

Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(An Autonomous College)

Reaccredited by NAAC with 'A+' Grade

New Syllabus For

Master of Science

Part - II

Computer Science

Syllabus

To be implemented from June, 2022 onward

**Department of Computer Science Scheme of Credit for
M.Sc. Computer Science
Under Choice Based Credit System (CBCS)
W.e.f. (June 2021-22)**

• **OBJECTIVES:**

1. To create post-graduates with sound knowledge of Computer Science , who can contribute towards recent advances in technology
2. To provide advanced and in-depth knowledge of computer science and specialization in one or two subjects of new era of technology.
3. To prepare Post Graduates who will achieve peer-recognition, as an individual or in a team, through demonstration of good analytical, design, programming and implementation skills.
4. To enable students, pursue a professional career in Artificial Intelligence and IOT in related industry, business and research.
5. To impact industry knowledge and practical skills of current trends in IT field to the students.
6. To develop ability among students to formulate, analyze and solve real life problems faced in Computer Science industry.
7. To produce computer science professionals who can be directly employed or start his/her own work as Freelance Software Developer, IT consultant, Software Tester, Service engineer, Project Manager and even an entrepreneur in Computer Science industry.
8. To Develop designing, analyzing and critical thinking skill among students.

• **OUTCOMES:**

After completing this courses students shall be expert in following things:

1. Avail the skills of Current trends in IT Industries and new Technologies.
2. Apply knowledge of programming platforms in IOT and AI in real life.
3. Student should avail detail knowledge of Artificial Intelligence, IOT, and Networking etc.
4. Students will demonstrate their ability of advanced programming to design and develop innovative applications.
5. Student will be able to Access, evaluate, understand, and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation
6. Students will critically evaluate, analyze, and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
7. Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills, and lead a team for planning and execution of a task.
8. Student can start his own business or start up.

• **SCOPE:**

After Successful completion of two years Master's Degree in Computer Science, we observed that the students have the ample opportunities in diversified areas such as:

1. Software Industry.
2. Communication Industry
3. Digital Media
4. Agriculture Industry
5. Health and Care.
6. Research Field.
7. IoT Architects

Courses Structure for Postgraduate Programme to be implemented from Academic year 2020-21 for Computer Science

Course Code	Title of the Course	Credits	Teaching Scheme (h/w)		Evaluation Scheme (marks)		Total
			L	P	ESE	ISE	
M.Sc. Part I - Semester I							
MCST 101	Design and Analysis of Algorithms	4	4	-	60	40	100
MCST 102	Principles of Programming languages	4	4	-	60	40	100
MCST 103	Advanced Database Management Systems	4	4	-	60	40	100
MCST 104	Advanced Networking	4	4	-	60	40	100
MCSP 105	Lab I: Design and Analysis of Algorithms and Principles of Programming languages	4	-	12	60	40	100
MCSP 106	Lab II: Advanced Database Management Systems and Advanced Networking	4	-	12	60	40	100
	Total	24	16	24	360	240	600
M.Sc. Part I - Semester II							
MCST 201	Python Programming	4	4	-	60	40	100
MCST 202	Cloud Computing	4	4	-	60	40	100
MCST 203	Cyber Security and Laws	4	4	-	60	40	100
MCST 204	Digital Image Processing	4	4	-	60	40	100
MCST 205	Mathematical and Statistical Foundations	4	4	-	60	40	100
MCSP 206	Lab III: Python Programming and Cloud Computing	4	-	12	60	40	100
MCSP 207	Lab IV: Cyber Security and Laws, Mathematical and Statistical Foundations and Digital Image Processing	4	-	12	60	40	100
	Total	28	20	24	420	280	700
M.Sc. Part II - Semester III							
MCST 301	Emerging Technologies	4	4	-	60	40	100
MCST 302	Data Mining	4	4	-	60	40	100
MCST 303	Data Visualization using Tableau	4	4	-	60	40	100
MCST 304	Elective I	4	4	-	60	40	100
MCST305	Elective I	4	4	-	60	40	100
MCSP 306	Lab V: Emerging Technologies, Data Mining and Data Visualization using Tableau	4	-	12	60	40	100
MCSP 307	Lab VI: Elective I	4	-	12	60	40	100
	Total	28	20	24	420	280	700
M.Sc. Part II - Semester IV							
MCST 401	Elective II	4	4	-	60	40	100
MCST 402	Elective II	4	4	-	60	40	100

MCSP 403	LAB VII: Elective II	4	-	12	60	40	100
MCSP 404	LAB VIII: Internship Program (Industrial Training)	4	-	12	60	40	100
	Total	16	8	24	240	160	400
	Grand Total	96	64	96	1440	960	2400

Course Code	Elective-I	Course Code	Elective-II
MCST 30x	Artificial Intelligence	MCST 40x	Deep Learning
MCST 30x	Machine Learning	MCST 40x	Big-data Analytics
MCST 30x	Fundamentals of IOT	MCST 40x	Control Systems
MCST 30x	Microcontrollers for IoT	MCST 40x	Wireless Sensor Networks

Project Academic Project is divided into 4 phases.

Phase I : Literature Survey
Phase II : Data Collection &
Design Phase III : Implementation
Phase IV : Publication

Evaluation Pattern PG: M.Sc. I

Semester-I

Theory: Practical (60: 40)

ESE: ISE (60: 40)

Class	Semester	Paper Name	Theory			Practical			Total	
			ES E	ISE	Total	ESE	ISE	Total		
M.Sc. I	I	Paper I: MET101	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Book Review)	100	-	-	-	100	
		Paper II: MET102	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Home Assignments)	100	-	-	-	100	
		Paper III: MET103	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Survey/Seminar)	100	-	-	-	100	
		Paper IV: MET104	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Group Discussion/Innovative Idea Presentation)	100	-	-	-	100	
		Practical P-I: MEP105	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	-	100
		Practical P-II: MEP106	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part I)	100	-	100
		Total			240	160	400	120	80	200

Class	Semester	Paper Name	Theory			Practical			Total	
			ESE	ISE	Total	ESE	ISE	Total		
M.Sc. I	II	Paper V: MXT201	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Book Review)	100	-	-	-	100	
		Paper VI: MXT202	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Home Assignments)	100	-	-	-	100	
		Paper VII: MXT203	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Survey/Seminar)	100	-	-	-	100	
		Paper VIII: MXT204	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Group Discussion/ Innovative Idea Presentation)	100	-	-	-	100	
		Paper IX: MXT205	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (MOOC/Open Book Test)	100	-	-	-	100	
		Practical P-III: MXP206	-	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	100
		Practical P-IV: MXP207	-	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part II)	100	100
		Total		300	200	500	120	80	200	700

Class	Semester	Paper Name	Theory			Practical			Total
			ESE	ISE	Total	ESE	ISE	Total	
M.Sc. II	III	Paper X: MXT301	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Book Review/ Innovative Idea Presentation)	100	-	-	-	100
		Paper XI: MXT302	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Home Assignments)	100	-	-	-	100
		Paper XII: MXT303	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Seminar)	100	-	-	-	100
		Paper XIII: MXT304	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (Open Book Test)	100	-	-	-	100
		Paper XIV: MXT305	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (MOOC/Group Discussion)	100	-	-	-	100
		Practical P-V: MXP306	-	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100

	Practical P-VI: MXP307	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part III)	100	100
	Total	300	200	500	120	80	200	700

Class	Semester	Paper Name	Theory			Practical			Total	
			ESE	ISE	Total	ESE	ISE	Total		
M.Sc. II	IV	Paper XV: MXT401	60	40 ISE I: 10 ISE II: 10 (online) Activity : 20 (Paper Presentation/ Webinar Participation)	100	-	-	-	100	
		Paper XVI: MXT402	60	40 ISE I: 10 ISE II: 10 (online) Activity: 20 (MOOC/Open Book Test)	100	-	-	-	100	
		Practical P-VII: MXP403	-	-	-	60	40 Journal: 10 Day to Day Performance: 10 Activity: 20 (Case Study/Survey Report)	100	100	100
		Internship	-	-	-	60 Internship: (Report Submission: 30 Presentation and Viva: 30)	40 Internship certificate: 10 Day to Day Performance: 10 Activity: 20 (Model Presentation/ Project Part IV)	100	100	100
		Total	120	80	200	120	80	200	400	400

Note:

The strength of the student per batch is as per university norms.

The duration of practical examination for M.Sc. Semester I, II, III and IV should be 2 days of 12 hours excluding inspection day.

1. SUBJECT: Computer Science

2. YEAR OF IMPLEMENTATION: New Syllabi for the M.Sc. Computer Science will be implemented from June 2021 onwards.

3. PREAMBLE:

Master of Science is an integrated academic degree in faculty of Science. The faculty is not ignoring the developments in the field of Computer Science. The revision of existing syllabus of 6 Computer Science subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. The students from science faculty should also be competent for this change in the technology. In this year, a student will be able to understand Computer languages and technologies to build software with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Artificial Intelligence and IOT.

4. GENERAL OBJECTIVES OF THE COURSE:

1. To create post-graduates with sound knowledge of fundamentals of Computer Science, who can contribute towards advancing science and technology.
2. To create post-graduates with sufficient capabilities in Computer Science who can become researchers and developers to satisfy the needs of the core Computer Science Industry.
3. To develop ability among students to formulate, analyze and solve real life problems.
4. To provide opportunity to students to learn the latest trends in Computer Science and make them ready for life-long learning process.
5. To make the students aware of professional ethics of the industry, and prepare them with basic soft skills essential for working in community and professional teams.
6. To prepare the students for postgraduate studies through competitive examinations, enabling them to reach higher echelons of excellence.
7. To produce Computer Science professionals who can be directly employed or start his/her own work as Software Developer, Data Scientist, testing professional, Network engineer and even an entrepreneur in IT industry.

5. DURATION:02 Years (Full Time)

6. PATTERN: SEMESTER EXAM(CBCS)

7. MEDIUM OF INSTRUCTIONS :ENGLISH

8. STRUCTURE OF COURSE:

1. THIRD SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Computer Science	Paper I: MCST301	20	20	Practical Paper – V : MCSP306	12	4
		Paper II: MCST302					
		Paper III: MCST303			Practical Paper –VI : MCSP307	12	4
		Paper IV: MCST304					
		Paper IV: MCST305					

2. FOURTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Computer Science	Paper I: MCST401	8	8	Practical Paper – VII: MCSP403	12	4
		Paper II: MCST402					

3. Structure and Title of Papers of M. Sc. Course:

- **M. Sc. I Semester I**

Paper X: Emerging Technologies

Paper XI: Data Mining

Paper XII: Data Visualization using Tableau

Paper XIII: Elective I

Paper XIV: Elective I

- **M. Sc. I Semester II**

Paper XV : Elective II

Paper XVI: Elective II

MCST/Pxyz–

M M.Sc.

CS Computer Science

T Theory

P Practical

x 1 to 4 :Semester number

yz 1 to 7 :course number

Rules and Regulations:

1. Core courses will be offered only to the students of M.Sc. Computer Science.
2. The pre-requisites for electives courses will be decided by the departmental committee and Certificate and diploma program will be mandatory for all students.
3. Electives will be offered for minimum 08 and maximum 12 students in view of the infrastructure of the department. Electives to be offered or otherwise will be at the sole discretion of the departmental committee.
4. Minimum attendance required to appear for semester-end examination will be 75 % for each credit course.

4. OTHERFEATURES:

A. LIBRARY:

• REFERENCEBOOKS

1. Introductory and Advanced Topics by Margaret Dunham, S. Sridhar, Pearson Publication
2. Data Mining concepts and Techniques by Jiawei Han and Micheline Kamber, ELSEVIER,Third Edition,
3. R and Data Mining, By Yanchang Zhao, Elsevier Inc., ISBN-10: 0123969638
4. Data Science from Scratch: First Principles with Python By O'Reilly Media, 20153.
5. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining by Glenn J. Myatt John Wiley Publishers, 2007
6. Visual Analytics with Tableau 1st Edition by Alexander Loth m, John Willie and Sons
7. Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master O'Reilly Media
8. Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization, 4th Edition
9. Machine Learning and Artificial Intelligence, Ameet V. Joshi, Springer, Cham
10. Machine Learning in Action,Peter Harrington, April 2012 , Manning publications.
11. Artificial Intelligence and Machine Learning Fundamentals by Zsolt Nagy
12. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Else
13. Daniel Minoli, — “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
14. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
15. Learning internet of things Waher, Peter -Packt Publishing Ltd, 2015
16. 'Internet of Things – From Research and Innovation to Market Deployment',Peter Friess, , River Publishers, 2014
17. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
18. Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
19. Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
20. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O'Reilly Publisher Media, Inc."
21. Deep Learning with Python, FRANÇOIS CHOLLE
22. Dive into Deep Learning, Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola
23. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville
24. Neural Networks and Deep Learning, Michael Nielsen' Madhu Jagdeesh,Soumendra Mohanty,Harsha Srivatsa,”
25. Big Data Imperatives: Enterprise Big Data Warehouse,BI Implementations and Analytics”,1st Ediin, Apress(2013)
26. Frank J.Ohlhorst,”Big Data Analytics:Turning Big Data into Big Money”,Wiley Publishers(2012)
- 27.Cristian Molaro,Surekha Parekh,Terry Purcell,”DB2 11:The Database for Big Data & Analytics”,MC Press,(2013)
28. Tom White,”Hadoop-The Definitive Guide,Storage and analysis at internet scale”,SPD, O'Really. DT Editorial Services,”
29. Big Data, Black Book-Covers Hadoop2, MapReduce,Hive,YARN, Pig, R and Data Visualization” Dreamtech Press,(2015).
30. Big Data Case Study by Bernard Marr –Willey Publications. U.A.Bakshi, V.U.Bakshi
- 31.“Control System Engineering”, First Edition2008, Technical Publications, Pune ,I.J. agrath, M.Gopal
32. Ogata Katsuhiko, “Modern Control Engineering”, 4th Edition, PHI. Kuo B.C. Automatic Control System, PHI, New Delhi, Third Edition

- 33.Schaum's Series book "Feedback Control Systems". Les Fenical "Control Systems", 1st Edition, Cengage Learning India.
- 34.Samarjeet Ghosh, "Control Systems Theory & Applications", 1st Pearson education.
- 35.S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education.
36. Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.

- 37.Wireless Communication, Theodore S. Rappaport, Prentice hall
- 38.Wireless Communications and Networking,Vijay Garg, Elsevier
- 39.Wireless digital communication, Kamilo Feher, PHI
- 40.Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
 - 41.Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
 - 42.Wireless Communications-T.L.Singh-TMH 7 Adhoc Mobile Wireless network, C.K.Toh Pearson.
- 43.Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
- 44.Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
- 45.Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
- 46.Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications
47. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications

JOURNALS AND PERIODICALS

- 1.Acta Informatics. 0.900 Impact Factors 2019.
- 2.AI and Ethics.
- 3.AI & SOCIETY.
- 4.Algorithmic. 0.650 Impact Factors 2019.
- 5.Annals of Mathematics and Artificial Intelligence. 0.778 Impact Factor 2019.
- 6.Applicable Algebra in Engineering, Communication and **Computing**. ...
- 7.Applied Intelligence. ...
- 8.International journal of computer vision
- 9.Expert Systems with applications
- 10.IEEE Transactions on Image Processing

B. SPECIFIC EQUIPMENTS:

Computers, Laptops, Printers, Scanners, LCD Projectors, E- Podium, SmartBoard, Document Camera, Visualizer

C. LABORATORY EQUIPMENTS:

1. Digital storage Oscilloscope: 60MHz
2. Signal generator
3. Microwave Testbench (Gunn Source)
4. Antenna Trainer
5. Arduino Development Board
6. CPLD development boards
7. Microcontroller Boards – 8051, MSP430, PIC18F, AVR MEGA32, ARDUINO NANO, UNO, MEGA
8. KEIL-IDE
9. MikroC Compilers for 8051, PIC and ARM
10. Soft Computing Tools – SCILAB, MATLAB

Semester III

Paper X

MCST301: Emerging Technologies

Course Objectives: Student will able to

1. Study of creating Angular components
2. Understand concepts of Binding data and events
3. Study of Angular forms
4. Understand how to add routes to Angular applications

Credits=4	SEMESTER-III MCST 301: : Emerging Technologies	No. of hours per unit/ credits
Credit –I UNIT I	Angular JS Basics	(15)
	A. What is Angular JS? , B. Why Angular JS? , C. Why MVC matters, D. MVC-The Angular JS way , E. Features of Angular JS , F. Model-View-Controller, G. My First Angular JS app, H. All about Angular Expressions, I. How to use expressions, J. Angular vs JavaScript	
Credit -1 UNIT II	Filters & Directives	(15)
	A. Built-In Filters, B. Using Angular JS Filters, C. Creating Custom Filters, D. introduction to Directives, E. Directive Lifecycle, F. Binding controls to data, G. Matching directives, H. Using Angular JS built-in directives I. Creating a custom directive.	
Credit –1 UNIT III	Controllers & modules	(15)
	A. Role of a Controller, B. Controllers & Modules, C. Attaching Properties and functions to scope, D. Nested Controllers, E. Using Filters in Controllers, F. Controllers in External Files, G. Introduction to Angular JS Modules, H. Bootstrapping Angular JS I. MongoDB Relational vs NoSQL DB, MongoDB fundamentals, Data modeling, Aggregation pipeline, Grid FS, Performance	

	optimization	
Credit –1 UNIT IV	Angular JS Forms and Bootstrap	(15)
	A. Working with Angular Forms, B. Model Binding, C. Forms Events, D. Updating Models with a Twist E. Form Controller, F. Validating Angular Forms, G. \$error object H. Bootstrap: Bootstrap - Overview Environment Setup, Grid System ,Typography ,Code , Tables ,Forms, Buttons , Badges and Labels , Progress Bars , List Groups , Panels , Dropdowns ,Images , Helper Classes , Responsive utilities, navigation, modals, image carousels	

Course Outcome: Student should be able to

1. understand client-side JavaScript frameworks and the Angular framework.
2. Use various Angular features including directives, components, and services.
3. Apply a functional front-end web application using Angular.
4. Understand Model Binding

Reference Books:

- 1) Angular: Up and Running: Learning Angular, Step by Step, Shyam Seshadri, 2018
- 2) Learn AngularJS in 1 Day: Complete Angular JS Guide with Examples, Krishna Rungta, Kindle Edition, 2016
- 3) Angular 5: From Theory to Practice, Asim Hussain, Kindle Edition 2017.
- 4) Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, Kindle Edition 2017.

MCST 302 : Data Mining

Course Objectives: Student will able to:-

1. Understand the basics of Data Mining programming
2. Study facilities for performing data mining with Python packages
3. Understand python functionalities and features used for data mining
4. Study of Data analysis and Data Visualization using Python

Credits=4	SEMESTER-III Data Mining	No. of hours per unit/ credits
Credit –I UNIT I	Introduction to Data Mining	(15)
	A. Definition Data mining, B. Data Mining issues , C. Stages of the Data Mining Process (KDD), D. Data Mining Techniques/Tasks, E. Knowledge Representation Methods, F. Applications of Data mining, G. Data Pre-processing, H. Data Cleaning, I. Data Transformation, J. Data Reduction	
Credit - 1UNIT II	Data Warehousing	(15)
	A. Introduction to Data Warehouse, B. Data Warehouse Architecture and its components, C. Data Modeling with OLAP, D. Difference between OLTP and OLAP, E. Data Mart, Fact Table, F. Dimension Table, OLAP cube, G. Different OLAP Operations, Schema Design, H. Star and snow-Flake Schema, I. Introduction to Machine Learning, J. Introduction to Pattern Matching, K. Case study based on Schema Design	
Credit –1 UNIT III	Classification	(15)
	A. Introduction, Definition, B. Decision Tree, Construction Principle, C. Attribute Selection Measures D. Tree Pruning, Rule-Based Classification, E. Using IF-THEN Rules for Classification, F. Rule Extraction from a Decision Tree, G. Bayes Classification Methods, Bayes'' Theorem, H. Naive Bayesian Classification, I. Bayesian Networks, J. Parameter and structure learning,	

	K. Linear classifier, Perceptron, L. k-Nearest-Neighbor Classifiers, M. Regression, Linear Regression, Nonlinear Regression	
Credit –1 UNIT IV	Clustering and Association Rule Mining	(15)
	A. Cluster Analysis, Introduction, B. Requirements for Cluster Analysis, C. Hierarchical Methods, Agglomerative Hierarchical Clustering, Divisive Hierarchical Clustering, D. Partitioning Methods,k-Means: E. A Centroid-Based Technique, k-Medoids: F. A Representative Object-Based Technique G. Introduction to Association Rule Mining, H. Market Basket Analysis, I. Items, Itemsets and Large Itemsets J. Apriori Algorithm, Kinds of Association Rules, K. Mining Multilevel association rules L. Constraint Based Association rules mining	

Course Outcome: Student should be able to:

1. Implement data mining tasks using Python
2. Use the python packages to carry out data mining tasks.
3. Perform data analysis and data visualization using python packages.
4. Perform Cluster Analysis using python packages.

Reference Books:

- 1) Introductory and Advanced Topics by Margaret Dunham, S. Sridhar, Pearson Publication
- 2) Data Mining concepts and Techniques by Jiawei Han and Micheline Kamber, ELSEVIER,Third Edition,
- 3) R and Data Mining, By Yanchang Zhao, Elsevier Inc., ISBN-10: 0123969638
- 4) Data Science from Scratch: First Principles with Python By O'Reilly Media, 20153.
- 5) Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining by Glenn J. Myatt John Wiley Publishers, 2007

Paper XII
MCST303: Data Visualization using Tableau

Course Objectives: Student will able to:-

1. Understand and critically apply the concepts and methods of business analytics
2. Study of identification of model and solve decision problems in different settings
3. Study of appropriate courses of action for a given managerial situation whether a problem or an opportunity
4. Study of viable solutions to decision making problems

Credits=4	MCST-303 Data Visualization using Tableau	No. of hours per unit/ credits
Credit –I UNIT I	Tableau Software	(15)
	<ul style="list-style-type: none"> A. Understanding Data , B. What is data & Where to find data , C. Foundations for building Data Visualizations , D. Creating Your First visualization E. Getting started with Tableau Software Using Data file formats Connecting your Data to Tableau Creating basic charts (line, F. bar charts, Treemaps) using the <i>Show me</i> panel 	
Credit –1 UNIT II	Tableau Calculations & Visualization and Data Manipulation	(15)
	<ul style="list-style-type: none"> A. Overview of SUM, B. AVR, and Aggregate features C. Creating custom calculations and fields D. Applying new data calculations to your visualization E. Formatting Visualizations Formatting Tools and Menus F. Formatting specific parts of the view Editing and G. Formatting Axes, H. Cleaning - up the data with the Data Interpreter Structuring your data Sorting and I. filtering Table audata Pivoting Tableau data 	
Credit –1 UNIT III	Advanced Visualization Tools	(15)
	<ul style="list-style-type: none"> A. Using Filters, B. Using the Detail panel , C. Using the Size panels Customizing filters , D. Using and Customizing tool tips , E. Form at ting your data with colors 	

Credit –1 UNIT IV	Dashboards and Storytelling and Publishing your Visualization	(15)
	<ul style="list-style-type: none"> A. Using Story telling Creating your first dash board and Story Design for different displays Adding inter activity to your Dashboard, B. Tableau File Types, C. Publishing to Tableau Online, D. Sharing your Visualization. 	

Course Outcome: Student should be able to:

1. Identify and describe complex business problems in terms of analytical models.
2. Apply appropriate analytical methods to find solutions to business problems that achieve stated objectives.
3. Demonstrate ethical decision-making in structured or unstructured and ambiguous situations.
4. understand technical information to both technical and non-technical audiences in speech, in writing, and graphically.

REFERENCES:

- 1) Visual Analytics with Tableau 1st Edition by Alexander Loth m, John Willie and Sons
- 2) Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master
Oreilly Media
- 3) Learning Tableau: Create effective data visualizations, build interactive visual analytics, and transform your organization, 4th Edition, 2020

Paper XIII

MCSET 304: Elective I (Artificial Intelligence)

Course Objectives: Student will be able to

1. Study of a historical perspective of AI and its foundations.
2. Understand the basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. Study of applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. understand AI development tools such as an 'AI language', expert system shell, and/or data mining tool.

Credits=4	Paper XIII MCSET 304: Elective I (Artificial Intelligence)	No. of hours per unit/ credits
Credit –1 UNIT I	Introduction of AI and Problem Solving	(15)
	A. Artificial Intelligence, AI Problems, B. AI Techniques, The Level of the Model, C. Criteria For Success. Defining the Problem as a State Space Search, D. Problem Characteristics, E. Search and Game Playing: Breadth first search, depth first search, hill climbing, heuristic search, Best first search, F. A* algorithm, AO* algorithm, G. Minmax & game trees, refining minmax, H. Alpha – Beta pruning, I. Constraint satisfaction. AI and python programming.	
Credit –1 UNIT II	Knowledge Representation	(15)
	A. Introduction, Propositional Logic, Syntax and Semantics, B. Interpretations, Properties, Predicate Calculus, C. WFF, Free and Bound Variables, D. Normal Forms, Inference Techniques, E. Resolution, Unification, Modes Pones, F. Frames, Frame Representation Language, G. Conceptual Dependency, CD Theory, Script, H. Semantic Net, Conceptual Graph, Rule Based Representation, I. Forward and Backward Reasoning	
Credit –1 UNIT III	Neural Networks	(15)
	A. Introduction, Basic Concepts of Neural Networks, B. Model of an Artificial Neuron, Activation Functions, C. Feedforward Network, Recurrent Network, D. Learning Methods,	

	E. Deep learning and deep neural network. F. Fuzzy Set Theory, Fuzzy Membership, Fuzzy Operations, G. Fuzzy Logic Systems	
Credit –1 UNIT IV	Natural Language Processing:	(15)
	A. Introduction, Syntactic Processing, Semantic Analysis, B. Discourse and Pragmatic Processing. Genetic Algorithm: Genetic Algorithm (GA), Genetic Representations, C. (Encoding) Initialization and Selection, D. Different Operators of GA, E. Analysis of Selection Operations, F. The Hypothesis of Building Blocks, G. Schema Theorem and Convergence of Genetic Algorithm,	

Course Outcome: Student should be able to:

1. Apply problem solving by intelligent search approach.
2. understand AI techniques.
3. Design Machine learning solution to real life problems and solutions to Uncertainty using Fuzzy Theory.
4. understand a NLP problem and find a suitable solution to it and to develop a good understanding of all.

References: -

1. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill, 2002.
2. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers , Inc., San Francisco, California, 2000.
3. R. Akerkar, Introduction to Artificial Intelligence, Prentice-Hall of India, 2005
4. Winston P.H, “Artificial Intelligence”, Addison Wesley (1993)
5. B. Yegnanarayana, Artificial Neural Networks, Prentice-Hall of India, 2006
6. Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, S. Rajasekaran, G. A. VijayalakshmiPai, Prentice-Hall of India, 2003
7. Artificial Intelligence: A Modern Approach, 2nd edition, by Russell and Norvig, Prentice Hall

Paper XIV**MCST305: Elective II: Machine Learning****Course Objectives:** Student will able to: -

1. Understand the basic theory underlying machine learning.
2. Study of machine learning problems corresponding to different applications.
3. Understand a range of machine learning algorithms along with their strengths and weaknesses.
4. Study of machine learning algorithms to solve problems of moderate complexity.

Credits=4	SEMESTER-III MCST305: Elective II: Machine Learning	No. of hours per unit/ credits
Credit –I UNIT I	Outline to AI	(15)
	<ul style="list-style-type: none"> A. Introduction to Artificial Intelligence and Machine learning, B. Essential concepts in Artificial Intelligence and Machine learning. C. Machine learning basics: Key terminology, D. Key tasks of machine learning, E. Choosing the right algorithm, F. Steps in developing a machine learning application. How we split data in Machine, G. Best Python libraries for Machine Learning 	
Credit –1 UNIT II	Supervised Learning	(15)
	<ul style="list-style-type: none"> A. Supervised Learning The k-Nearest Neighbours classification algorithm, B. Parsing and importing data from a text file, C. Creating scatter plots with Matplotlib, D. Normalizing numeric values. E. Decision tree, Tree construction, plotting trees in Python, F. Testing and storing the classifier. 	
Credit –1 UNIT III	Naïve Theory and Unsupervised Learning	(15)
	<ul style="list-style-type: none"> A. A Naïve Bayesian decision theory, B. Conditional probability, C. Classifying with conditional probabilities, D. Document classification with naïve Bayes, E. Classifying text with python, F. Case study: classifying spam email with naïve Bayes. G. Unsupervised learning: Clustering, H. Grouping unlabelled data using K-Means clustering, I.K-means algorithm. 	
Credit –1 UNIT IV	Recommender System	(15)
	<ul style="list-style-type: none"> A. Recommender System: Introduction, B. Understanding Recommendation Systems, 	

	C. Content Based Filtering, D. User Based Collaborative Filtering, E. Item Based Collaborative Filtering, F. Methods and tricks of the trade, G. Issues in Recommendation Systems, H. Recommender System in Python.	
--	--	--

Course Outcome: Student should be able to:

1. analyze the basic principles, techniques, and applications of Artificial Intelligence.
2. implement machine learning techniques and AI computing environment that are suitable for the applications under consideration.
3. understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
4. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

References:-

- 1) 1 Machine Learning and Artificial Intelligence, Ameet V. Joshi, Springer, Cham.
- 2) Machine Learning in Action, Peter Harrington, April, Manning publications, 2012.
- 3) Artificial Intelligence and Machine Learning Fundamentals by Zsolt Nagy.
- 4) Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber.

Paper: XIII**MCSET 304: Elective I (Fundamentals of IOT)****Course Objectives:** Student will be able to:-

1. Study fundamental concepts of IoT
2. Understand roles of sensors in IoT
3. Study of different protocols used for IoT design
4. Understand data handling and analytics tools in IoT

Credits=2	Paper: XIII MCSET 304: Elective I (Fundamentals of IOT)	No. of hours per unit/ credits
Credit –I UNIT I	Essentials of IoT	(15)
	A. Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, B. History of IoT, About Things in IoT, C. The Identifiers in IoT, About the Internet in IoT, D. IoT frameworks, IoT and M2M.	
Credit –1 UNIT II	Supervised Learning	(15)
	A. Definition, Types of Sensors, B. Types of Actuators, Examples and Working, C. IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, D. RFID Principles and components, E. Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	
Credit –1 UNIT III	Naïve Theory and Unsupervised Learning	(15)
	A. WPAN Technologies for IoT: IEEE 802.15.4, B. Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. C. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. D. Edge connectivity and protocols	
Credit –1 UNIT IV	Recommender System	(15)
	A. Home Automation, Smart Cities, Energy, B. Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, C. IoT design Ethics, D. IoT in Environmental Protection.	

Course Outcome: Student should be able to:

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Use sensors and actuators for design of IoT.
3. Understand and apply various protocols for design of IoT systems
4. Use various techniques of data storage and analytics in IoT

Reference Books

- 1) Daniel Minoli, — “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
- 2) Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
- 3) Learning internet of things Waher, Peter -Packt Publishing Ltd, 2015
- 4) 'Internet of Things – From Research and Innovation to Market Deployment', Peter Friess, River Publishers, 2014.

Paper : XIV**MCSET 305: Elective I (Microcontrollers for IOT)****Course Objective:** Student will be able to:-

1. understand hands-on experience using different IoT architectures.
2. Study of skills for interfacing sensors and actuators with different IoT architectures.
3. Study of data collection and logging in the cloud.
4. Understand Arduino Uno boards and programming.

Credits=4	Paper : XIV MCSET 305 : Elective I (Microcontrollers for IOT)	No. of hours per unit/ credits
Credit –I UNIT I	Internet of Things	(15)
	A. Introduction and its components, B. IoT building blocks, C. Sensors and Actuators, D. IoT Devices, E. IoT boards (Arduino Uno, ESP 8266-12E Node MCU, F. and Raspberry Pi 3).	
Credit –1 UNIT II	Arduino Uno	(15)
	A. Arduino Uno – getting started with the Uno boards, blink program, B. Connection of sensors to the Uno board, reading values of sensors from the Uno board, C. Interrupts. Case study: Temperature/Humidity Control; D. Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.	
Credit –1 UNIT III	ESP 8266-12E Node MCU	(15)
	A. ESP 8266-12E Node MCU – getting started with the ESP board, B. Micropython and Esplorer IDE, C. Flushing the ESP8266 board with micropython, D. Connecting sensors to the ESP board, E. Connecting ESP board to WiFi,	

	<p>F. Interfacing ESP with the Cloud (REST API-GET, POST, MQTT), interrupts,</p> <p>G. Comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely.</p> <p>H. Case Study: Voice-based HomeAutomation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).</p>	
Credit –1 UNIT IV	Raspberry Pi 3	(15)
	<p>A. Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS,</p> <p>B. Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet,</p> <p>C. Headless - connecting Rpi3 remotely without Ethernet cable via SSH,</p> <p>D. IP address, Rpi 3 - Testing the GPIO pins through Scripts.</p>	

Course Outcome: Student should be able to:

1. use Arduino Uno, NODE MCU 8266.
2. use Raspberry PI along with critical protocols and its communication to cloud.
3. apply commonly used IOT protocols such as REST API, MQTT through IOT based demonstration.
4. solve analog sensor and digital sensor interfacing with IOT devices.

References:

- 1) Rao, M. ,Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd, (2018).
- 2) Baichtal, J. Arduino for beginners: essential skills every maker needs. Pearson Education, (2013)..
- 3) Schwartz, M. ,Internet of Things with ESP8266. Packt Publishing Ltd., (2016).
- 4) Richardson, M., & Wallace, S. ,Getting started with raspberry PI. " O'Reilly Publisher Media, Inc.", (2012).

Semester III

PRACTICAL COURSE: LAB-V

MCSP306: Angular JS and Data Mining and Data Visualization using Tableau

Course Objectives: Student will be able to

1. Understand the basics of Python programming
2. Study facilities for performing data mining with Python packages
3. Study of model and solve decision problems in different settings
4. Study of appropriate courses of action for agiven managerial situation whether a problem or an opportunity

Credits=4	SEMESTER-IV MAMiP 305: PRACTICAL COURSE – III: LAB - V	No. of hours per unit/ Credits (60)
UNIT I	Angular JS	
	A. Creating Project, Formatting Data B. Create Form to edit your data C. Operations on Form – Binding, Saving, Validation, Refactor. D. Create simple Testing Angular application. E. Angello: Creating controllers to manage views F. AngularJS: Declaring properties and methods in a controller G. Binding to properties and expressions in an AngularJS template, creating views and controllers and how to test them H. Directives uses in Angello I. Write a program demonstrating NodeJs application. J. Error handling in NodeJs. K. Express.js Installation L. Develop Website : Saving Time with Express M. Quality Assurance: Page Testing N. Building a web server with Express O. Proper Installation of MongoDB P. Simple MongoDB script with a native driver Q. Persistence With MongoDB and Mongoskin	
UNIT II	Data Mining	(60)
	A. Classification – Decision tree a) Conversion of Categorical values in numeric format for a given dataset. b) Perform Classification using Decision Tree algorithm B. Association Rules and Clustering (Using inbuilt Data set)	

	a) Perform ARM using Apriori Algorithm b) Perform Clustering using k-means clustering algorithm C. Regression Analysis and Outlier detection a) Perform Regression Analysis. b) Perform Linear Regression. D. Python programs for Clustering a) Write a python program to implement k-nearest Neighbors ML. b) Write algorithm to build prediction model (Use Forge Dataset) c) Write a python program to implement k-means algorithms on a synthetic database	
UNIT III	Data Visualization using Tableau	
	A. Introduction Of Tableau GUI B. Create Bar Chart Using Given Data C. Create line Chart Using Given Data D. Create Tree map Using Given Data E. Create Application for Data Sorting F. Create Application for Data filtering G. Create Dash Board.	

Course Outcome: Student should be able to

1. Use various Angular features including directives, components, and services.
2. Implement a functional front-end web application using Angular.
3. Create Application for Data Sorting, Data filtering
4. understand technical information to both technical and non-technical audiences in speech, in writing, and graphically.

References:

- 1) Learn AngularJS in 1 Day: Complete Angular JS Guide with Examples.
- 2) Angular 5: From Theory to Practice.
- 3) Angular 2 Cookbook.
- 4) Angular 6 for Enterprise-Ready Web Applications.
- 5) Pro Angular
- 6) Introductory and Advanced Topics by Margaret Dunham, S. Sridhar, Pearson Publication
- 7) Data Mining concepts and Techniques by Jiawei Han and Micheline Kamber, ELSEVIER, Third Edition,
- 8) R and Data Mining, By Yanchang Zhao, Elsevier Inc., ISBN-10: 0123969638
- 9) Data Science from Scratch: First Principles with Python By O'Reilly Media,

20153.

- 10) Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining by Glenn J. Myatt John Wiley Publishers, 2007
- 11) Visual Analytics with Tableau 1st Edition by Alexander Loth m, John Willie and Sons
- 12) Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master Oreilly Media
- 13) Learning Tableau 2020: Create effective data visualizations, build interactive visual analytics, and transform your organization, 4th Edition

PRACTICAL COURSE: LAB–VI
MCSP307: Elective (Machine Learning and Artificial Intelligence)

Course Objectives: Student will be able to

1. Understand the basic theory underlying machine learning.
2. Study of machine learning problems corresponding to different applications.
3. understand basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
4. Study of applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

Credits=4	SEMESTER-III PRACTICAL COURSE: LAB–VI MCSP307: Elective (Artificial Intelligence and Machine Learning)	No. of hours per unit/ credits (60)
UNIT I	Artificial Intelligence	
	A. Introduction of Artificial Intelligence and its application. B. Write a Program to Implement Depth First Search using Python. C. Write a Program to Implement Breadth First Search using Python. D. Write a Program to Implement Tower of Hanoi using Python. E. Write a Program to Implement Tic-Tac-Toe game using Python F. WAP to implement search problem of 3 x 3 puzzle. G. Write a Program to implement 8-Puzzle problem using Python. H. Write a Program to Implement Water-Jug problem using Python I. Write a Program to Implement Travelling Salesman Problem using Python J. Write a program to implement heuristic search procedure.	
UNIT II	Machine Learning	(60)
	A. Machine Learning and its application-oriented algorithms. B. Introduction to Machine Learning using Python and its libraries. C. Installation of pandas and use of pip command. D. Python program using NumPy for some basic mathematical operations E. Implementing KNN- classification algorithm using Python on IRIS dataset. F. Python script using Scipy for image manipulation. G. Python program using Theano for computing a Logistic Function. H. Python program using TensorFlow for multiplying two arrays.	

	I. Python program using Pandas for arranging a given set of data into a table.	
	J. Python program using Matplotlib for forming a linear plot.	

Course Outcome: Student should be able to:

1. Understand the basic principles, techniques, and applications of Artificial Intelligence.
2. apply machine learning techniques and AI computing environment that are suitable for the applications under consideration
3. understand Machine Learning using Python and its libraries
4. Design Machine learning solution to real life problems and solutions to uncertainty using Fuzzy theory.

References:

- 1) Machine Learning and Artificial Intelligence, Ameet V. Joshi, Springer, Cham
- 2) Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill, 2002.
- 3) Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.
- 4) R. Akerkar, Introduction to Artificial Intelligence, Prentice-Hall of India, 2005

LAB-IV

MCSP307: Elective (Fundamentals of IOT and Microcontrollers for IOT)

Course Objectives: Student will be able to:-

1. study fundamental concepts of IoT and familiar with data handling and analytics tools in IoT.
2. Study of hands-on experience using different IoT architectures.
3. understand skills for interfacing sensors and actuators with different IoT architectures.
4. Study of skills on data collection and logging in the cloud and understand Arduino Uno boards and programming.

Credits=4	LAB-IV MCSP307: Elective (Fundamentals of IOT and Microcontrollers for IOT)	No. of hours per unit/ credits
Credit -I UNIT I	Fundamentals of IOT	(15)
	A. Introduction to IOT B. IOT architecture and Pros and Cons C. To interface Bluetooth module with Arduino uno D. To interface ZigBee module with Arduino uno E. To interface WiFi module with Arduino uno F. TFT display using G. Camera interfacing	
Credit -1 UNIT II	Microcontrollers for IOT	(15)
	A. To Blink an On-Board LED on NodeMCU. B. To design and implement a circuit to detect Gas using MQ-135 with the help of NODEMCU. C. To know the amount pressure using BMP180 with the help of ESP32. D. To control the servo motor using ESP-32(BLUETOOTH MODULE) E. To send a message through webpage with ESP as server F. To interface servo motor to ESP32 and control from webpage. G. To monitor Temperature and Humidity using esp32 in cloud platform. H. To build a WiFi weather station using ESP8266 (NodeMCU) & Blynk app I. To open a window by using DTH11 sensor at certain temperature by using servo motor.	

Course Outcome: Student should be able to:

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Use sensors and actuators for design of IoT.
- 3 Understand and apply various protocols for design of IoT systems
4. Use various techniques of data storage and analytics in IoT

References:

- 1) Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
- 2) Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
- 3) Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
- 4) Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. "O'Reilly Publisher Media, Inc."

SEMESTER IV

Paper XV

MCST 401 : Elective II (Deep Learning)

Course Objectives: Student will be able to:-

1. Understand the context of neural networks and deep learning
2. Study of how to use a neural network
3. Understand the data needs of deep learning
4. Study of working knowledge of neural networks and deep learning

Credits=4	Paper XV MCST 401: Elective II (Deep Learning)	No. of hours per unit/ credits
Credit –I UNIT I	Neural Networks	(15)
	A. Introduction, Basic Concepts of Neural Networks, B. Model of an Artificial Neuron, C. Activation Functions, D. Feed forward Network, E. Recurrent Network	
Credit –1 UNIT II	Introduction to deep learning	(15)
	A. Definition, Need, and Relationship between Artificial intelligence, machine learning, and deep learning, B. Deep learning Process. C. Deep Learning Network: Convolutional neural networks (CNN), D. Deep learning applications, Advantages and Limitations of deep learning. E. Deep learning Libraries /Frameworks: Keras, Tensor Flow, F. PyTorch	
Credit –1 UNIT III	Deep Learning with Keras / PyTorch	(15)
	A. Deep Learning with Keras / PyTorch: Setting up Project, B. Starting Jupyter, C. Importing Libraries D. Creating Deep Learning Model.	
Credit –1 UNIT IV	Introduction to convnets	(15)

	A. Foundations of Convolutional Neural Networks, B. Training a convnet from scratch on a small dataset, using a pretrained convnet, C. Visualizing what convnets learn. D. Deep Convolutional Models: Case Studies	
--	---	--

Course Outcome: Student should be able to:

1. understand the fundamental techniques and principles of Neural Networks
2. apply the different models in ANN and their applications
3. understand the concepts of deep learning with Convolution Neural Network case studies and Apply deep learning mechanisms to various learning problems.
4. understand the open issues in deep learning, and have a grasp of the current research directions.

References:

1. Deep Learning with Python, François chollet.
2. Dive into Deep Learning, Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola
3. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville
4. Neural Networks and Deep Learning, Michael Nielsen's

Paper XVI

MCST 402: Elective II (Big Data Analytics)

Course Objectives: Student will be able to:-

1. Understand the Big Data challenges & opportunities, its applications
2. study of concepts of map and reduce and functional programming
3. understand conceptual understanding of Hadoop Distributed File System.
4. understand the gap between academics and industry needs.

Credits=2	Paper XVI MCST 402: Elective II (Big Data Analytics)	No. of hours per unit/ credits
Credit –I UNIT I	Introduction to Big data	(15)
	A. Big Data: Definition & taxonomy, B. Sources of Big Data,3V’s of Big Data (need for Hadoop), Varying data structures, C. Characteristics of Big Data, Applications of Big Data, Challenges in Big Data, D. Big Data Analytics for Telecom/Banking/Retail/HealthCare/IT/Operations, RDBMS Vs Non-Relational Database	
Credit –1 UNIT II	Application Architecture & Data Modeling For Big Data And Analytics	(15)
	A. Big Data Warehouse & Analytics, B. Big data Warehouse System requirements & Hybrid Architectures, C. Enterprise Data Platform Ecosystem, D. Big Data and Master Data Management, understanding data integration Pattern, E. Big Data Workload Design Approaches, F. Map-Reduce patterns, Algorithms and Use Cases	
Credit –1 UNIT III	The Hadoop Ecosystem	(15)
	A. Introduction to Hadoop, B. Hadoop Architecture, C. History of Hadoop-Facebook, Dynamo, Yahoo, Google D. Hadoop Components: HDFS, Map reduce,	

	Introduction to Pig, Hive, HBase, Mahout, E. Installation of single node cluster-installation of java Hadoop configuration	
Credit –1 UNIT IV	Big Data Analytics Methodology	(15)
	A. Big Data Analytics Methodology-Analyze & evaluate business case B. Develop Business Hypothesis –Analyze outcomes, C. Build & Prepare Data Sets, D. Select & Build Analytical Model, E. Design for Big Data scale . F. Build production ready system , G. Setting up the Big Data Analytics system , H. Gathering data ,measure & monitor	

Course Outcomes: After successful completion students will be able to:

1. understand the characteristics, applications of big data that make it useful to real-world problems.
2. Study of data using big data tools hadoop file system and predict outcomes to solve given problem.
3. Design various case studies using big data tools/commands and analyse it.
4. Evaluate business cases.

References:

1. Madhu Jagdeesh, Soumendra Mohanty, Harsha Srivatsa, "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", 1st Edition, Apress (2013)
2. Frank J. Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley Publishers (2012)
3. Cristian Molaro, Surekha Parekh, Terry Purcell, "DB2 11: The Database for Big Data & Analytics", MC Press, (2013)
4. Tom White, "Hadoop-The Definitive Guide, Storage and analysis at internet scale", SPD, O'Really.
5. DT Editorial Services, "Big Data, Black Book-Covers Hadoop2, MapReduce, Hive, YARN, Pig, R and Data Visualization" Dreamtech Press, (2015).
6. Big Data Case Study by Bernard Marr –Willey Publications.

Paper XV

MCST 401: Elective II (Control Systems)

Course Objectives: Student will be able to:-

1. Study of systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and state space equations.
2. understand system behavior based on the mathematical model of that system where the model may be expressed in time or frequency domain.
3. Study of the behavior of closed loop systems using various methods.
4. understand controllers using classical PID methods, root locus methods, and frequency domain methods.

Credits=2	Paper XV MCST 401 : Elective II (Control Systems)	No. of hours per unit/ credits
Credit –I UNIT I	Introduction to Control Theory	(15)
	A. Basic Concepts of Control System, B. Open loop and Closed loop systems, C. Classifications, effect of feedbacks on Control System performance. D. Transfer function modeling and representation of Control system, pole & zero concept, E. Mathematical modeling of linear mechanical and Electrical systems, F. Electrical analogy, Block reduction techniques, G. Signal flow graph, Mason's gain formula.	
Credit –1 UNIT II	Time Domain Analysis and stability	(15)
	A. Type and Order of Control system, B. Typical tests signal, Time Response of first and second order systems to unit step input, C. Steady state errors, D. Time Domain Specifications of Second Order System, E. Dominant Closed loop Poles of Higher Order Systems. F. Concept of Stability: absolute, relative and marginal, nature of system response, stability analysis using Hurwitz's criterion, Routh's criterion, G. Basic properties of Root Loci, Construction of Root loci,	

	H. Angle and magnitude condition for stable systems, I. Concept of inverse root locus and root contour.	
Credit –1 UNIT III	Frequency Domain and State Variable Analysis	(15)
	A. Steady state response of a system to sinusoidal input, B. Relation between time and frequency response for second order systems, C. Frequency response specifications, D. Stability Analysis with Bode Plots, E. Nyquist stability criterion. F. Introduction to state space analysis, G. State space representation for i) Electrical Network ii) nth order differential equation iii) Transfer function.	
Credit –1 UNIT IV	Control system components and controllers	(15)
	A. Modeling and transfer function of control system components- Potentiometer, B. DC and AC Servomotors, gear trains, C. Tacho-generators. D. Design concepts of P, PI, PD, PID controllers, Compensator Networks-lag and lead.	

Course Outcomes: After successful completion students will be able to:

1. Understand the modeling of discrete systems in state space
2. apply programming strategies in the domain of control systems
3. understand the systems in Time and frequency domain.
4. Design modern control systems with computer simulation

Reference Books:

1. I.J. Nagrath, M.Gopal “Control Systems Engineering”, 5th Edition, New Age International Publication
2. Ogata Katsuhiko, “Modern Control Engineering”, 4th Edition, PHI.
3. Kuo B.C. Automatic Control System, PHI, New Delhi, Third Edition
4. Schaum’s Series book “Feedback Control Systems”.Les Fenical “Control Systems”, 1st Edition, Cengage Learning India.
5. Samarjeet Ghosh, “Control Systems Theory & Applications”, 1st Pearson education.
6. S.K. Bhattacharya, “Control Systems Engineering”, 1st edition, Pearson education.
7. Norman S. Nise, “Control System Engineering”, 5th Edition, Wiley.
8. U.A.Bakshi, V.U.Bakshi “Control System Engineering”,First Edition 2008 , Technical Publications, Pune .

Paper XVI

MCST 402 : Elective II (Wireless Sensor Networks)

Course Objectives: Student will be able to:-

- 1) Study of different wireless techniques such as mobile, radio, satellite etc
- 2) Understand modern wireless Sensor Networks
- 3) Study of Distinguish wireless systems on the basis of performance features
- 4) Understand the architecture, structure and security as well as privacy aspects in IoT

Credits=2	<p style="text-align: center;">Paper XVI MCST 402 : Elective II (Wireless Sensor Networks)</p>	<p style="text-align: center;">No. of hours per unit/ credits</p>
<p style="text-align: center;">Credit –I UNIT I</p>	<p style="text-align: center;">Introduction to Wireless Communication System</p>	<p style="text-align: center;">(15)</p>
	<ul style="list-style-type: none"> A. Evolution of mobile communications, Mobile Radio System around the world, B. Types of Wireless communication System, Comparison of Common wireless system, C. Trend in Cellular radio and personal communication. D. Second generation Cellular Networks, Third Generation (3G) Wireless Networks , E. Wireless Local Loop(WLL),Wireless Local Area network(WLAN), F. Bluetooth and Personal Area Networks, G. satellite communication including GPS, H. wireless local loop, cordless phone, paging systems, RFID. 	
<p style="text-align: center;">Credit –1 UNIT II</p>	<p style="text-align: center;">Recent wireless technologies</p>	<p style="text-align: center;">(15)</p>
	<ul style="list-style-type: none"> A. Multicarrier modulation, OFDM, MIMO system, diversity multiplexing trade-off, B. MIMO-OFDM system, smart-antenna; beam forming and MIMO, C. Cognitive radio, software defined radio, communication relays, spectrum sharing. D. Wireless Systems: GSM system architecture, Radio interface, Protocols, Localization and calling, Handover, E. Authentication and security in GSM, GSM speech coding, F. Concept of spread spectrum, Architecture of IS-95 	

	<p>CDMA system, G. Air interface, CDMA forward channels, H. CDMA reverse channels, Soft handoff, CDMA features, Power control in CDMA, I. Performance of CDMA System, RAKE Receiver, J. CDMA2000 cellular technology, GPRS system architecture</p>	
Credit –1 UNIT III	Wireless Sensor Networks	(15)
	<p>A. History and context, WSN Architecture, the node, B. Connecting nodes, Networking Nodes, C. Securing Communication WSN specific IoT applications, challenges: Security, D. QoS, Configuration, Various integration approaches, E. Data link layer protocols, routing protocols and infrastructure establishment.</p>	
Credit –1 UNIT IV	Applications of WSN and IoT technologies	(15)
	<p>A. Applications of WSN, Identification of IoT Objects and Services, B. Structural Aspects of the IoT, C. Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, D. Security and Privacy, Open Architecture, E. Key IoT Technologies, Device Intelligence, F. Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology, G. RFID: Introduction, Principle of RFID, Components of an RFID system, Issues EPC H. Global Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things.</p>	

Course Outcomes: After completing this course the students should:

1. Understand and explain common wireless sensor node architectures.
2. Understand the simple analysis and planning of WSNs.
3. Demonstrate knowledge of MAC protocols developed for WSN.
4. Design and configure RFID and WSN networks considering security issues

Reference Books:

- 1) Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications
- 2) Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI). 6 Wireless Communications-T.L.Singh-TMH 7 Adhoc Mobile Wireless network, C.K.Toh Pearson.
- 3) Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
- 4) Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
- 5) Parikshit N. Mahalle& Poonam N. Railkar, “Identity Management for Internet of Things”, River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
- 6) Hakima Chaouchi, “ The Internet of Things Connecting Objects to the Web” ISBN : 978-1- 84821-140-7, Willy Publications
- 7) Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications.
- 8) Wireless Communication, Theodore S. Rappaport, Prentice hall
- 9) Wireless Communications and Networking, Vijay Garg, Elsevier
- 10) Wireless digital communication, Kamilo Feher, PHI

Paper VII

PRACTICAL COURSE : Elective-II: LAB VII :

MCSEP 403 : Deep Learning and Big Data Analytics

Course Objectives: Student will be able to:-

- 1) Understand the context of neural networks and deep learning
- 2) Study of working knowledge of neural networks and deep learning
- 3) understand the Big Data challenges & opportunities, its applications
- 4) study of conceptual understanding of Hadoop Distributed File System.

Credits=4	Paper VII PRACTICAL COURSE : Elective-II: LAB VII : MCSEP 403 : Deep Learning and Big Data Analytics	No. of hours per unit/ credits
UNIT I	Deep Learning	(60)
	<p>A. Installation of python libraries for deep learning.</p> <p>B. Download and install Python SciPy and get the most useful package for machine learning in Python.</p> <p>C. <u>Keras: Feature extraction on large datasets with Deep Learning.</u></p> <p>D. How does pandas fit into the data science toolkit?</p> <p>E. Creating Data Frames from scratch using Pandas.</p> <p>F. How to read in data (from CSVs ,JSON and SQL database)</p> <p>G. Write a program to converting back to a CSV, JSON, or SQL</p> <p>H. Plotting the Graphs using Matplotlib libraries.</p> <p>I. Load a dataset and understand its structure using statistical summaries and data visualization.</p> <p>J. Create 6 machine learning models, pick the best and build confidence that the accuracy is reliable.</p> <p>K. How to Use Feature Extraction on Tabular Data for Machine Learning</p> <p>L. Feature Extraction: a mental model for search and recommendation</p> <p>M. Create program using NumPy for Deep learning (pip install numpy)</p>	
UNIT II	Big Data Analytics	(60)
	<p>A. Downloading and Installing JDK 8.1</p> <p>B. Downloading and installing Hadoop; Understanding different Hadoop modes.</p> <p>C. Perform different HDFS commands in hadoop</p> <p>D. Implement Word count program using Mapreduce</p> <p>E. Perform CRUD Operations using MongoDB</p> <p>F. Install, Deploy & configure Apache Spark Cluster. Run apache</p>	

	spark applications G. Sentiment analysis of YouTube comments H. Olympics Data Analytics using Python I.	
--	--	--

Course Outcomes: After completing this course the students should be able to:

- 1) understand the fundamental techniques and principles of Neural Networks
- 2) study of different models in ANN and their applications
- 3) Apply deep learning mechanisms to various learning problems.
- 4) understand the characteristics, applications of big data that make it useful to real-world problems.

References:

- 1) Deep Learning with Python, FRANÇOIS CHOLLET
- 2) Dive into Deep Learning, Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola
- 3) Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville
- 4) Neural Networks and Deep Learning, Michael Nielsen's
- 5) Madhu Jagdeesh, Soumendra Mohanty, Harsha Srivatsa "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", 1st Edition, Apress (2013)
- 6) "Big Data Analytics: Turning Big Data into Big Money", Frank J. Ohlhorst Wiley Publishers (2012)
- 7) "DB2 11: The Database for Big Data & Analytics", Cristian Molaro, Surekha Parekh, Terry Purcell MC Press, (2013)
- 8) "Hadoop- The Definitive Guide, Storage and analysis at internet scale", Tom White SPD, O'Really.
- 9) "Big Data, Black Book- Covers Hadoop2, MapReduce, Hive, YARN, Pig, R and Data Visualization", DT Editorial Services Dreamtech Press, (2015).
- 10) Big Data Case Study by Bernard Marr – Willey Publications.

Paper X

PRACTICAL COURSE: Elective-II: LAB VII

MCSEP 403: Control Systems and Wireless Sensor Networks

Course Objectives: Student will be able to:-

- 1) Understand the systems theory to complex real world problems in order to obtain models that are expressed using differential equations, transfer functions, and statespace equations.
- 2) understand system behavior based on the mathematical model of that system where the model may be expressed in time or frequency domain.
- 3) Study of controllers using classical PID methods, root locus methods, and frequency domain methods.
- 4) Study of different wireless techniques such as mobile, radio, satellite etc

Credits=4	Paper X PRACTICAL COURSE: Elective-II: LAB VII MCSEP 403: MCSEP 403 : Control Systems and Wireless Sensor Networks	No. of hours per unit/ credits
UNIT I	Control Systems	(60)
	A. Study of introduction to MATLAB. B. Study of commands in MATLAB. C. MATLAB base program along with the functions from the Control System Toolbox. D. Design and analysis of first order control system(Simulink) E. Design and analysis of second order control system(Simulink) F. BODE PLOT USING MAT LAB G. NYQUIST PLOT USING MAT LAB H. To obtain step response of the given system and evaluate the effect P,PD controllers I. To obtain step response of the given system and evaluate the effect PI and PID controllers J. Simulation of transfer function using Poles and Zeros	
UNIT II	Wireless Sensor Networks	(60)
	A. Study of Wireless Sensor Networks B. Describes the RF communication using Wireless sensor nodes C. Selecting different transmission range with respect to the available power levels D. Wireless Sensor Network Duty Cycle Implementation vs. Analysis of Power Consumption E. Implementation of wireless sensor network (WSN) to acquire	

	<p>sensor data from the wireless .</p> <p>F. sensor board and also from external sensors such as dielectric moisture sensor, rain gauge, temperature sensor, humidity sensor etc</p> <p>G. Wireless Sensor Network Data Collection Frequency and transmission vs. Analysis of Power Consumption</p> <p>H. To provide an overview of real time exposure on the wireless propagation effects</p> <p>I. Design wireless sensor network topologies and experiment data sending and reception at various power levels</p> <p>J. Program the WSN to acquire sensor data, transmit it to the nearby nodes, and aggregate it</p>	
--	--	--

Course Outcomes: At the end of this course, students will be able to:

1. understand modeling of discrete systems in state space.
2. Evaluate programming strategies in the domain of control systems
3. Design wireless sensor network topologies
4. Design modern control systems with computer simulation

References:

- 1) Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
- 2) Parikshit N. Mahalle& Poonam N. Railkar, “Identity Management for Internet of Things”, River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
- 3) Hakima Chaouchi, “ The Internet of Things Connecting Objects to the Web” ISBN : 978-1- 84821-140-7, Willy Publications
- 4) Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications.
- 5) I.J. Nagrath, M.Gopal “Control Systems Engineering”, 5th Edition, New Age International Publication
- 6) Ogata Katsuhiko, “Modern Control Engineering”, 4th Edition, PHI.
- 7) Kuo B.C. Automatic Control System, PHI, New Delhi, Third Edition
- 8) Schaum’s Series book “Feedback Control Systems”.Les Fenical “Control Systems”, 1st Edition, Cengage Learning India.

SEMESTER IV

Paper VIII

MCSEP 404 : Industrial Training