

Annasaheb Dange College of Engineering and Technology, Ashta

Department of Aeronautical Engineering



Structure and Curriculum Contents

B.Tech (Second Year)

Revision - 3

SEMESTER - 3

(ACADEMIC YEAR 2026-2027)

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Course Information:								
Class, Semester	S.Y. B.Tech, Semester - III				Category	BS		
Course Code, Course Title:	3AEPC201, Mathematical Modelling and Problem Solving				Type	T1		
Prerequisites	3AEBS101, Applied Mathematics - I 3AEBS109, Applied Mathematics - II							
Teaching Scheme (Per Week)	Lecture	Tutorial		Practical		Self Study	Credits	
	2	1		-		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	Develop mathematical models for simple engineering systems by applying fundamental modelling principles.							
CO2	Apply vector calculus concepts to analyse the behaviour of dynamic systems.							
CO3	Solve differential equations using analytical and transform-based methods for basic engineering applications.							
CO4	Implement numerical methods to approximate solutions for engineering problems and interpret the results.							
CO5	Use basic statistical tools to analyse engineering data and support simple design and performance evaluation tasks.							

Syllabus:

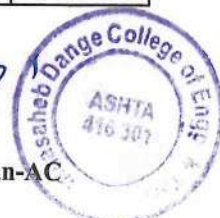
Module	Contents	Lecture Hours
I	Introduction to Mathematical Modelling: Mathematical models, variables, formulation of real-world problems, stages of modeling (formulation, solution, interpretation, and validation), and graphical methods for problem solving.	04
II	Vector Calculus for Modelling: Vectors and vector operations in 3D, Dot and cross product, Gradient, divergence and curl, Solenoidal and Irrotational vector fields, vector integration- Line and Surface integral.	05
III	Differential Equations and Its Applications: Second-order differential equations, Methods to find Complementary function, Methods to find Particular Integral, Applications of Differential equations- Spring-Mass Oscillator.	06
IV	Numerical Differentiation and Integration: Numerical differentiation – Newtons forward backward and central difference, Numerical integration – Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Numerical root-finding – Newton-Raphson method, Numerical solution of simple equations of motion,	05

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V	Laplace Transform and Its Applications: Laplace Transform fundamentals, Standard Laplace properties, Laplace Transform of Derivative, Laplace Transform of Integral, Inverse Laplace Transform, Inverse Laplace Transform by Method of Partial fraction and Convolution Theorem, Applications of L.T. to Solve ODEs	06
VI	Probability and Statistical Tools For Aeronautics: Basic probability concepts, Types of random variables, Binomial Distribution, Poisson's Distribution and Normal Distribution.	04
Total Lecture Hours		30

List of Tutorials with CO Mapping:

S. No.	Title of Tutorial	CO Mapped
1	Formulation of mathematical models from real-world problems.	CO1
2	Solution and interpretation of models using graphical methods.	CO1
3	Vector Differentiation	CO2
4	Vector Integration	CO2
5	Solutions of differential equations	CO3
6	Applications of differential equations	CO3
7	Numerical Differentiation techniques	CO4
8	Numerical Integration techniques	CO4
9	Laplace Transform and its properties	CO3
10	Inverse Laplace Transform and its applications	CO3
11	Discrete Probability Distributions	CO5
12	Continuous Probability Distributions	CO5
Total Tutorial Sessions		15
Total Tutorial Hours		15

Text Books:

1. Kapur, J. N. (2015). Mathematical modelling. New Age International.
2. Grewal, B. S. (2022). Higher engineering mathematics. Khanna Publishers.
3. Sastry, S. S. (2023). Introductory methods of numerical analysis (6th ed.). PHI Learning.


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References:

1. Anderson, J. D. (2017). Introduction to flight (9th ed.). McGraw-Hill Education.
2. Devore, J. L. (2019). Probability and statistics for engineering and the sciences (10th ed.). Cengage Learning.
3. Rao, S. S. (2019). Engineering optimization: Theory and practice (5th ed.). New Age International / Wiley India.
4. Dr. B. S. Grewal, Higher Engineering Mathematics, 45th Khanna Publication, 2022.
5. H. K. Das, Advanced Engineering Mathematics, 24th Edition, S. Chand, 2022.

Online Learning Resources

1. NPTEL – Mathematical Modelling (IIT Guwahati) - <https://nptel.ac.in/courses/109103140>
2. MIT OpenCourseWare – Introduction to Modelling and Simulation - <https://ocw.mit.edu>
3. <https://www.youtube.com/watch?v=ZurvUcEPUFA> (Unit-III)
4. https://www.youtube.com/watch?v=n9XP6pljtw8&list=PLbRMhDVUMngfsMNuiGSQQuNwPevZukOY_ (Unit: V)
5. <https://www.youtube.com/playlist?list=PLbRMhDVUMngfIrZCNOyPZwHUU1pP66vQW> (Unit-II, Lecture No. 36 – 43)

Experiments that may be performed through virtual labs

1. <https://www.geogebra.org/>


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**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - III					Category	PC	
Course Code, Course Title:	3AEPC202, Solid Mechanics					Type	LIT1	
Prerequisites	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	50

Course Outcomes (COs) :

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

CO1	Explain the properties, applications, and microstructures of aerospace materials using observations from metallographic preparation and hardness testing.
CO2	Interpret stresses, strains, elastic constants, and safety factors under axial and thermal loading by relating them to results from tensile and compression tests.
CO3	Construct shear force and bending moment diagrams, and stress distribution in symmetric and composite beam sections.
CO4	Apply beam deflection methods, torsional analysis, and the principle of superposition to analyze structural members.
CO5	Determine principal stresses and predict material failure under different loading conditions using appropriate failure theories.

Syllabus:

Module	Contents	Lecture Hours
I	Aerospace Materials: Fabrication, Microstructure, and Hardness Testing: Steel and its types with properties & application - Aluminium and its alloys with properties & application - Magnesium and its alloys with properties & application - Titanium and its alloys with properties & application - Material fabrication for microstructure inspection - Introduction to hardness testing and its types.	04
II	Axial Loading and Material Modulus: Concept of stress and strain & its types - Elastic constants and its types - Relation between elastic constants - Stresses in the bars - Thermal stress - Factor of safety.	05
III	Transverse Loading on Beams and Stresses in Beam: Shear force and Bending moment of beams - Theory of pure bending - Bending stress and shear stress distribution of symmetrical cross sections - Bending & Shear stress on Simple beams	06

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IV	Bending Deflection and Torsional Twist in Structural Members: Deflection of beam using Double integration method - Macaulay's method - Strain energy and Castigliano's theorem. Shear stress and angle of twist in the shaft of uniform and varying cross section.	05
V	Stress Transformation in Materials and Pressure Vessels: Principal Plane and Stresses - Stresses on oblique sections of the body - Mohr's circle and its construction for different cases - Stresses in thin-walled pressure vessels.	06
VI	Theories of Failure: Ductile and Brittle materials - Maximum principal stress theory - Maximum principal strain theory - Maximum Shear stress theory - Maximum strain energy theory - Maximum shear strain energy theory - Introduction to Fracture Mechanics & Creep.	04
Total Lecture Hours		30

List of Tutorials with CO Mapping:

S. No.	Title of Tutorial	CO Mapped
1.	Resolution of forces, moment. Centroid and Moment of Inertia	CO3 & CO4
2.	Application of metallic materials in Aircraft parts or components	CO1
3.	Stresses in the bars of composite system	CO2
4.	Thermal stress in composite bar	CO2
5.	Shear force and bending moments on inclined loads	CO3
6.	Bending stress on the composite section.	CO3
7.	Deflection of beam when subjected to moment	CO4
8.	Solid and Hollow shaft	CO4
9.	Mohr's circle	CO4
10.	Stresses in thin Spherical shells	CO4
11.	Application-Focused Design Problem	CO5
12.	Fatigue and Stress relaxation	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	Microstructural inspection using a metallurgical microscope	CO1
2	Brinell Hardness Testing.	CO1
3	Rockwell Hardness Testing	CO1
4	Tensile test on Ductile materials	CO2
5	Impact Testing	CO4
6	Principle of Superposition theorem	CO4
7	Deflection of a cantilever beam with a load at the midpoint & eccentric loading	CO4
8	Deflection of a Simply Supported beam with load at the midpoint & eccentric loading	CO4
9	Torsion test on the shaft	CO4, CO5
10	Tension and Compression test on springs	CO2
Total Practical Sessions		15
Total Practical Hours		30

Text Books:

1. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2017
2. R.S. Khurmi, "Strength of Materials", S. Chand & Company Ltd., 2021
3. R.K. Rajput, "A Textbook of Strength of Materials", S. Chand & Company Ltd., 2022

References:

1. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2018.
2. T H G Megson, "Aircraft Structures for Engineering Students", Elsevier, 6th Edition, 2021.

Online Learning Resources

1. Mechanics of Solids by Prof. Priyanka Ghosh, IIT Kanpur - Swayam
<https://nptel.ac.in/courses/105104160>

Experiments that may be performed through virtual labs

1. Tensile testing- <https://vlae-iitk.vlabs.ac.in/str1/ap.html>

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Course Information:

Class, Semester	S.Y. B.Tech, Semester - III					Category	PC	
Course Code, Course Title:	3AEPC203, Fluid Mechanics					Type	LIT1	
Prerequisites	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	50

Course Outcomes (COs) :

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

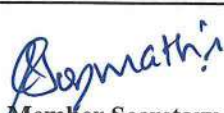
CO1	Explain the pressure, buoyancy, and hydrostatic forces for fluid systems and manometers using the principles of fluid statics with correct engineering applications.
CO2	Determine velocity, acceleration, and vorticity for given flow fields using fluid kinematics principles with accurate mathematical formulation.
CO3	Solve flow measurement and model analysis problems using conservation laws, Bernoulli's equation, and dimensional analysis with appropriate engineering assumptions.
CO4	Apply pipe flow principles to determine head losses in laminar and turbulent pipe flow systems using the Darcy-Weisbach equation, Hagen-Poiseuille equation, and friction factor correlations with correct engineering calculations and interpretation of results.
CO5	Assess the performance of reciprocating and centrifugal pumps using velocity triangle analysis under specified operating conditions with appropriate performance evaluation.
CO6	Design impulse and reaction turbines using velocity triangles to satisfy specified hydraulic operating conditions

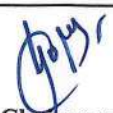
Syllabus:

Module	Contents	Lecture Hours
I	Fluid Statics: Introduction - Continuum mechanics, Fluid Properties; Pressure and its Measurements- Pascal Law and its application, Simple and Differential manometer; Buoyancy and Hydrostatic forces.	05
II	Flow kinematics: Introduction- Eulerian and Lagrangian approach, Fluid flow types and its patterns; Conservation of mass, Substantial Derivative, Velocity and Acceleration fields; Flow deformations: translation, linear and angular deformation; Rotation and vorticity concepts and vortex flow.	05
III	Flow Dynamics: Introduction – Forces acting on fluid flow, Conservation of Momentum; Conservation of Energy and Bernoulli's equation; Flow measurement techniques – venturimeter, orificemeter and visualization	05


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	(application streakline, streamline); Dimensional analysis- Dimensional homogeneity, Unit conversion ratio, Rayleigh's and Buckingham's method; Model analysis – similarity laws or model laws;	
IV	Flow through conduits: Introduction- Laminar and Turbulent flows, relation between shear and pressure gradient; Laminar flow in circular pipes- Hagen-Poiseuille equations; Flow between parallel plates- Couette Flow; Turbulent flow in pipes; Energy losses in the pipe flow – Major and Minor losses;	05
V	Pumps: Introduction; Reciprocating Pumps- types and working principles; Centrifugal pumps- working principle, heads efficiencies; Velocity triangle- work done;	05
VI	Turbines: Introduction- Impact of jets; types of hydropower plants; Impulse turbine- Pelton wheel, velocity triangle and work done; Reaction turbines- Kaplan and Francis turbines, velocity triangle and work done;	05
Total Lecture Hours		30

List of Tutorials with CO Mapping:

S. No.	Title of Tutorial	CO Mapped
1.	Numerical problems on pressure measurement using simple and differential manometers	CO1
2.	Problems on buoyancy, stability of floating bodies, and hydrostatic force on submerged surfaces	CO1
3.	Numerical problems on velocity and acceleration fields using substantial derivative	CO2
4.	Conceptual and numerical problems on vorticity, circulation, and vortex flow	CO2
5.	Numerical problems using Bernoulli's equation and flow measurement devices (Venturimeter, Orifice meter)	CO3
6.	Dimensional analysis and model analysis problems using Buckingham π -theorem and similarity laws	CO3
7.	Numerical problems on laminar flow in pipes and Couette flow	CO4
8.	Problems on head loss in pipes including major and minor losses in pipe networks	CO4
9.	Numerical problems on performance of centrifugal pumps (head, efficiency, power, velocity triangles)	CO5
10.	Conceptual and numerical problems on reciprocating pumps (slip, indicator diagram, acceleration head)	CO5
11.	Numerical problems on Pelton wheel turbine (velocity triangles, work done, efficiency)	CO6
12.	Numerical problems on Francis/Kaplan turbines (velocity triangles, power, efficiency)	CO6
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.	Determination of head loss and discharge of the water using volumetric method.	CO1
2.	Demonstration of laminar and turbulent flows using Reynolds' apparatus	CO4
3.	Verification of Bernoulli's theorem	CO3
4.	Determination of major losses in the given set of pipes	CO4
5.	Determination of minor losses in the given set of pipes	CO4
6.	Determination of Coefficient of discharge of Venturimeter and Orifice meter	CO1
7.	Performance Characteristics of Centrifugal pump	CO5
8.	Performance Characteristics of Reciprocating pump	CO5
9.	Performance Characteristics of Pelton Wheel turbine	CO6
10.	Performance Characteristics of Kaplan turbine	CO6
Total Practical Sessions		15
Total Practical Hours		30

Text Books:

1. Yunus A. Cengel and John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw-Hill Education, 4th Edition, 2018.

References:

1. Streeter, V.L., Wylie, E.B. and Bedford, K.W., Fluid Mechanics, McGraw-Hill Education, 9th Edition, 2017.
2. White, F.M., Fluid Mechanics, McGraw-Hill Education, 9th Edition, 2021.

Online Learning Resources

1. NPTEL – Fluid Mechanics by IIT Professors, <https://nptel.ac.in/courses/112>
2. MIT OpenCourseWare – Fluid Mechanics, <https://ocw.mit.edu>
3. LearnChemE (University of Colorado) – Interactive Fluid Mechanics Simulations, <https://www.learncheme.com>

Experiments that may be performed through virtual labs

1. Virtual Labs Portal: <https://www.vlab.co.in>
2. <https://aero-iitkgp.vlabs.ac.in/exp/verification-bernoullis-equation/simulation.html>
3. <https://fm-iitk.vlabs.ac.in/exp/pelton-wheel/simulation.html>


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Course Information:								
Class, Semester	S.Y. B.Tech, Semester - III					Category	PC	
Course Code, Course Title:	3AEPC204, Applied Thermodynamics & Heat Transfer					Type	LIT2	
Prerequisites	3AEES104 - Basic Mechanical 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	-
Course Outcomes (COs) : Upon successful completion of this course, the student will be able to:								
CO1	Explain the fundamental principles of thermodynamics and heat transfer using appropriate engineering concepts and property relations.							
CO2	Apply thermodynamic principles and energy balance equations to solve engineering problems involving thermal systems under specified operating conditions.							
CO3	Analyze the behavior and efficiency of thermal systems using the Second Law of Thermodynamics, entropy, and exergy principles.							
CO4	Implement the governing laws of conduction, convection, and radiation to determine heat transfer characteristics in engineering systems.							
CO5	Utilize appropriate analytical methods to assess the performance of heat exchangers and related thermal systems for engineering applications.							

Syllabus:

Module	Contents	Lecture Hours
I	Fundamentals of Thermodynamics: Thermodynamic systems, properties, state and equilibrium, processes and cycles, temperature concepts, Zeroth Law of Thermodynamics, pure substances, ideal gas behavior.	05
II	First Law of Thermodynamics for Engineering Systems: Heat and work interactions, energy balance for closed and open systems, steady-flow energy equation: turbines, compressors, pumps, boilers, nozzles, diffusers, heat exchangers, mass conservation, efficiency.	05
III	Second Law, Entropy and Exergy: Second Law statements, heat engines, refrigerators, heat pumps, Carnot limits, entropy, Clausius inequality, entropy change for substances and ideal gases, exergy, reversible work, irreversibility, exergy balance.	05


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IV	Heat Conduction: Fourier's law, thermal conductivity, steady-state conduction, thermal resistance concept, insulation, transient conduction, lumped system analysis, infinite and semi-infinite solids, extended surfaces (fins), fin efficiency and effectiveness	05
V	Convection and Thermal Radiation: Free and forced convection, thermal boundary layer concepts, boiling and condensation fundamentals, radiation laws, radiation properties, blackbody concept, emissivity	05
VI	Heat Exchangers and Applications: Heat exchanger types, construction and applications, LMTD method and correction factors, NTU-effectiveness method, HVAC concepts, heat exchanger positioning and placement	05
Total Lecture Hours		30

List of Tutorials with CO Mapping:

S. No.	Title of Tutorial	CO Mapped
1	Systems, State, and Properties	CO1
2	Processes, Cycles, and the Zeroth Law	CO1
3	First Law for Closed Systems	CO2
4	Energy Equation for Steady-Flow Devices	CO2
5	Second Law and Carnot Efficiency	CO3
6	Entropy and Exergy Analysis	CO3
7	1D Steady-State Conduction	CO4
8	Transient Conduction and Fins	CO4
9	Convection Fundamentals	CO4
10	Radiation Heat Transfer	CO4
11	LMTD Method for Heat Exchangers	CO5
12	NTU-Effectiveness Method for Heat Exchangers	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	Experimental Verification of Boyle's Law Using IC Engine	CO1


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2	Measurement of Valve timing diagram of four-stroke diesel engine	CO2
3	Measurement of Flash and fire point of a given fuel	CO2
4	Measurement of Calorific Value of solid fuel.	CO2
5	Performance Measurement of a Refrigeration System	CO3
6	Performance measurement of Diesel engine	CO2
7	Measurement of thermal conductivity of a metal rod	CO4
8	Measurement of Performance of Parallel-flow Heat Exchanger	CO5
9	Measurement of Performance of Counter-flow Heat Exchanger	CO5
10	Measurement of Thermal conductivity of a composite wall	CO4
Total Practical Sessions		15
Total Practical Hours		30

Text Books:

1. Nag, P. K. (2023). Engineering Thermodynamics (7th ed.). New Delhi, India: McGraw Hill Education.
2. Çengel, Y. A., & Boles, M. A. (2019). Thermodynamics: An Engineering Approach (9th ed.). New York, NY: McGraw-Hill Education.
3. Incropera, F. P., DeWitt, D. P., Bergman, T. L., & Lavine, A. S. (2020). Fundamentals of Heat and Mass Transfer (8th ed.). Hoboken, NJ: John Wiley & Sons.
4. Holman, J. P. (2020). Heat Transfer (11th ed.). New York, NY: McGraw-Hill Education.

References:

1. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. B. (2018). Fundamentals of Engineering Thermodynamics (9th ed.). Hoboken, NJ: John Wiley & Sons.
2. Incropera, F. P., DeWitt, D. P., Bergman, T. L., & Lavine, A. S. (2020). Fundamentals of Heat and Mass Transfer (8th ed.). Hoboken, NJ: John Wiley & Sons.

Online Learning Resources

1. S. K. Som (IIT Kharagpur) – Basic Thermodynamics (YouTube playlist)
Comprehensive lecture series covering zeroth law, first law, second law, ideal gas behavior, entropy, and related fundamentals, presented by Prof. S. K. Som.
YouTubeLink: <https://www.youtube.com/playlist?list=PLD8E646BAB3366BC8>
2. S. P. Sukhatme & U. N. Gaitonde (IIT Bombay) – Heat and Mass Transfer (YouTube playlist)
Comprehensive lecture series covering conduction, convection, radiation, extended surfaces, and related fundamentals, presented by Prof. S. P. Sukhatme and Prof. U. N. Gaitonde.
YouTubeLink: <https://www.youtube.com/playlist?list=PL5F4F46C1983C6785>

Experiments that may be performed through virtual labs

1. Thermal Conductivity of Metal Rod (Equivalent)-Lee's Disc Apparatus (Virtual Lab)

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2. Thermal Conductivity of Composite Wall (Equivalent)- Heat Transfer by Conduction (Virtual Lab)

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**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - III					Category	PC	
Course Code, Course Title:	3AEPC205, Introduction to Aeronautical Engineering					Type	L2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	1	-	2		1	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	Calculate pressure altitude and density altitude using ISA tables and measured atmospheric data, compared to standard ISA values.
CO2	Identify airfoil terminology, NACA codes, aircraft parts and structural elements using models, posters, technical diagrams or manuals.
CO3	Classify aerodynamic phenomena including lift, drag types, flow separation, and control-surface effects—from demonstration-based observations.
CO4	Analyse major components and flow paths of hydraulic, fuel, electrical, landing gear, braking and propulsion systems using schematics and trainer models.
CO5	Interpret indications and functions of primary flight instruments and navigation systems from simulator screens and panel mock-ups.

Syllabus:

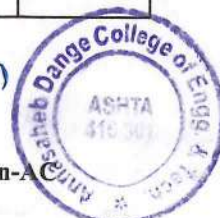
Module	Contents	Lecture Hours
I	Standard Atmosphere: Standard atmosphere - pressure, temperature, and density altitude	02
II	Anatomy of an Aircraft: NACA Nomenclature, Airfoil and its terminologies, Anatomy of an aircraft, Aircraft types	02
III	Aerodynamics: Aerodynamic lift, Viscous and pressure drag, flow separation, aerodynamic drag, Moment, induced drag, aerodynamic center, Center of Pressure, Pressure distribution, lift slope	03
IV	Propulsion: Airbreathing- IC Engines & Gas turbine Engines, RAM & SCRAM, Non Air Breathing-Rocket Engines	03

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V	Aircraft Structures: Monocoque and Semi-monocoque constructions - Load acting on Aircraft structures - Wing, Fuselage, Landing gear structure	03
VI	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.	02
Total Lecture Hours		15

List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment	CO Mapped
1	Study of Standard Atmosphere & ISA Tables	CO1
2	Measurement of Pressure Altitude & Density Altitude	CO1
3	Identification of Airfoil Terminology & NACA Nomenclature	CO2
4	Anatomy of an Aircraft	CO2
5	Study of Primary & Secondary Flight Control Surfaces, and Flow Behaviour Visualisation	CO3
6	Study of Aircraft Hydraulic System	CO4
7	Study of Aircraft Landing Gear and Braking System	CO4
8	Study of Aircraft Fuel System	CO4
9	Study of Aircraft Electrical Power System	CO4
10	Study of Piston Engine Components (Disassembly & Assembly)	CO4
11	Study of Gas Turbine Engine Components (Cut-section)	CO4
12	Study of Aircraft Structural Elements (Wing, Fuselage, LG)	CO2
13	Study of Basic Flight & Navigation Instruments	CO5
Total Practical Session		15
Total practical Hours		30

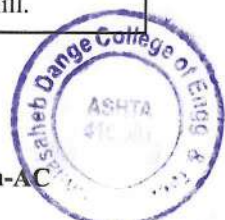
Text Books:

1. Anderson, J. D. (2021). Introduction to flight (10th ed.). McGraw-Hill Education.
2. Kermode, A. C. (2012). Mechanics of flight (12th ed.). Pearson Education.
3. Houghton, E. L., & Carpenter, P. W. (2021). Aerodynamics for engineering students (8th ed.). Butterworth-Heinemann.
4. Gupta, S. C. (2017). Fundamentals of aerodynamics. New Age International Publishers.
5. Newman, S. (2018). The foundations of aerodynamics: Bases of aerodynamic design (6th ed.). McGraw-Hill.


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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. NASA Glenn Research Center. (2023). Beginner's guide to aeronautics. <https://www.grc.nasa.gov/www/k-12/airplane>
2. NPTEL. (2023). Introduction to aerospace engineering (IIT Kanpur). <https://nptel.ac.in/courses/101104018>
3. MIT OpenCourseWare. (2023). Introduction to aerodynamics (Course 16.100). <https://ocw.mit.edu>
4. Federal Aviation Administration. (2023). Aviation maintenance technician handbooks. https://www.faa.gov/regulations_policies/handbooks_manuals
5. Coursera. (2023). Introduction to aerospace engineering (University of Toronto). <https://www.coursera.org/learn/airplane-design>

Experiments that may be performed through virtual labs

1. Flow past a airfoil / wing using flow visualization

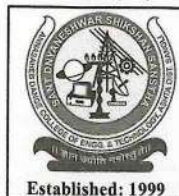

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**Course Information:**

Class, Semester	S.Y. (B.Tech), Semester - III					Category	VS	
Course Code, Course Title:	3AEVS206, Parametric Modelling and Assembly					Type	L2	
Prerequisites	3AEES103, Engineering Graphics							
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	Explain the core elements of the CAD workspace and interpret the use of essential navigation and sketch-defining tools.
CO2	Apply suitable sketching constraints and modelling features to develop fundamental and supplementary aircraft component geometries.
CO3	Utilize imported airfoil profiles and appropriate CAD workflows to generate aerodynamically relevant component models.
CO4	Examine the interaction of aircraft components within an assembly by employing mating techniques, exploded representations, and basic motion analyses.
CO5	Prepare structured engineering drawings for aircraft components and assemblies using standardized drafting practices.

List of Experiments with CO Mapping:

S. No.	Title/Topic of the Experiment	CO Mapped
1	Exploring the CAD interface and mastering essential navigation tools.	CO1
2	Creating fully defined technical sketches using geometric constraints.	CO2
3	Exploring sketched and applied features to create CAD models.	CO2
4	Importing airfoil profile to build appropriate aircraft components.	CO3
5	Creation of essential aircraft components by leveraging the CAD tools.	CO2
6	Creation of supplementary aircraft models employing CAD workflows.	CO3
7	Utilising the mates concept for the assembly of the 3D aircraft models.	CO4

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8	Exploded view and Motion study of the assembled aircraft component.	CO4
9	Producing professional engineering drawings with standardized annotations.	CO5
10	Comprehensive CAD modelling of any major aircraft system.	CO5
Total Practical Sessions		15
Total Practical Hours		30

Text Books:

1. Engineering Design Graphics with CAD Applications, James D. Bethune, 15th Edition, Pearson, 2022.
2. Engineering Graphics and Design Using SolidWorks, David A. Planchard, 2023 Edition, SDC Publications, 2023.

References:

1. Engineering Design Graphics with CAD Applications, James M. Leake & Jacobson, 6th Edition, Wiley, 2022.
2. Solid Modeling and Applications: Rapid Prototyping, CAD and CAE Theory, Edward J. Haug, 3rd Edition, Springer, 2021.
3. Engineering Drawing and Design, David A. Madsen & David P. Madsen, 9th Edition, Cengage Learning, 2023.
4. Mastering SolidWorks, Ibrahim Zeid & Serope Kalpakjian, 2nd Edition, Pearson, 2020.

Online Learning Resources

1. Computer Aided Design, Prof. Sajan Kapil & Prof. Samit Bhattacharya, Indian Institute of Technology Guwahati, <https://www.coursera.org/learn/computer-aided-design>
2. How to CAD Almost Anything, MIT AeroAstro, MIT, <https://ocw.mit.edu/courses/res-16-002-how-to-cad-almost-anything-january-iap-2024/>
3. SOLIDWORKS CAD Fundamentals, Dassault Systèmes / edX, edX (MITx), <https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals>

Experiments that may be performed through virtual labs

S. No.	Experiment Name	Experiment Link
1.	CAD/CAM based Part Programming and operation of a 3-axis CNC Milling Machine	https://vlabs.iitkgp.ac.in/cim/

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**Course Information:**

Class, Semester	S.Y. B.Tech, Semester - III					Category	HS	
Course Code, Course Title:	3AEHS207, Environment Studies					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	Explain environmental systems, population dynamics, natural resources, and sustainability concepts.
CO2	Explain the Sustainable Development Goals (SDGs) and their significance in engineering for sustainable development.
CO3	Apply pollution concepts to identify sources, impacts, and suitable control measures for air, water, soil, and noise pollution.
CO4	Apply principles of climate change mitigation and adaptation, renewable energy, waste management, and environmental governance to recommend sustainable engineering practices.

Syllabus:

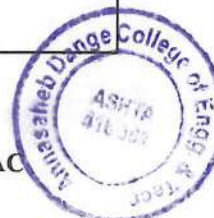
Module	Contents	Lecture Hours
I	Environmental Systems, Population and Resource Use: Components of environment and earth systems; Population growth, urbanization and industrialization; Natural resources – water, land and minerals; Resource depletion, carrying capacity and environmental stress; Human–environment interactions and sustainability challenges	05
II	Ecology, Biodiversity and Climate Change: Basic ecological concepts; Ecosystem structure and functions; Biodiversity and ecosystem services; Man-engineered ecosystem, Greenhouse effect and scientific basis of climate change; Climate impacts, mitigation and adaptation concepts.	05
III	Pollution Science and Environmental Quality: Air pollution: sources, impacts and control overview; Water pollution: indicators, standards, reuse and recycling; Soil pollution: contamination sources and remediation concepts; Noise pollution: sources, impacts and mitigation approaches	05
IV	Waste Management and Resource Conservation: Solid waste management; Municipal and industrial waste management; Waste minimization and segregation; Water conservation practices; Resource efficiency concepts; Environmental stewardship and sustainable consumption	05

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V	Environmental Governance and Ethics: Environmental policies and legislation; Environmental standards and regulatory framework; Environmental ethics; Professional responsibilities of engineers; Environmental issues and case studies.	05
VI	Sustainable Development Goals and Engineering Responsibility: Concept and evolution of sustainable development; Overview of SDGs and key targets; Interlinkages among SDGs; Engineering-relevant SDGs; Water-energy-food-climate nexus; Role of engineers in achieving SDGs	05
Total Lecture Hours		30

Text Books:

1. Singh, J. S., Singh, S. P., Gupta, S. R., and Singh, R. Ecology, Environmental Science and Conservation. 2nd Edition. S. Chand Publishing, 2025.
2. Bharucha, E. Environmental Studies for Undergraduate Courses. 4th Edition. Universities Press (India) Pvt. Ltd. 2025.
3. Cunningham, W.P., & Cunningham, M.A., Environmental Science: A Global Concern, 15th Edition, McGraw-Hill Education, New Delhi, 2020.
4. Rathoure, V.C., Fundamentals of Environmental Studies, 2nd Edition, Tata McGraw-Hill Education, New Delhi, 2019.
5. Singh, J.S., & Singh, S.P., Environmental Science: An Integrated Approach, 5th Edition, Jones & Bartlett Learning, 2019.
6. Kaushik, A., & Kaushik, C.P., Perspectives in Environmental Studies, 5th Edition, New Age International Publishers, New Delhi, 2018.

Reference Books:

1. Trivedi, R.K., & Goel, P.K., An Introduction to Environmental Biology, 1st Edition, University Book House, Jaipur, 2018.
2. Odum, E.P., Fundamentals of Ecology, 5th Edition, Cengage Learning, 2017.
3. Dash, M.C., Fundamentals of Ecology, 4th Edition, McGraw-Hill Education, New Delhi, 2016.

Online Learning Resources

1. <https://www.youtube.com/watch?v=MtpxOdtS9KU&list=PL3qvHcrYGylu2egw2tipHWODV6elVC2Gg>
2. <https://niti.gov.in/divisions/division/sustainable-development-goal>
3. <https://sdgs.un.org/goals>
4. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_de04


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Course Information:

Class, Semester	S.Y. (B.Tech), Semester - III					Category	HS	
Course Code, Course Title:	3AEHS208, Universal Human Values					Type	T2	
Prerequisites	-							
Teaching Scheme (Per Week)	Lecture	Tutorial	Practical		Self Study	Credits		
	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	Explain the concept, significance, and need of Universal Human Values and their role in achieving harmony in personal, social, and professional life.
CO2	Apply the principles of harmony, social responsibility, and environmental sustainability in day-to-day life and professional situations.
CO3	Classify ethical issues in engineering, society, and emerging technologies using ethical principles and professional guidelines.
CO4	Demonstrate value-based behaviour and ethical decision-making for personal growth and professional practice through self-reflection and case-based situations.

Syllabus:

Module	Contents	Lecture Hours
I	Evolution and Need of Universal Human Values: Meaning and concept of Universal Human Values, Historical evolution of value systems, Impact of Industrial Revolution on society and lifestyle, Consequences of World War II and global conflicts, Emergence of global value frameworks, Role of United Nations and UNESCO, Introduction of UHV in Indian education system by AICTE, Present-day challenges: stress, lack of purpose, environmental issues	05
II	Understanding the Human Being: Human being as a combination of self and body, Distinction between self (consciousness) and body (physical entity), Needs of self vs needs of body, Happiness vs physical pleasure, Harmony in the self (thoughts, feelings, actions), Self-exploration and self-awareness	05
III	Harmony in Relationships: Meaning and importance of relationships, Values in relationships (Trust, Respect, Affection, Care, Guidance, Reverence, Love), Mutual fulfillment in relationships, Role of family in value development, Interpersonal conflicts and resolution, Relationship in professional environment	05

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IV	Harmony in Society and Nature: Individual → Family → Society → Nation → World, Concept of undivided society, Social harmony and responsibility, Coexistence in nature, Human-nature relationship, Environmental degradation and its causes, Sustainable living and resource utilization, Local and global environmental issues	05
V	Universal Human Values in Engineering and Technology: Professional ethics in engineering, Role of engineers in society, Guidelines by IEEE, Ethical issues in modern technology, Role of institutions like OpenAI, Core Framework to Assess Values: Self-Reflection Model, Value-Action Gap Model, Emotional Intelligence (EQ) Framework (The Nine Values (Bhavas) Assessment Model)	05
VI	Application of UHV in Personal and Professional Life: Self-reflection and personal development, Value-based decision making, Goal setting with values, Fulfilling Basic Human Aspirations, Application of UHV in career and workplace, Development of holistic and responsible lifestyle, Core Framework to Assess Values: Emotional Intelligence (EQ) Framework, (Human-AI Value Alignment) Ikigai Model	05
Total Lecture Hours		30

Text Books:

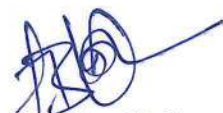
1. Human Values and Professional Ethics: R. R. Gaur, R. Sangal, G. P. Bagaria, Excel Books, New Delhi, 2010
2. Engineering Ethics: Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2013
3. Understanding Human Being, Nature and Existence Comprehensively: UHV Team, UHV, 2022.
4. Life 3.0, Max Tegmark, Knopf, 2017

References:

1. AICTE Universal Human Values Course Material, 2017 onwards
2. IEEE Code of Ethics
3. Engineering Ethics: Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2013

Online Learning Resources

1. TED Talks on ethics, happiness, human behaviour
2. NPTEL Courses on UHV and Engineering Ethics
3. MIT: AI Ethics lectures (OpenCourseWare)


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**Course Information:**

Class, Semester	S.Y. (B.Tech), Semester - III					Category	HS	
Course Code, Course Title:	3AEHS209, Indian Constitution					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	Describe the evolution and salient features of the Indian Constitution using the Government of India Acts of 1935 and 1947.
CO2	Illustrate the philosophy of the Indian Constitution using the Preamble, Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy.
CO3	Explain the constitutional amendment process, principles of the Basic Structure, and emergency provisions under the Indian Constitution.
CO4	Summarize the structure and functioning of the Union and State Governments using the parliamentary and legislative systems.

Syllabus:

Module	Contents	Lecture Hours
I	Constitution: Basic Structure & Making of Constitution: Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution, Preamble.	04
II	Fundamental Rights & Fundamental Duties Fundamental Rights – Features and characteristics, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles-Definition and Meaning, 42nd Constitutional Amendment Act, List and Importance of Fundamental Duties.	06
III	Amendments of Constitution and Emergency Provisions: Meaning and need of Constitutional Amendments, Procedure of Amendment under Article 368, Types of Amendments, Important Constitutional Amendments (42nd, 44th, 73rd, 74th, 86th and 101st Amendments), Basic Structure Doctrine.	03

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	Emergency Provisions – Meaning and Objectives, National Emergency (Article 352), State Emergency/President's Rule (Article 356), Financial Emergency (Article 360), Effects of Emergency on Fundamental Rights and Centre-State Relations, Safeguards introduced by 44th Constitutional Amendment.	
IV	Government of The Union and States: President of India – Election and Powers, Prime Minister of India - Election and Powers, Lok Sabha - Structure, Rajyasabha – Structure, Governor of State, Chief Minister and Council of Ministers in a state.	02
Total Lecture Hours		15

Text Books:

1. M. Laxmikanth, Indian Polity, 7th Edition, McGraw Hill Publications Delhi, 2023.
2. P. M. Bakshi, The Constitution of India, 19th Edition, Lexis Nexis, 2023.
3. Durga Das Basu, Introduction to the Constitution of India, 26th Edition, Lexis Nexis, 2022.
4. M. Laxmikanth, Governance in India, 3rd Edition, McGraw Hill Publications Delhi, 2021.
5. J. N. Pandey, The Constitutional Law of India, 59th Edition, Allahabad: Central Law Agency, 2022.

References:

1. V. N. Shukla, Constitution of India, 14th Edition, EBC, 2022.
2. V. N. Tripathi, Constitution of India, 9th Edition, Premier Publishing Company, 2021.
3. M. V. Pylee, India's Constitution, 18th Edition, S. Chand Publications, New Delhi, 2020.

Online Learning Resources

1. <https://legislative.gov.in/constitution-of-india/>
2. https://onlinecourses.nptel.ac.in/noc23_lw03/preview

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**Course Information:**

Class, Semester	S.Y. (B.Tech), Semester - III					Category	MA	
Course Code, Course Title:	3AEMA210, Aptitude and Reasoning - I					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:

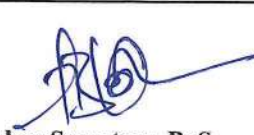
CO1	Solve problems based on HCF & LCM, Vedic Math, Ages
CO2	Solve problems based on Number Series, Alphabet Series (Quant), Percentage
CO3	Solve problems based on Profit & Loss, Coding-Decoding, Cubes & Dice
CO4	Apply SWOT Analysis Engineering Ecosystem Email writing, Essay writing Logical Thinking Basics for personality development

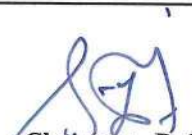
Syllabus:

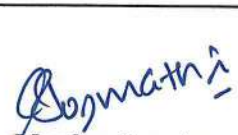
Module	Contents	Lecture Hours
I	HCF & LCM, Vedic Math	04
II	Number Series, Alphabet Series (Quant), Percentage	04
III	Profit & Loss Coding-Decoding	04
IV	Cubes & Dice SWOT Analysis	04
V	Introduction to Engineering Ecosystem Ages	04
VI	Email writing, Essay writing, Logical Thinking Basics	04
Total Lecture Hours		24

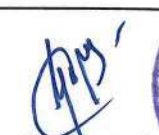
Text Books:

- 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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