M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: B.Tech. in Aerospace Engineering

Programme Code: 012

Programme Outcome (PO)
Programme Specific Outcome (PSO)
Program Educational Objectives (PEO)
Course Outcomes (CO)

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Bangalore-560058

Registrar
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Approved in 23rd ACM (Resolution 23.05) held on 15th July 2021

Faculty of Engineering and Technology (FET)

Programme Name: B.Tech. (Aerospace Engineering)

Programme Outcomes (POs)

B. Tech. graduates will be able to:

PO-1. Apply knowledge of mathematics, science, basic engineering fundamentals and engineering specialization concerned for the solution of complex engineering problems

PO-2. Identify, formulate and analyze engineering problems using first principles of mathematics, science and engineering to interpret data and reach substantiated conclusions

PO-3. Provide solutions to engineering problems by designing systems, components or processes to meet the specified needs considering public health, safety, societal andthe environmental considerations

PO-4. Apply the knowledge of laboratory techniques and research methods to solve complex engineering problems through experimental investigations, analysis and interpretation of results

PO-5. Gain proficiency in modelling complex engineering activities by selecting appropriate techniques and IT Tools and utilize available resources effectively

PO-6. Understand the effect of engineering solutions on legal, cultural, social, public healthand safety aspects and the consequent responsibilities

PO-7. Develop sustainable engineering solutions and assess their effect on society and environment

PO-8. Understand and apply ethical principles to engineering practices and professional responsibilities

PO-9. Function effectively as an individual or a team player to handle diverse problems inmulti-disciplinary settings

PO-10. Make oral and written presentations to communicate technical ideas effectively to engineering community and society at large

PO-11. Apply the knowledge of engineering and management principles to manage projectsin multi-disciplinary environments with consideration to cost and time

PO-12. Recognize and engage in lifelong learning to adapt to changing needs and advancements in technology

Programme Specific Outcomes (PSOs)

At the end of the B. Tech. (Aerospace Engineering) program, the graduate will be able to:

PSO-1. Apply the knowledge in aerospace domain including Aerodynamics, Propulsion, Structures, Flight Mechanics, CFD, Composite Materials, Drones, Machine Learning and artificial Intelligence technologies to develop efficient solutions for complex problems in aerospace engineering and allied areas

PSO-2. Design and develop the sustainable solutions using aerospace engineering principles, concepts, experimentation and appropriate tools to address industry and societal requirements

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PSO-3. Demonstrate ethics, leadership qualities, communication, entrepreneurial skills and involvement in lifelong learning for betterment of organization, environment and society.

Program Educational Objectives (PEOs)

The Programme educational objectives of the B. Tech. (Aerospace Engineering) Programme are:

PEO-1. To provide students with knowledge in mathematics, science and core engineering area to enable them to deliver efficient solutions for complex engineering problemsusing analytical and cognitive skills

PEO-2. To enable students to design and develop the sustainable innovative solutions for industry and societal requirements by conducting engineering investigations through experimentation and usage of modern tools.

PEO-3. To inculcate ethics, communication, leadership, soft, managerial and entrepreneurial skills for successful career in industries and to engage in lifelong learning

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 1 (MTB101A)

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

CO-1. State and discuss basic concepts related to single, two variable calculus and matrix algebra
CO-2. Perform basic operations of matrix algebra and apply them to solve systems of linear equations
CO-3. Solve simple mathematical problems associated with linear algebra, single and two variable calculus
CO-4. Demonstrate competence with the basic ideas of linear systems, independence, bases and dimension, linear transformations, eigenvalues, eigenvectors and diagonalization
CO-5. Solve complex real-world problems associated with linear algebra, single and two variable calculus

Course Outcomes (COs)

Course Title & Code: Engineering Physics and Laboratory (PYB102A)

CO-1. State, explain the concepts of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
CO-2. Derive standard relationships in mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser & fiber optics, and interpret them
CO-3. Discuss the applications of mechanics, electrical conductivity, quantum mechanics, crystal structure and material science, laser and fiber optics
CO-4. Solve problems in mechanics, electrical conductivity, quantum mechanics, crystal structure, material science, laser and fiber optics
CO-5. Plan the experimental set-up, conduct experiments, calculate and plot the graphs to obtain the results and write a laboratory report as per the prescribed format.

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Course Outcomes (COs)

Course Title & Code: Engineering Mechanics (CEF101A)

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

- **CO-1.** State and describe the laws of Statics, Friction and Dynamics and their contexts of application.
- **CO-2.** Interpret standard mathematical relationships and apply for solving simple static and dynamic problems in engineering mechanics
- **CO-3.** Calculate moment of inertia, determine centroid, center of gravity for the structural members
- **CO-4.** Apply the laws of statics and dynamics for the equilibrium analysis of rigid bodies withand without friction
- **CO-5.** Apply energy methods in analyzing of static and dynamic aspects of engineeringstructures made of rigid bodies

Course Outcomes (COs)

Course Title & Code: Elements of Electronics Engineering and Laboratory (ECF102A)

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

- **CO-1.** Explain working principles of PN junction diode, Zener diode, transistors, amplifier configurations, Op-Amps, power supply, logic gates and electronic displays
- **CO-2.** Derive mathematical relationships for electronic devices and circuits
- **CO-3.** Solve simple numerical and design problems related to analog / digital circuits as well as devices
- **CO-4.** Design and analyze operation of standard analog / digital circuits for a given application
- **CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
- **CO-6.** Interpret and compare with standard results, and draw conclusions and Write report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Engineering Drawing (MEF103A)

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

- **CO-1.** Describe the conventions used in projections of geometric entities and interpret thesame
- **CO-2.** Draw orthographic projections for the geometric entities in specified positions
- **CO-3.** Develop lateral surfaces of un-sectioned and sectioned regular solids
- **CO-4.** Develop orthographic projections for given applications
- **CO-5.** Draw isometric projections for the solids and their combinations
- **CO-6.** Demonstrate competency in using CAD tool for drawing projections of geometric entities

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Course Outcomes (COs)

Course Title & Code: Constitution, Human Rights and Law (LAN101A)

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

- **CO-1.** Explain the key principles of the Indian Constitution
- **CO-2.** Explain Indian legal system and judicial structure that govern the citizens
- **CO-3.** Discuss UN Declaration of Human Rights
- **CO-4.** Discuss the scope and application of Human Rights Principles and Law
- **CO-5.** Suggest strategies for protection of human rights and resolving legal issues in compliance with applicable laws

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 2 (MTB102A)

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

- **CO-1.** Describe the fundamentals of ordinary differential equations and Laplace transform
- **CO-2.** Solve standard forms of ordinary differential equations
- **CO-3.** Solve simple problems in ordinary differential equations and Laplace transform
- **CO-4.** Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations using Laplace transform
- **CO-5.** Apply Laplace transform in solving complex real world engineering problems

Course Outcomes (COs)

Course Title & Code: Engineering Chemistry and Laboratory (CYB104A)

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

- **CO-1.** Explain the basic concepts of electrochemistry, conversion of chemical energy into electrical energy, theory of corrosion and principles of metal finishing
- **CO-2.** Differentiate renewable - nonrenewable fuels, primary - secondary electrodes & primary - secondary batteries, batteries - fuel cells, electroplating – electroless plating, thermosetting – thermoplastic polymers and dry corrosion - wet corrosion
- **CO-3.** Discuss the reaction chemistry and stoichiometry of combustion of fuels, remedial measures to control oxides of nitrogen, sulphur and carbon, polymerization – methods, mechanism, preparation, properties and applications of some polymers, concepts of nano science and nanotechnology
- **CO-4.** Identify the types of corrosion and methods to prevent corrosion, suitable polymers and nanocomposite materials for engineering applications
- **CO-5.** Derive kinetic rate equations for various chemical systems and equation for electromotive force
- **CO-6.** Analyze the suitability of polymers & composites for various applications and solve problems related to storage devices, chemical kinetics, electro chemistry, corrosion and metal finishing
- **CO-7.** Plan the experimental set up, conduct experiments, calculate and plot the graphs to obtain results, and write a laboratory report as per the prescribed format

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Course Outcomes (COs)

Course Title & Code: Elements of Mechanical Engineering and Workshop Practice (MEF104A)

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

- **CO-1.** Demonstrate the understanding on Classification of energy sources, energy conversion systems, mechanical power transmission systems, machine tools and processes
- **CO-2.** Describe various energy conversion systems, mechanical power transmission systems and machine tools
- **CO-3.** Explain the working principle of refrigeration systems, biomass conversion technologies and machining operations
- **CO-4.** Solve numerical problems on IC engines and mechanical power transmission systems
- **CO-5.** Apply principles of energy conversion systems, power transmission systems, machining processes and mechanical joints to practical applications

Course Outcomes (COs)

Course Title & Code: Elements of Electrical Engineering and Laboratory (EEF105A)

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

- **CO-1.** State and explain various laws of electric circuits, magnetic circuits and their significance, phasor diagrams for electrical elements
- **CO-2.** Explain construction, principle of operation, working and characteristics of DC machines, transformers, AC rotating machines and their applications
- **CO-3.** Derive equations for electrical circuits, magnetic circuits and performance of various AC and DC machines
- **CO-4.** Solve problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines
- **CO-5.** Conduct experiments as per the standard procedures and tabulate/calculate/plot the measured values
- **CO-6.** Interpret and compare with standard results, and draw conclusions and write report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Elements of Computer Science and Engineering and Laboratory (CSF106A)

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

- **CO-1.** Describe the elements and methodology of Computer Science and Engineering
- **CO-2.** Explain the basic principles and techniques of algorithms and programming
- **CO-3.** Select appropriate approach to solve a computational problem
- **CO-4.** Design an algorithmic solution and draw a flow chart of the solution
- **CO-5.** Develop computer programs for moderately complex problems
- **CO-6.** Test and validate developed computer programs

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Course Outcomes (COs)

Course Title & Code: Professional Communication (TSN101A)

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

- **CO-1.** Apply the concepts of grammar for communication
- **CO-2.** Compose precise paragraphs
- **CO-3.** Demonstrate professional etiquette
- **CO-4.** Demonstrate appropriate verbal and non-verbal communication in the given context
- **CO-5.** Develop professional written document

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 3 (MTF201A)

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

- **CO-1.** State and explain the important theorems in Fourier series, transforms and vector integral calculus
- **CO-2.** Solve simple problems in Fourier series, transforms and vector calculus
- **CO-3.** Apply Fourier series, transforms and vector calculus in solving complex real world engineering problems
- **CO-4.** Implement the programs to solve system of linear equations and non-linear equations of single variable using MATLAB
- **CO-5.** Apply interpolation and numerical integration method in analyzing some real world problems

Course Outcomes (COs)

Course Title & Code: Materials Science for Engineers (AAC202A)

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

- **CO-1.** Explain different types of diffusion mechanisms, engineering materials and its properties.
- **CO-2.** Describe phase diagrams and heat treatment processes of metals.
- **CO-3.** Identify the different types of strengthening mechanisms and compositions in metals and alloys.
- **CO-4.** Discuss the various types of defects in material and relate it to the material behavior.
- **CO-5.** Assess the different properties of materials and characterization techniques.
- **CO-6.** Analyze different methods for improving the properties of materials for specific requirements and applications

Course Outcomes (COs)

Course Title & Code: Elements of Aerospace Engineering (21ASC203A)

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

- **CO-1.** Describe construction and functional aspects of major components and sub-systems of aircraft and rocket launch vehicle.
- **CO-2.** Explain the aerodynamic, propulsion and structural aspects of aircraft and rocket launch vehicle.

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CO-3. Differentiate the mission requirements and related performance parameters of air and space vehicles.
CO-4. Solve numerical problems to understand the basic of aerodynamics, propulsion, structural loads of aircrafts and performance parameters for air and space vehicles.
CO-5. Discuss recent developments in aerospace technology.
CO-6. Discuss stability requirements and control surfaces used for guidance and control of aerospace vehicles.

Course Outcomes (COs)

Course Title & Code: Thermodynamics for Engineers (AAC204A)

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

CO-1. Describe thermodynamic processes, laws, concepts of heat, work, and energy
CO-2. Derive and apply the laws of thermodynamics to thermodynamic systems
CO-3. Explain the merits, limitations and equivalence of laws of thermodynamics
CO-4. Compute the parameters for thermodynamics processes and systems
CO-5. Analyze thermodynamic cycles, mixture of gases using thermodynamic relations and draw conclusions
CO-6. Solve complex thermodynamic problems using various thermodynamic relations

Course Outcomes (COs)

Course Title & Code: Fluid Mechanics and Machines (AAC205A)

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

CO-1. Describe different types of fluid flows, fluid machines and principle of dimensional homogeneity
CO-2. Derive important fluid mechanics relations, governing equations, Bernoulli's equation, Euler equation and Euler turbine equation
CO-3. Explain the working principle of flow meters and fluid machines using the appropriate governing equations
CO-4. Apply Buckingham π-theorem for problems in fluid mechanics and fluid machines
CO-5. Solve practical fluid flow problems like flow through ducts/pipes, flow meters, pumpsand turbines
CO-6. Select a suitable type of fluid machine for a given application

Course Outcomes (COs)

Course Title & Code: Aeromodelling Laboratory (ASL206A)

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

CO-1. Plan the experimental setup to achieve the stated aim.
CO-2. Study the requirements of different class of fixed wing aircraft, rotary wing and multicopter.
CO-3. Compare and select the appropriate airfoil sections for the specified requirements.
CO-4. Design, build gliders with paper/balsa wood/ Depron sheets, fly and assess their Performance.
CO-5. Design, simulate and build the RC multi-copters with mission requirements.
CO-6. Write laboratory report as per the prescribed format.

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Course Outcomes (COs)

Course Title & Code: Fluid Mechanics and Machines Laboratory (ASL207A)

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

- **CO-1.** Plan the experimental setup to achieve the stated aim
- **CO-2.** Conduct experiments as per the standard procedures and tabulate themeasured values
- **CO-3.** Calculate the required parameters and plot the results
- **CO-4.** Interpret, compare with standard results and draw conclusions.
- **CO-5.** Write the laboratory report as per prescribed format.

Course Outcomes (COs)

Course Title & Code: Environmental Studies (BTN101A)

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

- **CO-1.** Illustrate the multidisciplinary nature of environmental studies and recognize the needfor public awareness
- **CO-2.** Explain the various natural resources and their associated problems, ecosystem, andenvironmental pollution
- **CO-3.** Analyze the concept of ecosystem and classify various types
- **CO-4.** Compare biodiversity at local, national and global levels
- **CO-5.** Discuss various social issues pertaining to environment including sustainable development and energy issues

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 1 (MTB103A)

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

- **CO-1.** State and explain the important theorems and solve simple mathematical problems in one variable calculus and vector algebra
- **CO-2.** State theorems and solve simple problems in two variable calculus
- **CO-3.** Solve complex real world problems associated with one and two real analysis
- **CO-4.** Illustrate fundamentals of MATLAB programming and write simple programs
- **CO-5.** Solve complex mathematical problems associated with linear algebra and compare the results with that of solutions obtained using MATLAB

Course Outcomes (COs)

Course Title & Code: Engineering Mathematics - 4 (MTF202A)

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

- **CO-1.** Define and explain the concepts of correlation, regression, random variables, probability distribution, partial differential equations and complex analysis
- **CO-2.** State theorems and solve simple problems in partial differential equations, complex

analysis, probability, probability distributions

CO-3. Apply numerical methods to solve ordinary and partial differential equations using MATLAB

CO-4. Solve complex engineering problems associated with numerical methods using MATLAB

CO-5. Analyze real world problems associated with probability, probability distributions, partial differential equations and complex analysis

CO-6. Construct the Bar chart, pie chart, Histogram, Box-plot and fitting of curves by using MATLAB

Course Outcomes (COs)

Course Title & Code: Strength of Materials (AAC212A)

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

CO-1. Describe the types of stresses and strain, stress-strain relationship, strain energy, theories of failure, elastic constants and their relations.

CO-2. Explain various methodologies to determine reaction forces, deformation, stress, strain, and strain energy on various structures such as rod, bar, beam for different types of loading and buckling load on columns.

CO-3. Solve simple numerical problems to compute the deformation, stress, strain for various structures with different loading and buckling load on columns.

CO-4. Calculate dimensions of structural members including bars and beams using appropriate method and stress distribution in thick and thin cylinders.

CO-5. Draw SFD and BMD for different beams subjected to different loads and couples.

CO-6. Calculate deformation, stress, and strain for given aerospace component and draw BMD, SFD with appropriate assumption.

Course Outcomes (COs)

Course Title & Code: Manufacturing Processes for Aerospace Systems (ASC213A)

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

CO-1. Describe casting, forming, additive manufacturing, machining, and joining processes.

CO-2. Explain the principle of operation and equipment required for different casting, forming, additive manufacturing, machining and joining techniques.

CO-3. Calculate power requirements for forging and cutting forces.

CO-4. Explain design guidelines and features in components for different processes.

CO-5. Examine the need and suitability of non-conventional machining and CNC machining processes

CO-6. Select suitable casting, forming, additive manufacturing, machining and joining process to meet the design requirement of the component.

Course Outcomes (COs)

Course Title & Code: 3D Modeling and Machine Drawing (AAC214A)

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

CO-1. Describe the role of CAD in product development cycle.

CO-2. Apply geometric modeling techniques to build complex geometric models and assemblies of Mechanical components.

CO-3. Use drawing standards and principles, symbolic representation of mechanical

components, sign conventions, sectional views, and bill of material for developing machine drawings.

CO-4. Create representative drawings of riveted joint, welded joints, pipe joints, bearings, couplings and fasteners, transmission system components.

CO-5. Create 3D assembly models and draw 2D detailed drawings with sectional details wherever required and prepare BOM for IC engine, transmission system, aircraft components, machine tool with components.

CO-6. Read and interpret the industrial drawing which includes limits-fits-tolerance information, datum references, GD & T symbols, surface roughness.

Course Outcomes (COs)

Course Title & Code: Aerodynamics-1 (ASC215A)

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

CO-1. Describe different regimes of fluid flow and their importance in aerodynamics.

CO-2. Explain the geometric features of airfoils, wings and their influence on aerodynamicperformance.

CO-3. Derive basic governing equations for incompressible flow over bodies and discuss various forces and moments.

CO-4. Use simple analytical methods to compute flow fields and non-dimensional coefficients over airfoils.

CO-5. Apply lifting-line theory to compute the flow field over a finite 3-D wing and discuss the influence of aerodynamic parameters.

CO-6. Use the Panel Method and the Vortex Lattice Method to analytically compute the aerodynamic parameters.

Course Outcomes (COs)

Course Title & Code: Materials and Testing Laboratory (ASL216A)

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

CO-1. Plan the experimental setup to achieve the stated aim

CO-2. Conduct experiments as per the standard procedures and tabulate the measured values

CO-3. Calculate the required parameters and plot the results

CO-4. Interpret, compare with standard results and draw conclusions

CO-5. Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Manufacturing Process Laboratory (ASL217A)

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

CO-1. Identify forging and foundry tools, machine tools, cutting tools and accessories for turning, milling, drilling, sawing and grinding.

CO-2. Test for moulding sand properties and recommend suitable composition

CO-3. Prepare sand mould cavity, melt and pour the casting and perform forging operations.

CO-4. Operate the machine tools and perform machining operations like turning, milling, gear cutting, drilling and grinding

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CO-5. Perform turning and machining operations on CNC turn center and machining center

CO-6. Write laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Aerodynamics Laboratory (ASL218A)

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

CO-1. Simulate elementary irrotational flows, and combination of elementary flows to obtain flows over bodies of engineering interest.

CO-2. Simulate flow over airfoils using vortex panel method.

CO-3. Plan a wind tunnel experiment to achieve the stated aim.

CO-4. Conduct experiments in a wind tunnel as per standard procedure and tabulate measured values.

CO-5. Calculate the required parameters, interpret the results and draw conclusions.

CO-6. Write laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: Innovation and Entrepreneurship (BAU201A)

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

CO-1. Explain the concepts and process of Innovation as well as entrepreneurship

CO-2. Construct and apply the idea generation techniques

CO-3. Discuss the opportunities for launching of new venture and various entry strategies

CO-4. Examine innovative ideas for the creation and management of entrepreneurship

CO-5. Formulate and present a viable business plan to the investors appraisal

Course Outcomes (COs)

Course Title & Code: Additional Mathematics - 2 (MTB104A)

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

CO-1. Describe the fundamentals of ordinary differential equations State theorems and solve simple problems in two variable calculus

CO-2. Solve standard forms of ordinary differential equations Illustrate fundamentals of Linear algebra

CO-3. Model real world problems using ordinary differential equations and solve complex problems associated with ordinary differential equations

CO-4. Apply numerical methods to solve nonlinear equations in one variable, system of linear equations, interpolation and numerical quadrature, and implement the same using MATLAB

CO-5. Solve complex problems associated with nonlinear equations and linear systems, interpolation and numerical integration using MATLAB

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Course Outcomes (COs)

Course Title & Code: Aerospace Structures (ASC301A)

After undergoing this course students will be able to:

- **CO-1.** Describe the needs, requirement of airframe structures, Vibration phenomenon, elasticityconcepts and applications
- **CO-2.** Explain the methods for computations of deformation, stress, strain and buckling load inairframe structures and joints
- **CO-3.** Solve simple numerical problems to compute the deformation, stress, strain and critical buckling load in airframe structures and joints
- **CO-4.** Compute Eigen Values and Eigen vectors for single and multi DOF models
- **CO-5.** Discuss the failure modes of composite structures and the associated principles for design
- **CO-6.** Design aircraft components for given loads from strength and stability considerations

Course Outcomes (COs)

Course Title & Code: Theory of Machines and Mechanisms (ASC302A)

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

- **CO-1.** Describe commonly used planar, spatial mechanisms and illustrate various constraints
- **CO-2.** Explain various principles used for kinematic and dynamic analysis of machines, and construction of cam profiles for desired motion
- **CO-3.** Solve simple problems to calculate the inertia forces at various joints, balancing force, gyroscopic forces using analytical and graphical methods
- **CO-4.** Analyze mechanisms for kinematic and dynamic properties like displacement, velocity, acceleration, force and torque
- **CO-5.** Perform static and dynamic balancing of rotating and reciprocating masses and assess the influence of gyroscopic effect
- **CO-6.** Solve complex problems to calculate inertia forces at various joints, balancing force and gyroscopic forces using appropriate method for a given application

Course Outcomes (COs)

Course Title & Code: Aerodynamics - 2 (ASC303A)

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

- **CO-1.** Describe the interaction between thermodynamics and fluid flow, acoustic speed and dependence of fluid properties on Mach number
- **CO-2.** Explain the change in flow properties across different types of shock waves and expansion fans
- **CO-3.** Derive the one-dimensional isentropic flow equations and compute the change in flow properties across shocks and expansion fans
- **CO-4.** Compute and analyze the flow fields and non-dimensional coefficients over airfoils in compressible flow using simple analytical methods
- **CO-5.** Discuss compressible flow over wings and the significance of Critical and Drag Divergence Mach numbers
- **CO-6.** Solve numerical problems related to compressible flow

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Course Outcomes (COs)

Course Title & Code: Aerospace Propulsion - 1 (ASC304A)

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

- **CO-1.** Describe various types of aircraft engines and its applications
- **CO-2.** Explain the construction and working principles of aircraft engines and matching of their components
- **CO-3.** Derive the equations of thrust, power, efficiency, heat rate, mass flow rate, TSFC, BSFC, Bypass ratio and pressure ratio for aircraft engines
- **CO-4.** Compute the performance parameters such as efficiency, thrust, TSFC , pressure ratio of gas turbine engine
- **CO-5.** Analyze the installed performance of the propulsion system to meet the requirements
- **CO-6.** Discuss and recommend the propulsion system for a given class of aircraft

Course Outcomes (COs)

Course Title & Code: Artificial Intelligence and Machine Learning (AAC305A)

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

- **CO-1.** Explain the techniques of solving problems by searching, adversarial search and constraint satisfaction problems.
- **CO-2.** Discuss intelligent agents, knowledge, reasoning and planning as well as uncertain knowledge and reasoning
- **CO-3.** Apply Learning from examples, knowledge in learning, learning from probabilistic models and elementary concepts of reinforcement learning
- **CO-4.** Discuss application of AI in autonomous vehicles; communicating, perceiving and acting
- **CO-5.** Explain principles of localization, tracking and control with a focus on examples from aviation

Course Outcomes (COs)

Course Title & Code: Control System Engineering and Laboratory (AAC306A)

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

- **CO-1.** Explain the basic concepts of control system and associated terminologies
- **CO-2.** Develop mathematical models of mechanical systems and determine their transfer functions
- **CO-3.** Discuss time and frequency response analysis and stability of a system
- **CO-4.** Design controller for a system and analyse performance of the system
- **CO-5.** Perform stability analysis for a given system and interpret results
- **CO-6.** Apply control system techniques to a given application and analyse the response for suitability of design using standard software

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Course Outcomes (COs)

Course Title & Code: Aerospace Structures Laboratory (ASL307A)

After undergoing this course students will be able to:

- **CO-1.** Conduct experiments as per the standard procedures and tabulate the measured values
- **CO-2.** Calculate the required parameters and plot the results
- **CO-3.** Interpret, compare with standard results and draw conclusions
- **CO-4.** Write laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Aerospace Propulsion Laboratory (ASL308A)

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

- **CO-1.** Plan the experimentation to achieve the stated aim
- **CO-2.** Conduct the experiment as per the standard procedure and tabulate the measured values
- **CO-3.** Determine the required parameters and plot the results
- **CO-4.** Interpret, compare with standard results and draw conclusions
- **CO-5.** Prepare laboratory report as per the prescribed format

Course Outcomes (COs)

Course Title & Code: Aerospace Propulsion - 2 (ASC311A)

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

- **CO-1.** Describe the need, requirements, types of advanced propulsion system and their applications.
- **CO-2.** Explain the construction and working principle of advanced air-breathing and rocket propulsion systems.
- **CO-3.** Derive equation of thrust, TSFC, specific impulse, efficiency and other performance parameters of a propulsion system
- **CO-4.** Compute thrust, efficiency, velocity increment, mass ratio, burnout velocity, distance, specific impulse of a propulsion system.
- **CO-5.** Analyze the performance of a propulsion system to meet the requirements.
- **CO-6.** Select a propulsion system for a given application

Course Outcomes (COs)

Course Title & Code: Finite Elements Analysis (AAC312A)

After undergoing this course students will be able to:

- **CO-1.** Describe the need, requirements, element types, loads, boundary conditions, modeling procedure, and analysis type for performing FE analysis
- **CO-2.** Explain the concepts of discretization, convergence requirements, analytical and numerical methods required to solve engineering problems using FE Analysis
- **CO-3.** Derive governing equations, stiffness matrix using various methods for different types of elements.
- **CO-4.** Solve simple numerical problems in structural and thermal applications using finite element methods

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CO-5. Discuss the selection of elements, analysis, and boundary condition for given engineering application

CO-6. Perform FE analysis for given aerospace components and assess the results

Course Outcomes (COs)

Course Title & Code: Aircraft Performance Stability and Control (ASC313A)

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

CO-1. Describe the fundamental principles and parameters influencing flight, stability and control of an aircraft

CO-2. Explain the influence of aerodynamic characteristics, weight, engine performance, flight altitude on the aircraft performance

CO-3. Discuss the limitations imposed by load factors for different classes of aircraft

CO-4. Discuss longitudinal, lateral and directional stability requirements and sizing of the control surfaces

CO-5. Calculate the take-off and landing performance of an aircraft

CO-6. Evaluate the various performance parameters by considering aerodynamic and structural limitations for a given aircraft

Course Outcomes (COs)

Course Title & Code: Computational Fluid Dynamics (ASC314A)

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

CO-1. Describe the need, requirements and techniques for CFD.

CO-2. Explain the appropriate boundary conditions and discretization procedures to solve a practical fluid flow problem.

CO-3. Discuss CFD modelling including discretization and applying boundary conditions for a given problem.

CO-4. Choose appropriate numerical methods to perform CFD.

CO-5. Formulate, simulate and analyze practical fluid mechanics problems.

CO-6. Use CFD software tools to solve problems in aerospace applications.

Course Outcomes (COs)

Course Title & Code: Engineering Economics (AAC315A)

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

CO-1. Describe the various costs, cash flow and cost estimation methods

CO-2. Explain various factors in value engineering and depreciation methods

CO-3. Discuss influence of interest rate, maintenance and replacement cost on economic life of an asset

CO-4. Estimate the production cost for aerospace/automotive vehicle component

CO-5. Compare the methods for evaluation of depreciation

CO-6. Compute the total cost required for making the aerospace or automotive component / subsystem from concept to product

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Course Outcomes (COs)

Course Title & Code: Computational Fluid Dynamics Laboratory (ASL316A)

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

- **CO-1.** Plan the numerical simulation to achieve the stated aim.
- **CO-2.** Conduct numerical simulations as per the standard procedures and tabulate the computed values.
- **CO-3.** Calculate the required parameters and plot the results.
- **CO-4.** Interpret, compare with standard analytical and experimental results and draw conclusions.
- **CO-5.** Write laboratory report as per the prescribed format.

Course Outcomes (COs)

Course Title & Code: CAE Practices for Aerospace Applications (ASL317A)

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

- **CO-1.** Understand the importance and basics of finite element modelling and analysis procedures.
- **CO-2.** Perform the different kinds of analysis and apply the basic principles to find out the stress and other related parameters.
- **CO-3.** Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function.
- **CO-4.** Interpret, compare with standard results and draw conclusions.
- **CO-5.** Write the laboratory report as per prescribed format.

Course Outcomes (COs)

Course Title & Code: Seminar (ASS311A)

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

- **CO-1.** Prepare and deliver seminar on a given topic.
- **CO-2.** Write a report on the seminar topic.

Course Outcomes (COs)

Course Title & Code: Hypersonic Flow (ASE311A)

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

- **CO-1.** Identify the fundamental features of hypersonic flows, and how these differ from other flows
- **CO-2.** Classify hypersonic vehicles and describe their requirements
- **CO-3.** Explain the importance and influence of rarefied gas dynamics and real-gas effects in high temperature flows
- **CO-4.** Identify the physical mechanisms causing aerodynamic heating of high speed vehicles
- **CO-5.** Analyse how the above influence the design of hypersonic vehicles
- **CO-6.** Apply appropriate computational methods to high speed and/or high temperature flows

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Course Outcomes (COs)

Course Title & Code: Composite Structures (ASE312A)

After undergoing this course students will be able to:

- **CO-1.** Understand constitutive relationship and failure criteria of orthotropic lamina
- **CO-2.** Understand elasticity approach to determination of material constants in a lamina
- **CO-3.** Understand classical laminate theory and its design based on strength
- **CO-4.** Understand the concept behind inter-laminar stresses
- **CO-5.** Understand bending, buckling and vibration of laminated plates

Course Outcomes (COs)

Course Title & Code: Light Weight and Novel Materials (ASE313A)

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

- **CO-1.** Describe the importance, need, principles, properties and usage of light weight metals, alloys, polymers and ceramics for aerospace applications.
- **CO-2.** Explain the concepts, properties and application of composite materials for aerospace applications.
- **CO-3.** Discuss the various functional materials used for sensors and actuators, smart structures and stealth technology.
- **CO-4.** Evaluate different forming operations, joining strategies for lightweight materials.
- **CO-5.** Discuss Non-Destructive Testing (NDT) techniques used for determining flaws / defects.
- **CO-6.** Select suitable materials and manufacturing processes for given applications.

Course Outcomes (COs)

Course Title & Code: Probability and Statistics (MTE301A)

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

- **CO-1.** Explain the concepts of random variables, probability distribution, joint probability distribution and sampling distribution
- **CO-2.** Explain the principles of convex optimization, regression, confidence interval and hypothesis testing
- **CO-3.** Solve simple problems associated with probability distribution, regression, confidence interval and hypothesis testing
- **CO-4.** Model real word problems by using probability distribution and regression
- **CO-5.** Solve complex problems associated with probability distribution, regression, confidence interval and hypothesis testing

Course Outcomes (COs)

Course Title & Code: Advanced Mathematics (MTE302A)

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

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CO-1. Define and explain Legendre and Bessel differential equation, curvature, torsion, geodesics, manifolds and tensors

CO-2. State the results and theorems and solve simple problems in Legendre differential equations, Bessel differential equation, theory of curves and surfaces

CO-3. Apply differential geometry techniques to compute Gaussian curvature, mean curvature, principal curvature and torsion

CO-4. Solve complex engineering problems associated with Bessel differential equation, theory of curves and surfaces, orthogonal curvilinear coordinates and spherical curvilinear system

CO-5. Analyze real world problems associated with Bessel differential equation and curvature of space curves

Course Outcomes (COs)

Course Title & Code: Unmanned Air Vehicles (ASE411A)

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

CO-1. Describe the need, requirements, components of Unmanned Air Vehicle (UAV) and their applications

CO-2. Explain the underlying principles of UAVs, configurations, different launch and recovery mechanisms

CO-3. Explain the selection of propulsion system, geometry, and structure for different UAV applications

CO-4. Discuss the various parameters influencing the performance of UAVs

CO-5. Design the UAV with appropriate propulsion system, geometry and control system for

Course Outcomes (COs)

Course Title & Code: Aerospace Structural Dynamics (ASE412A)

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

CO-1. Determine natural frequencies and transient responses for SDOF models of aerospace structures

CO-2. Solve for the shock response, transmissibility and frequency response function of SDOF models.

CO-3. Solve for periodic response of SDOF models from Fourier decomposition.

CO-4. Build MDOF models to determine eigenvalues/ eigenvectors as well as frequency and transient responses.

CO-5. Identify sources of vibration in real- world aerospace systems and tune the associated structural design towards desired modal characteristics.

Course Outcomes (COs)

Course Title & Code: Surface Engineering (ASE413A)

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

CO-1. Describe importance, principles of surface engineering processes used for aerospace components.

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CO-2. Explain physical, mechanical and chemical characteristics of surface layers, significance of diffusion process in surface treatment.

CO-3. Discuss the principle, parameters and applications of conventional and advanced surface engineering processes.

CO-4. Examine the application of coating technology for the development of thermal barrier coatings, electronic devices for aerospace applications.

CO-5. Assess the surface morphology and properties of modified surfaces.

CO-6. Select suitable surface engineering process based on component requirements.

Course Outcomes (COs)

Course Title & Code: Data Sciences Foundation (CSE411A)

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

CO-1. Describe the facilities—features, constructs, idioms, patterns and packages—of Python programming platform for building data science tasks

CO-2. Explain the applicability of the Python programming constructs for a given task

CO-3. Choose/recommend appropriate facilities of Python for data science tasks

CO-4. Design data science tasks using the facilities of Python platform

CO-5. Use parallelization and advanced programming constructs in the design of data science tasks

CO-6. Synthesize and test data science tasks employing the Python platform facilities

Course Outcomes (COs)

Course Title & Code: Optimization Techniques – 1 (MTE401A)

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

CO-1. Describe fundamentals of convex and concave functions, linear programming and constraint nonlinear optimization

CO-2. State and explain important classical techniques and numerical methods of constraint optimization

CO-3. Demonstrate the skill to analyze a problem by choosing effective optimization tools

CO-4. Apply optimization techniques to model real world problems

CO-5. Solve complex problems associated with linear programming and constraint optimization of function of several variables

Course Outcomes (COs)

Course Title & Code: Conceptual Design of Aircraft (ASE421A)

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

CO-1. Describe the requirements for different classes of aircraft

CO-2. Explain the design requirements obtained based on fundamental principles and historical data

CO-3. Analyse the various constraints coming from specifications and choose total weight, wing planform, thrust/power required

CO-4. Calculate performance and stability characteristics to generate a layout

CO-5. Evaluate the design specifications and arrive at an aircraft design to meet the given requirements

Course Outcomes (COs)

Course Title & Code: Fatigue and Fracture Mechanics (ASE422A)

After undergoing this course students will be able to:

- **CO-1.** Describe the need, requirements, methodologies, strategies for fatigue based design of components and significance of fracture mechanics in design
- **CO-2.** Explain the various fatigue theories and their application for prediction of life and fatigue
- **CO-3.** Discuss methods and procedure of stress analysis of cracked components based on theory of fracture mechanics
- **CO-4.** Solve simple fatigue problems based on fracture mechanics approach
- **CO-5.** Apply different methods of fatigue analysis to design components against fatigue failure
- **CO-6.** Estimate the life of a given component by adopting suitable methodology and validate the result with virtual simulation

Course Outcomes (COs)

Course Title & Code: Testing Techniques for Aerospace Systems (ASE423A)

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

- **CO-1.** Describe need, importance of testing, failure analysis, ground testing of aerospace systems, airworthiness standards and certification processes
- **CO-2.** Explain the different testing techniques and their application for aerospace systems.
- **CO-3.** Discuss validation and verification process for testing, and airworthiness certification processes.
- **CO-4.** Discuss the various parameters influencing the testing and their impact.
- **CO-5.** Select the appropriate testing technique and failure analysis for a given aerospace component/system.

Course Outcomes (COs)

Course Title & Code: Data Analytics (CSE411A)

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

- **CO-1.** Discuss data analytics application development using knowledge representation, data warehousing, machine learning and data mining techniques.
- **CO-2.** Choose appropriate techniques and technology for data warehousing, machine learning and Data mining for knowledge discovery.
- **CO-3.** Design data analytics processes using data warehousing, machine learning and data mining techniques for knowledge representation and discovery.
- **CO-4.** Analyze the data and the performance of data analytics applications.
- **CO-5.** Synthesize data analytics applications using machine learning and data mining techniques and enterprise platforms.
- **CO-6.** Solve problems associated with large scale data analysis, machine learning and data mining.

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Course Outcomes (COs)

Course Title & Code: Advanced Numerical Methods (MTE403A)

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

- **CO-1.** Illustrate various methods of numerical computation of Eigen values
- **CO-2.** Illustrate various methods to solve partial differential equations
- **CO-3.** Apply numerical methods to solve partial differential equations using MATLAB
- **CO-4.** Analyze real world problems associated with computing eigenvalues and partial differential equations
- **CO-5.** Solve complex problems arising in real world using finite volume and finite elements methods to solve partial differential equations

Course Outcomes (COs)

Course Title & Code: Optimization Techniques - 2 (MTE402A)

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

- **CO-1.** Describe fundamental of integral equations, variational problems and unconstrained optimization
- **CO-2.** State and explain important classical techniques to solve integral equations and numerical methods of unconstrained optimization
- **CO-3.** Demonstrate the skill to analyze variational problem and choose effective optimization tools
- **CO-4.** Apply optimization techniques to model real world problems involving linear and non-linear optimization
- **CO-5.** Solve complex problems associated with integral equations, calculus of variations and unconstrained optimization of function of several variables

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