RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Programme Specifications

M. Tech. Programme

Programme:	Department:
Aerospace Engineering	Aerospace Engineering

Faculty of Engineering & Technology
M.S. Ramaiah University of Applied Sciences

University House, New BEL Road, MSR Nagar, Bangalore – 560 054

www.msruas.ac.in

Programme: M. Tech. in Aerospace Engineering	
Faculty	Faculty of Engineering
Department	Aerospace Engineering
Programme	M.Tech in Aerospace Engineering
Dean of Faculty	Prof. H M Rajashekara Swamy
HOD	Prof. Raja R

Programme Specification

	1. Title of the Award	
		M. Tech. in Aerospace Engineering
	2. Modes of study	
		Full Time
	3. Awarding Institution / Body	
		M. S. Ramaiah University of Applied Sciences – Bengaluru, India
	4. Joint Award	
		--
	5. Teaching Institution	
		Faculty of Engineering & Technology
		M S Ramaiah University of Applied Sciences - Bengaluru, India
	6. Date of Programme Specification	
		March 2020
	7. Date of Programme Approval by the Academic Council of MSRUAS	
		July 2020
	8. Next Review Date	
		June 2022
	9. Programme Approving Regulatory Body and Date of Approval	
		--
	10. Programme Accrediting Body and Date of Accreditation	
		--
	11. Grade Awarded by the Accreditation Body	
		--
	12. Programme Accreditation Validity	
		--
	13. Programme Benchmark	
		--

14. Rationale for the Programme

The present global economic recession is showing signs of abating and India's growth story continues to hold promise. Demographically India is at a great advantage as close to half of the population are in the 14 to 35 years age group.

Aerospace sector in India has seen robust growth and most big OEMs and service sector giants can be found in here. India is home to government organisations like Defence Research and Development Organisation (DRDO), Aeronautical Development Agency (ADA), Council for Scientific and Industrial Research (CSIR), Hindustan Aeronautics Limited (HAL), and private enterprises like Boeing, Airbus, General Electric, Pratt and Whitney, SNECMA, Honeywell, Goodrich Aerospace.

Some are involved in Aerospace research and development, while others provide engineering services. Their already high annual average growth rate is likely to be boosted by the 'off-set' clause included by Government of India in all major aerospace transactions.

High competitiveness in the airline sector has forced the manufacturers to not only continuously improve their product but also introduce cutting edge technology in their products. Aerospace industry traditionally has pushed technological boundaries in a bid to meet the ever increasing demand for faster, safer and cheaper travel. With the available experienced person power and infrastructure in the areas of fluid mechanics, structural engineering, propulsion, artificial intelligence and machine learning, the University will be able to support their requirement for advanced products.

To sustain the growth rate the organisations are in need of designers, analysts, developers, innovators, manufacturing, testing and marketing engineers as well as managers with a postgraduate degree in aerospace engineering. It is estimated that these organisations will require annually 500-600 such postgraduates for the next 5-6 years.

Aerosapce is a highly interdisciplinary programme where there is interaction between aerodynamicists, structural engineers, control system engineers, manufacturers and electronic engineers. In this situation, University gives an ideal platform for the students as they are exposed to different disciplines with artificial intelligence and machine learning, and thereby increase their breadth of knowledge in aerospace. The department is staffed with professors with extensive experience in national aerospace projects, excellent infrastructure and has developed a reputation amongst students, parents, industry and research sponsors.

The Faculty of Engineering and Technology plans for further development of Aerospace Engineering programme and compete with the best universities in the world and attract high quality graduates as well as teaching talent from all over the country and abroad.

15. Programme Aim

The aim of the programme is to produce postgraduates with advanced knowledge and understanding of aerospace system design; higher order critical, analytical, problem solving and transferable skills; ability to think rigorously and independently to meet higher level expectations of aerospace industry, academics, research or take up entrepreneurial route

16. Programme Objectives

The programme enables the students to design, develop and test aerospace systems with the help of modern engineering modelling and simulation tools. In this programme, analytical and simulation approaches to design will be emphasized, with an exposure to hands-on implementation of design

The objectives of the programme are to enable the students to:

1. Knowledge and understanding of the construction, working principles and functional requirements of aerospace systems with respect to their performance
2. Plan viable design specification according to customer requirements and evolve it to conceptual design
3. Develop, simulate, analyse and validate the aerospace conceptual design to meet operational requirements using commercially available tools
4. Demonstrate critical, analytical problem solving and research skill the domain of aerospace engineering
5. Develop a career in aerospace Engineering
6. Practice Teamwork, lifelong learning and continuous improvement

17. Intended Learning Outcomes of the Programme

The Intended Learning Outcomes (ILOs) are listed under four headings:

1. Knowledge and Understanding,
2. 2. Cognitive Skills
3. 3. Practical Skills and
4. 4. Capability / Transferable Skills.

1. Knowledge and Understanding

After undergoing this programme, a student will be able to:

KU1: Explain the working and underlying aerodynamic principles of lifting and control surfaces

KU2: Define and describe aerospace system performance, stability and control in steady and accelerated flight

KU3: Explain the behaviour of different structural components in normal and extreme flight conditions and influence of buckling, modal and aeroelastic criteria on aerospace structural weight

KU4: Explain the design principles involved in the technological developments of a modern aerospace system

2. Cognitive Skills

After undergoing this programme, a student will be able to:

CS1: Select appropriate materials and manufacturing processes for various components/systems to meet overall specifications

CS2: Design , model and simulate wing, tail plane and other aerodynamics surfaces to meet the mission specification along with required control systems

CS3: Design , model and simulate vehicle with required stability, control, handling qualities, to complete its mission

CS4: Design, model and simulate the structure and other systems for the control of the aerospace vehicle to complete its mission.

3. Practical Skills

After undergoing this programme, a student will be able to:

PS1: Create 3D geometric models for further assessment and trials

PS2: Apply commercially available software tools for design and analysis of (a) material and manufacturing process (b) aerodynamics of components including wing and tail plane (c) stiffness & strength of wing, fuselage components

PS3: Use commercially available software tools for assessing the characteristics of aerospace vehicle performance

PS4: Calculate stability margins and control power, takeoff and landing roll requirements

4. Capability / Transferable Skills

After undergoing this programme, a student will be able to:

TS1: Manage information, develop technical reports and make presentations

TS2: Build, Manage and Lead a team to successfully complete a Project and communicate across teams and organizations to achieve professional objectives

TS3: Work under various constraints to meet project targets

TS4: Adopt to the chosen profession by continuously upgrading his/her knowledge and understanding through Life-long Learning philosophy

18. Programme Structure

The Programme consists of four terms as shown below. A student is required to successfully complete the following Courses and earn credits for the award of the degree.
Complete details of each of the Courses such as ILO's, content, resources, teaching-learning processes and other related information are outlined in Course Specification of the respective programme.

SEMESTER 1

Sl. No	Course Code	Name of the Course	hours (h/W/S)			Credits	Max. Marks
			Theory	Tutorial	Practical		
1	20ASC501A	Applied Mathematics	4	0	0	4	100
2	20ASC502A	Aerodynamics	3	0	2	4	100
3	20ASC503A	Propulsion	3	0	0	3	100
4	20ASC504A	Aerospace Structures	3	1	0	4	100
5	20ASC505A	Flight Mechanics	3	0	0	3	100
6	20ASC506A	Computer Aided Engineering	3	0	2	4	100
7	20FET508A	Research Methodology and IPR	2	0	0	2	50
8	20FET509A	Professional Communication	2	0	0	0	0
Total			23	1	4	**24**	**650**
Total Number of Contact Hours per Week			**28**	**Hours**			
Number of Credits can be registered			Minimum	**18**	Maximum		**24**

SEMESTER 2

Sl. No	Course Code	Name of the Course	hours (h/W/S)			Credits	Max. Marks
			Theory	Tutorial	Practical		
1	20ASC507A	Artificial Intelligence and Machine Learning	4	0	0	4	100
2	20ASE5XXA	Professional Core Elective-1	4	0	0	4	100
3	20ASE5XXA	Professional Core Elective-2	4	0	0	4	100
4	20ASE5XXA	Professional Core Elective-3	4	0	0	4	100
5	20ASE5XXXA	Professional Core Elective -4	4	0	0	4	100
6	20FET510A	Value Education	2	0	0	0	0
Total			22	0	0	**20**	**500**
Total Number of Contact Hours per Week			**22**	Hours			
Number of Credits can be registered			Minimum	**18**	Maximum		**22**

SEMESTER 3

Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	20ASP521A	Internship			10	4	100
2	20ASP522A	Group project			15	8	200
3	20ASP523A	Dissertation and Publication Phase-1					
Total					25	12	300
Total number of contact hours per week			**25 hours**				
Number of credits can be registered			**Minimum**	**8**	**Maximum**		**12**

SEMESTER 4

Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	20ASP524A	Dissertation and Publication Phase-2			24	24	400
Total					**24**	**24**	**400**
Total number of contact hours per week			**24 hours**				
Number of credits can be registered			**Minimum**	**24**	**Maximum**		**24**

Professional Core Elective Courses List			
Stream / Specialization	**Course Designation**	**Course Code**	**Course Title**
Aerodynamics	E11	20ASE511A	Computational Fluid Dynamics
	E12	20ASE512A	Engineering Optimization
	E13	20ASE513A	Hypersonic Flow
	E14	20ASE514A	Flight Dynamics and Orbital Mechanics
Propulsion	E21	20ASE511A	Computational Fluid Dynamics
	E22	20ASE521A	Design of Turbomachines
	E23	20ASE522A	Combustion
	E24	20ASE523A	Launch Vehicle Design
Structures	E31	20ASE512A	Engineering Optimization
	E32	20ASE531A	Fracture Mechanics and Fatigue
	E33	20ASE532A	Aircraft Structural Dynamics
	E34	20ASE533A	Composite Structures
General	E41	20ASE541A	Stochastic Mechanics and Reliability
	E42	20ASE542A	Aerospace Materials
	E43	20ASE543A	Conceptual Design of Aerospace Vehicle
	E44	20ASE544A	Unmanned Aerial Vehicles

19. Programme Delivery Structure

A Programme is delivered from Monday to Saturday of the week as per the Time-Table for every batch.

20. Teaching and Learning Methods

The Course delivery comprises of a combination of few or all of the following:

1. Face to Face Lectures using Audio-Visuals
2. Workshops, Group Discussions, Debates, Presentations
3. Demonstrations
4. Guest Lectures
5. Laboratory/Field work/Workshop
6. Industry Visit
7. Seminars
8. Group Exercises
9. Project Exhibitions
10. Technical Festivals

21. Courses

Programme has seven Professional core courses, four Professional elective courses, two audit courses, and one compulsory course followed by Group Project, Internship and Dissertation & Publication courses.

Core courses are Programme Specialization courses which normally include both theory and laboratory sessions. Alternate activities are planned in case of laboratory sessions do not exist in a Course.

Compulsory course is Research Methodology and IPR course which is mandatory.

All courses of the programmes are categorized as indicated in the **Annexure I.**

22. Electives

There are 4 electives in the programme. The electives are grouped such a way that a student can choose a set of electives to specialize in a chosen field/stream. However, if the student wishes to opt for elective Course that spans multiple streams, the case may be considered subject to the affordability of academic logistics and approval by the Course leader, HODs and Dean.

For every elective offered, there will be a minimum and a maximum number of registrations that is decided by the department.

There is also a provision for the students to choose 3rd and 4th electives through on-line mode such as MOOC's, SWAYAM, NPTEL and other equivalent platforms. The guidelines prescribed by the University for such courses to be adhered to. The student can also earn 3 or 4 credits by participating in the international competitions like technical presentation/ conference/ publications in the journal etc and winning the award in that. In that case he/she can be exempted from one of the elective courses of the programme.

23. Group Project

The main objective of group project is to provide an ambiance to work in groups towards achieving a common goal. A group shall have up to 5 students. In case of Group Project work is based on inter-disciplinary in nature, team can be constituted with members from across departments of the Faculty.
The students are required to develop a report for assessment and also need to demonstrate the working of the product. The IPR rights of all such work lies with the University only. The project should be approved by a committee constituted by respective HoDs before the start of the project.
For further details related to the Group Project refer to Course Specification of the respective programmes

24. Industry Internship/Other Activities

A student can opt for an internship in an industry, a business or research organization during the Course.
Alternately, can undertake a mini-project requiring self-directed study that can be perused within the affiliated Faculty.
Prior approval of the internship / mini-project by the HoD and Dean is mandatory. It is also necessary for the student to submit a report and make a presentation to the members of the panel constituted by the HoD for assessment.
For further details related to this Course, please refer to Course Specification of the respective programmes.

25. Dissertation and Publication

This Course has two parts – Dissertation and Publication.
Every student, has to undertake the dissertation work individually on a chosen relevant topic. The topic needs to be approved by the committee constituted by HoD.
Publication is a stage wherein dissertation work of the student is converted into a technical paper to be published in reputed conferences/journals.
For further details related to the this Course refer to Course Specifications of the respective programme.

26. Course Assessment

1. Every course will be assessed for a weight of 100%
2. There are two components-Component-1 and Component-2
3. Component-1 carries a weight of 50% and Component -2 carries a weight of 50%
4. Component -1 (CE) is subdivided into Term Tests , Assignments and laboratory examinations/ technical presentation

a. For the courses having 100% theory

There are two components-Component-1 and Component-2
Component-1 (CE) carries a weight of 50% and Component -2 (SEE) carries a weight of 50%.

Component-1 (CE): 50% weight:

The course leader will indicate the mode of assessment in consultation and approval of the respective HoD and the faculty Dean, before commencement of the semester. The template for weightage of CE and SEE in percentages for each theory course is indicated in Table below.

ILO No.	Intended Learning Outcome	CE (Weightage: 50 %)				SEE
		Assessment Type	Comp-1a	Comp-1b	Comp-1c	(Weightage: 50 %)
		Comp Weightage (%)	xx	xx	xx	SEE
1	ILO-1					
2	ILO-2					
3	ILO-3					
4	ILO-4					
5	ILO-5					
6	ILO-6					

CE – can be from any combination of the following:

Assignments, term Tests, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, others, if any.

b. For courses with a combination of theory and laboratory

There are two components-Component-1 and Component-2
Component-1 (CE) carries a weight of 50% and Component -2 (SEE) carries a weight of 50%.

Component-1 (CE): 50% weight

The course leader will indicate the mode of assessment in consultation and approval of the respective HoD and the faculty Dean, before commencement of the semester.

The template for weightage of CE and SEE in percentages for each course is indicated in Table below.

ILO No.	Intended Learning Outcome	CE (Weightage: 50 %)				SEE
						(Weightage: 50 %)
		Assessment Type	Comp-1a	Comp-1b	Comp-1c Lab	SEE
		Comp Weightage (%)	xx	xx	xx	50
1	ILO-1					
2	ILO-2					
3	ILO-3					
4	ILO-4					
5	ILO-5					
6	ILO-6					

CE – can be from any combination of the following:

Assignments, term Tests, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, others,

5. Component -2 (SEE) is Written Examination for 100 Marks. It will be reduced to 50 Marks.
6. A minimum of overall 40% is required for a pass with 40% in each of the Components
7. The marks distribution for each course is given in the programme structure-section 18. Other flexibilities(exceptions) as per the programme regulations

27. Failure in Course and Makeup Examinations

Makeup Examinations are provided for the students who are not able to meet all pass criteria prescribed for a Course during the regular term and fail in the Course.
For further details related to makeup examination, please refer to M.Tech. Programme Academic Regulations document.

28. Attendance

Please refer to M.Tech. Programme Academic Regulations document for attendance requirements and condonation related details.

29. Award of Grades

As per the M.Tech. Programme Academic Regulations document.

30. Student Support for Learning

Students are provided with various facilities to support learning such as the following:

1. Course notes
2. Reference books in the library
3. Magazines and Journals
4. Internet facility
5. Computing facility
6. Laboratory facility
7. Workshop facility
8. Staff support
9. Lounges for discussions
10. Any other support that enhances their learning

31. Quality Control Measures

Following are the Quality Control Measures:

1. Review of course notes
2. Review of question papers and assignment questions
3. Student Feedback Analysis
4. Moderation of assessed work
5. Opportunities for the students to see their assessed work
6. Review by external examiners and external examiners reports
7. Staff Student Consultative Committee meetings
8. Student exit feedback analysis
9. Subject Assessment Board (SAB)
10. Programme Assessment Board (PAB)

32. Curriculum Map

Course Code	Intended Learning Outcomes											
	Knowledge and Understanding				Cognitive (Thinking) Skills (Critical, Analytical, Problem Solving, Innovation)				Practical Skills			
	KU1	KU2	KU3	KU4	CS1	CS2	CS3	CS4	PS1	PS2	PS3	PS4
20ASC501A												
20ASC502A				x		x			x	x		
20ASC503A		x				x	x				x	x
20ASC504A			x		x			x	x	x		
20ASC505A	x					x					x	x
20ASC506A	x					x					x	x
20ASC507A	x				x							
20ASE5XXA	x	x	x	x	x	x	x	x	x	x	x	x
20ASC521A				x		x	x	x			x	x
20ASC522A	x	x	x	x	x	x	x	x	x	x	x	x
20ASC524A	x	x	x	x	x	x	x	x	x	x	x	x
20FET508A				x	x	x	x					

33. Capability / Transferable Skills Map

Course Code	Group work	Self -learning	Research Skills	Written Communication Skills	Verbal Communication Skills	Presentation Skills	Behavioural Skills	Information Management	Personal management / Leadership
20ASC501A		x		x	x	x		x	
20ASC502A		x		x	x	x		x	
20ASC503A		x		x	x	x		x	
20ASC504A		x		x	x	x		x	
20ASC505A		x		x	x	x		x	
20ASC506A		x	x	x	x	x		x	
20ASC507A		x	x	x	x	x		x	
20ASE5XXA		x	x	x	x	x		x	
20ASC521A		x		x	x	x	x	x	x
20ASC522A	x	x	x	x	x	x	x	x	x
20ASC524A		x	x	x	x	x	x	x	x
20FET50XA	x	x	x	x	x	x	x	x	x

34. Co-curricular Activities

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposium, paper writing, attending industry exhibitions, project competitions and related activities to enhance their knowledge and network.

35. Cultural and Literary Activities

To remind and ignite the creative endeavors, annual cultural festivals are held and the students are made to plan and organize the activities.

36. Sports and Athletics

Students are encouraged to develop a habit of taking part in outdoor and indoor games on regular basis.