University of Mumbai

AAMS_UGS /ICC/2022-23/83

CIRCULAR:-

Sub :- Certificate Course in Artificial Intelligence for Healthcare.

Ref :- RB/MU-2022/CR-207/Edn-5/899, dated 18th August, 2022.

All the Principals of the Affiliated Colleges, the Head of the University Department and Directors of the recognized Institutions in Faculty of Science and Technology are hereby informed that the recommendations made by the Ad-hoc Board of Studies in **Pharmacy** at its online meeting held on 17th March, 2022 **vide** item No. **1** and subsequently passed in the faculty of Science & Technology and then by the Board of Deans at its online meeting held on 2nd May, 2022 **vide** item No. **6.2(N)** have been accepted by the Academic Council at its meeting held on 17th May, 2022, **vide** item No. **6.5 (N)** and subsequently approved by the Management Council at its meeting held on **25th May, 2022** **vide** item No. 4 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 **6793 & 6794** Regulations **9552 to 9554** and the syllabus of **Certificate Course in Artificial Intelligence for Healthcare** has been introduced and the same have been brought into force with effect from the academic year **2022-23**, accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032
20th August, 2022

(Dr. Vinod Patil)
I/c. REGISTRAR

To,

The Principals of the Affiliated Colleges, the Head of the University Department and Directors of the recognized Institutions in Faculty of Science and Technology.

A.C/6.5(N)/17/5/2022
M.C/4/25/5/2022

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AAMS_UGS/ICC/2022-23/83

20th August, 2022

Copy forwarded with Compliments for information to:-

1) The Chairman, Board of Deans
2) The Dean, Faculty of Science and Technology,
3) The Chairman, Ad-hoc Board of Studies in Pharmacy,
4) The Director, Board of Examinations and Evaluation,
5) The Director, Board of Students Development,
6) The Director, Department of Information & Communication Technology,
7) The Co-ordinator, MKCL.

(Dr. Vinod Patil)
I/c REGISTRAR

Copy to :-

1. **The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
2. **The Deputy Registrar, College Affiliations & Development Department (CAD),**
3. **The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
4. **The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
5. **The Deputy Registrar, Executive Authorities Section (EA),**
6. **The Deputy Registrar, PRO, Fort, (Publication Section),**
7. **The Deputy Registrar, (Special Cell),**
8. **The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
9. **The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

1. **P.A to Hon'ble Vice-Chancellor,**
2. **P.A Pro-Vice-Chancellor,**
3. **P.A to Registrar,**
4. **All Deans of all Faculties,**
5. **P.A to Finance & Account Officers, (F.& A.O),**
6. **P.A to Director, Board of Examinations and Evaluation,**
7. **P.A to Director, Innovation, Incubation and Linkages,**
8. **P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
9. **The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
10. **The Director of Board of Student Development,**
11. **The Director, Department of Students Walfare (DSD),**
12. **All Deputy Registrar, Examination House,**
13. **The Deputy Registrars, Finance & Accounts Section,**
14. **The Assistant Registrar, Administrative sub-Campus Thane,**
15. **The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
16. **The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
17. **The Assistant Registrar, Constituent Colleges Unit,**
18. **BUCTU,**
19. **The Receptionist,**
20. **The Telephone Operator,**
21. **The Secretary MUASA**

for information.

AC - 17/05/2022
Item No. 6.5 (N)

UNIVERSITY OF MUMBAI

Syllabus

For

Certificate Course in

Artificial Intelligence for Healthcare

(To introduce with effect from the academic year 2022-23)

UNIVERSITY OF MUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course 0.6793	**Certificate Course in Artificial Intelligence for Healthcare**
2	Eligibility for Admission 0.6794	A candidate for being eligible at admission to the Certificate Course in 'Artificial Intelligence for Healthcare' must be student pursuing UG/ PG / Ph.D. program in Pharmacy.
3	Passing Marks R.9552	50%
4	Ordinances / Regulations (if any)	----
5	No. of ~~Years~~ /~~Semesters~~ / Duration of Course	30 Hours
6	Level	Certificate
7	Pattern	Not Applicable
8	Status	~~Revised~~ / New / ~~Amended~~ (Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year: 2022-2023

Date:

Signature:
Name: Prof. Supriya Shidhaye
Chairman of BoS of Pharmacy

Signature:
Dr. Anuradha Majumdar
Dean, Science and Technology

PREAMBLE

This is with reference to the AICTE Initiative & University of Mumbai guidelines, Artificial Intelligence for HealthCare, thirty hours Value added certificate course is introduced from the academic Year 2022-23. The students may take up this course as value-added certificate course offered by their Pharmacy Institute while pursuing their education in Pharmacy.

The Primary aim and scope of this 30 hours certificate course is to impart specific skills that students must acquire during their academic program with the aim of preparing well-rounded learners. The Program will serve as a sound introduction to Artificial Intelligence for Pharmacy students even if they plan on not joining the domain in their industry career. The syllabus for the course shall be subjected to revision after every three years.

O.6793: Title of Course

"Certificate Course in Artificial Intelligence for Healthcare"

O6794: Eligibility

A candidate for being eligible at admission to the Certificate Course in 'Artificial Intelligence for Healthcare' must be student pursuing UG/ PG / Ph.D. program in Pharmacy.

R.9553: Duration of Course

30 Hours

R.9554: Intake Capacity:

Maximum 45 candidates in one batch

Teachers: Subject experts from HEIs and industry having the domain knowledge.

Regulation: Fees

It is an autonomous value-added paid course conducted at the Institution level. Examination will be conducted by the Institute and certificate will be issued by the Institute. However, the certificate will be jointly signed by the principal and Director, BOEE with logos of both organisations appearing on the certificate. All financial aspects will be taken care by the institution running the course. There won't be any provision for sharing of fees with University of Mumbai.

EXAMINATION/ ASSESSMENT AND GRADING:

The certificate course shall be conducted at the Institute level. The institute shall conduct an examination and issue a certificate of completion of the course with credits assigned.

Performance assessment of every registered learner is to be carried out through various modes of examinations. These include Internal Assessment and Course Completion Exam.

Table-1: Scheme for Assessment

Nature of Assessment	Nomenclature	Maximum Marks
Internal Assessment/ Continuous Mode of Assessment: to be conducted intermittently during the course conduction	**Quiz 1**	**10**
	Quiz 2	**10**
	Quiz 3	**10**
	Quiz 4	**10**
Course Completion Exam: to be conducted upon completion of the course	**Course Completion Exam**	**60**
	Total	**100**

Paper pattern for Internal Assessment i.e. Quiz

Question paper pattern for Quiz:

I. Multiple Choice Questions (MCQs) [Duration: 20 Mins] = 10 x 1 = 10
(Answer all the questions)

Total **= 10 marks**

Paper pattern for Course Completion Exam

Question paper pattern for Course Completion Exam:

MCQs: (Answer all the questions) **[Duration: 60 Mins]** = 30 x 2 = 60

Total **= 60 marks**

GRADING OF PERFORMANCES

- **Letter grades and grade points allocations:**

  Based on the performances, each student shall be awarded a final letter grade at the completion of the course.The letter grades and their corresponding grade points are given in Table – 2.

Table – 2: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Performance
90.00 – 100	O	Outstanding
80.00 – 89.99	A	Excellent
70.00 – 79.99	B	Good
60.00 – 69.99	C	Fair
50.00 – 59.99	D	Average
Less than 50	F	Fail
Absent	AB	Fail

A learner who remains absent for Course Completion Examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

CRITERIA FOR AWARD OF THE CERTIFICATE:

A student shall be declared **PASS** and eligible for getting the certificate of completion of the course if he/she secures at least **50%** marks in the course out of a total of 100 marks. There are no separate criteria for passing in the individual head of assessment.

The list of the students successfully completing the certificate course will be submitted by the host institute to University of Mumbai along with the certificate signed by the head of the host institute. The certificate will be jointly signed by the head of the host institute and Director, Board of examination and evaluation and will bear logo of both- host institute and University of Mumbai.

The detailed syllabus of the **Artificial Intelligence for HealthCare** certificate course is given in the consequent section of this document.

Dr. Anuradha Majumdar (Dean, Science and Technology)
Prof. Shivram Garje (Associate Dean, Science)
Prof. Supriya Shidhaye (Chairperson BoS)
Dr. Shrirang Joshi (Member BoS)
Prof. K.G. Akamanchi (Member BoS)
Prof. Krishna Iyer (Member BoS)
Prof. Rajani Athawale (Member BoS)
Dr. Mohan Kale (Member BoS)
Dr. Meena Kanyalkar (Member BoS)

Artificial Intelligence for Healthcare

(Total Hours- 30)

Course Code	Course Name	Credits
PH-AI	**Artificial Intelligence for Healthcare**	**03**

- **Prerequisites:**
  - Desire to learn Artificial Intelligence and machine learning
  - Knowledge of higher school level math
- **Course Outcomes: After completion of this course students should be able to:**
  - Understand what is Artificial Intelligence (AI) and Machine learning (ML)
  - Understand the concept of Internet of Things (IoT) and its applications in healthcare
  - Analyze the healthcare data and process it using data analysis and statistical tools
  - Explore the applications of AI and ML with respect to healthcare domain

Unit no.	Course content (topics and subtopics)	Hours
1.	• Introduction to **Artificial Intelligence (AI) and Machine learning (ML)** • Importance and Applications of AI and ML in Healthcare	**3**
2.	**Types of Machine Learning and its classification** -Decision Tree, Bayesian Classifier, Regression	**2**
3.	**Neural Networks, their types, and processing** • Neural Networks – learning Models. • Deep Neural Network, Convolution Neural Networks & Recurrent Neural Networks • Natural Language Processing • Commonly Used and Advanced Neural Network architectures • Computer Vision	**4**
4.	• **Internet of Things (IoT)** o Introduction o Process flow and Tools o Use Cases o Remote Patient Monitoring	**3**
5.	• **Data Representation:** o Introduction to data, data frames o Data standardization o Dealing with noise and missing values o Transforming and normalizing data	**4**
6.	• **Data Analytics:** o Overview of tools like R, Python o Statistical and Visualization tools	**4**
7.	• **Healthcare data Analysis:** o Sources of the healthcare data o Pre-processing of the healthcare data o Handling of the healthcare data o Creation of analysis-ready datasets	**5**
8.	Healthcare datasets – Examples and Case studies	**3**
9.	Case studies and Future trends in AI Healthcare	**2**
	Total	**30**

** Healthcare-related case studies should be discussed in relevance to the topics mentioned in the syllabus.*

References:

1. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence 3
2. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press.
3. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning, Springer
4. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.
5. Guoguang Rong, Arnaldo Mendez, Elie Bou Assi, Bo Zhao, Mohamad Sawan, Artificial Intelligence in Healthcare: Review and Prediction Case Studies, Engineering, Volume 6, Issue 3, 2020, Pages 291-301, ISSN 2095-8099, https://doi.org/10.1016/j.eng.2019.08.015.

(Appendix 'B')

New ordinances 6793 & 6794 relating to the Certificate Course in Artificial Intelligence for Healthcare

1	**Necessity of starting these courses**
	The primary aim and scope of suggesting value-added course undermentioned are to boost the employability of the B. Pharm students and to help them to be at par with global trends and global technology. Artificial Intelligence (AI) is a buzzword and has manifold applications in the healthcare field. The role of artificial intelligence in healthcare has been a huge talking point in recent months and there's no sign of this technology slowing down. AI in healthcare has huge potential in drug discovery, manufacturing process improvisation, diagnostics, drug repurposing, predicting treatment results, etc.
2	**Whether UGC has recommended to start the said courses?**
	UGC Quality mandate states that to ensure holistic development of the students at the university/college level, efforts need to be made to reorient the teaching pattern with a focus on all types of courses including Elective courses — chosen by students from other departments as per their aptitude. UGC Quality mandate mentions Learning Outcome-based Curriculum Framework (LOCF) — revision of curriculum in regular intervals. Under this objective, UGC suggests that HEIs should boost the employability of graduates through curriculum reform. **National Education Policy (chapter 20.5) mentions –"**India must also take the lead in preparing professionals in cutting-edge areas that are fast gaining prominence, such as **Artificial Intelligence (AI),** 3-D machining, **big data analysis**, **and machine learning**, in addition to genomic studies, biotechnology, nanotechnology, neuroscience, with important applications to health, environment, and sustainable living that will be woven into undergraduate education **for enhancing the employability** of the youth" Artificial Intelligence (AI) is a new buzzword and has immense applications in healthcare. Value-added course in AI will help students to: • Get insights into this field in relevance with the Healthcare domain • Identify problems healthcare providers face that machine learning can solve and • Learn potential applications of AI with respect to patient care safety, quality, and research. • Relate AI to the science, practice, and business of medicine. This course will help Undergraduate students to be at par with global trends and global technology.
3	**Whether all the courses have commenced from the academic year 2022-23?**

	It is proposed to be introduced from academic year 2022-23. Since it is avalue-added course, not confined within the framework of syllabus of B. Pharm/ M. Pharm / Ph.D. for award of degree or credit transfer, any affiliated Pharmacy college can conduct the coursebased on the availability of the resource persons and interest of the students. Students may take up the course as per their interests. Any student pursuing UG/ PG / Ph.D. program in Pharmacy is eligible for admission to this course.
4	**The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?**
	It is a paid course. It is optional for theUOM-affiliated colleges to conduct the course at their respective institutions. It is an autonomous value-added course independent of the student-teacher ratio and may be delivered by guest faculty from HEIs and Industry.
5	**To give details regarding duration of the Course and is it possible to compress the course?**
	• Duration: 30 Hours • This is the minimum duration required and not recommended for further compression.
6	**The intake capacity of each course and number of admissions given in the current academic year 2022-23?**
	Batch size should be ideally restricted to maximum 45 to increase the effectiveness of the course. The course is proposed to be introduced from academic year 2022-23
7	**Opportunities of employability / employment available after undertaking these courses.**
	Artificial Intelligence (AI) will create many new job roles. The course will help the students get insights and provide an upper edge over regular Pharmacy students by equipping them with basic understanding of the scope of **Artificial Intelligence (AI) in healthcare** and the methodologies involved.

Signature –
Dr.SupriyaShidhaye,
Chairman, Ad-hoc Board of Studies in Pharmacy
Under the faculty of Science and Technology