

SU/BOS/Science/497

Date: 10/07/2023

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.
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Subject: Regarding syllabi of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

M.Sc.Part-II (Sem. III & IV) as per NEP-2020			
1.	Microbiology (HM)	8.	Food Science & Nutrition
2.	Pharmaceutical Microbiology (HM)	9.	Food Science & Technology
3.	Microbiology	10.	Biochemistry
4.	Computer Science	11.	Biotechnology
5.	Computer Science (Online Mode)	12.	Medical Information Management
6.	Data Science	13.	Environmental Science
7.	Information Technology (Entire)	14.	Physics

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,



Dy Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

Shivaji University, Kolhapur



NAAC “A++” Grade with CGPA 3.52

Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)

Syllabus for

Master of Science

In

Data Science

(Under Faculty of Science and Technology)

PART–II SEMESTER- III & IV

(Syllabus to be implemented from Academic Year 2022-23)

Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP-2020)
M.Sc. Program Structure
M. Sc. Part -II(Level -9)

Semester – III (Duration Six Months)											
	Sr No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam Hours	Maximum Marks	Minimum Marks	Exam Hours
CGPA	1.	CC-301: Artificial Intelligence	4	4	4	80	32	3	20	8	1
	2.	CC-302: Web Technology	4	4	4	80	32	3	20	8	1
	3.	CC-303: R Programming	4	4	4	80	32	3	20	8	1
	4.	CCS- 304: Data Visualization	4	4	4	80	32	3	20	8	1
	5.	CCPR- 305: Web Technology Lab	--	6	4	100	40	3	--	--	*
	6.	CCPR- 306: R Programming Lab	--	6	4	100	40	3	--	--	*
	7.	CCPR- 307: Project	--	6	4	100	40	3	--	--	*
	Total (C)		16	34	28	620	--	--	80	--	
Non- CGPA	1	AEC-107: Communicative English-II	2	2	2	--	--	--	50	20	2

Semester –IV (Duration Six Months)

CGPA	1	CCPR-401: Research Seminar		6	4				100	40	*
	2	CCPR- 402: Research /Industrial Project		6	16	300	120	--	100	40	*
	Total (D)		--	12	20	300	--	--	200	--	--
	1	GE-403:	2	2	2	--	--	--	50	20	2
Total (C+D)					48	920	--	--	280	--	--

<ul style="list-style-type: none"> Students Contact Hours Per Week : 46 Hours(Min.) 	<ul style="list-style-type: none"> Total Marks for M.Sc-II : 1200
<ul style="list-style-type: none"> Theory and Practical Lectures : 60 Minutes Each 	<ul style="list-style-type: none"> Total Credits for M.Sc.-II (Semester- III and IV) : 48
<ul style="list-style-type: none"> CC – Core Course CCPR – Core Course Practical CCS – Core Course Specialization AEC- Mandatory Non-CGPA compulsory Ability Enhancement Course SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course GE- Generic Elective 	<ul style="list-style-type: none"> Practical Examination is Semester wise after theory examination. Examination for CCPR-305 and CCPR-306 shall be based on Semester-III Practical. Examination for CCPR-401 and CCPR-402 shall be based on Semester-IV Practical. * Duration of Practical Examination as per respective BOS guidelines. <i>Separate passing is mandatory for Theory, Internal and Practical Examination.</i>
<ul style="list-style-type: none"> Requirement for Entry at Level 9 : Completed all requirements of the relevant Post Graduate Diploma in Computer Science (Level 8) 	
<ul style="list-style-type: none"> Exit at Level 9: Student can exit after Level 9 with Master’s Degree in Data Science if he/she completes the courses equivalent to minimum of 96 credits. 	

	M.Sc. I	M.Sc. II	Total
Marks	1200	1200	2400
Credits	48	48	96

Research Seminar

At the end of fourth semester student shall deliver seminar on one of the advanced topic chosen in consultation with the guide after compiling the information from the latest literature and also internet. The concepts must be clearly understood and presented by student. Prior to presentation, he/she shall carry out the detailed literature survey from standard references such as International & National journals and periodicals recently published reference books etc. A hard copy of the report (A4 size, 12 fonts, Times New Roman, Single spacing both side printed) should be submitted to the Department before delivering the seminar. This seminar will be evaluated internally for 100 marks by the respective guides.

At the end of the Fourth semester of study, a student will be examined in the course "Industrial / Research Project ".

1. Fourth semester Project work can be carried out as industrial training of four months in the Industry or in the Institute as Research project with prior permission of the Institute.
2. Project viva-voce by the University panel will be conducted at the end of semester.
3. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.
4. Project work may be done individually or in groups in case of bigger projects.
5. The major project work carry 100 marks for internal assessment and 300 marks for External viva. The external viva shall be conducted by a panel of external examiners.

OR

1. The student will be allowed to formulate a proposal for start-up and the same will be rated equivalent to an industrial project. A detailed problem statement showing innovation along with markability, business plan and cash flow will be part of the Evaluation criteria.

M.Sc.- II Semester- III (Data Science)
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)

Course Code: CC-301

Title of Course: Artificial Intelligence

Syllabus to be implemented from Academic Year 2023-24

Course Outcomes(CO)

CO1 Apply problem solving by intelligent search approach.

CO2 Represent knowledge using AI knowledge representation techniques.

CO3 Design Machine Learning solution to real life problems.

CO4 Derive solutions for problems with uncertainty using Fuzzy theory.

CO5 Define a NLP problem and find a suitable solution to it.

CO6 To develop a good understanding of all aspects of Natural Language Processing (NLP) and Genetic algorithm

Unit No.	Title of Unit and Contents	
I	Introduction of AI and Problem Solving: Historical Development of AI, Role of heuristic in problem solving, AI problems and Expert Problems, Comparison of database with knowledge base	(15)
II	Fuzzy System and ANN: Predicate Logic, Fact- Table, Predicate Calculus, WFF, Fuzzy logic, Design of fuzzy rulebase. Fuzzy Set Theory, Fuzzy Operations. Artificial Neural Networks- concept and ANN architectures, Training and implementation of neural network	(15)
III	Genetic Algorithm: History and evolution of G.A, Modeling a problem for the application of G.A.- Representation of data in chromosomes, Fitness Function, Comparison of ANN and GA, Application of G.A.	(15)
IV	Natural Language Processing: Text categorization, text summarization, vision and perception, pattern matching, Robotics	(15)

Reference Book

1. Neural networks, fuzzy logic and genetic algorithms, synthesis and applications by S. Rajsekaran, G.A. Vijayalaxmi Pai (EEE)
2. Genetic algorithms by David Goldberg (Addison and Wesley)
3. Principles of AI and Expert system development by David Rolston (MGH)
4. Artificial Intelligence by E. Ritch and K. Knight (MGH)

M.Sc.- II Semester- III (Data Science)
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)
Course Code: CC - 302
Title of Course: Web Technology
Syllabus to be implemented from Academic Year 2023-24

Course Outcomes(CO)

CO1 Students will understand windows and web based application

CO2 Help them understand Syntax and semantics of C#.

CO3 Debug and deploy ASP.NET Application.

CO4 Help them to understand different validation controls..

CO5 help them to understand different controls in windows and web based.

Unit No.	Title of Unit and Contents	
I	Introduction to .Net Platform, .Net architecture. JIT compiler, Microsoft Intermediate Language, Metadata. Common Language Runtime, Common Type System, Common Language Specification.	(15)
II	Concepts of Visual Basic using C#: IDE, data type, operators, control statements: branching and looping, array functions, procedures, OOP concepts, Exception Handling in C#.	(15)
III	Introduction to C#: Windows Form, Windows Form Controls, MDI Applications, Sample application development, Deployment of C#	(15)
IV	ASP.NET: Page Life Cycle, ASP.NET Server side controls, Data Controls, Server side validations, Web Services.	(15)

Reference Book

1. C# 4.0 The Complete Reference by Herbert Schildt
2. Essential C# 4.0” by Mark Michaelis and Eric Lippert
3. “C# in Depth” by Jon Skeet
4. “Head First C#: A Learner’s Guide to Real-World Programming with C#, XAML, and .NET” by Jennifer Greene and Andrew Stellman
5. “Microsoft Visual C# Step by Step” by Sharp John
6. “Let Us C#” by Yashavant P Kanetkar

M.Sc.- II Semester- III (Data Science)
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)
Course Code: CC-303
Title of Course: R Programming
Syllabus to be implemented from Academic Year 2023-24

Course Outcomes(CO)

CO1 Learn Fundamentals of R.

CO2 Apply OOP concepts in R programming

CO3 Covers how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions.

CO 4 Apply various concepts to write programs in R

CO5 Cover the Basics of statistical data analysis with examples.

Unit No.	Title of Unit and Contents	
I	Introduction to R: What is R, Why R, Advantages of R over Other Programming Languages . R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Few commands to get started: installed. packages(), package Description(), help(), find.package(), library() - Input and Output – Entering Data from keyboard.	(15)
II	Basic Concepts of R Programming: R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame. R - Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables, R Operators: R Decision Making: if statement, if – else statement, if – else if statement, switch statement, R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.	(15)
III	R-Function : function definition, Built in functions: mean(), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values, R-Strings : Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower(), R Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements.	(15)
IV	Data Frames: Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() , Merging Data frames merge(), Melting and Casting data melt(), cast(). R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – Bar Charts: Bar Chart Labels, Title and Colors.	(15)

REFERENCES

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017.
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018.

3. Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015.

M.Sc.-II Semester- III (Data Science)
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)

Course Code: CCS- 304

Title of Course: Data Visualization

Syllabus to be implemented from Academic Year 2023-24

Course Outcomes (CO)

CO1 Demonstrate understanding of Data Visualization and key Terms

CO2 Will demonstrate skills on creating visual representation of Data

CO3 Will demonstrate understanding of Visualization classification and its techniques

CO4 Will demonstrate skills in creating different types of Representation

Unit No	Title of Unit and Contents	
I	Introduction: Acquiring and visualizing data, simultaneous acquisition and visualization, Application of Data Visualization, Exploring the Visual Data Spectrum: charting primitives(Data Points, Line Charts, Bar Charts, Pie Charts, Area Charts). Making use of HTML5 CANVAS, Integrating SVG.	(15)
II	Basic of Data Visualization: Reading Data from standard text files, Displaying JSON content Outputting Basic Table Data, Assuring Maximum readability, Including computations, Using data tables library, relating data table to a chart	(15)
III	Visualizing data Programmatically: Creating HTML5 CANVAS Charts (HTML5 Canvas basics, Linear interpolations, A Simple Column Chart, Animations), Starting with Google charts (Google Charts API Basics, A Basic bar chart, A basic Pie chart, Working with Chart Animations).	(15)
IV	Introduction to D3.js: Getting setup with D3, Making selections, changing selection's attribute, Loading and filtering External data : Building a graphic that uses all of the population distribution data, Data formats you can use with D3.	(15)

References:

Reference Books:

1. Jon Raasch, Graham Murray, Vadim Ogievetsky, Joseph Lowery, "JavaScript and jQuery for Data Analysis and Visualization", WROX
2. Ritchie S. King, Visual story telling with D3" Pearson
3. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
4. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Relly
5. Andy Kirk, Data Visualization: A Successful Design Process, PAKT
6. Scott Murray, Interactive Data Visualization for Web, O'Relly

7. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.

M.Sc-II Semester-III (Computer Science)
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)

Course Code: CCPR-305

Title of Course: Web Technology Lab

Syllabus to be implemented from Academic Year 2022-23

Course outcomes:

- 1) Debug and deploy ASP.NET web applications
 - 2) Discuss the insights of internet programming and implement complete application over the web
 - 3) Use the features of Dot Net Framework along with the features of C#
 - 4) Build and host web applications using ASP.NET
 - 5) Develop and deploy Windows applications
 - 6) Handle data by using ADO.NET architecture
 - 7) Create database-driven ASP.NET web applications and web services
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M.Sc.- Semester- (Data Science)
Choice Based Credit System with Multiple Entry and Multiple Exit Option
(NEP-2020)

Course Code: CCPR- 306

Title of Course: Practical- (R Programming)

Syllabus to be implemented from Academic Year 2022-23

Course outcomes:

1. Demonstrate use of basic functions
 2. Create their own customized functions
 3. Construct tables and figures for descriptive statistics
 4. Learn to understand new data sets and functions by yourself
 5. Work on built in real time cases for analysis and visualization
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Lab assignments based on R Programming course.