Programme Specifications

M. Tech. Programme

Programme: Data Science and Engineering	Department: Computer Science and Engineering

Faculty of Engineering & Technology

M.S. Ramaiah University of Applied Sciences

Programme Specification

Programme: M. Tech. in Data Science and Engineering	
Faculty	Engineering & Technology
Department	Computer Science and Engineering
Programme	**M. Tech**
Dean of Faculty	Prof.Arulanantham
HOD	Prof.PVR Murthy

1.	**Title of the Award**	
		M. Tech. in Data Science and Engineering
2.	**Modes of study**	
		Full Time
3.	**Awarding Institution / Body**	
		M. S. Ramaiah University of Applied Sciences – Bengaluru, India
4.	**Joint Award**	
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5.	**Teaching Institution**	
		Faculty of Engineering & Technology
		M S Ramaiah University of Applied Sciences - Bengaluru, India
6.	**Date of Programme Specification**	
		20/05/2019
7.	**Date of Programme Approval by the Academic Council of MSRUAS**	
		24/07/2019
8.	**Next Review Date**	
		May 2021
9.	**Programme Approving Regulatory Body and Date of Approval**	
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10.	**Programme Accrediting Body and Date of Accreditation**	
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11.	**Grade Awarded by the Accreditation Body**	
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12.	**Programme Accreditation Validity**	
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13.	**Programme Benchmark**	
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14. Rationale for the Programme
The ability to understand data and gain insights has become extremely critical to success in innovation and businesses in various domains. While Data Science and Engineering, as a field, is still evolving, the demand for professionals and researchers in the area is increasing day by day. It is quite well known that currently industry and R&D establishments have a very high recruitment need for professionals in Data Science while the production of qualified personnel is rather low.

With the advent of Big Data in all spheres of human activity, Data Science and Engineering as a programme needs to enable students to gain a deep knowledge of various phases of Big Data life cycle, starting from data pre-processing, curation to effective data mining algorithms and finally to efficient architectures based on the map-reduce paradigm for deployment of such applications. Knowledge discovery from huge volumes of data can be a significant differentiating factor in achieving success in research activities and also for decision making in various businesses. A quick glance at the status of production of data science and engineering professionals with comprehensive knowledge and insights, to meet the demands of niche jobs in the industry and R&D labs and academia, reveals that there is a strong need for MTech programmes of high quality covering relevant breadth and depth requirements in data science and engineering. There is an urgent need for high-quality Data Science professionals to address the design and implementation requirements of various phases of Big Data Life Cycle in various application domains such as Healthcare, Genomics and Cyber Security. Thus there is a strong need for a programme that allows a student to delve into theory and practice of Data Science and Engineering, enabling him or her to innovate in the process of solving data mining problems for various applications and efficiently deploying Big Data applications employing appropriate distributed computing paradigms.

15. Programme Aim

The aim of the programme is to enable postgraduates with advanced knowledge and understanding of Data Science and Engineering; higher order critical, analytical, problem solving and transferable skills; ability to think rigorously and independently to meet higher level expectations of industries related to data science and engineering; Big data applications, academics, research or take up an entrepreneurial role.

16. Programme Objectives

The programme in Data Science and Engineering, firstly, lays an adequate foundation in data science, mathematics and programming. The programme also lets the student acquire specialized knowledge and insights with a balance in coverage of theory and practice to be able to build effective big data applications.

The objectives of the programme are to enable the students to:
1. Data life cycle and associated functions
2. Programming for data science along with libraries
3. Mathematical pre-requisites required for data science and engineering
4. Distributed computing concepts and techniques for Big data
5. Mechanisms related to data storage, data access, data transfer, visualization and predictive modelling in a cost-effective manner
6. Key aspects of distributed processing in big data analytics
7. Data Visualization
8. Machine learning

17. Intended Learning Outcomes of the Programme

The Intended Learning Outcomes (ILOs) are listed under four headings:
1. Knowledge and Understanding, 2. Cognitive Skills 3. Practical Skills and 4. Capability / Transferable Skills.

1. Knowledge and Understanding

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

KU1:	Discuss various phases of data life cycle along with the associated functions
KU2:	Discuss security and privacy policies that are appropriate for data processing
KU3:	Discuss efficient distributed computing solutions for Big data processing
KU4:	Discuss techniques for data visualization

2. Cognitive Skills

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

CS1:	Apply computational and statistics concepts to work with real data in various fields
CS2:	Design solutions for Big data processing problems
CS3:	Apply suitable techniques for data visualization
CS4:	Infer meaningful insights from data

3. Practical Skills

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

PS1: Use appropriate methods, tools and frameworks to implement various steps in a typical data life cycle created for a Big data application

PS2: Implement distributed solutions for data processing using tools such as Hadoop

PS3: Develop programs for Big data applications with visualization features

PS4: Test solutions of Big data problems from both functional and non-functional requirement perspectives

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: Adapt 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 modules and earn credits for the award of the degree.

Complete details of each of the modules such as ILO's, content, resources, teaching-learning processes and other related information are outlined in Module Specification of the respective programme.

(Total 44 credits : 06 core courses total 26 credits and 4 elective courses total 16 credits spread in first two semesters)

SEMESTER 1

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	19MIC501A	Applied Mathematics				4	100
2	19DSC501A	Programming for Data Science				4	100
3	19DSC502A	Data Mining				4	100
4	19DSC503A	Data Processing				4	100
5	19DSE501A	*Artificial Intelligence*				4	100
7	19FET508A	Research Methodology & IPR	2	--	--	2	50
8	19FET509A	Professional Communication	1	--	--	0	
	XX					**22**	**550**
	XX hours						
	Minimum	**18**			**Maximum**		**24**

SEMESTER 2

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	19MIC504A	Artificial Neural Networks				5	100
2	19DSC504A	Advanced Data Processing				5	100
3	19DSE502A	*Distributed Computing*				4	100
4	19DSE503A	*Natural Language Processing*				4	100
5	19DSE504A	*Text Mining and Visualization*				4	100
6	19FET510A	Value Education	1			0	
		XX	**X**	**X**		**22**	**500**
	XX hours						
	Minimum	**18**			**Maximum**		**24**

SEMESTER 3

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	19DSC521A	*Internship*			10	4	100
2	**19DSC522A**	Group project			**15**	8	200
3	19DSC523A	Dissertation and Publication Phase-1					
Total					25	12	300
Total number of contact hours per week			XX hours				
Number of credits can be registered			Minimum	XX		Maximum	XX

SEMESTER 4

Sl.No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1	19DSC523A	Dissertation and Publication			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

Elective Modules List			
Stream / Specialization	S. No.	Module Code	Module Title
Stream -1: Natural Language Processing	E11	19DSE501A	Artificial Intelligence
	E12	19DSE502A	Distributed Computing
	E13	19DSE503A	Natural Language Processing
	E14	19DSE504A	Text Mining and Visualization
Stream-2: Big Data Applications	E21	19DSE501A	Artificial Intelligence
	E22	19DSE502A	Distributed Computing
	E23	19DSE505A	Big Data & Healthcare
	E24	19DSE506A	Big Data & Software Defined Networks

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 module 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 six Professional core courses (PM1- PM6), four Professional elective courses (PE1 – PE4), two audit courses (NC), and one compulsory course (CC) followed by Group Project, Internship and Dissertation & Publication courses.

Core courses (PC1- PC6) 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 module.

Compulsory course (CM) 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 (PE1 – PE4) 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 module that spans multiple streams, the case may be considered subject to the affordability of academic logistics and approval by the module leader, HODs and Deans.

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 PE3 and PE4 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 Module 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 module.

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 send a report and make a presentation to the members of the panel constituted by the HOD for assessment.

For further details related to this module, please refer to Module Specification of the respective programmes.

25. **Dissertation and Publication**

This module 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 module refer to Module Specifications of the respective programmes

26. **Course Assessment**

      a.   Every course will be assessed for a weight of 100%

      b.   There are two components-Component-1 and Component-2

      c.   Component-1 carries a weight of 50% and Component -2 carries a weight of 50%

      d.   Component -1 (CE) is subdivided into Term Tests , Assignments and laboratory examinations/ technical presentation

           Test carry 25 Marks

           Assignment carry 50 Marks.

           Laboratory assessment/ technical presentation carry 25 Marks

           Total 100 marks will be reduced to 50 Marks.

      e.   Component -2 (SEE) is Written Examination for 100 Marks. It will be reduced to 50 Marks.

      f.   A minimum of overall 40% is required for a pass with 40% in each of the Components

      g.   The marks distribution for each course is given in the programme structure-section 20

      9.   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 module during the regular term and fail in the module.

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. Module 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 module 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

Module 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
19MIC501A	X									X		
19DSC501A	X	X			X	X				X	X	
19DSC502A	X	X				X				X	X	
19DSC503A	X	X				X				X	X	
19DSE501A	X	X				X				X	X	
19FET508A	X	X	X	X								
19FET509A	X	X										
19MIC504A	X	X				X				X	X	
19DSC504A	X	X				X				X	X	
19DSE502A	X	X				X				X	X	
19DSE503A	X	X				X				X	X	
19DSE504A	X	X				X				X	X	
19FET510A	X	X										
19DSC521A	X	X								x	x	
19FET522A	X	X	X	X								
19FET523A	X	X	X	X	X	X	X	X	X	X	X	X
19FET524A					X	X	X	X				
19FET525A	X	X	X	X	X	X	X	X	X	X	X	X
19FET526A					X	X	X	X				
19FET527A	X	X	X	X								
19FET528A	X	X	X	X	X	X	X	X				
19FET529A					X	X	X	X	X	X	X	X
19FET530A					X	X	X	X	X	X	X	X
19DSC522A	X	X	X	X	X	X	X	X	X	X	X	X
19DSC523A	X	X	X	X	X	X	X	X	X	X	X	X

33. Capability / Transferable Skills Map

Module Code	Group work	Self -learning	Research Skills	Written Communication Skills	Verbal Communication Skills	Presentation Skills	Behavioural Skills	Information Management	Personal management/ Leadership
19MIC501A		X		X	X	X		X	
19DSC501A		X		X	X	X		X	
19DSC502A		X	X	X	X	X		X	
19DSC503A		X	X	X	X	X		X	
19DSE501A		X	X	X	X	X		X	
19FET508A		X	X	X	X	X		X	
19FET509A		X	X	X	X	X		X	
19MIC504A		X	X	X	X	X		X	
19DSC504A		X	X	X	X	X		X	
19DSE502A		X	X	X	X	X		X	
19DSE503A		X	X	X	X	X		X	
19DSE504A		X	X	X	X	X		X	
19FET510A		X	X	X	X	X	X	X	
19DSC521A		X	X	X	X	X		X	X
19FET522A		X	X	X	X	X	X	X	
19FET523A	X	X	X	X	X	X	X	X	
19FET524A		X	X	X	X	X		X	
19FET525A	X	X	X	X	X	X	X	X	
19FET526A	X	X		X	X	X	X	X	X
19FET527A		X	X	X	X	X	X	X	
19FET528A		X		X	X	X	X	X	X
19FET529A	X	X		X	X	X		X	
19FET530A	X	X		X	X	X		X	
19DSC522A	X	X		X	X	X	X	X	X
19DSC523A		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 invoke 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.

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