



# **Programme Specifications**

**B.Sc.(Hons) (Data Sciences) Degree Programme**

**School of Social Sciences**

**Batch 2020-2021**

# University's Vision, Mission and Objectives

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

## Vision

MSRUAS aspires to be the premier university of choice in Asia for student centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

## Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation and excellence in our teaching and research. We value integrity, quality and teamwork in all our endeavors. We inspire critical thinking, personal development and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

## Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to equip students and scholars to meet the needs of industries, business and society
2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society
3. To promote health, human well-being and provide holistic healthcare
4. To provide technical and scientific solutions to real life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences
5. To instill the spirit of entrepreneurship in our youth to help create more career opportunities in the society by incubating and nurturing technology product ideas and supporting technology backed business
6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in
7. To develop partnership with universities, industries, businesses, research establishments, NGOs, international organizations, governmental organizations in India and abroad to enrich the experiences of faculties and students through research and developmental programmes

**Programme Specifications: B. Sc. (Psychology)**

<b>Faculty</b>	School of Social Sciences
<b>Department</b>	Data Sciences
<b>Programme Code</b>	-
<b>Programme Name</b>	B.Sc. (Hons) (Data Sciences)
<b>Dean of the Faculty/PVC</b>	Prof. Anindya Sen
<b>Head of the Department</b>	TBA

1. **Title of the Award:** B.Sc. (Hons) (Data Sciences)
2. **Mode of Study:** Full-Time
3. **Awarding Institution /Body:** M. S. Ramaiah University of Applied Sciences, Bengaluru
4. **Joint Award:** Not Applicable
5. **Teaching Institution:** School of Social Sciences, M. S. Ramaiah University of Applied Sciences, Bengaluru
6. **Date of Programme Specifications:** October 2020
7. **Date of Programme Approval by the Academic Council of MSRUAS:** 23-Oct-2020
8. **Next Review Date:** May 2024
9. **Programme Approving Regulating Body and Date of Approval:** Karnataka State Council of Higher education
10. **Programme Accredited Body and Date of Accreditation:** Not Applicable
11. **Grade Awarded by the Accreditation Body:** Not Applicable
12. **Programme Accreditation Validity:** Not Applicable
13. **Programme Benchmark:** Not Applicable

**14. Rationale for the Programme**

The **B.Sc. (Hons.) in Data Sciences and Analytics** program enables students to engage in the domains of data mining, analysis, and predictive modelling. The programme's curriculum is more application-oriented, and the curriculum mainly stresses basic mathematics, statistics, and computer science. The programme's emphasis is to expose students to advanced concepts, developments, and techniques in data analytics. The programme is designed to meet the rising workforce demand of professionals in data management, big data, and data analytics fields.

The **B.Sc. (Hons.) in Data Sciences and Analytics** program is developed by the faculty members based on various universities, financial institutions, and industries. The curriculum is outcome-based, and it imbibes required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop application-oriented learning skills, critical, analytical thinking, and problem-solving abilities for a smooth transition from academic to the real-life work environment.

## 15. Programme Mission

The purpose of the programme is to enable students to acquire the type of skills, critical thinking, and competencies needed in data science and analytics. The program will educate a new generation of information professionals, particularly those students with a science background pursuing an analytic related field.

## 16. Graduate Attributes (GAs)

- GA-1. Engineering knowledge:** Ability to apply knowledge of mathematics, science, and Engineering fundamentals to solve complex problems in engineering.
- GA-2. Problem Analysis:** Ability to analyse engineering problems, interpret data and arrive at meaningful conclusions involving mathematical inferences.
- GA-3. Design and Development of Solutions:** Ability to design an engineering system, component, or process to meet desired needs considering public health and safety, and the cultural, societal, and environmental considerations.
- GA-4. Conduct Investigations of Complex Problems:** Ability to understand and solve complex engineering problems by conducting experimental investigations.
- GA-5. Modern Tool Usage:** Ability to apply appropriate tools and techniques and understand utilization of resources appropriately to complex engineering activities.
- GA-6. The Engineer and Society:** Ability to understand the effect of engineering solutions on legal, cultural, social, and public health and safety aspects.
- GA-7. Environment and Sustainability:** Ability to develop sustainable solutions and understand their effect on society and environment.
- GA-8. Ethics:** Ability to apply ethical principles to engineering practices and professional responsibilities.
- GA-9. Individual and Teamwork:** Ability to work as a member of a team, to plan and to integrate knowledge of various engineering disciplines and to lead teams in multidisciplinary settings.
- GA-10. Communication:** Ability to make effective oral presentations and communicate technical ideas to a broad audience using written and oral means.
- GA-11. Project Management and Finance:** Ability to lead and manage multidisciplinary teams by applying engineering and management principles.
- GA-12. Life-long learning:** Ability to adapt to the changes and advancements in technology and engage in independent and life-long learning.

## 17. Programme Outcomes (POs)

### **B.Sc. (hons) (Data Sciences) graduates will be able to:**

- PO-1.** Apply the knowledge of data sciences and analytics to the solution of complex societal problems.
- PO-2.** Identify problems by closely examining the situations around them and think holistically about the phenomena and generate viable solutions to these problems. Exhibit the skill of critical thinking and understand scientific texts and place scientific statements and themes in contexts and evaluate them in terms of generic conventions.
- PO-3.** Demonstrate ability to accommodate the views of others and present their own opinions and complex ideas, in written or oral form, in a clear and concise manner in group settings. Exhibit thoughts and ideas effectively in writing and orally; communicate with others using appropriate media, build effective interactive and presenting skills to meet global competencies.
- PO-4.** Infer scientific literature, build a sense of enquiry and be able to formulate, test, analyze, interpret, and establish hypothesis and research questions; and to identify and consult relevant sources to find answers.
- PO-5.** Create new conceptual, theoretical, methodological innovations that integrate and transcend beyond discipline-specific approaches to address a common problem.
- PO-6.** Perform independently and collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
- PO-7.** Demonstrate empathetic social concern and equity centered national development and act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
- PO-8.** Analyze the impact of the scientific solutions in societal and environmental contexts for sustainable development.
- PO-9.** Demonstrate attitudes of being a life-long learner who passionately pursues self-determined goals in the broadest context of socio-technological changes.

## 18. Programme Goal

The programme goal is to produce graduates having critical, analytical and problem-solving skills, and ability to think independently, and to pursue a career in data sciences/analytics and allied areas.

### **19. Program Educational Objectives (PEOs)**

The objectives of the B.Sc. (Hons.) in Data Sciences and Analytics programme are to:

- PEO-1.** Create a community of informed purveyors of knowledge geared towards academic excellence and increase the knowledge base and skill sets aimed at enhancing their professional competence.
- PEO-2.** Promote innovation and research by instilling a sense of independent and critical thinking with sensitivity to social needs.
- PEO-3.** Inculcate strong human values and social, interpersonal and leadership skills required for professional success in evolving global professional environments.

### **20. Programme Specific Outcomes (PSOs)**

At the end of the B.Sc. (hons) (Data Sciences) program, the graduate will be able to:

- PSO-1.** Apply the knowledge of data sciences and analytics to develop innovative and inclusive understanding to real-world issues.
- PSO-2.** Acquire the skills necessary to think critically and communicate effectively about data sciences and analytics and allied domains.
- PSO-3.** Demonstrate the understanding of life-long learning and leadership qualities through professional development and strive for the betterment of organization, environment, and society.

**21. Programme Structure:**

Semester 1							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Compulsory Foundation Course 1 (CFC 1)	3	1		4	100
2		Compulsory Foundation Course 1 (CFC 2)	3	1		4	100
3		Linear Algebra (CC)	4	1		5	100
4		Programming in R Lab (CC)	4	1		5	100
5		Data Visualization (CC)	4	1		5	100
6		Ability Enhancement Course 1	1	1		2	100
<b>Total</b>			<b>19</b>	<b>6</b>		<b>25</b>	<b>600</b>
<b>Total number of contact hours per week</b>			<b>25</b>				

Semester 2							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Compulsory Foundation Course 3 (CFF 3)	3	1		4	100
2		Compulsory Foundation Course 4 (CFC 4)	3	1		4	100
3		Inferential Statistics (CC)	4	1		5	100
4		Regression Techniques and Time Series Analysis (CC)	4	1		5	100
5		Python Programming Lab (CC)	4	1		5	100
6		Generic Elective 1	4	1		5	100
7		Skill Enhancement Course – 1 (SEC-1)	1	1		2	100
<b>Total</b>			<b>23</b>	<b>7</b>		<b>30</b>	<b>700</b>
<b>Total number of contact hours per week</b>			<b>30</b>				

Semester 3							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Multivariate Analysis (CC)	4	1		5	100
2		Database Management Systems (CC)	4	1		5	100
3		Data Pre-processing (CC)	4	1		5	100
4		Generic Elective 2	4	1		5	100
5		Ability Enhancement Course 1	1	1		2	100
<b>Total</b>			<b>17</b>	<b>22</b>		<b>22</b>	<b>500</b>
<b>Total number of contact hours per week</b>			<b>22</b>				

Semester 4							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Operations Research & Optimisation Techniques ion Techniques (CC)	4	1		5	100
2		Data Warehousing & Mining (CC)	4	1		5	100
3		Artificial Intelligence (CC)	4	1		5	100
4		Generic Elective-3	4	1		5	100
5		Skill Enhancement Course – 2 (SEC-2)	1	1		2	100
<b>Total</b>			<b>17</b>	<b>5</b>		<b>22</b>	<b>500</b>
<b>Total number of contact hours per week</b>			<b>22</b>				

Note: Students must choose one DSE out of three DSEs

Semester 5							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Machine Learning (CC)	4	1		5	100
2		Big Data (CC)	4	1		5	100
3		Deep Learning (DSE) (Track 1)	4	1		5	100
4		Introduction to Computational Social Sciences (DSE) (Track 2)	4	1		5	100
5		Open Elective-1 (SSS)	4	1		5	100
<b>Total</b>			<b>20</b>	<b>5</b>		<b>25</b>	<b>500</b>
<b>Total number of contact hours per week</b>			25				

Note: Students must choose three DSE out of four DSEs

Semester 6							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Dissertation/Project (CC)	12			6	100
2		Computing for Data Sciences (DSE) (Track 1)	4	1		5	100
3		Risk Management (DSE) (Track 2)	4	1		5	100
4		Open Elective-2 (SSS)	4	1		5	100
<b>Total</b>			<b>24</b>	<b>3</b>		<b>21</b>	<b>400</b>
<b>Total number of contact hours per week</b>							

Note: Students must choose one DSE out of three DSEs

Semester 7							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Cloud Computing (DSE) (Track 1)	4	1		5	100
2		Advanced Computing for Data Sciences (DSE) (Track 1)	4	1		5	100
3		Advanced Machine Learning (DSE) (Track 1)	4	1		5	100
4		Applied Social Network Analysis with Python (DSE) (Track 2)	4	1		5	100
5		Applications in Economics (DSE) (Track 2)	4	1		5	100
6		Consumer Behavior (DSE) (Track 2)	4	1		5	100
7		Open Elective-3 (SSS)	4	1		5	100
<b>Total</b>			<b>28</b>	<b>5</b>		<b>35</b>	<b>700</b>
<b>Total number of contact hours per week</b>			35				

Semester 8							
Sl. No.	Code	Course Title	Theory (h/W/S)	Tutorials (h/W/S)	Practical (h/W/S)	Total Credits	Max. Marks
1		Capstone/project/ Internship	12			6	100
<b>Total</b>			<b>12</b>			<b>6</b>	<b>100</b>
<b>Total number of contact hours per week</b>			12				

Note:

## 22. Open Elective Courses

A number of Open Elective Courses from Faculties of engineering, management and commerce, art and design, hospitality management and catering technology, pharmacy, dental sciences are



offered as mentioned in the University's website. Students can choose the Open Electives on their own choice.

### **22.1. Innovation Courses in Lieu of Open Elective Courses**

Students can take the following 3-credit innovation courses in lieu of Open Elective Courses.

- a) Design Thinking and Innovation (20INO250A)
- b) Skill Development (20INO251A)
- c) Industrial Problem Solving and Hackathons (20INO252A)

### **23. Course Delivery:** As per the Timetable

### **24. Teaching and Learning Methods**

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

### **25. Assessment and Grading**

#### **25.1. Components of Grading**

There shall be **two components** of grading in the assessment of each course:

**Component 1, Continuous Evaluation (CE):** This component involves multiple subcomponents (SC1, SC2, etc.) of learning assessment. The assessment of the subcomponents of CE is conducted during the semester at regular intervals. This subcomponent represents the formative assessment of students' learning.

**Component 2, Semester-end Examination (SEE):** This component represents the summative assessment carried out in the form an examination conducted at the end of the semester.

Marks obtained CE and SEE components have equal weightage (CE: 50% and SEE: 50%) in determining the final marks obtained by a student in a Course.

The complete details of Grading are given in the Academic Regulations.

#### **25.2. Continuous Evaluation Policies**

Continuous evaluation depends on the type of the course as discussed below:

### 25.2.1 Theory Courses

The following **TWO options** are available for each Faculty to perform the CE exercise.

#### Option 1 for a Theory Course:

Theory Course			
SC1	SC2	SC3	SC4
25 Marks	25 Marks	25 Marks	25 Marks

In Option 1, there shall be four subcomponents of CE (SC1, SC2, SC3 and SC4). Each subcomponent is evaluated individually for 25 marks. It is mandatory that two of the four subcomponents are term-tests. The remaining two subcomponents can be of any of the following types:

- a) Online Test
- b) Assignments/Problem Solving
- c) Field Assignment
- d) Open Book Test
- e) Portfolio
- f) Reports
- g) Case Study
- h) Group Task
- i) Any other

After the four subcomponents are evaluated, the CE component marks are determined as:

$$\text{CE Component Marks} = (\text{Total of the marks obtained in all the four subcomponents}) \div 2$$

An additional subcomponent (SC5) may be used at the discretion of the Faculty/Department. The department can conduct the 5<sup>th</sup> subcomponent SC5 if this subcomponent gives benefit to students. If the Department/Faculty conducts the SC5 subcomponent of evaluation, and the score obtained by the student in SC5 is greater than the lowest score of the previous four subcomponents SC1 to SC4, then it replaces the lowest of the four scores.

#### Option 2 for a Theory Course:

Theory Course			
SC1	SC2	SC3	SC4
25 Marks	25 Marks	25 Marks	25 Marks

In Option 2, there shall be four subcomponents, each carrying 25 marks. Out of these, there shall be two assignments and two term-tests. The assignments can be of any of the following types:

- a) Online Test

- b) Problem Solving
- c) Field Assignment
- d) Open Book Test
- e) Portfolio
- f) Reports
- g) Case Study
- h) Group Task
- i) Any other

After the four subcomponents of CE are evaluated, the CE component Marks are determined as:

CE Component Marks = (Best of two Assignment Marks) + (Best of two Term-Test Marks)

Each Faculty Dean, in consultation with the heads of all departments in the Faculty and the Faculty Academic Registrar, decides whether Option 1 or Option 2 is adopted for each programme offered by the Faculty. He/she notifies the students about the option at the beginning of the semester.

### 25.2.2 Laboratory Course

For a laboratory course, the scheme for determining the CE marks is as under:

Laboratory Course		
SC1	SC2	SC3 (Optional)
25 Marks	25 Marks	25 Marks

The subcomponents can be of any of the following types:

- a) Laboratory / Clinical Work Record
- b) Experiments
- c) Computer Simulations
- d) Creative Submission
- e) Virtual Labs
- f) Viva / Oral Exam
- g) Lab Manual Report
- h) Any other (e.g. combinations)

After the subcomponents of CE are evaluated, the CE component Marks are determined as:

CE Component Marks = (Total of the best two subcomponent marks out of the three) ÷ 2

### 25.2.3 Course Having a Combination of Theory and Laboratory

For a course that contains the combination of theory and laboratory sessions, the scheme for determining the CE marks is as under:

For a Course having a Combination of Theory and Laboratory Sessions			
SC1 (Theory)	SC2 (Theory)	SC3 (Theory)	SC4 (Laboratory)
25 Marks	25 Marks	25 Marks	25 Marks

There shall be four subcomponents, each carrying 25 marks. Out of these, there shall be two term-tests and an assignment to evaluate the students' performance in theory. The fourth subcomponent shall be set to evaluate the students' performance in the laboratory.

The theory assignment can be of any of the following types:

- a) Online Test
- b) Problem Solving
- c) Field Assignment
- d) Open Book Test
- e) Portfolio
- f) Reports
- g) Case Study
- h) Group Task
- i) Any other

The laboratory subcomponent can be of any of the following types:

- a) Laboratory / Clinical Work Record
- b) Experiments
- c) Computer Simulations
- d) Creative Submission
- e) Virtual Labs
- f) Viva / Oral Exam
- g) Lab Manual Report
- h) Any other (e.g. combinations)

After the four subcomponents are evaluated, the CE component marks are determined as:

$$\text{CE Component Marks} = (\text{Total of the marks obtained in all the four subcomponents}) \div 2$$

## 26. Minor Programme

Not applicable

## 27. Student Support for Learning

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

## **28. Quality Control Measures**

1. Review of Course Notes
2. Review of Question Papers and Assignment Questions
3. Student Feedback
4. Moderation of Assessed Work
5. Opportunities for 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
9. Subject Assessment Board (SAB)
10. Programme Assessment Board (PAB)

**29. Programme Map (Course-PO-PSO Map)**

Sem.	Course Title	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PSO-1	PSO-2	PSO-3
1	Compulsory Foundation Course 1 (CFC 1)	3		2			1				3	1	2
1	Compulsory Foundation Course 1 (CFC 2)	3		2				1		1	3	1	2
1	Linear Algebra (CC)	3		2			1				3	1	2
1	Programming in R Lab (CC)	3	2						1		3	2	1
1	Data Visualization (CC)			2		3			2	1	2	3	1
1	Ability Enhancement Course 1	2	3							1	3	2	1
2	Compulsory Foundation Course 3 (CFC 3)	3		2			1				3	1	2
2	Compulsory Foundation Course 4 (CFC 4)	3	2							1	3	2	1
2	Inferential Statistics (CC)	3		2			2				2	3	1
2	Regression Techniques and Time Series Analysis (CC)	2		3		3	3		2		2	3	1
2	Python Programming Lab (CC)					3	2			2	2	3	1
2	Generic Elective 1	3		2			1				3	1	2
2	Skill Enhancement Course – 1 (SEC-1)			1		2			3		3	2	1
3	Multivariate Analysis (CC)	3		2			1				3	1	2
3	Database Management Systems (CC)	2		3			1				2	3	1
3	Data Pre-processing (CC)			3	2			1			2	3	1
3	Generic Elective 2	3		2			1				3	1	2
3	Ability Enhancement Course 1		3	2			1				3	2	1
4	Operations Research & Optimisation Techniques ion Techniques (CC)	2					1		3		3	2	1
4	Data Warehousing & Mining (CC)		3	2						1	3	1	2
4	Artificial Intelligence (CC)	3		2			1				3	1	2
4	Generic Elective-3		3	1			2				3	2	1
4	Skill Enhancement Course – 2 (SEC-2)			3				1	2		2	3	1
5	Machine Learning (CC)				3		2			1	2	3	1
5	Big Data (CC)				3	3			2		3	1	2

5	Deep Learning (DSE) (Track 1)	3		2			2				2	3	1
5	Introduction to Computational Social Sciences (DSE) (Track 2)		3	1			2				3	2	1
5	Open Elective-1 (SSS)		3				1	2		2	3	1	
6	Dissertation/Project (CC)				3	3			2		3	1	2
6	Computing for Data Sciences (DSE) (Track 1)	2	3						1		3	2	1
6	Risk Management (DSE) (Track 2)	3		2			1				3	1	2
6	Open Elective-2 (SSS)	3	2						1		3	2	1
7	Cloud Computing (DSE) (Track 1)		3	1			2				3	2	1
7	Advanced Computing for Data Sciences (DSE) (Track 1)				3	2			2	2	3	1	
7	Advanced Machine Learning (DSE) (Track 1)	2		3		3	3		2		2	3	1
7	Applied Social Network Analysis with Python (DSE) (Track 2)					3	2			2	2	3	1
7	Applications in Economics (DSE) (Track 2)	3		2			1				3	1	2
7	Consumer Behavior (DSE) (Track 2)			1		2			3		3	2	1
7	Open Elective-3 (SSS)	3		2			1				3	1	2
8	Capstone/project/ Internship				3	3			2		3	1	2
<b>3: Very Strong, 2: Strong Contribution, 1: Moderate Contribution</b>													

### 30. Co-curricular Activities

Students are encouraged to take part in co-curricular activities like seminars, conferences, symposia, paper writing, attending industry exhibitions, project competitions and related activities for enhancing their knowledge and networking.

### 31. Cultural and Literary Activities

Annual cultural festivals are held to showcase the creative talents in students. They are involved in planning and organizing the activities.

### 32. Sports and Athletics

Students are encouraged to take part in sports and athletic events regularly. Annual sports meet will be held to demonstrate sportsmanship and competitive spirit.