M.S. Ramaiah University of Applied Sciences

New BEL Road, MSR Nagar, Bangalore – 560054

RAMAIAH UNIVERSITY
OF APPLIED SCIENCES

PO, PSO, PEO & CO

Programme: M.Tech. in Aerospace Engineering

Programme Code: 124

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
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Faculty of Engineering and Technology (FET)

Programme Name: M.Tech. (Aerospace Engineering)

Programme Outcomes (POs)

M.Tech. graduates will be able to:

PO-1. Acquire, comprehensive knowledge and understanding of the methodologies, principles, practices and technologies of the engineering domain to solve complex problems with technical competence

PO-2. Conceptualize, apply, analyze, synthesize and evaluate information related to complex engineering problems using principles of mathematics, science and engineering to create new and innovative solutions

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

PO-4. Review research literature, standards, guidelines, best practices, research methods and laboratory techniques to solve engineering problems through experimental investigations, analysis and interpretation of results

PO-5. Create, select and apply appropriate techniques and IT tools to model and solve complex engineering activities and utilize available resources effectively

PO-6. Understand the effect of engineering solutions on legal, cultural, social, public health and 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 in multi-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 projects in multi-disciplinary environments with consideration to cost and time

PO-12. Engage in lifelong learning and adapt to changing engineering/technology and societal requirements

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Programme Specific Outcomes (PSOs)

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

PEO-1. To provide in-depth knowledge in the specialized engineering domain to enable them to deliver efficient solutions for complex engineering problems by critical thinking

PEO-2. To enable students to design and develop sustainable innovative solutions for industry and societal requirements through applied research 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

Program Educational Objectives (PEOs)

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

PSO-1. Apply the knowledge and principles of aerospace design to conceptualize and develop efficient solutions to complex engineering problems through critical analysis

PSO-2. Design and develop sustainable aerospace design solutions to industry and societal requirements through applied research, concepts and techniques involving experimentation and usage of modern design and modelling tools

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

Course Outcomes (COs)

Course Title & Code: Applied Mathematics **(**20ASC501A**)**

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

CO-1. Discuss the concepts of complex variables, matrix algebra, data modelling, numerical techniques and probability theory

CO-2. Develop and implement mathematical models for data analysis

CO-3. Apply linear algebraic concepts to solve linear system of equations

CO-4. Analyse and evaluate different numerical schemes to solve ordinary and partial differential equations

CO-5. Develop and analyse probabilistic models for continuous and discrete systems

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Course Outcomes (COs)

Course Title & Code: Aerodynamics **(20ASC502A)**

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

- **CO-1.** Discuss the role of aerodynamics in aircraft design.
- **CO-2.** Discuss the geometric features of airfoils, wings, and airplanes and their influence on aerodynamic performance.
- **CO-3.** Apply thin airfoil theory, lifting line theory, panel methods, vortex lattice method and CFD to determine the performance characteristics of airfoils, wings and non-lifting bodies.
- **CO-4.** Plan and perform experiments on appropriate models in a low speed wind tunnel.
- **CO-5.** Evaluate the results from computations and wind tunnel tests.

Course Outcomes (COs)

Course Title & Code: Propulsion **(20ASC503A)**

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

- **CO-1.** Discuss the constructional features, functioning and application of various propulsion engines.
- **CO-2.** Perform aero-thermodynamic analysis of propulsion engines.
- **CO-3.** Estimate the performance of propulsion engine components.
- **CO-4.** Analyse the requirements of matching of the propulsion engine components.
- **CO-5.** Suggest a propulsion system and performance enhancement techniques for an application

Course Outcomes (COs)

Course Title & Code: Aerospace Structures **(20ASC504A)**

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

- **CO-1.** Elucidate with reasons the rationale governing forms of typical aerospace structures; identify sources of loads on typical aerospace structures
- **CO-2.** Analyse structural layouts to assess the adequacy of design under the prescribed functional and operational loads
- **CO-3.** Apply knowledge of strength of materials and engineering mechanics to design, model, simulate and analyse components/systems of generic aerospace structural components such as slender beams and frames
- **CO-4.** Analyse dynamic responses of aircraft structural components by analytical (energy) methods and interpret the responses for design needs
- **CO-5.** Develop designs for structures of laminated composite construction and analyze by finite element methods.

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Course Outcomes (COs)

Course Title & Code: Flight Mechanics **(20ASC505A)**

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

- **CO-1.** Discuss the influence of aerodynamic characteristics, weight, engine performance and flight altitude on the performance of aircraft and launch vehicles
- **CO-2.** Distinguish performance requirements between different class of aircraft and launch vehicles.
- **CO-3.** Analyse and evaluate aeroplane performance for different phases of flight: level flight, turning, gliding, climb, take-off and landing.
- **CO-4.** Critically evaluate the stability derivatives and establish flight boundaries such as range and endurance, payload-range, V-n diagram and turn
- **CO-5.** Compute short period and long period longitudinal modes.
- **CO-6.** Calculate launch vehicle trajectories and optimal staging for payload requirements.

Course Outcomes (COs)

Course Title & Code: Computer Aided Engineering **(20ASC506A)**

After undergoing this course students will be able to:

- **CO-1.** Discuss the need and usage of CAE tools in product development cycle.
- **CO-2.** Create geometrical models of complex engineering components and assemblies.
- **CO-3.** Formulate 1-D, 2-D and 3-D elements for finite element modelling.
- **CO-4.** Synthesize finite element models and solve linear, non-linear, dynamic and thermal problems as applied to engineering components/systems.
- **CO-5.** Analyze for design requirements and redesign the given component.
- **CO-6.** Use CAE tools like CATIA/UG, HYPERMESH and ANSYS and operate 3D scanner

Course Outcomes (COs)

Course Title & Code: Research Methodology and IPR **(20FET508A)**

After undergoing this course students will be able to:

- **CO-1.** Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research, Nature of Intellectual Property.
- **CO-2.** Discuss the guidelines to progress from the choice of broad field of research to specific topic of research, patent rights, process of patenting at National and International level, New Developments in IPR.
- **CO-3.** Demonstrate the application and utility of the Systematic approach and out of box thinking concepts for research to be effective.
- **CO-4.** Adapt, analyze and prepare well-structured research proposal and research paper invoking clearly outlined principles.

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Course Outcomes (COs)

Course Title & Code: Professional Communication **(**20FET509A**)**

After undergoing this course students will be able to:

- **CO-1.** Compose effective written business communication
- **CO-2.** Practice the techniques of presentation

Course Outcomes (COs)

Course Title & Code: Artificial Intelligence and Machine Learning **(**20ASC507A**)**

After undergoing this course students will be able to:

- **CO-1.** Explicate 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.** Discuss the principles of localization, tracking and control with a focus on examples from Autonomous Vehicle /Self-driving cars

Course Outcomes (COs)

Course Title & Code: Value Education **(**20FET510A**)**

After undergoing this course students will be able to:

- **CO-1.** Discuss the role of Values and Ethics in Self-Development
- **CO-2.** Appreciate the importance of Universal Brotherhood

Course Outcomes (COs)

Course Title & Code: Computational Fluid Dynamics **(**20ASE511A**)**

After undergoing this course students will be able to:

- **CO-1.** Review different types of fluid flow, PDEs and identify the governing equations.
- **CO-2.** Discretize the given equation, analyze the equation for stability and perform computation to solve simple problems.
- **CO-3.** Identify appropriate algorithms, turbulence model, boundary conditions for numerical simulations of fluid flow.
- **CO-4.** Perform CFD simulations with the use of commercial software including discretization, incorporating various models and methods.

CO-5. Analyze the results by plotting various quantities of interest, understanding physics of the flow and critically evaluate the results.

Course Outcomes (COs)

Course Title & Code: Engineering Optimization **(**20ASE512A**)**

After undergoing this course students will be able to:

- **CO-1.** Describe theory and concept of Optimization techniques to engineering systems design
- **CO-2.** Explain classical unconstrained and constrained Optimization methods
- **CO-3.** Explain the modern methods of Optimization and their applications such as genetic algorithm, simulated annealing, particle swarm Optimization
- **CO-4.** Solve simple numerical problems in engineering Optimization
- **CO-5.** Apply numerical techniques to complete the design of engineering systems for optimum performances
- **CO-6.** Develop computer programs to implement and analyze Optimization approaches in the aerospace engineering context

Course Outcomes (COs)

Course Title & Code: Hypersonic Flow **(**20ASE513A**)**

After undergoing this course students 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

Course Outcomes (COs)

Course Title & Code: Flight Dynamics and Orbital Mechanics **(**20ASE514A**)**

After undergoing this course students will be able to:

- **CO-1.** Discuss various axes of reference used in describing dynamics of aircraft flight and discuss the complexities of Six Degrees of Freedom (6DOF) equations.
- **CO-2.** Identify short and long period oscillations seen in Longitudinal, lateral and directional modes and propose remedies.
- **CO-3.** Discuss different types of satellite orbits and laws governing them.

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CO-4. Identify and analyse different types of satellite attitude control.

CO-5. Use MATLAB and similar software to simulate dynamic responses, and identify critical modes.

Course Outcomes (COs)

Course Title & Code: Design of Turbomachines **(**20ASE522A**)**

After undergoing this course students will be able to:

CO-1. Discuss the constructional features, functioning, aerodynamics losses and application of various turbomachines

CO-2. Perform aero-thermodynamic analysis of a turbomachine

CO-3. Select an appropriate loss correlation and cascade data for turbomachinery design

CO-4. Analyse the performance map and off-design operation

CO-5. Suggest a suitable turbomachine and performance enhancement techniques for an application.

Course Outcomes (COs)

Course Title & Code: Combustion **(**20ASE523A**)**

After undergoing this course students will be able to:

CO-1. Discuss fuel properties, combustion process associated with air-breathing and rocket engines.

CO-2. Perform thermo-chemical calculations.

CO-3. Develop simple mathematical models and analyse combustion phenomena.

CO-4. Perform combustor sizing calculations for gas turbine and rocket engines and analyse it for various operating conditions

CO-5. Simulate co-axial burner and explain the combustor aerodynamics

CO-6. Suggest suitable solution to the given critical problem from combustion fundamentals

Course Outcomes (COs)

Course Title & Code: Launch Vehicle Design **(**20ASE524A**)**

After undergoing this course students will be able to:

CO-1. Identify the types of space launch vehicles and missiles.

CO-2. Classify different propulsion systems Distinguish the solid and liquid propellant motors

CO-3. Classify different types of trajectories used for rockets and missiles

CO-4. Analyse launch vehicle dynamics and arrive at appropriate velocity increments

CO-5. Identify different types of rocket testing in order to evaluate launch vehicle performance.

CO-6. Calculate launch vehicle trajectories and optimal staging for payload requirements.

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Course Outcomes (COs)

Course Title & Code: Fatigue and Fracture Mechanics **(**20ASE531A**)**

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: Aircraft Structural Dynamics **(**20ASE532A**)**

After undergoing this course students 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: Composite Structures **(**20ASE533A**)**

After undergoing this course students will be able to:

- **CO-1.** Describe the strengths and limitations of composite materials vis- a- vis metals, from property and processing aspects
- **CO-2.** Compute the 'on- axes' and 'off- axes' stiffness constants of an orthotropic lamina and the A, B, D matrices of laminates for a given stacking sequence
- **CO-3.** Calculate deformation and stresses in simple composite beam and plate structural components using MATLAB programs and draw conclusions from the solutions
- **CO-4.** Compute modal and buckling eigenvalues of composite beam, plate and stiffened shell components using FEA tools and draw conclusions from the solutions

CO-5. Describe the test principles and methods of characterizing composite materials for elastic constants, as well as the NDE principles for composite structure damage detection and assessment.

Course Outcomes (COs)

Course Title & Code: Stochastic Mechanics and Reliability **(**20ASE541A**)**

After undergoing this course students will be able to:

CO-1. Describe basics and concept of probability theory
CO-2. Explain concept of random variable, random field, Probability density functions, Cumulative distribution functions, correlation and covariance analysis
CO-3. Explain different functional relationships between response and random variables
CO-4. Elucidate the concept of risk and safety factor, fundamentals of reliability analysis and Simulation techniques
CO-5. Apply reliability methods to solve simple numerical examples
CO-6. Develop computer programs to implement probabilistic methods in the aerospace engineering context

Course Outcomes (COs)

Course Title & Code: Aerospace Materials and Manufacturing Processes **(**20AUC542A**)**

After undergoing this course students will be able to:

CO-1. Discuss different types of materials, properties, processes and type of heat treatments given for aerospace components.
CO-2. Identify materials and manufacturing processes used for aerospace systems.
CO-3. Review different types corrosion, coatings and Non-Destructive Testing used for aerospace components.
CO-4. Analyse functional requirements of components and suggest suitable material and manufacturing processes for the same.
CO-5. Analyse component failures and suggest remedies in terms of materials and processes.
CO-6. Use appropriate database tools to select suitable combination of materials and manufacturing process for a specified application.

Course Outcomes (COs)

Course Title & Code: Conceptual Design of Aerospace Vehicles **(**20ASE543A**)**

After undergoing this course students will be able to:

CO-1. Identify and describe requirements for different classes of aerospace vehicles
CO-2. Contrast and explain the design requirements obtained based on fundamental principles and historical data
CO-3. Evaluate the design specifications and then critically arrive at an aerospace vehicle design

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that is likely to meet the requirements

CO-4. Analyse the various constraints coming from specifications and choose key parameters (total weight, wing plan form, thrust/power required etc.)

CO-5. Calculate and compare performance and stability characteristics against design goals and make necessary changes to choices already made and generate a layout.

CO-6. Analyse design issues for aerodynamics, propulsion, structure, weights, stability, cost, and performance, and then calculate range or sizing the design to a specified mission.

Course Outcomes (COs)

Course Title & Code: Unmanned Air Vehicles **(**20ASE544A**)**

After undergoing this course students will be able to:

CO-1. Analyse and study the system components, technology trends, configurations, and capabilities of UAVs

CO-2. Describe UAV geometric relationships, graphically depict UAV geometry from parametric definition

CO-3. Estimate aerodynamic performance of UAVs for different propulsion systems and define flight regimes for various UAS classes

CO-4. Select wing and fuselage configurations and arrive at a structural layout using fast and in-expensive methods

CO-5. Select appropriate avionics, launch and recovery techniques for the UAV

Course Outcomes (COs)

Course Title & Code: Internship **(**20ASP521A**)**

After undergoing this course students will be able to:

CO-1. Describe the organization structure of the industry/business

CO-2. Identify Business objectives of the organization

CO-3. Describe the various departments of the organization and their activities and responsibilities to meet the business objectives

CO-4. Discuss the limitations and new opportunities for growth of the organization

CO-5. Express the education and skill requirement of graduates to pursue their career in industry

Course Outcomes (COs)

Course Title & Code: Group Project **(**19ASP522A**)**

After undergoing this course students will be able to:

CO-1. Work in a team and undertake a project in their area of specialization

CO-2. Apply their knowledge of general and automotive engineering and application, develop a system for automotive application

CO-3. Apply appropriate research methodology while formulating a project.

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CO-4. Prepare specifications, design, analyse, synthesize, prototype and assess the system

CO-5. Prepare and present appropriate forms of audio-visual and verbal presentations, and written document, to describe the project, its execution and outcome

Course Outcomes (COs)

Course Title & Code: Dissertation and Publication **(**19ASP524A**)**

After undergoing this course students will be able to:

CO-1. Critically review scholarly literature collected from various sources for the project purpose and formulate a research problem

CO-2. Prepare and present a research proposal

CO-3. Conduct research to achieve research objectives

CO-4. Propose new ideas/methodologies or procedures for further improvement of the research undertaken

CO-5. Create research document and write research papers for publications

CO-6. Defend the research findings in front of scholarly audience

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