UNIVERSITY OF MUMBAI No. UG/138 of 2018-19

CIRCULAR:-

The Principals of the affiliated Colleges, the Head of the University Departments and Directors of the recognized Institutions in Science & Technology Faculty.

They are hereby informed that the recommendations made by the Ad-hoc Board studies in Computer Science at its meeting held on 4th July, 2018 have been accepted by the Academic Council at its meeting held on 10th July, 2018 vide item No. 4.14 and subsequently approved by the Management Council at its meeting held on 10th September, 2018 vide item No.11 and that in accordance therewith, in exercise of the powers conferred upon the Management Council under Section 74(4) of the Maharashtra Public Universities Act, 2016 (Mah. Act No. VI of 2017) the Ordinance 6462 & 6463 and Regulations 9202 & 9203 the syllabus of Master's Degree/Micro Degree in Data Science has been introduced and the same have been brought into force with effect from the academic year 2018-19, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032 3rd January, 2019 To,

January, 2019

(Prof. Sunil Bhirud) I/c. REGISTRAR

The Principals of the affiliated Colleges, the Head of the University Departments and Directors of the recognized Institutions in Science & Technology Faculty.(Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C/4.14/10/07/2018 M.C/11/10/09/2018 No. UG/138 - A of 2018 MUMBAI-400 032 Copy forwarded with Compliments for information to:-1) The I/c Dean, Faculty of Science & Technology, 2) The Chairman, Board of Studies in Computer Science' 3) The Director, Board of Examinations and Evaluation, 3) The Director, Board of Students Development, 4) The Co-ordinator, University Computerization Centre,

370

(Prof. Sunil Bhirud) I/c. REGISTRAR



6.6462	-	Title of the Programme	specialization in Data Science (each Course of this Programme is available as a Micro degree Programme)			
0.6463	2	Eligibility for Admission	A candidate with minimum 50% score in XII can appear for the entrance examination through which the admission merit list will be generated; Graduate students are eligible for Master's Programme and others are eligible for taking admission in Micro degrees			
12-9202	- 3	Passing Marks	40%			
	4	Ordinances / Regulations (if any)	Per the requirement of the detail Programme structure attached herewith.			
R.9203	5	No. of Years / Semesters	4 Semesters for Master's degree; Each Course is of one semester duration			
	6	Level	P.G. / U.G. / Diploma / Certificate (Strike out which is not applicable)			
	7	Pattern	Yearly / Semester (Strike out which is not applicable)			
	8	Status	New / Revised (Strike out which is not applicable)			
	9	To be implemented from Academic Year	From Academic Year 2018-19			

Master's and Micro degree Programmes with Data Science specialization

Objective: To produce world class data scientists in diverse domains. An avenue for a graduate of any discipline to earn MSc in Computer Science with a special training for making career in the domain of his / her liking by employing innovations and applications that are based on data science and artificial intelligence. This Programme is a quality assured alternative for the employed learners who generally prefer the Distance learning.

Intake: As the Programme shall be offered in blended MOOC model, there shall not be any limit on the intake; To begin with we plan to offer admissions to top 1000 scorers in the admission entrance test [Ref. Annexure I].

Duration: 2 years, i.e., 4 semester, a specialized Programme including a rigorous training, a capstone project and one semester internships with WIAI or any such AI industry.

Eligibility: Anybody having passed XII or higher standard examination with minimum 50% score can appear for the national level entrance examination and take admission if gets through. The admissions to Master's degree (MSc in Computer Science, specialization data science) shall be open to the graduates of this University or its equivalents.

The candidates who qualify the entrance test and not having completed their graduation could take admission to micro degrees (Certificates) and are allowed to accumulate credits by qualifying discrete Courses of this Programme by following the pre-requisite structure. The credits earned by such candidates shall be recognized and transferred by this University and be utilized by the candidates wherever applicable.

The candidates who qualify the entrance test and have taken admission in any of the Programmes of This University including a Master's Degree Programme, can accumulate up to half of the credits of this Programme while completing the other Programme and secure Master's in Computer Science with specialization in Data Science by earning the remaining credits in one year any time after his / her graduation.

The admission procedure to this Programme shall be opened twice a year, i.e., in the months July and December. The on-line applications for the entrance examination for the academic year starting in the Second half of 2018 are available till 18th July 2018. Please visit: <u>www.mahapariksha.gov.in</u> and <u>http://udcs.mu.ac.in/</u>

Since the Programme will be offered in the blended MOOC model the students taking admission to this Programme would be eligible to take admission simultaneously in some other Programme of This or any other University subject to the Dual degree facilities at the respective Institutions.

Mode of dissemination of knowledge: Each Course shall be equivalent of 6 credits, the teaching-learning spreads over 16 weeks, ideally each week a student is expected to study 6 videos, each of 15-20 minutes, each ending with an activity that calls for the similar amount of time, attends 2 hours of tutoring and 2 hours of practical offered in a flipped classroom and, contributes to forum discussions on 2 threads by spending half an hour on each thread.

Evaluation model: For each Course a student has to secure minimum 16% of the total marks through a Semester-end examination that would carry 40% weight in the total evaluation; the 60% weight would be for the students' attendance and submissions in response to the video-based learning and flipped classroom activities, call it continuous internal evaluation

(CIE). In order to qualify a Course a student has to earn minimum 40% of the total marks in the same; There shall not be minimum passing requirement for the students score in CIE. However, a failed student can choose to improve CIE score once by paying only examination fees and by submitting all the assignments and term-work as prescribed by the on-going term. The students failed in the second attempt have to pay 30% of the tuition fees in addition to the examination fees, i.e., to avail the Course-ware of the year they will wish to appear for the CIE.

Subject to the availability of the Programme / Course in the University, there shall be no limit on the number of attempts a student takes to qualify the same. A syllabus will be valid only for a year and shall be kept up-to-date by generating a refinement almost every year. The repeaters have to follow the syllabus and assignments that are available at the time they wish to appear for the examination.

The Semester examinations shall be conducted in the months December and May.

Fees:

Fees for the Entrance Examination shall be Rs 500/- per student per attempt;

If admitted to the Courses from the first three semesters then a student has to pay Tuition fee Rs 4000 / - and Examination fee Rs 1000 / - per Course plus, Convocation and other fees like Gymkhana, insurance etc., as prescribed by UoM.

Fees for the Fourth semester will be 10K that includes the Departmental support for mentoring the students and processing fees that may require to publish or file patents of their work etc.

The people interested in attending a few of the Courses of the whole Programme in order to seek micro-degree (Certification) in each Course they complete are welcome to do.

A performance based incentive: A candidate scoring 50% or more shall be awarded up to 50% discount in the fees in his / her further studies towards the completion of This Programme. The proposed discount pattern based upon a student's score is given in the Table below.

% score	Discount: % of fee
	paid
50 – 59	10
60 – 74	20
75 – 84	30
85 – 94	40
94 and above	50

Highlights of the Syllabus: Tentatively 75% content is focused to the core data science and 25% is from the interdisciplinary fields of its applications. Theory and practice have been given equal weights. The scope of the Research methodology Course involves mentoring students for a research and an industrial project start from problem formulation phase to publishing the research and securing its IPR. A student alone or in a group is expected to publish his / her work carried out during this Programme, in a good impact factor journal or

file a patent or make its outcome available under Open Source licences etc. The syllabus emphasizes the project based learning.

The recommended curriculum:

Semester I	Semester II
CSDC 101: Programming paradigms UI: Essentials of Algorithms and Data structures; Introduction to Programming paradigms – Functional, Imperative and Object Oriented UII: Software Engineering – Trends and techniques CSDC 102: Database Technologies UI: Databases and Datawarehousing; Data preparation UII: Data Science using R, Excel, Python, SQL, Tableau CSDC 103: Data modeling UI: Descriptive and Inferential statistics, Data visualization UII: Exploratory data analytics, Hypothesis testing	CSDC 201: Artificial Intelligence and Machine Learning UI: Introduction to Artificial intelligence, conventional techniques and Logic programming UII: Introduction to Machine learning, regression, classification (ANN, SVM and Decision tree) and clustering CSDC 202: Soft computing UI: Concepts in Soft and Evolutionary computing – GA and other nature inspired search algorithms UII: Fuzy, Rough and Granular computing CSDC 203: Data Analytics UI: Big data, parallel algorithms, Association rule mining, time series analysis UII: Managing Big data with Hadoop and SPARK
Semester III	Semester IV
CSDC 301: Research Methodology UI: Introduction to Research Methodology, Literature survey and referencing, Problem formulation, Data preparation UII: Design and implementation of experiment	<u>CSDI 401: Internship</u> A semester long internship with an Institution that works in the domain of AI for social good (~400 hours efforts by each student)
<u>CSDC 302: Research Publishing</u> UI: writing and publishing results UII: IPR, patent, copyright and Free knowledge sources	
<u>CSDP 303: Project</u> A mentored Capstone Project in a team of 2-4 (~100 hours efforts by each student)	

Compulsory Elective	Audit Course
CSDE1 104: Robotics I	CSDA1: Robotics I
CSDE2 104: Computer assisted music learning I	CSDA2: Computer assisted music learning I
CSDE3 104: Uncertainty and deep learning I	CSDA3: Scalability and Optimizations I
CSDE4 104: Mastering SAS	

- For each of the papers in Semester I, II and III, UIII will be Case study and Unit IV will be Practical implementation
- CSDE* 104, 204 and 304: Interdisciplinary studies from the domain selected for Capstone project; to be completed preferably through MOOC or with a mentoring institution independently. University may require to give an ancillary affiliation to the Institutions those would like to enrol our students for these Courses. The choice of the interdisciplinary domain is totally at the discretion of the students. It can be Science, Social science, Commerce and Management, Languages or Fine arts or anything that the student likes to works in.
- Passing at least one of the first three Courses of the previous Semester is necessary in order to take admission to the semester two or three; Passing minimum two of the *04 is necessary in order to submit the Capstone project.
- The First Semester Courses follow pre-requisite of qualifying the entrance test. CSDC 101 and 102 together form a pre-requisite for CSDC 201 that is the pre-requisite for CSDC 202; CSDC 301 could be opted by by-passing the entrance test examination and by providing a recommendation of a designated research mentor. Such students will have to pay Rs 500/- admission fees in addition to the Tuition fee and the Examination fee.
- The Capstone project and a Semester long internship is only for the students who opt for the Master's degree and not for the ones who opt Micro-degrees. However the Master's and Micro degree students may plan to appear for NPTEL-IITM certification exams simultaneously.
- Considering the nature and requirement of the Programme it has been proposed that there will be Teaching-learning in blended MOOC model from August to November and January to April in the respective Semesters. The Semester-end examinations shall start on the Second Saturday of December and April. Per Course there shall be one Paper that is to be attempted in two hours. The number of questions may vary depending upon the nature of its content.
- In addition to this mandatory requirement a student in the interest of enhancing his / her CV can opt up to 2 audit Courses (each equivalent of 6 credits in F2F model) while completing this Programme.

Time	2 nd Sat	Sun	Mon	Tue	Wed	Thr	Fri	Sat
10 to	101	201	102	202	103	203	104	204
12								
3 to 5	301	-	302	-	303	-	304	-

Tentative Schedule of Semester End Examination:

Generally the result will be published on the forth Saturday of the same month.

Annexure I

	Syllabus for Entrance Examination
	(5 Questions in English and 10 in each of the other 5)
1	Section name – English Three questions to test English comprehension of class XII level, Two questions to test the vocabulary knowledge / an appropriate usage of a word / correct forms of words
2.	Section name- General knowledge Questions on History, Culture, Literature, Civics & Politics, Sports, Environmental science, Technology, Behavioural science & Psychology, knowledge of current affair from news broadcast
3.	Section Name- Logic Analogy, Sequence, Blood relations. Predicate and Propositional logic
4.	Section name-Mathematics Matrices and Determinants, Lattice theory and linear algebra, Differentiation and integration, 2-D and 3-D geometry, Numerical methods
5.	Section name-Statistics Elementary statistics: Aggregation and measure of central tendency, Probability and Random numbers, Discrete and continuous probability distributions, Hypothesis testing, Operations research
6	Section name-Computer Science Algorithms and data structures, Operating environments and operating systems, Programming and software engineering, Finite state machines and Artificial intelligence, Networking and databases

November 15, 2017: The first meeting of CM War room interns with the University Officials [Attached the presentation copy and a draft proposed MOU]

November 26, 2017: The detail draft of agreement submitted; Dr Anandan added a note that initially they will fund the Teaching positions for DS programme for three years and depending upon the performance of the system they would extend the support for another 2 years. A review after 5 years will tell if we want to continue with DS or any other new thing of the then contemporary requirement; Agreed by all the three parties.

January 18, 2018: The WIAI Team visited campus and met University Engineer for the selection of venue for the inauguration of WIAI

February 2, 2018: Agreement revision submitted by WIAI, annexure regarding DS programme is pending.

[The drafts attached]

February 10, 2018: WIAI communicated a list of requirement at Green-Tech-Audi for the inauguration of WIAI in the hands of Hon PM on February 18, 2018 (They co-ordinated with Team UoM on everyday basis till 17 and we had a successful event on 18)

February 16, 2018: A long meeting of all parties took place in the Hon Vice-Chancellor's Office. The Registrar, The Legal Advisor and HoD UDCS were present. A revised draft was prepared. [Copy attached].

May 15, 2018: The gist of the outcome of our meetings after the Inaururation and progress on the front of the DS Programme was communicated to all parties by Dr Ambuja of UoM and Er Kirtee of WIAI with an assurance that we shall launch the DS Programme in July 2018.

Jun 8, 2018: University formulated a Committee for formalizing the requirement of launching the proposed DS Programme w.e.f. the academic year 2018-19. WIAI was notified it. June 19, 2018: We have joint meeting of all the Parties (the first formal introduction of Hon Vice-Chancellor, Professor Pednekar, to this Project) in which only the DS Programme plans were discussed. No discussion happened on WIAI; In the end Dr Anandan indicated that they have started work in some place and therefore they do not require place in Vidyanagari campus for the Institute of Artificial Intelligence.

Jul 28, 2018: With the active support of CMO we conducted a national level entrance test for the DS Programme

Aug 22, 2018: WIAI sponsored Professor Lakshminarayana Subramaniyam of New York University as the Chief speaker of the formal inauguration session of the Data Science Programme.

Aug 26, 2018: CMO communicated approval to UoM draft to WIAI with the modification that now the agreement would be only regarding the DS Programme. WIAI in the Vidyanagari campus is no longer a valid proposal [copy attached].

Aug 28, 2018: WIAI requested to replace the name, Dr Rahul Panikar from their team with Professor Subhashis and that was acceptable to UoM.