

University of Mumbai



No. UG/ 04 of 2021

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the recognized Institutions in Faculty of **Science & Technology**.

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in **Computer Science** at its meeting held on 25th September, 2019 vide item No. 1 and subsequently passed by the Board of Deans at its meeting held on 19th October, 2019 vide item No. 7 have been accepted by the Academic Council at its meeting held on 23rd February, 2021 vide item No. 4.3 and subsequently approved by the Management Council at its meeting held on 9th April, 2021 vide item No.15 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 **6613 & 6614 Regulations 9356 & 9357** and the syllabus of **Machine Assisted Music Learning (Micro degree)** has been introduced and the same have been brought into force with effect from the academic year **2019-20**. (The said course might be introduced from the academic year 2021-2022 in the wake of prolonged Covid-19 pandemic situation in the country) accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032

1st June, 2021

To,

(Dr. B.N. Gaikwad)
I/c. REGISTRAR

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

A.C/4.3/23/02/2021

M.C/15/9/04/2021

No. UG/ 04- of 2021

MUMBAI-400 032

1st June, 2021

Copy forwarded with Compliments for information to:-

- 1) The Chairman, Board of Deans
- 2) The Dean Faculty of **Science & Technology**,
- 3) The Chairman, Ad-hoc Board of Studies in Computer Science,
- 4) The Director, Board of Examinations and Evaluation,
- 5) The Director, Board of Students Development,
- 6) The Co-ordinator, University Computerization Centre,

(Dr. B.N. Gaikwad)
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 Welfare (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 09/04/2020

Item No. 4.3

UNIVERSITY OF MUMBAI**Syllabus for Approval**

Sr. No.	Heading	Particulars
1	Title of the Course 0.6613	Machine Assisted Music Learning (Micro degree)
2	Eligibility for Admission 0.6614	A candidate with minimum 50% score in XII pass can appear for entrance examination through which the admission merit list will be generated.
3	Passing Marks R.9356	40%
4	Ordinances / Regulations (if any)	The credits shall be considered for the degree programme as and when the student shall do a degree
5	No. of Years / Semesters R.9357	One semester one Course; There are three levels.
6	Level	Certificate/Diploma/UG/PG (Strike out which is not applicable)
7	Pattern	Semester/Yearly (Strike out which is not applicable)
8	Status	Revised/New / (Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year:2021-2022

Dr. Jyotshna Dongardive
Chairman of BoS in Computer Science

Dr. Anuradha Majumdar
Dean, Science and Technology

1. Necessity of starting these course: The domain has tremendous potential for interdisciplinary research; There is no such Course exists to train the potential researchers.
2. Whether UGC has recommended to start this Course: UGC has accepted some Courses in Music and Dance from Swayam where the aspirants could generate credits from. The domain is new, the skills have market values in various desciplines including recreational and health industry.
3. Whether all the Courses have been commenced in 2019-20: The Course was first time introduced for MSc CS with specialization in Data Science during 2018-19; For the application of Swayam it was recommended to start during 2019-20. However project evaluation from Swayam is yet awaited and hence not commenced during 2019-20.
4. The Courses are self-financed, whether adequate number of permanent faculty available: Department has a faculty to teach computational part; Need to hire a faculty from Music background with sufficient background / experience / interest in technology part.
5. To give duration of the Course, is it possible to compress the duration: Its 3 semester Course, Introduction and assignment level problem solving skills are taught in the first semester; Advanced concepts in computational musicology are the part of the second semester and the third semester is for learning research skills and completing a small research project. Exit is available at any point. Corresponding credits could be earned by the learners.
6. Intake capacity of the Course and number of admissions in the year 2019: Intake capacity is 200; We did not admit any new student in 2019-20 and 2020-21. The 56 students enrolled in the year 2018 were taught their semester III during 2019-20.
7. Opportunities of employability / employment available after taking this Course: Opportunities varies from efficient on line music teaching to become an AI scientist to create music assisting app in the recreation and health industry.

UNIVERSITY OF MUMBAI



Syllabus for the Program: Machine Assisted Music Learning

(Choice Based and Credit System with effect from
the academic year 2021-22)

AC _____
Item No. _____

UNIVERSITY OF MUMBAI



Syllabus for Approval

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8	Status	Revised/New / (Strike out which is not applicable)
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Dr. Jyotshna Dongardive
Chairman of BoS in Computer Science

Dr. Anuradha Majumdar
Dean, Science and Technology

Detailed MOOC Proposal

Machine assisted Music Learning; a 3 credit Course

Proposed by Department of Computer Science, University of Mumbai

(The duly filled form as per the instruction given in respected columns and submit at cec.pgmooc@gmail.com)

Sr NO	DELIVERABLE	DESCRIPTION	REMARKS
1.0	Course Title	Machine Assisted Music Learning	The proposal forms 50% of the “Computer Assisted Music Learning”, a Course that we teach for MSc Computer Science with specialization in Data Science. The said MSc Programme being interdisciplinary in nature has specially been designed by following modular structure. It has been offered in the blended MOOC form. Each Course comprised of 6 credits, 4 credits theory and 2 credits practical.
2.0	Subject/	Computer Science	To encourage the students of interdisciplinary background only the first 50% of the syllabus is proposed to be converted in the MOOC form to start with. The extension of the same will be submitted shortly in order to make it a 6 credit Course as we offer it in our MSc Programme. Also, the students of this Course can opt for any other Course in pure music or pure computing or computational modeling in any other domain for one or three additional credits per their requirement.
3.0	Degree	Masters in Computer Science with specialization in Data Science	Potential learners are from Masters and research degrees in Mathematical sciences, Music, Law etc. In general, wherever logic is the part of their learning.
3.1	Course Category	Elective	Most of the topics are relevant to the modern research methodology for Music.
3.2	Semester / paper	Half Semester	

4.0	Specify the universities/ institute name, where this course is being taught	Department of Computer Science, University of Mumbai	
4.1	Course Credits	3 Credits	Graded assignments leading to an end-Course Project for 1 Credit; to be completed in the 4 weeks following the completion of 40 hours tutoring; The learners will be mentored for the completion of their projects.
4.2	Total No of Modules	40 for tutoring and 20 for Project guidance	
4.3	Course Duration (in Weeks)	8 Weeks tutoring plus 4 weeks mentoring for a Project	Have been presented in the attached proforma
4.4	Weekly Study Plan	Appended	
4.5	Rationale for developing this Course	Computer Assisted Music is an emerging field of interdisciplinary research with numerous applications including the health care. A Course that provides a basic guidance to the Students with technical or musical background to take music and applications of music ahead is a need. As the domain has been evolved through the need and experiments, there is no directly available material on the same. Hardly there are skilled teachers who know both the domains sufficiently well. Creating a guided Course that facilitates a self-paced learning for the aspirants in this domain is a need.	
4.6	Course Description	This interdisciplinary Course combines Computer Science and Music. It describes the technical framework of Indian classical music (ICM) and sets foundation to appreciate the same; it describes foundations of computing in order to model the important musical phenomena. The lectures and demonstrations will explain the concepts: musical notes, scales, musical phrases, ornamentations, Raag (melodic component), Taal (rhythmic component), notation systems for ICM and introduces the analogous concepts in the Western classical music. The learners will be introduced to the software that are useful for analysis of music. For example, Tanpura Droid, Praat, Sonic	Course Description

		visualizer and Audacity and, the programming language, ChuckK. Learners' understanding of the musical concepts and modeling them computationally, both shall be facilitated through the assignments and feedback on the learners' responses.				
5.0	Course Objectives	The Course lets the students of science and technology and that of music, acquire the following: Learn a language to share their ideas and work together to produce an enhanced experience of music learning Learn to seek machine assistance for some of the tasks in music domain Learn to employ artificial intelligence in music domain The long term goals include: Create a music-metric Create a new music				
5.1	Learning Outcomes	Appended				
5.2	Course introductory video	Introductory video link: https://www.youtube.com/watch?v=daHsX59bTMs				
5.3	Pre - requisites	A graduate with the inclination for learning music and software				
5.4	Intended Audience	Students, Teachers, Researchers, Psychiatrists, Yoga and Medical practitioners, Homemakers; In general, those who would like to learn and employ music and / or data science in their professions				
6.0	Host Institution	University of Mumbai				
7.0	Faculty profile					
7.1	Sr No	Name	Designation	Department, Institute	e-mail	Mobile
	1	Ambuja Salgaonkar	Head, Department of Computer Science	University of Mumbai	ambujas@udcs.mu.ac.in	8097479787
	2	Omkar Barve	Assistant Professor, Department of Computer Science	University of Mumbai	omkarbarve.udcs@gmail.com	9404269380
	3	Atindra Sarvadikar	Assistant Professor,	University of Mumbai	atindra2010@gmail.com	9823626480

			Department of Music			
	4	Hari Sahasrabuddhe	Retired Professor, Kanwal Rekhi School of Information Technology	IITB, Mumbai	hvs_buddhe@hotmail.com	8975538035
7.2		Brief about Course Co-ordinator: Ambuja Salgaonkar, PhD in CS, Bridge Course in Violin; 25 yrs experience of teaching, 1 year in blended MOOC; 15 years research, 8 years in computational linguistics and musicology; Patent published 5; Research: 25+ conference papers including 6 on music and music teaching, 5 journal papers, a patent on music-metric is in progress; Authored 40 articles in newspapers including 3 on the music-gurus; Discography: Ravi kirananche kavadas - Marathi translation of Ravindranath's poems in Geetanjali, Marathi translation of Mumbai Veedyapeeth Geetam; Book: Tapedi - Marathi Hayku Bees (Shirish Pai award), Spiral - a multi-monologue and a play: Dujachi Janeev dei Panduranga; Unpublished work: Kabirachya dohyanche haiku, Marathi translation of Alice in wonderland, Poetry of APJ Abdul Kalam, Poetry of Vivekananda; 100+ articles in various forms of literature.			A brief biography , career highlights , affiliations etc. in context of the MOOC course (not to exceed 100 Words)	
7.3		Brief about the Course developer (PI/SME) and Team: PI: Omkar Barve, Sangeet Visharad, MCA, NET in CS; Experience of teaching Computer Science 8 years, Music 4 years and Computer Assisted Music Learning in blended MOOC 1 year; B grade artist of All India Radio in the category of Natyasangeet at Akashwani Sangali; appeared in 15+ concerts; 2 conference papers in musicology; Co-Convener of "The International workshop on Computer Assisted Music and Dramatics: Possibilities and Challenges'19 (CAMAD'19)" SME: Atindra Sarvadikar, PhD and NET in Music; Teaching and research experience of 4 years; B grade artist of All India Radio in the category of Hindustani classical vocal music at Akashwani Mumbai; appeared in 30+ concerts; PhD work on the Kirana Gharana has been published in the form of a book; Published 5 papers, 1 on Music teaching in Distance mode; Resource person for the International workshop on CAMAD'19 Content Reviewer: Hari Sahasrabuddhe, PhD in CS; Published work in Musicology; Taught				

		CS and guided research in Musicology at various Institutions of global reputes in India and abroad Technical reviewer: Mandar Bhanushe, Assistant Professor in the Institute of Distance and Open Learning of University of Mumbai; PI of SWAYAM MOOC: Topology; Resource person for ICT facilitated learning.	
8.0	Interactivity – Discussion forum	Discussion related to subject matter, Discussion forum, Video, Text, Feedback, Assignment, Activities and Quizzes	We can have 2 forum discussions, a bank of 100 feedback questions, a weekly quiz and a set of 5 assignments leading to the completion of a project.
9.0	Assessment Plan	Forum participation and discussions in subject related matter: 10% Feedback questions and quizzes on video tutorials: 20% Activities and assignments: 30% Final examination: 40% Passing marks: minimum 40% in total	
10.0	Term End assessment- and interaction	Proctored on-line exam, with 2 question paper sets (non-identical, non-shuffled) set by Course faculty.	Shall be provided by the offering faculty/instructor per the requirement of National Coordinator CEC guidelines for Evaluation strategy and question paper setting

Weekly Course Plan of the Course: Machine assisted Music learning

Weekly Course Plan aims at Scheduling video lectures and related text materials (e-book, references, glossary, FAQs etc.) in weeks, so that overall learning outcome of the course can be achieved in a systematic way throughout the course following weekly learning objectives.

Week	Day	Title of Lesson/Module	Objectives of the module-Point wise	Expected Learning outcome
First Week	Day 1	Introduction to Computational Musicology	Introducing learners to the domain of Computational Musicology	Know the following: 1. Significance of learning Computational musicology 2. Basic terminology of the ICM 3. Know the installation and use of Tanpura Droid
	Day 2	Various Applications of Computational Musicology	To know Opportunities in the domain	
	Day 3	'Sangeet', 'Naad'	Introduction to ICM	
	Day 4	Introduction to software: 'Tanpura	Learn to use 'Tanpura	

		Droid'	Droid'	4. The installation and use of Praat
	Day 5	Introduction to software: 'Praat'	Learn basics of 'Praat'	
Second Week	Day 1	Notes in Indian Classical Music	Introduction to Musically significant sounds	Know the following:
	Day 2	Shadja i.e. 'Sa', Tonic	Learning the Importance of Tonic	1. Notes used in the ICM
	Day 3	Shuddha Notes	Discuss the properties of Shuddha notes	2. Significance of Sa
	Day 4	Introduction to software: 'Audacity'	Learn to use Audacity	3. The installation and use of Audacity
	Day 5	Relation amongst Shuddha Notes	Know the positions of Shuddha notes with respect to a tonic	4. Relative positions of Shuddha notes
Third Week	Day 1	Mathematics of positions of Notes	Computing the frequencies of diverse notes w.r.t. the frequency of a given tonic	Understand the following:
	Day 2	Vikrut Notes	Understand the properties of Vikrut notes	1. How to compute positions of notes with respect to a tonic
	Day 3	Relation amongst Vikrut Notes	Define the positions of Vikrut notes with respect to a tonic	2. The relative positions of Vikrut notes
	Day 4	Variations in note positions per the different scales	Discuss the musical scales used in various music cultures	3. The diverse musical scales used in different music cultures
	Day 5	Introduction to software tool: 'Sonic Visualizer'	Learn to use Sonic Visualizer	4. Installation and use of Sonic Visualizer
Fourth Week	Day 1	Visualisation and analysis of Shuddha notes with the help of software tools	Analysis of Shuddha notes using Praat and Sonic Visualizer	Learn to analyze Notes, Octaves and Note Patterns
	Day 2	Visualisation and analysis of Vikrut notes with software tools	Analysis of Vikrut Notes using Praat and Sonic Visualizer	
	Day 3	Octaves: Mandra, Madhya and Taar Saptakas	Discuss the concept of Octave and the three octaves	
	Day 4	Alankars: Basic	Definition, generating	

		Alankars, Bhatkhande notations	and noting patterns with permutation - combination of notes	
	Day 5	Advanced Alankaras, Paluskar notations, Complexity analysis	Know the complex patterns; Discuss: the complexity of Patterns	
Fifth Week	Day 1	Introduction to a Music Programming Language: Chuck	Introduction to Chuck	Learn Chuck programming
	Day 2	Writing Simple Programs in Chuck	Write your first Chuck program	
	Day 3	Programming constructs in Chuck – I	Learn Chuck programming	
	Day 4	Programming constructs used in Chuck – II	Learn Chuck programming	
	Day 5	Generation of Alankars using Chuck	Write an Alankar generator in Chuck	
Sixth Week	Day 1	Pitch, Frequency, Amplitude	Learn fundamental properties of Sound	1. Know properties of Sound 2. Understand the terminology of the Western music
	Day 2	Tone, Timber, Intensity, loudness	Properties of Sound continued	
	Day 3	Major Scale, Minor Scale	Terminology in Western music	
	Day 4	Triad	Terminology in Western music	
	Day 5	Comparison of the terminology in Indian and Western classical music	Understanding similarities and differences between Western and Indian Music	
Seventh Week	Day 1	Concept of Taal, Lay	Understanding Rhythm and Tempo	1. Know basics of the rhythmic framework of ICM 2. Know basics of the melodic framework of ICM 3. Know the use of rhythmic and melodic framework 4. Generating practice
	Day 2	Matras (beats), Khand (division), Sam, Tali, Khali, Tabla-bol	Discuss the components of Taal	
	Day 3	Taal : Teentaal	Practice Teentaal	
	Day 4	Taal : Keharava	Practice Keharava	
	Day 5	Simulation of alankars in Teentaal and	Generating Alankars in a given Taal	

		Keharava		examples by Chuck programming
Eighth Week	Day 1	Introduction to Raag, Aaroh, Avaroh and, Jaati of a Raag	Discuss the aspects of the melodic framework of ICM with the note sequence in a Raag	Understand 1. The important features of a Raag 2. Raga characterization 3. Rendering a Raag 4. A machine model to represent a Raag
	Day 2	Features of Raag Pakad and Chalan	Understand the Raag characterization	
	Day 3	Hierarchy of Notes in Raag: Vadi, Samvadi, Anuvadi, Vivadi and Varjya swara	Hierarchy of notes	
	Day 4	Raag-Samay and Raag-Rasa	Raag samay-chakra and Rasa-siddhant	
	Day 5	Machine model of Raga	Automata to recognize a Raaga	
Ninth Week	Day 1	Recap the learning	Revision of the concepts learnt in the past 8 weeks	A learner has identified a project and is ready with a draft requirement specifications
	Day 2	Explore the potential problems	Generating a bank of research problems in the research in musicology	
	Day 3	Benchmark and select one for solving	Learn benchmarking	
	Day 4	Study the state-of-the-art	Learn how to do research survey	
	Day 5	Compilation of ideas	Learn to formulate a concept note and compare yours with one of your peer's	
Tenth Week	Day 1	Compile the outcome of an literature survey	Learn to draft a report on the literature survey	A learner is ready with a draft Project proposal
	Day 2	Paraphrasing and citations		
	Day 3	Reviewing a literature survey report and generating inputs on it	Prepare a discussion note on a given literature survey report	
	Day 4	Take the state of the art ahead	Suggest two ways to take the state of the art ahead	
	Day 5	Articulation of a research problem	Learn to define a research problem	

Eleventh Week	Day 1	Design a solution to a given problem	Learn to design a solution to a given problem	A learner is ready with a solution
	Day 2	Implement a research strategy per the given design	Learn to implement a given solution	
	Day 3	Test and explore enhancements	Learn to test a given solution and suggest a betterment	
	Day 4	Implement refinement	Learn to modify a given solution per the suggestions for the enhancements	
	Day 5	Report your observations and comment on the same	Learn to report observations of your experiments and comment on two of your peers' projects	
Twelve-th Week	Day 1	Evaluate a given solution	Learn to contextualize your research findings	A learner is ready with a draft research article based on his / her experimentation
	Day 2	Report your conclusion		
	Day 3	Organize your work in a standard template	Learn to find out suitable journals / conferences to publish / present your work; Learn to use documentation template to publish / present your work	
	Day 4	Find out a right location to publish your work and revise and refine a research article accordingly		
	Day 5	Evaluate three research articles in the domain of your interest	Learn to write a review of a research article	