M.Sc. Semester 3

Sr. No.	Course Type	Course Title	Max. Marks			Credits
			Int.	Ext.	Total	
1	MDS/3/CC7/T	RESEARCH METHODLOGY	30	70	100	4
2	MDS/3/DSC2(i)/T	EVOLUTIONARY ALGORITHM	30	70	100	4
	MDS/3/DSC2(ii)/T	MACHINE LEARNING				
3	MDS/3/DSC2(i)/P	LAB EVOLUTIONARY ALGORITHMS		50	50	2
	MDS/3/DSC2(ii)/P	LAB MACHINE LEARNING				
4	MDS/3/DSC3(i)/T	PROGRAMMING WITH MATLAB	30	70	100	4
	MDS/3/DSC3(ii)/T	PROGRAMMING WITH R				
5	MDS/3/DSC3(i)/P	LAB MATLAB		50	50	2
	MDS/3/DSC3(ii)/P	LAB R PROGRAMMING				
6	MDS/3/AEC3/T	HEALTH AND FITNESS	25	50	75	3
7	MDS/3/SEC3/T	DIGITAL MARKETING	15	35	50	2
8	MDS/3/SEC3/P	LAB DIGITAL MARKETING		25	25	1
9	MDS/3/OEC2/T		30	70	100	4
Sub Total Semester III			160	490	650	26

M.Sc. Semester 4

Sr. No.	Course Type	Course Title		Max Marks			Credits
				Int.	Ext.	Total	
1	MDS/4/CC8/T	IOT & CLOUD COMPUTING		30	70	100	4
2	MDS/4/DSC4(i)/T	SOFT COMPUTING		30	70	100	4
	MDS/4/DSC4(ii)/T	DEEP LEARNING					
3	MDS/4/CC9/P	RESEARCH PROJECT	Proposal Seminar	75	-	75	3
			Internal Assessment	75	-	75	3
			Project Documentation	-	100	100	4
			Project Viva	-	100	100	4
Sub Total Semester IV				210	340	550	22

MDS/3/CC7/T Research Methodology								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment / Attendance
					20	5 5		

Instructions to paper setter for Final Term Examination: The Final Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with different aspects of research methodology, namely, research design, collection and analysis of data, and interpretation of results.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: objectives, hypothesis, interpretation, data analysis, data collection, research design and method, interpretation, data analysis, sampling.
CO2	describe: objectives, hypothesis, interpretation, data analysis, data collection, research design and method, interpretation, data analysis, sampling.
CO3	Illustrate: measurement, data collection, processing, sampling, analysis and its strategies, reports.
CO4	categorize: research, sampling methods, data collection techniques, reports ,and data processing strategies. perform: data analysis.
CO5	compare: sampling methods, data collection techniques, reports and data processing strategies.
CO6	create: thesis, reports. design: research tool . interpret(drive): results.

CO-PEO Mapping Matrix for Course MDS/3/CC7/T

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MDS/3/CC7/T

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	3	-	3	1	3
CO2	2	1	1	3	1	-	-	3	-	3	2	3
CO3	3	1	1	3	3	-	-	3	-	3	3	3
CO4	3	3	1	3	1	-	-	3	-	3	3	3
CO5	3	1	1	3	3	-	-	3	-	3	3	3
CO6	3	3	3	3	3	-	-	3	-	3	3	3
Average	2.5	2	1.3	2.6	2	-	-	3	-	3	2.5	3

CO-PSO Mapping Matrix for Course MDS/3/CC7/T

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	3	3	2.5	3	3

Course Content MDS/3/CC7/T: Research Methodology	
Unit – I	Objectives and types of research: motivation and objectives- research methods vs. methodology, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs empirical research formulation: defining and formulating the research problem-. selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary source reviews, hypothesis- definition, qualities of a good hypothesis, null hypothesis and alternatives.
Unit – II	Research design and methods: basic principles, need of research design-features of good design, important concepts relating to research design, criteria of selecting a sampling procedure, characteristics of a good sample design, sampling methods, measurement: concept of measurement, problems in measurement in research - validity and reliability. levels of measurement- nominal, ordinal, interval, ratio.
Unit – III	Data collection and analysis: execution of the research, observation and collection of data,methods of data collection, data processing and analysis strategies, data analysis with statistical packages, hypothesis testing, generalization and interpretation, univariate analysis (frequency tables, bar charts, pie charts, percentages).
Unit – IV	Meaning of interpretation, need of interpretation, technique of interpretation, precaution in interpretation, layout of a research paper, journals in computer science, impact factor of journals, ethical issues related to publishing, plagiarism and self-plagiarism. reports and thesis writing: structure and components of scientific reports, types of report-technical reports and thesis, writing-synopsis, abstract, illustrations and tables, results, summary, reference citing and listing.
Text/Reference Books	
Text Books	1. J. Garg, B.L, Karadia, R, Aggarwal F, An Introduction to Research Methodology, RBSA Publishers, 2002. 2. Kothari, Chakravanti Rajagopalachari. Research methodology: Methods and techniques. New Age International, 2004. 3. Santosh Gupta, Research Methodology and Statistical Techniques, Deep & Deep Publications Pvt. Ltd., 2008
Reference Books	1. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers. Montgomery, Douglas C, Design and Analysis of Experiments, Wiley India Pvt. Ltd.

MDS/3/DSC2(i)/T:Evolutionary Algorithms								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: To study fundamental concepts of evolutionary algorithm, genetic algorithm, their applications, genetic operators, the theoretical Analysis of Evolutionary Algorithms , Niche and Speciation

Course Outcomes	At the end of this course, the student will be able to:
CO1	define: concepts of evolutionary algorithms, population, gene, alleles, phenotype, fitness function, crossover, selection and mutation.
CO2	describe/explain: crossover, selection mutation, Diploid, dominance, abeyance, Niche and Speciation. understand: application of genetic algorithms for job shop scheduling problems.
CO3	use: encoding scheme, crossover, selection, mutation operators and fitness scaling.
CO4	differentiate: evolutionary algorithms and traditional algorithms, types of crossover, mutation, selection, inversion and reordering operator, crowding and restricted mating.
CO5	select and defend: crossover, mutation and selection operators of genetic algorithms.

CO-PEO Mapping Matrix for Course MDS/3/DSC2(i)/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MDS/3/DSC2(i)/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MDS/3/DSC2(i)/T

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content MDS/3/DSC2(i)/T: Evolutionary Algorithms	
Unit - I	**Introduction:** Introduction to evolutionary algorithm, history of evolutionary algorithm, advantage of evolutionary algorithm, application of evolutionary algorithm - biological and AI, introduction of genetic algorithm, difference between traditional approach and evolutionary algorithm.
Unit - II	**Genetic modelling:** Basic terminologies and operators like individual, gene, alleles, phenotype and fitness function. simple genetic algorithm, its representation, advantage and limitation of genetic algorithm.
Unit - III	**Operators of GA Selection:** Roulette wheel selection, random, rank, tournament, Boltzmann selection. **Crossover and its types:** Single point crossover, two point crossover, multipoint crossover, ordered crossover, uniform crossover, crossover for real-valued representation. **Mutation and its types:** Flipping, Interchanging, reversing, replacement, mutation for real-valued representation, crossover rate, mutation rate and convergence criteria
Unit - IV	**Theoretical Analysis of Evolutionary Algorithms:** Diploid, dominance and abeyance, inversion and reordering operator, fitness scaling. **Niche and Speciation:** Fitness sharing, crowding and restricted mating. **Application of GA:** Genetic Algorithm for travelling salesman problems (TSP).
Text/Reference Books	
Text Books	1. Deepa, S.N. and Sivanandam, S.N. Principles of soft computing, 2011. 2. Michael D. Vose. The Simple Genetic Algorithm - Foundations and Theory. Prentice Hall India Learning Private Limited, 2004.
Reference Books	1. David E. Goldberg, Genetic Algorithms in Search, Optimization and machine learning. Pearson Education India, 2008. 2. D. Nagesh Kumar, Multicriterion Analysis in Engineering and Management, PHI Learning, 2010. 3. Chambers, Lance D., ed. Practical Handbook of Genetic Algorithms: Complex Coding Systems, Volume III. Vol. 3. CRC press, 2019.

MDS/3/DSC2(ii)/T: Machine Learning								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: the terms of machine learning: types of machine learning, data preprocessing, classification, regression, and neurons.
CO2	explain: learning types, data preprocessing and architecture of ANN.
CO3	apply: training and testing data using data pre processing and model selection techniques and classification, regression, clustering techniques according to their problem.
CO4	classify: data preprocessing, model selection, regression, classification, and unsupervised learning techniques.
CO5	compare: Data Preprocessing techniques, Supervised and unsupervised learning.

CO-PEO Mapping Matrix for Course MDS/3/DSC2(ii)/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MDS/3/DSC2(ii)/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-

CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MDS/3/DSC2(ii)/T

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MDS/3/DSC2(ii)/T :Machine Learning

Unit – I	**Basics of Machine Learning:** Introduction to artificial Intelligence and machine learning, types of machine learning and its comparisons, applications of machine learning, issues in machine learning.
Unit – II	**Preparing to Model:** Introduction, machine learning activities, types of data in machine learning, exploring structure of data, data pre-processing (dimension reduction and feature subset selection)
Unit – III	**Supervised Learning:** Introduction, classification (introduction, classification model, learning steps. **Classification algorithm** :Logistic Regression , Naive Bayes, K-Nearest Neighbours, Decision Tree, Support Vector Machines. **Regression:** linear regression, multivariable regression, logistic regression.
Unit – IV	**Unsupervised Learning:** Introduction and its applications, K-means, KNN (k-nearest neighbours), Hierarchal clustering, Apriori Algorithm. **Neural Network:** Introduction, architecture of artificial neural network.

Text/Reference Books

Text Books	1. Mitchell, Tom M. *Machine learning*. New York: McGraw-Hill, 2021. 2. Khan, Shahzad. "Ethem Alpaydin. Introduction to Machine Learning (Adaptive Computation and Machine Learning Series). The MIT Press, 2004.

Reference Books	1. Mildenberger, Thoralf. "Stephen marsland: Machine learning. an algorithmic perspective." Statistical Papers 55, no. 2 2014. 2. Flach, Peter. Machine learning: the art and science of algorithms that make sense of data. Cambridge university press, 2012. 3. Harrington, Peter. Machine learning in action. Simon and Schuster, 2012. 4. Shalev-Shwartz, Shai, and Shai Ben-David. Understanding machine learning: From theory to algorithms. Cambridge university press, 2014.

MDS/3/DSC3(i)/T: Programming with MATLAB							
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Compulsory Theory	04	04	Lecture	70	30 (20 / 5 / 5)	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final Term Examination: The Final Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to study, learn, and understand the major concepts of MATLAB Programming, namely, data types, data structure, matrices, data import/export, graphics, control structure, toolboxes, image and video processing.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define: features, commands, data types, hierarchy of operations, matrix, tools, functions related to input/output, file handling and graphics, control structure and toolboxes used in MATLAB.
CO2	describe: history, features, commands, data types, hierarchy of operations, matrix, tools, functions related to file, function related to graphics, control structure and various toolboxes of MATLAB.
CO3	use: commands, operations, tools, menus, toolbars, input/output functions, file handling, functions related to graphics, 2D and 3D plotting, control structure, debugging, simulink and image processing toolboxes in MATLAB.
CO4	analyze: commands, data types, operations, control structure, matrix, tools, different functions related to graphics and file handling in given MATLAB program.
CO5	determine: command, data type, tool, menu, control structure, debugging technique, function, feature or toolbox of MATLAB to use in given condition.
CO6	create: basic or advanced program in MATLAB using different commands, 2D and 3D plotting, functions, tools, features, simulink, image processing toolbox of MATLAB.

CO-PEO Mapping Matrix for Course MDS/3/DSC3(i)/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3

CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MDS/3/DSC3(i)/T

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	-	-	-	1	3
CO2	2	1	1	3	1	-	-	-	-	-	2	3
CO3	3	1	1	3	3	-	-	-	-	-	3	3
CO4	3	3	1	3	1	-	-	-	-	-	3	3
CO5	3	1	1	3	3	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3
Average	2.5	2	1.33	2.67	2	-	-	-	-	-	2.5	3

CO-PSO Mapping Matrix for Course MDS/3/DSC3(i)/T

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	-	3
CO2	3	3	2	-	3
CO3	3	3	3	-	3
CO4	3	3	3	-	3
CO5	3	3	3	-	3
CO6	3	3	3	-	3
Average	3	3	2.5	-	3

Course Content
MDS/3/DSC3(i)/T: Programming with MATLAB

Unit I	MATLAB: Introduction, history, features, menus and the toolbar, computing, types of file, useful commands, help system, constants variables and expressions-character set, data type, constants, variables and expressions, operators, hierarchy of operations, built-in-function, assignment statements. Vectors and matrices: scalars and vectors, entering data in matrices, line continuation, matrices subscripts, multi-dimensional matrices and arrays, matrix manipulation, special matrices, commands related to matrices.
Unit - II	Polynomials: entering, evaluation, roots, operations. Input/output statements: data input, interactive inputs, reading/storing data files, output commands, low level input output functions. Introduction to data import and export, supported file format, working with audio/video file, importing audio/video data, reading audio/video data from a

	file, exporting audio/video data, example, working with graphics file, importing graphics data, exporting graphics data, creating a simple GUI programmatically, dissertations of different components in guide, creating menus.
Unit - III	MATLAB graphics: 2d/3d plotting visualization, 2d plot , multiple plot, style options, legends, subplots, specialized 2d plot- logarithmic, polar, area, bar, barh, hist, rose, pie, stairs, stem, compass. 3d plot - plot3, bar3, bar3h, pie3, stem 3, meshgrid, mesh, surf, contour, contour3.
Unit - IV	Control Structures: for, nested for, while, branch control structure- if, switch, break, continue, error, try-catch, debugging. Introduction to MATLAB toolboxes: Simulink, image processing toolbox, application level image processing techniques.
Text/Reference Books	
Text Books.	1. Bansal RK, Goel AK, Sharma MK. MATLAB and its applications in engineering. Pearson Education India; 2009. 2. Patel RN, Mittal A. Programming in MATLAB®: A Problem-solving Approach. Pearson India; 2014. 3. Hanselman DC, Littlefield BL. Mastering matlab. Prentice Hall Press; 2011 Oct 8. 4. Gilat A. MATLAB: An introduction with Applications. John Wiley & Sons; 2004.
Reference Books	1. Sizemore J, Mueller JP. MATLAB for Dummies. John Wiley & Sons; 2014 Nov 10. 2. Stephen J. Chapman, MATLAB programming for engineers.

MDS/3/DSC3(ii)/T: Programming with R

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
Optional Theory	04	04	Lecture	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts in R programming language, data types, operators, decision making statements and iteration, functions, different data structures like list, vectors, matrices, data frames, charts and graphs, graphics functions and statistical analysis.

Course Outcomes	At the end of this course, the student will be able to:
CO1	list: data types, functions in R programming, visualization.
CO2	describe: the syntax of decision making statements, loops, user defined functions,used define packages; explain: the process of import and export of data in text file, excel file and MYSQL .
CO3	use: various in built ,user defined function and packages . apply: R programming constructs to solve real world problems.
CO4	categorize:data types,conditional& control statements, in built and user defined functions and packages.
CO5	compare: data types, conditional & control statements,functions, packages in R programming.
CO6	design:basic and advanced applications in R programming.

CO-PEO Mapping Matrix for Course MDS/3/DSC3(ii)/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MDS/3/DSC3(ii)/T

COs	PO	PO2	PO	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO12

CO1	1	3	1	1	1	-	-	-	-	-	1	3
CO2	2	1	1	3	1	-	-	-	-	-	2	3
CO3	3	1	1	3	3	-	-	-	-	-	3	3
CO4	3	3	1	3	1	-	-	-	-	-	3	3
CO5	3	1	1	3	3	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3
Average	2.5	2	1.3	2.6	2	-	-	-	-	-	2.5	3

CO-PSO Mapping Matrix for Course MDS/3/DSC3(ii)/T

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	-	3
CO2	3	3	2	-	3
CO3	3	3	3	-	3
CO4	3	3	3	-	3
CO5	3	3	3	-	3
CO6	3	3	3	-	3
Average	3	3	2.5	-	3

Course Content MDS/3/DSC3(ii)/T: Programming with R	
Unit - I	Basic of R: Introduction to R, Features of R, Variables in R, In-Built Functions in R (mathematical, trigonometric, logarithmic, Date and Time, Sequence, I/O). Data Types in R: Vectors, Matrices, Arrays, Lists, Factors, Data Frames.
Unit - II	Programming in R: Decision making structures (if, Switch), Loops (For, while, repeat), User Defined functions (with argument without argument), User Defined Package. Reports using remark down (direct rendering, in-direct rendering).
Unit - III	Data Exploration and Manipulation: Missing Data Management, Data reshaping through melting and casting, special functions across data elements. Import and Export of data: Import and Export of data in text files, excel files and MySQL.
Unit - IV	Basic Visualization: Pie chart, bar chart, Histogram, Line chart, Dot Chart, Bubble plot, Image Plot, Violin Plot. Advanced Visualization: Scatter plot, corrgram, star and segment plots, tree maps, heat map.
Text/Reference Books	
Text Books	1. Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis - with Exercises, Solutions and Applications in R, Springer, 2016. 2. Pierre Lafaye de Micheaux, RémyDrouilhet, Benoit Liquet, The R Software-Fundamentals of Programming and Statistical Analysis, Springer 2013.
Reference Books	1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Use R - A Beginner's Guide to R, Springer 2009.

MDS/3/DSC3(i)/P: MATLAB Programming

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Lab Work	50	-	3 Hours	TEE/ Practical File

Instructions to paper setter for Final Term Examination: The Final Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of practical file, performance in practical and a viva voce exam.

Course Objectives: The objective of this course is to get the students hands on practice with programming constructs of MATLAB and their usage. This course is based on **MDS/3/DSC3(i)/T**: Programming with MATLAB.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define: features, commands, data types, hierarchy of operations, matrix, tools, functions related to input/output, file handling and graphics, control structure and toolboxes used in MATLAB.
CO2	describe: history, origin, features, commands, data types, hierarchy of operations, matrix, tools, functions related to file, function related to graphics, control structure and various toolboxes of MATLAB.
CO3	use: commands, operations, tools, menus, toolbars, input/output functions, file handling, functions related to graphics, 2D and 3D plotting, control structure, debugging, simulink and image & video processing toolboxes in MATLAB.
CO4	analyze: commands, data types, operations, control structure, matrix, tools, different functions related to graphics and file handling in given MATLAB program.
CO5	determine: command, data type, tool, menu, control structure, debugging technique, function, feature or toolbox of MATLAB to use in given condition.
CO6	create: basic or advanced program in MATLAB using different commands, 2D and 3D plotting, functions, tools, features, simulink, fuzzy logic, neural network and image & video processing toolbox of MATLAB.

CO-PEO Mapping Matrix for Course MDS/3/DSC3(i)/P

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MDS/3/DSC3(i)/P

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	-	-	-	1	3
CO2	2	1	1	3	1	-	-	-	-	-	2	3
CO3	3	1	1	3	3	-	-	-	-	-	3	3
CO4	3	3	1	3	1	-	-	-	-	-	3	3
CO5	3	1	1	3	3	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3
Average	2.5	2	1.33	2.67	2	-	-	-	-	-	2.5	3

CO-PSO Mapping Matrix for Course MDS/3/DSC3(i)/P

Cos	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	-	3
CO2	3	3	2	-	3
CO3	3	3	3	-	3
CO4	3	3	3	-	3
CO5	3	3	3	-	3
CO6	3	3	3	-	3
Average	3	3	2.5	-	3

MDS/3/DSC3(ii)/P: R Programming Lab

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Practical	02	04	Practical/ Lab Work	50	-	-	TEE/ Practical File

Instructions to paper setter for Final-Term Examination: The Final-Term examination will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of practical file, performance in practical and a viva voce exam.

Course Objectives: The objective of this course is to get the students hands on practice with scripting/programming concepts of R programming language as covered in course **MDS/3/DSC3(ii)/T.**

Course Outcomes	At the end of this course, the student will be able to:
CO1	list : data types, functions in R programming, visualization.
CO2	describe: the syntax of decision making statements, loops, user defined functions,used define packages; explain: the process of import and export of data in text file, excel file and MYSQL .
CO3	use: various in built ,user defined function and packages . apply: R programming constructs to solve real world problems.
CO4	categorize:datatypes,conditional& control statements, in built and user defined functions and packages.
CO5	compare: datatypes, conditional & control statements,functions, packages in R programming.
CO6	design:basic and advanced applications in R programming.

CO-PEO Mapping Matrix for Course MDS/3/DSC3(ii)/P

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MDS/3/DSC3(ii)/P

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-
CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	1	3	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.3	2.6	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MDS/3/DSC3(ii)/P					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-

MDS/3/AEC3/T Health and Fitness

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Ability Enhancement Course	03	03	Lecture	50	25	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to understand the importance of fitness, Yoga, lifestyle and other factors on our health. It also describes important concept of stress management.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define:**good diet, importance of fitness, yoga and lifestyle.
CO2	**explain:** the basic yoga asanas, balanced diet and the ways of handling the stress
CO3	**use:**ways of handling physical and mental stress in their lives.
CO4	**classify:**different asanas according to health and ways of managing the stress
CO5	**compare and select:**asanas and diet according to body and mind.

CO-PO Mapping Matrix for Course MDS/3/AEC3/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-

CO5	2	1	3	1	3	-	3	3	-	2	-	-
Avg	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

Course Content
MDS/3/AEC3/T Health and Fitness

Unit – I	**Introduction to Fitness and Training:** Benefits of exercise, components of physical fitness, types of physical fitness, Health related physical fitness and performance related physical fitness, cosmetic fitness, effect of specific nutrients on work performance, diets for physical fitness & training.
Unit – II	**Introduction of Cardio:** Respiratory System, Holistic approach to management of health and fitness including diet and exercise (Aerobic and anaerobic), effect of aerobic exercise on heart rate, blood pressure and lung function, recognizing symptoms to stop any exercise, emergency procedures, and exercise prescriptions in special conditions.
Unit - III	**Yoga and Stress Management:**Asanas and its effects (Padmasana, Halasana, Bhujangasana, Shalabhasana, Dhanurasana, Shavasana, Vajrasana, Chakrasana, Trikonasana, Padahasthasana) Postural Deformities and corrective measures, Stress management and relaxation Techniques
Unit – IV	**Lifestyle:** Hypo-kinetic diseases and its management, diabetes, hypertension, obesity, osteoporosis , CHD, Back pain, health related physical fitness and assessment, body mass index/skin fold measurement, BMR, pulse rate, blood pressure, health related physical fitness test.
Text/Reference Books	
Text Books	1.Bates, Mike. Health fitness management: a comprehensive resource for managing and operating programs and facilities. Human kinetics, 2008. 2.Melvin H. Williams, Eric S. Rawson, J. David Branch, Nutrition for health, fitness and sport, McGraw Hill,2016.
Reference Books	1.Corbin.CharlesBeetal. C.A., (2004) Concepts of Fitness and Welfare Boston McGraw Hill. 2.ACSM"s "Health Related Physical Fitness Assessment Manual Lippincott Williams and Walkins USA, 2005.

MDS/3/SEC3/T Digital Marketing

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Skill Enhancement Course	02	02	Lecture	35	15	3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to learn the concepts of digital marketing, social media marketing and other online marketing strategies.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define**: the basic concepts of digital marketing, social media marketing and other online marketing strategies.
CO2	**explain:** the effective usage of digital marketing, social media marketing and other online marketing strategies.
CO3	**use:** different strategies in digital marketing.
CO4	**classify:** strategies and tools used in digital marketing.
CO5	**compare and select types of:** tools, strategies, digital editing tools.

CO-PO Mapping for Course MDS/3/SEC3/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-

CO 3	3	1	1	3	3	-	3	3	-	2	-	-
CO 4	2	1	1	3	1	-	3	3	-	2	-	-
CO 5	2	1	3	1	3	-	3	3	-	2	-	-
Avg	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

Course Content
MDS/3/SEC3/T Digital Marketing

Unit – I	**Introduction Digital Marketing:** Changing face of advertisement, technology behind digital marketing, need of digital marketing, defining your digital marketing strategy, understanding digital consumer.
Unit – II	**Website for Digital Marketing:** Need of website, steps of building website, choosing domain name, hosting website, arranging information and writing effective web content, advertising on search engine.
Unit - III	**Social Media and Email Marketing:** Introduction to social media, different forms of social media, rules of engagement, Introduction to email marketing, planning your campaign, measuring success.
Unit – IV	**Other Marketing Strategies:** Introduction to mobile marketing, mobile application, performance marketing, understanding content marketing, content strategy and content promotion.

Text/Reference Books

Text Books	1. Ryan, Damian. Understanding digital marketing: marketing strategies for engaging the digital generation. Kogan Page Publishers, 2016.
Reference Books	1. Pulizzi J. Epic content marketing. McGraw-Hill Publishing; 2013. 2. Oliver J. Rich ,Digital Marketing for Beginners 2020

MDS/3/SEC3/P Digital Marketing

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
Skill Enhancement Course	01	02	Lab work	25		3 Hours	TEE/MTE/ Assignment/ Attendance

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will consist of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to learn the concepts of digital marketing, social media marketing and other online marketing strategies.

Course Outcomes	At the end of this course, the student will be able to:
CO1	**define**: the basic concepts of digital marketing, social media marketing and other online marketing strategies.
CO2	**explain:** the effective usage of digital marketing, social media marketing and other online marketing strategies.
CO3	**use:** different strategies in digital marketing.
CO4	**classify:** strategies and tools used in digital marketing.
CO5	**compare and select types of:** tools, strategies, digital editing tools.

CO-PO Mapping for Course MDS/3/SEC3/P

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO 2	2	1	1	3	1	-	3	2	-	2	-	-

CO 3	3	1	1	3	3	-	3	3	-	2	-	-
CO 4	2	1	1	3	1	-	3	3	-	2	-	-
CO 5	2	1	3	1	3	-	3	3	-	2	-	-
Avg	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

SEMESTER 4th

MDS/4/CC8/T: IoT& Cloud Computing								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Compulsory Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts of cloud computing, its enabling technologies, cloud service models and security concerns, to learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes	At the end of this course, the student will be able to:
CO1	list/defineIoT: framework, architecture, design, communication challenges, applications, principles of web connectivity. list/define cloud computing: evolution, characteristics, working, service models, virtualization, architecture, security challenges and risks.
CO2	understand and describe IoT: framework, architecture, design, communication challenges, applications, principles of web connectivity. understand and describe cloud computing: evolution, characteristics, working, service models, virtualization, architecture, security challenges and risks.
CO3	use cloud computing services in different fields of applications.
CO4	diagrammatiseIoT: framework, architecture, physical and logical design. diagrammatise cloud computing: service models, service-oriented architecture.
CO5	grade/compareIoT: communication challenges, security issues, enabling technologies, application areas, and protocols. grade/compare cloud computing: service models. virtualization, and hypervisors.

CO-PEO Mapping Matrix for Course MDS/4/CC8/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3

CO5	3			3			1			3		3
Average	2.4			3			1			3		3

CO-PO Mapping Matrix for Course MDS/4/CC8/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MDS/4/CC8/T

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
Average	3	3	3	2.4	-

Course Content
MDS/4/CC8/T: IoT& Cloud Computing

Unit - I	Internet of Things: what is the IOT and why is it important, IoT conceptual framework, IoT architectural view, technology behind IoT, sources of IoT, examples of IoT, M2M communication, layered architecture (3 & 5 Layered) of IoT, physical design and logical design, domain-specific IoTs, security issues of IoT.
Unit - II	Communication challenges related to IoT, enabling technologies for IoT. Applications of IoT: home automation, smart cities, social life and entertainment, health & fitness, smart environment and agriculture, supply chain and logistics, energy conservation. Design principles for web connectivity: web communication protocols for connected devices, message communication protocols for connected devices.
Unit - III	Introduction to cloud computing: what is a cloud, definition of cloud

	computing, evolution of cloud computing, characteristics of cloud computing, how cloud computing works, role of networks in cloud computing. Service models: IaaS, PaaS, SaaS, public, private and hybrid cloud.
Unit - IV	Introduction to virtualization, resource virtualization-server, storage, network, load balancing and virtualization. Hypervisors and its types, service oriented architecture (SOA), overview of security issues, challenges and risks of cloud.
Text/Reference Books	
Text Books	1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing a Practical Approach, Tata McGraw Hill, New Delhi, 2010 2. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, Cloud Computing: A Practical Approach, 1e, Tata McGraw Hill Education, 2011. 3. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publishing, 2010
Reference Books	1. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing-Principles and Paradigms, Wiley, 2011. 2. Raj Kamal, Internet of Things-Architectures and Design Principles, McGraw Hill Education, 2017

MDS/4/DSC4(i)/T: Soft Computing								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to cover fundamental soft computing concepts with an exposure to ANN, fuzzy Logic, optimization techniques using Genetic Algorithm (GA).

Course Outcomes	By the end of this course, the student will be able to:
CO1	recognize the concept of: soft computing and hard computing, simple g algorithm, fuzzy set, neuron, neural network and activation function.
CO2	understand and describe: the role of genetic algorithm ope representation of fuzzy set and its operation, types of neural netwo activation function including their pros and cons.
CO3	use: genetic algorithm, fuzzy logic , ANN and their constituents for solving optimization problem.
CO4	differentiate: soft computing and hard computing, operators of g algorithm and activation functions of ANN. Analyze: fuzzification and defuzzification.
CO5	compare: soft computing and hard computing, operators of genetic alg and different activation functions of ANN.

CO-PEO Mapping Matrix for Course MDS/4/DSC4(i)/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MDS/4/DSC4(i)/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MDS/4/DSC4(i)/T

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MDS/4/DSC4(i)/T: Soft Computing

Unit – I	**Introduction to Soft Computing:** Overview of Soft Computing, difference between soft and hard computing, brief descriptions of different components of soft computing including artificial neural networks, fuzzy logic, genetic algorithms.
Unit – II	**Genetic Algorithm:**Introduction to genetic algorithm, simple genetic algorithm, its representation. Selection: Roulette wheel selection, random, rank, tournament, Boltzmann selection. **Crossover and its types:** Single point crossover, two point crossover, multipoint crossover, ordered crossover, uniform crossover, crossover for real-valued representation. **Mutation and its types:** Flipping, Interchanging, reversing, replacement, mutation for real-valued representation, crossover rate, mutation rate and convergence criteria.
Unit – III	**Fuzzy Logic:** Introduction to fuzzy logic, representation of a classical set, representation of fuzzy set, basic properties of fuzzy sets.

	Fuzzy set operation: Intersection of fuzzy sets, union of fuzzy sets, complement of fuzzy sets, important terminologies in fuzzy set operations, properties of fuzzy sets, fuzzy arithmetic. **Fuzzy Composition:** Max-Min composition, max-star composition, max-product composition, max-average composition. fuzzification and de-fuzzification.
Unit - IV	**Artificial Neural Network:** Basic of neural network: neuron, artificial neuron, neural network, artificial neural network , perceptron, feed forward, multilayer perceptron neural network, advantage and disadvantage of ANNs. activation function and types of activation function.
Text/Reference Books	
Text Books	1. David E. Goldberg, Genetic Algorithms in Search, Optimization and machine learning. Pearson Education India, 2008. 2. Roy, S. and Chakraborty, U. Soft computing. Pearson Education India, 2013.
Reference Books	1. Michael D. Vose. The Simple Genetic Algorithm - Foundations and Theory. Prentice Hall India Learning Private Limited,2004. 2. Rajasekaran, Sanguthevar, and GA Vijayalakshmi Pai. Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd., 2003. 3. Deepa, S.N. and Sivanandam, S.N. Principles of soft computing ,2011. 4. Haykin, S. and Network, N.A comprehensive foundation. Neural networks, 2(2004).

MDS/4/DSC4(ii)/T:Deep Learning								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
Optional Theory	04	04	Lecture	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions to paper setter for Final-Term Examination: The Final-Term examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: the terms of machine learning: deep learning, regression, classification, regression, neurons, CNN and RNN.
CO2	explain: architecture of ANN and deep learning, variants of the basic convolution function, Long short-term memory.
CO3	apply: classification, regression, clustering techniques, Feed forward multilayer neural network, CNN, RNN according to their problem.
CO4	Classify: regression, classification, Convolutional Neural networks, RNN
CO5	compare: Single-layer and Multi-layer Perceptron, CNN and RNN

CO-PEO Mapping Matrix for Course MDS/4/DSC4(ii)/T

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MDS/4/DSC4(ii)/T

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-

CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MDS/4/DSC4(ii)/T

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content MDS/4/DSC4(ii)/T:Deep Learning	
Unit – I	**Introduction:** Introduction to Machine learning, Deep learning and AI , Historical trends in Deep learning ,Architecture of deep learning, Significance of Deep learning, application of deep learning, challenges of Deep learning. **Neural Network**: Introduction, architecture, difference between Biological Neuron Network and Artificial Neuron Network.
Unit – II	**Foundation of Deep Learning:**Vector, scalars, matrix, statistics, probability.Regression, classification, underfitting, overfitting, gradient descent, logistic regression, confusion matrix. Activation functionsof Neural Network (liner, sigmoid, tanh, softmax).
Unit – III	**Fundamental of Deep Learning:** common architectural principles of deep learning, Single-layer and Multi-layer Perceptron , Cross-entropy loss functions for Neural net , Matrix representation of Neural nets. **Building block of deep network**: Feed forward multilayer neural network, RBMs, Autoencoders.
Unit – IV	**Convolutional Neural networks:** Deep Learning and Neural Networks Perceptrons, Convolutional networks , variants of the basic convolution function, efficient convolution algorithms. **Recurrent Neural networks :** Bidirectional RNNs , Deep recurrent networks , recursive neural networks , The Long short-term memory and other gated RNNs.

Text/Reference Books	
Text Books	1. David Foster, Generative Deep Learning, O'Reilly, 2019. 2. Goodfellow, Y. Bengio, A. Courville, Deep Learning, MIT Press, 2016. 3. Patterson, Josh, and Adam Gibson. Deep learning: A practitioner's approach. " O'Reilly Media, Inc.", 2017. 4 Charu, C. Aggarwal. Neural networks and deep learning: a textbook. 2018.
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