

Estd. 1962

With CGPA 3.52

H<sup>™</sup> Accredited by NAAC (2021)

#### SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र

दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४ ०२३१—२६०९४८७



#### SU/BOS/Science/09

#### Date: 02/01/2024

To,

The Principal,	The Head/Co-ordinator/Director
All Concerned Affiliated Colleges/Institutions	All Concerned Department (Science)
Shivaji University, Kolhapur	Shivaji University, Kolhapur.

Subject: Regarding syllabi of M.Sc. Part-II (Sem. III & IV) as per NEP-2020 (1.0) 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 (1.0) degree programme under the Faculty of Science and Technology.

	M.Sc.Part-II (Sem. III & IV) as per NEP-2020 (1.0)						
1.	Computer Science	7.	Biochemistry (HM)				
2.	Data Science	8.	Biotechnology (HM)				
3.	Information Technology (Entire)	9.	Biotechnology				
4.	M.C.A.	10.	Medical Information Management				
5.	Food Science & Nutrition	11.	Environmental Science				
6	Food Science & Technology	12.					

This syllabus, nature of question and equivalence shall be implemented from the academic year 2024-2025 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website <u>www.unishivaji.ac.in NEP-2020 (Online Syllabus)</u>

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2024 & March/April 2025. 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: The Dean, Faculty of Science & Technology 8 P.G. Admission/Seminar Section 1 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

Established: 1962

A<sup>++</sup> Accredited by NAAC (2021) with CGPA 3.52

Structure and Syllabus in Accordance with National Education Policy - 2020 with Multiple Entry and Multiple Exit

Master of Science (Data Science) Part - II

under Faculty of Science and Technology

(To Be Implemented From Academic Year 2024-25)

# **5. Program Structure**

#### Structure in Accordance with National Education Policy - 2020 With Multiple Entry and Multiple Exit Options M.Sc. (Data Science) Part – II (Level-6.5)

	Course Code	Teaching Scheme		Examination Scheme						
		Theory and Practical		University Assessment (UA)			Internal Assessment (IA)			
		Lectures +	Hours	Credit	Maximum	Minimum	Exam. Hours	Maximum	Minimum	Exam.
		Tutorial	(Per		Marks	Marks		Marks	Marks	Hours
		(Per week)	week)							
					Semester-III					
	MMT-301	4		4	80	32	3	20	8	1
Major	MMT -302	4		4	80	32	3	20	8	1
Mandatory	MMPR -303		8	4	80	32	3	20	8	1
	MMT - 304	2		2	40	16	2	10	4	1
Major	MET -305	4		4	80	32	3	20	8	1
Elective	MET - 306									
Research	RP-307			4	80	32		20	8	
Project										
To	tal			22	440			110		
				1	Semester-IV					
Maian	MMT-401	4		4	80	32	3	20	8	1
Mandatawy	MMT -402	4		4	80	32	3	20	8	1
	MMPR -403		8	4	80	32	3	20	8	1
Major	MET -404	4		4	80	32	3	20	8	1
Elective	MET - 405									
Research	RP-406			6	100	40		50	20	
Project										
Total				22	420			130		
Total (Sem III + Sem IV)				44						

MMT–MajorMandatory Theory	• Total Marks for M.ScII : 1100					
MMPR–MajorMandatoryPractical	• Total Credits for M.ScII (Semester III & IV) : 44					
MET–MajorElective Theory	• Separate passing is mandatory for University and Internal					
MEPR–MajorElective Practical	Examinations					
• RP- Research Project						
# Evaluation scheme for Research Project shall be decided by concerned BOS						
## Evaluation scheme for Research Project shall be decided by concerned BOS						
Requirement for Exit after Level 6.5:						
Students can exit after completion of Level 6.5 with Master of Data Science						

# **Course Codes**

M.Sc. Semester-III						
Course Code	Major Mandatory					
MMT- 301	Machine Learning (4 credits)	MSU0325MML911I1				
MMT - 302	R Programming (4 credits)	MSU0325MML911I2				
MMPR - 303	Practical - III (4 credits)	MSU0325MMP911I1				
MMT - 304	Power BI (2 credits)	MSU0325MML911I3				
RP - 307	Research Project (4 credits)	MSU0325RP911I				
	Major Elective					
MET - 305	Cyber Security (4 credits)	MSU0325MEL911I1				
MET - 306	Software Project Management (4 credits)	MSU0325MEL911I2				
	M.Sc. Semester	r-IV				
Course Code	Major Mandator	y				
MMT – 401	Internet of Things (4 Credits)	MSU0325MML911J1				
MMT - 402	Data Visualization with Tableau (4 Credits)	MSU0325MML911J2				
MMPR - 403	Practical - IV (4 Credits)	MSU0325MMP911J1				
RP - 406	Research Project (6 Credits)	MSU0325RP911J				
Major Elective						
MET - 404	Deep Learning (4 Credits)	MSU0325MEL911J1				
MET - 405	Soft Computing (4 Credits)	MSU0325MEL911J2				

#### 8. Syllabus

#### M. Sc. Data Science (Part II) (Level-6.5) (Semester III) (NEP-2020) (Introduced from Academic Year 2024-25)

#### Title of Course: Machine Learning Course Code: MMT - 301 Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Acquire fundamental knowledge of learning theory
- 2. Design and evaluate various machine learning algorithms
- 3. Use machine learning methods for multivariate data analysis in various scientific fields
- 4. Choose and apply appropriate Machine Learning Techniques for analysis, forecasting, categorization and clustering of the data

Unit I: Machine Learning Concepts: Introduction to Machine, Machine Learning applications, Types of learning: Supervised, unsupervised and semi-supervised, reinforcement learning technique, Models of Machine Learning: Geometric, Probabilistic, Logical, Grouping and grading models. Predictive and descriptive learning, Classification Concepts. 15 Lectures

#### Unit II: Learning Theory

# Feature: Feature Extraction, Feature Construction and Transformation, Feature Selection. Principle Component Analysis, Independent Component analysis. Factor Analysis, Multidimensional Scaling

#### Unit III: Geometric Models

# Regression, Logical regression, Overfitting, Multivariate Linear regression, Simple neural network, Kernel based methods, Support Vector Machines(SVM), Limitations of SVM, K-nearest neighbor algorithm

#### **15 Lectures**

**15** Lectures

#### Unit IV: Logical, Grouping and Grading Models

Decision tree representation, decision tree algorithm, Regression trees, Clustering Tree, Association rule mining, K-means algorithm, Hierarchical clustering, Ensemble methods: Bagging and boosting.

#### **15 Lectures**

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Book:**

- 1. Peter Flach, Machine Learning: The Art and Science of Algorithms that make sense of data, Cambridge University Press, 1st Edition, 2012, ISBN No.: 978-1-316-50611-0
- 2. Ethem Alpaydin, Introduction to Machine Learning, PHI, 2nd edition, 2013, 978-0-262-01243-0
- Kevin Murphy, Machine Learning: a Probabilistic Approach, MIT Press, 1st Edition, 2012, ISBN No.: 978-0262-30616-4

- 1. C.M. Bishop, Pattern Recognition and Machine learning, Springer, 1st Edition, 2013, ISBN No.: 978-81-322-0906-5
- 2. Hastie, Tibshirani, Friedman, Introduction to statistical machine learning with applications in R, Springer, 2nd Edition, 2013, ISBN No.: 978-1-4614-7138-7
- 3. Tom Mitchell, Machine Learning, McGraw Hill, 1997, 0-07-042807-7
- 4. Parag Kulkarni, Reinforcement and Systemic Machine learning for Decision Making, Wiley- IEEE Press, 2012, 978-0-470-91999-6
- 5. M. F. Der, L. K. Saul, S. Savage, and G. M. Voelker (2014). Knock it off: profiling the online storefronts of counterfeit merchandise. In Proceedings of the Twentieth ACM Conference on

Knowledge Discovery and Data Mining (KDD-14), pages 1759-1768. New York, NY.

- 6. J. T. Ma, L. K. Saul, S. Savage, and G. M. Voelker (2011). Learning to detect malicious URLs. ACM Transactions on Intelligent Systems and Technology 2(3), pages 30:1-24.
- D.-K. Kim, G. M. Voelker, and L. K. Saul (2013). A variational approximation for topic modeling of hierarchical corpora. To appear in Proceedings of the 30th International Conference on Machine Learning (ICML-13). Atlanta, GA.
- M. Bozorgi, L. K. Saul, S. Savage, and G. M. Voelker (2010). Beyond heuristics: learning to classify vulnerabilities and predict exploits. In Proceedings of the Sixteenth ACM Conference on Knowledge Discovery and Data Mining (KDD-10), pages 105-113. Washington, DC

#### Title of Course: R Programming Course Code: MMT - 302 Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Learn Fundamentals of R.
- 2. Apply OOP concepts in R programming
- 3. 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.
- 4. Apply various concepts to write programs in R
- 5. Cover the Basics of statistical data analysis with examples.

Unit 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 – Printing fewer digits or more digits – Special Values functions : NA, Inf and –inf. **15 Lectures** 

Unit II: R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame. R - Variables: Variable assignment, Data types of Variable, Finding Variable Is(), Deleting Variables , R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous 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 Lectures**

Unit 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 Vectors : Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting R List : Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector. R Matrices : Accessing Elements of a Matrix.R Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements. 15 Lectures

**Unit 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(). **Loading and handling Data in R:** Getting and Setting the Working Directory – getwd(), setwd(), dir() - **R-CSV Files** - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply(). **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 Lectures**

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017.

#### **Reference Books:**

Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018.
Andrie de Vries, Joris Meys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015.

#### Title of Course: Practical - III Course Code: MMPR - 303 Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 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

Lab assignments based on Course Code MMT-302 (R Programming course).

#### Title of Course: Power BI Course Code: MMT - 304 Total Credits: 02

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Identify the primary components of Power BI.
- 2. Identify common challenges in Power BI data models.
- 3. Implement smart solutions.
- 4. Understand Power Query.

#### Unit I: Introduction to Power BI:

Data Visualization, Reporting, Business Intelligence(BI), Traditional BI, Self- Serviced BI, Cloud Based BI, On Premise BI, Power BI Products, Power BI Architecture, A Brief History of Power BI.

#### **15 Lectures**

#### **Unit II: Power Query:**

Data Transformation, Benefits of Data Transformation, Overview of Power Query/ Query Editor, Query Editor User Interface, Datatypes, changing the datatype of a column filter, Filter a Column using Text Filters, Number Filters, Date Filters, Multiple Columns, Remove Columns, rename a column, Sort Columns, PIVOT, UNPIVOT Columns, Header Row or Use First Row as Headers

#### **15 Lectures**

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

1. Mastering Microsoft Power BI – Brett Powell

- 1. Beginning Power BI by Dan Clark
- 2. Microsoft Power BI Cookbook Brett Powell

#### Title of Course: Cyber Security Course Code: MET - 305 Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Realize the need for Cyber Security.
- 2. Understand the fundamental of Cyber crimes and cyber security
- 3. Understand the need for Security in day to day communication
- 4. understand the vulnerabilities in Network and computer System
- 5. Understand the different security in different layers of protocol.

**Unit I: Introduction to Cyber Security:** Cyber security, Cyber Threats: Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber espionage.

**Cyber Vulnerabilities:** Vulnerabilities in software, System administration, Complex Network Architecture, Weak Authentication.

#### **15 Lectures**

**Unit II: Cyber Security Safeguards:** Access Control, Audit, Biometrics, Cryptography, Deception, Ethical Hacking, Detection Systems, Response, Scanning, Security Policy, Threat Management. **Active Attack:** Phishing, Sniffing, spoofing, Denial of Service attack.

#### **15 Lectures**

**Unit III: Cryptography:** Introduction to cryptography, Types of Cryptography Symmetric key cryptography, Asymmetric key cryptography, Message Authentication, Digital Signature, Application of Cryptography.

#### **15 Lectures**

**Unit IV: Firewalls:** Types of Firewall, Security at the Application Layer: PGP and S/MIME, Security at SSL and TLS, Security at Network Layer- IP Security.

**Cyber Forensics:** Introduction to cyber forensics, Handling preliminary investigation, Controlling an investigation, Investigating Information Hiding, Conducting disk-based analysis.

#### **15 Lectures**

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

- 1. Preston Gralla, How Personal and Internet Security Work, Que Publications
- 2. Alfred Basta and Wolf Halton, Computer Security Concepts, Issues and Implementation, Cengage Learning

- 1. Digital Defense: A Cybersecurity Primer by Joseph Pelton , Indu B. Singh
- 2. Cryptography and Network Security: Principles and Practice by William Stallings
- 3. Computer and Information Security Handbook by John R. Vacca .

# Title of Course: Software Project Management

### Course Code: MET – 306

# **Total Credits: 04**

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Identify the different project contexts and suggest an appropriate management Strategy.
- 2. Practice the role of professional ethics unsuccessful software development.
- 3. Identify and describe the key phases of project management.
- 4. Determine an appropriate project management approach through an evaluation of the business context and scope of the project

### Unit I: Project Management:

# Concept of Project Management, Project Organization, Planning a software project, Project Management Life Cycle, Risk Management, Identification of Risks, Risk Analysis, Risk Planning and Monitoring.

15 Lectures

#### Unit II: Software Project Estimation:

# Concept of Project Estimation, Different methods of software project estimation, Function point analysis, Software Project Management Tools and Techniique- PERT and Gantt Charts

**15 Lectures** 

#### Unit III: Software Quality Management and Testing:

Quality Assurance and standard, Quality Planning, Quality control, Role of testing in software development, Testing Procedure, Defect Management.

#### **15 Lectures**

#### Unit IV: Configuration Management:

CM Planning, Change Management, Version and Release, Management Configuration, Management Tools. Software Team Management: Characteristics of Performance management, High Performance Directive and Collaborative styles, Team Structure, Team Communication, Managing customer expectations, Group Behavior.

15 Lectures

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

- 1. Software Project management By Edwin Bennatan
- 2. Software Engineering By Roger S. Pressman

- 1. Software Engineering concepts by Richard Fairley
- 2. Software Project Management by S.A. Kelkar
- 3. Software Engineering by IAN Sommerville
- 4. System Analysis and Design Methods By J.L Whitten , L.D.Bentley and K.C. Dittman

#### **Title of Course: Internet of Things**

#### Course Code: MMT - 401

#### **Total Credits: 04**

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Apply the concepts of IoT.
- 2. Identify the different technologies.
- 3. Apply IoT to different applications.
- 4. Analysis& evaluate protocols used in IoT.
- 5. Design smart city in IoT.
- 6. Analysis data received through sensors in IoT.

#### Unit I: Basics of IoT:

Characterization of IoT, Physical design, Functional blocks, Communication model, Communication APIs, ireless sensor networks, Big data analytics, M2M, Difference between IoT and M2M.

#### **IoTSmart-X** applications:

Home Automation, Cities, Environment, Energy, Logistics, Agriculture, Industry, Health & Lifestyle.

**15 Lectures** 

#### Unit II: Architecture for IoT:

Domain Model Specification, Information Model Specification, Service specification, IoT Level specification, Functional view, Operational view, Device and Component Integration, User centered design, Open source development.

Unit III: Towards web of things:

Platform design methodologies, Servicing through uniform interface, Future Web of things. **IoT physical devices and End points:** 

IoT devices, Raspberry Pl interfaces, Arduino interfaces, OtherIoT devices.

**15 Lectures** 

#### Unit IV: IoT Analytics-

Business Process in IoT, Creative Thinking Techniques, Modification, Combination Scenarios, Decentralized and Inter operable, Approaches, Object.

**15 Lectures** 

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

1. Internet Of Things And Its Applications by Prof. Satish Jain Shashi Singh, BPB Publications

#### **Reference Books:**

1. Internet of Things: Architecture and design principles by Samrat Krishna Gaddam.

2. Internet of Things by Vijay Madisetti

### 15 Lectures

#### Title of Course: Data Visualization with Tableau Course Code: MMT - 402

#### **Total Credits: 04**

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Helps to understand the data precisely.
- 2. Makes it easier to explore and manage data.
- 3. Identify and share insights that can change businesses and world.
- 4. Determine an appropriate project management approach through an evaluation of the business context and scope of the project

#### **Unit 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.

#### **Basic of Data Visualization:**

Reading Data from standard text files(.txt, .csv, XML) Displaying JSON content Outputting Basic Table Data (Building table, Using Semantic Table, Configuring the columns), Assuring Maximum readability (Styling your table, Increasing readability, Adding dynamic Highlighting), Including computations, Using data tables library, relating data table to a chart **15 Lectures** 

#### Unit II: Tableau:

Getting Started, Overview, Environment, Navigation, Design Flow File Types, Data Types, Data Terminology, Data Source, Custom Data View, Extracting Data, Fields Operation, Editing Meta data 15 Lectures

#### Unit III: Tableau Worksheets:

Add Worksheet, Rename Worksheet, Save and Delete Worksheet, Reorder Worksheet, Paged Workbook **Tableau Charts:** 

Bar Chart, Line Chart, Pie Chart, Crosstab, Scatter Plot, Bubble Graph, Gantt Chart, Histogram

#### **Unit IV: Tableau Calculation:**

Operators, Functions, Numeric Calculation, String Calculation, Date Calculation, Table Calculation, Basic Sort, Basic Filters, Quick Filters

#### **15 Lectures**

**15 Lectures** 

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended 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

- 1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
- 2. A Julie Steele and Noah Iliinsky, Designing Data Visualizations: Representing Informational Relationships, O'Relly
- 3. Andy Kirk, Data Visualization: A Successful Design Process, PAKT

#### Title of Course: Practical - IV Course Code: MMPR - 403 Total Credits: 04

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 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

Lab assignments based on Course Code MMT – 402 (Data Visualization with Tableau course).

# Title of Course: Deep Learning Course Code: MET - 404

#### **Total Credits: 04**

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand the role of Deep Learning in Machine Learning Applications.

2. To get familiar with the Deep Learning Applications.

3. Critically Analyse Different Deep Learning Models.

4. TO design and implement Convolutional Neural Networks

**Unit I: Basic of Neural Networks:** Basic concepts of Neuron, Perceptron Algorithm, Sigmoid Neuron, Shallow neural networks, Deep Neural networks, Feed Forward and Back Propagation Networks

**15 Lectures** 

**Unit II: Optimization and Deep learning:** Learning Parameters of Feedforward neural network, the vanishing gradient problem, ways to mitigate it, ReIU Heuristics for avoiding bad local minima, Heuristics for fater training, Principal Component Analysis, Singular Value Decomposition.

**15 Lectures** 

#### **Unit III: Convolutional Neural Networks:**

Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, Visualizing Convolution Neural Networks, Deep Dream, Deep Art, Fooling Convolutional Neural Network.

**15 Lectures** 

#### **Unit IV: Applications of Deep Learning:**

Image Segmentation, object Detection, Automatic Image Captioning, Image Generation with Generative Adversarial networks, Video of Text with LSTM Models, Attention Models for Computer Vision.

**15 Lectures** 

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

- 1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
- 2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

- 1. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress , 2017.
- 2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
- 3. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
- 4. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016Dittman

#### Title of Course: Soft Computing Course Code: MET - 405

#### **Total Credits: 04**

Course Outcomes: Upon successful completion of this course, the student will be able to:

- 1. Differentiate Conventional AI and Computational Intelligence.
- 2. Discuss on machine learning through neural networks.
- 3. Apply knowledge in developing a Fuzzy expert system.
- 4. Model Neuro Fuzzy system for clustering and classification.
- 5. Discover knowledge to develop Genetic Algorithm and Support vector machine based machine learning system

**Unit I: Introduction To Soft Computing:** Evolution of Computing, Soft Computing Constituents, From Conventional AI to Computational Intelligence, Machine Learning Basics

#### **15 Lectures**

**Unit II: Genetic Algorithm:** Introduction to Genetic Algorithm, Application of genetic Algorithm, Genetic Operators, GGenetic based Machine Learning.

#### **15 Lectures**

#### **Unit III : Fuzzy Logic:**

Fuzzy Set, Operations on Fuzzy Set, Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

#### **15 Lectures**

#### **Unit IV: Neuro- Fuzzy Modelling:**

Adaptive Neuro, Fuzzy Inference System, Coactive Neuro, fuzzy Modelling, classification and regression Trees, Data Clustering Algorithms, Rule based structure identification, Neuro-Fuzzy Control.

#### **15 Lectures**

Seminars, Tutorials, Problem solving session and group discussions on above four units.

#### **Recommended Books:**

- 1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
- 2. KwangH.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.

- 1. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1996.
- 2. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.
- 3. David E.Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1989.
- 4. Mitchell Melanie, "An Introduction to Genetic Algorithm", MIT Press, 1996.
- 5. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2008 edition.

#### **Scheme of Teaching and Practical**

- 1. Each contact session for teaching or practical should be of 60 minutes each.
- 2. Minimum 48 periods should be conducted for each subject of 100 Marks.
- 3. Minimum 24 periods should be conducted for each subject of 50 Marks.
- 4. One Practical Batch should be of 30 students.
- 5. Practical evaluation should be conducted before the commencement of University examination.

# **10. Examination Pattern**

#### Theory:

The final total assessment of the candidate is made in terms of an internal assessment and an external assessment for each course.

- 1. For each theory paper, 20% marks will be based on internal assessment and 80% marks for semester examination (external assessment), unless otherwise stated.
- 2. The division of the 20 marks allotted to internal assessment of theory papers is as Follows:
  - Two tests should be conducted of MCQ type questions. Each test will be of 10marks.
  - The division of the 10 marks allotted to internal assessment of theory papers is as: Test o f 10 marks should be conducted of MCQ type questions.

#### **Practical:**

 The final practical examination will be conducted by the university appointed examiners both internal as well as external at the end of semester for each lab course and marks will be submitted to the university by the panel. The pattern of final Practical Examination will be as follows:

1	Coding and Execution of Program	60 Marks
2	Viva-voce	20 Marks
3	Journal	20 Marks
4	Total	100 Marks

The practical examination will be conducted semester wise in order to maintain the relevance of the respective theory course with laboratory course.

The project will be evaluated by the university appointed examiners both internal as well as external.

### 11. Nature of Question Paper and Scheme of Marking

#### Theory:

#### Theory Examination (For 80 Marks):

- 1. There will be seven (7) questions of 16 Marks and out of which four (4) to be attempted from question no 2 to 7.
- 2. Question No.1 is compulsory and is of multiple-choice questions. There will be 8 multiple choice questions each carrying 2 marks each.
- 3. Question No.2 to Question No. 7 should consist of 2 sub questions each carrying 8 marks.
- 4. Question No. 7 should be a short note, where 4 questions will be given, out of which two questions should be attempted.

#### Theory Examination (For 40 Marks):

- 1. There will be six (6) questions of 10 Marks and out of which three (3) to be attempted from question no 2 to 6.
- 2. Question No.1 is compulsory and is of multiple choice questions. There will be5 multiple choice question each carrying 2 marks.
- 3. Questions No. 2 to Question No. 6 should consists of 2 sub questions each carrying 5 marks.
- 4. Question No. 6 should be a short note where 4 questions will be given out of which two questions should be attempted.

#### **Practical:**

- 1. Duration of Practical Examination: 3 Hrs
- 2. Nature of Practical Question paper: There will be three questions out of which any two

questions to be attempted and each question carries 30 Marks.

Old Course				Equivalent Course			
Sem No.	Course Code	Title of Old Course	Credit	Course Code Title of New Course		Credit	
III	CC- 301	Artificial Intelligence	4		*No Equivalence		
III	CC- 302	Web Technology	4		*No Equivalence		
III	CC- 303	R Programming	4	MMT - 302	R Programming	4	
III	CCS- 304	Data Visualization	4	MMT- 402	Data Visualization with Tableau	4	

# M. Sc. ( Data Science ) Part II (Semester III and IV)

\* Two more chances be given to the student.