, Interests and Social Interaction: - Hobbies and leisure activities - Sports, movies, music, manga, and anime - Inviting friends - Accepting and declining invitations - Expressing preferences and interests - Social conversations	10
MODULE 3 - SELF STUDY		
VIII	Transportation and Navigation: - Public transportation vocabulary - Trains, buses, stations, and landmarks - Asking for directions - Giving simple directions - Understanding signs and notices - Travel-related conversations	10
IX	Shopping and Everyday Transactions: Shopping vocabulary	10

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	- Asking for products and prices - Quantities and measurements - Locating items in stores - Purchasing goods - Customer-service interactions	
X	Holidays, Experiences and Future Plans: - Talking about past weekend activities - Introduction to simple past tense - Expressing wishes and desires - Travel plans and future intentions - Introduction to frequently used Kanji - Course review and consolidation - Speaking role-plays and presentations - Reading and writing assessment	10
Total Lecture Hours		100

Text Books:

1. Irodori: Japanese for life in Japan (A1), The Japan Foundation, 2020

References:

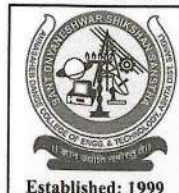
1. Marugoto Starter (A1) Katsudoo + Rikai (2 Books set) <https://amzn.in/d/07fApBbW>
2. Genki: An Integrated Course in Elementary Japanese Vol. 1 [3rd Edition] <https://amzn.in/d/0gXGM2Ef>
3. Minna no Nihongo 1-1&1-2 Main Textbook elementary +Translation & Grammatical with downloadable CDs. <https://amzn.in/d/0dyQ9ips>


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**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - IV					Category	RM	
Course Code, Course Title:	3AERM227, Research Methodology					Type	L2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	-	-	2		-	1		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-

Course Outcomes (COs) :

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

CO1	Utilize fundamental concepts of research, research problems, literature sources, and research methodologies for engineering applications under given research scenarios.
CO2	Apply appropriate research design, sampling techniques, and data collection methods to conduct systematic research studies under given problem statements.
CO3	Analyze research data using qualitative, quantitative, statistical, and hypothesis testing techniques under given research scenarios.
CO4	Develop a technical research article with ethical publication practices, appropriate referencing standards, and quality research guidelines.

Syllabus:

Module	Contents	Lecture Hours
I	Research Fundamentals: Meaning and objectives of research, Significance of research, Types of research, Research process, Criteria of Good Research, Importance of Research in Engineering	04
II	Research Problem & Literature Review: Meaning of Research Problem, Identification & Formulation of research Problem, Techniques for defining Research Problem, Literature Sources: Journals, Conferences, Patents, Use of Digital Libraries, Literature Review techniques and gap identification.	05
III	Research Design & Methodology: Need & Features of Good Research Design, Types of Research Design: Exploratory, Descriptive, Experimental, Sampling Techniques. Data Collection: Types of Data: Primary, Secondary, Methods of Data Collection: Survey, Questionnaire, Interview, Observation, Experimentation	06
IV	Data Analysis & Testing of Hypothesis: Types of data: Qualitative and Quantitative, Basic statistical tools: Mean, Median, Standard Deviation, Data representation: Tables, Graphs, Charts, Introduction to analysis tools, Interpretation	05

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Module	Contents	Lecture Hours
	of results, Hypothesis, Basic concepts concerning testing of hypothesis, Procedure for hypothesis testing, Flow diagram of hypothesis testing, Test of hypothesis, Hypothesis testing of Means, Hypothesis testing for differences between Means.	
V	Report Writing: Introduction Technical Report Writing and tools (Latex), Significance of report writing, Steps in writing report, Types of reports, Layout and structure of reports, Documentation and Referencing Styles, Presentation Tools & Techniques: Zotero & Mendeley.	04
VI	Research Journals and Publication Ethics: Research Journals, Types of Journals, Research Publication Process, Journal Indexing: Meaning and Importance of Journal Indexing, Benefits of Indexed Journals, Major Indexing Databases, (Scopus, Web of Science, Google Scholar, SCI, ESCI, and PubMed), Journal Metrics and Quality Indicators: Impact Factor, h-index, i10-index, CiteScore, SNIP and SJR, Types of Publications, Ethics in Research Publication: Plagiarism and Similarity Index (Turnitin Software), Copyright and Authorship, Duplicate Publication, Clone, Predatory, and Fake Journals, Researcher Profiles and Identifier (ORCID, Researcher ID)	06
Total Lecture Hours		30

Text Books:

1. Research Methodology–Methods and Techniques by C. R. Kothari, Second Edition, New Age International Publishers
2. Dr. Santosh M Nejakar, Dr. Harish Bendigeri “Research Methodology and Intellectual Property Rights”, ISBN 978-93-5987-928-4, Edition: 2023-24

Reference Books:

1. Research Methodology Concept and cases By Deepak Chawala and Neena Sondhi
2. Research Methodology: Step by step guide for beginners, Ranjeet Kumar, 5th Edition, SAGE Publications
3. How to Write and Publish a Scientific Paper, Robert A. Day, Barbara Gastel, 8th Edition: 8th Edition, Cambridge University Press

Online Learning Resources

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed28
2. https://onlinecourses.swayam2.ac.in/e-learning/course/nou26_ge46

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Course Information:

Class, Semester	S.Y. B.Tech, Semester - IV					Category	EL	
Course Code, Course Title:	3AEEL228, Innovation and Product Development					Type	L2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	-	-	2		-	1		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-

Course Outcomes (COs) :

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

CO1	Identify innovative product ideas by observing real-world problems and user needs using creativity and design thinking tools.
CO2	Apply design thinking techniques to generate and refine innovative solutions for identified engineering or societal problems based on user requirements.
CO3	Construct functional prototypes and estimate preliminary production costs using appropriate materials, manufacturing methods, and engineering tools.
CO4	Analyze prototype performance and production feasibility by interpreting testing results, cost data, and scalability requirements.
CO5	Evaluate intellectual property opportunities, commercialization potential, and production planning based on technical feasibility, market requirements, and economic considerations.
CO6	Develop a comprehensive entrepreneurial proposal integrating intellectual property protection, commercialization strategy, and production planning for an innovative product.

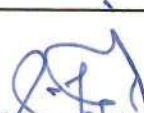
Syllabus:

The Innovation Prototype course is designed to provide students with experiential learning in innovation, prototyping, product development, and commercialization. The course focuses on identifying real-world problems and transforming innovative ideas into functional prototypes/models/products through systematic design and development processes.

Students will learn techniques for validating innovative concepts, assessing feasibility and utility, selecting suitable materials, along with design thing approach and developing prototypes/models/products through iterative improvement and performance testing. The course also emphasizes expert reviews, prototype assessment, cost estimation, pricing strategies, and preliminary production planning for scalability.

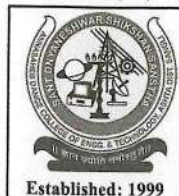
Further, students will gain exposure to Intellectual Property Rights (IPR), commercialization processes, and startup development, enabling them to prepare draft proposals for patenting, commercialization, or entrepreneurial ventures based on their innovative solutions.


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INNOVATION PRODUCT DEVELOPMENT ACTIVITY PLAN

Sr. No	Innovation Prototype Course Activities	Planned Week
01	Introduction to Innovation and Prototyping	Week 1
02	Revising Design Thinking Approach	Week 2
03	Identifying Innovative Problems (Students & Faculty)	Week 3
04	Validating Innovation: Assessing Utility of a Proposed Concept	Week 4
05	Review No. 1 – by Guides - Innovativeness Assessment - (Final Idea Presentation)	Week 5
06	Planning and Designing the Prototype	Week 6
07	Choosing and Testing Materials for the Prototype	Week 7
08	Building the working Prototype / Model/ Product	Week 8
09	Improving working Prototype / Model/ Product	Week 9
10	Testing the Prototype / Model/ Product Performance	Week 10
11	Review No. 2 – by Expert Panel - Prototype/Model/Product Assessment along with poster	Week 11
12	Estimating Costs & Formulating a Pricing Strategy for Product	Week 12
13	Creating a Preliminary Production Plan for Scaling the Prototype	Week 13
14	Formulating IPR or Commercialization or Start up	Week 14
15	Review No. 3 – Submission of Draft Copy for IPR or Commercialization or Start up	Week 15


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Course Information:

Class, Semester	S.Y. (B.Tech), IV					Category	CC	
Course Code, Course Title:	3AECC229, Aptitude and Reasoning - II					Type	T2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	2	-	-		-	-		
Examination Scheme (Marks)	Theory		MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-

Course Outcomes (COs) :

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

CO1	Solve problems based on Partnership Average Syllogism.
CO2	Solve problems based on Seating Arrangements Puzzles Direction .
CO3	Apply Presentation Skills, Grooming & Body Language, Group Discussion, and Interview techniques for the hiring process
CO4	Apply Resume Writing, LinkedIn Cold Calling for internship and job opportunity

Syllabus:

Unit	Contents	Lecture Hours
I	Partnership Average	04
II	Seating Arrangements Puzzles	04
III	Syllogism Direction	04
IV	Presentation Skills Grooming & Body Language	04
V	Resume Writing LinkedIn Cold Calling	04
VI	Group Discussion Interview	04
Total Lecture Hours		24

Text Books:

1. Quantitative Aptitude, R.S. Agarwal, S Chand, 2019.


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2. Verbal & Non-verbal Reasoning, R.S. Agarwal, S Chand, 2010.
3. Wren & Martin (Verbal, Grammar), P.C. Wren, S Chand, 2017.

References:

1. APTIPEDIA (Quantitative, Logical, Verbal Aptitude), Face, Wiley, 2017.
2. Wiley (Quantitative Aptitude), P.A. Anand, Maestro, 2015.
3. Arun Sharma (Verbal Ability), Meenakshi Upadhyay, McGraw Hill, 2020.

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