SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Fourth Meeting of the Board of Studies

Department of Computational Studies

for the Programme

Bachelor of Data Science and Analytics

Venue

First Floor, SAS Block

Sri Manakula Vinayagar Engineering College

Madagadipet, Puducherry – 605 107

Date & Time

10-04-2024 & 10.00 pm to 01.00 pm

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

School of Arts and Science
Department of Computational Studies
Board of Studies Meeting for B.Sc. Data Science and Analytics

The fourth meeting of Board of Studies for the course B.Sc. Data Science and Analytics was held through online on 10.04.2024 at 10:00 am in the Department of Computational Studies, School of Arts and Science, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.
The following members were present for the Fourth Meeting of Board of Studies.

S. No.	Name of the Member with Designation and official Address	Responsibility in the BoS
1	**Dr. N. MOGANARANGAN, M.E., Ph.D.** Professor & Head, Department of Computational Studies, School of Arts & Science, Sri Manakula Vinayagar Engineering College (Autonomous) Madagadipet, Puducherry 605 107 **E-mail: moganarangan.cse@smvec.ac.in** **Mobile: 98945 33661**	Chairman
2	**Dr. PUNAM BEDI M.Sc., M.Tech., Ph.D.** Professor, Department of Computer Science, University of Delhi, Delhi – 110 007. **Email: punambedi@gmail.com , Mobile:9899125785**	Pondicherry University Nominee
3	**Dr. R. AROKIA PAUL RAJAN MCA, PGDBA, MA, PhD.,** Associate Professor, Computer Science, School of Sciences, Bangalore Central Campus, Christ University, Bangalore, Karnataka. **Mail id: paulraajan@gmail.com, Ph: 9443459242**	Subject Expert (Academic Council Nominee)
4	**Dr. M. DURAISAMY, MCA., M.Phil., Ph.D., TNSET.** Associate Professor and Head, Department of Computer Applications, Government Arts and Science College, Kariyampatti, Tirupattur, Tamilnadu - 635 901. **E-mail: duraimca78@gmail.com, Mobile: 98431 55358.**	Subject Expert (Academic Council Nominee)
5	**Mr.E.IYYAPPAN,** Senior Application Developer, IQVIA, Bangalore. **E-mail: eiyyappan.mca@gmail.com, Mobile:9790700670**	Member (Industry Representative)

Co-opted Expert Members		
6	**Dr. J. MADHUSUDANAN, ME., Ph.D.,** Professor and Head, Department of Artificial Intelligence and Data Science, Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry. 605 107. **E-mail: madhu@smvec.ac.in** **Mobile: 9003739274**	Co-opted Expert Member
7	**Mr. M. SHANMUGAM, M.Sc., M.Phil., M.E., SET, (Ph.D).,** Associate Professor, Department of Computer Science Engineering, Sri Manakula Vinayagar Engineering College **E-mail: shanmugam.mm@smvec.ac.in** **Mobile: 9444370963**	Co-opted Expert Member
Internal Members		
8	**Mrs. A. SHAMSATH BEGAM, M.C.A.,** Assistant Professor, Department of Computational Studies, School of Arts and Science, Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry. 605 107. **E-mail: shamsathbegum.sas@smvec.ac.in, Mobile: 9500399774**	Internal Member
9	**Mr. K. SANTHOSHKUMAR, M.C.A. M.Phil. B.Ed.,** Assistant Professor Department of Computational Studies School of Arts and Science Sri Manakula Vinayagar Engineering College **Mail id: santhoshkumark.sas@smvec.ac.in, Phone: 8508068040.**	Internal Member
10	**Dr. M.A. ISHRATH JAHAN M.A., M.Phil., Ph.D.,** Associate Professor & Head, Department of English, School of Arts and Science, Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry. 605 107. **E-mail: ishrath@smvec.ac.in, Mobile: 9443075126.**	Internal Member
11	**Mr. P.KRISHNAMOORTHY M.Sc., M.Phil.,** Assistant Professor and Head, Department of mathematics, School of Arts and Science, Sri Manakula Vinayagar Engineering College, Madagadipet, Puducherry. 605 107. **E-mail: krishnamoorthymaths@smvec.ac.in, Mobile: 9750028056.**	Internal Member

ANNEXURE – II

AGENDA OF THE MEETING

Item No.: BoS//2024/SAS/DSA / 4.1

- Confirmation of Minutes of 3rd Meeting of BOS - Modifications if any.

Item No.: BoS//2024/SAS/DSA / 4.2

- To discuss the criteria for fixing (MJD) Major Disciplinary Courses, (MID) Minor Disciplinary Courses, (MLD) Multi-Disciplinary Courses, (AEC) Ability Enhancement Courses, (SEC) Skill Enhancement Courses and (VAC) Value Added Courses from semesters II-VIII.

Item No.: BoS//2024/SAS/DSA / 4.3

- To discuss the curriculum framework for the UG programme B.Sc. Data Science and Analytics for semesters (I – VIII) based on National Education Policy Regulations 2023 of Pondicherry University.

Item No.: BoS//2024/SAS/DSA / 4.4

- To discuss the already approved curriculum R2020 and the syllabus of Semester V and Semester VI.
- To add Value Added Course – Understanding India in II semester.

Item No.: BoS//2024/SAS/DSA / 4.5

- Any other additional points to be discussed with the permission of the chair.

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
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SCHOOL OF ARTS AND SCIENCE

Department of Computational Studies

B.Sc. Data Science and Analytics

Minutes of 4th meeting of Board of Studies

ANNEXURE – I

ACADEMIC REGULATIONS 2020

(R 2020)

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of livesto serve the society.

Mission

M1: Quality Education:

To provide comprehensive academic system that amalgamates the cutting-edge technologies with bestpractices.

M2: **Research and Innovation:**

To foster value-based research and innovation in collaboration with industries and institutions globally forcreating intellectuals with new avenues.

M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill-based training.

M4: Ethical Values:

To instil deep sense of human values by blending societal righteousness with academic professionalism for thegrowth of society.

DEPARTMENT OF COMPUTATIONAL STUDIES

VISION AND MISSION

Vision:

To come up with successfully as a high-quality human capital in Computer Science and related areas for thesustainable growth of the IT industry needs of the country.

Mission:

M1: Innovative Skills:

Ensuring deeper understanding of fundamentals and acquiring innovative skills within core areas of ComputerScience.

M2: Motivated Graduates:

Producing highly skilled and motivated graduates with the ability of problem solving individually and in teams.

M3: Ethical Responsibilities:

Providing a deep awareness of our ethical responsibilities to our profession and to the society.

SEMESTER - V										
S. No	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	A20DAT509	Introduction to Machine Learning	DSC	4	0	0	4	25	75	100
2	A20DAT510	IoT Cloud and Data Analytics	DSC	4	0	0	4	25	75	100
3	A20DAT511	Software Project Management	DSC	4	0	0	4	25	75	100
4	A20DAE5XX	**Discipline Specific Elective–III**	DSE	3	0	0	3	25	75	100
Practical										
6	A20DAL509	Machine Learning Lab	DSC	0	0	4	2	50	50	100
7	A20DAP501	Mini Project	DSC	0	0	4	2	50	50	100
Skill Enhancement Course										
8	A20DAS505	R Programming Lab	SEC	0	0	4	2	100	0	100
Other Certification Course										
9	A20DAX501	NPTEL – Big Data Computing	OCC	0	0	0	0	0	0	100
							21	**300**	**400**	**800**

DISCIPLINE SPECIFIC ELECTIVES

Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Discipline Specific Elective (DSE - I) – offered in Third Semester										
1	A20DAE301	Operating System	DSE	3	-	-	3	25	75	100
2	A20DAE302	Information Security	DSE	3	-	-	3	25	75	100
3	A20DAE303	Computer Networks	DSE	3	-	-	3	25	75	100
Discipline Specific Elective (DSE - II) – offered in Fourth Semester										
1	A20DAE404	Infrastructure Management	DSE	3	-	-	3	25	75	100
2	A20DAE405	Client Server Technology	DSE	3	-	-	3	25	75	100
3	A20DAE406	Image Processing	DSE	3	-	-	3	25	75	100
Discipline Specific Elective (DSE - III) – offered in Fifth Semester										
1	A20DAE507	Wireless Sensor Network	DSE	3	-	-	3	25	75	100
2	A20DAE508	Data Science using R	DSE	3	-	-	3	25	75	100
3	A20DAE509	Virtualization using Cloud	DSE	3	-	-	3	25	75	100
Discipline Specific Elective (DSE - IV) – offered in Sixth Semester										
1	A20DAE610	Process Management	DSE	3	-	-	3	25	75	100
2	A20DAE611	Software Engineering	DSE	3	-	-	3	25	75	100
3	A20DAE612	Introduction to Digital Marketing	DSE	3	-	-	3	25	75	100

Department	**Computational Studies**	Programme: **B.Sc DATA SCIENCE AND ANALYTICS**						
Semester	**Fifth**	Course Category Code: **DSC**			*End Semester Exam Type: **TE**			
Course Code	**A20DAT509**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTRODUCTION TO MACHINE LEARNING**	**4**	**0**	**0**	**4**	**25**	**75**	**100**
Prerequisite	Basic knowledge about Machine Learning							

Course Objectives

- To understand the machine learning theory.
- To implement linear and non-linear learning models.
- To implement distance-based clustering techniques.
- To build tree and rule based models.
- To apply reinforcement learning techniques

Course Outcome	*After the completion of this course, the students will be able to:*	BT Mapping (Highest Level)
CO1	Understanding the Machine Learning Concepts	**K2**
CO2	Implement the Machine Learning Models	**K3**
CO3	Analyse the principle of cluster technologies	**K3**
CO4	Implement the linear and Boolean Functions	**K4**
CO5	Methods to work with Kernal Principles	**K4**

UNIT-I	**INTRODUCTION TO MACHINE LEARNING**	**Periods: 12**
Introduction – machine learning applications – learning associations, classification, regression, unsupervised learning – Reinforcement Learning – Supervised Learning – VC Dimension – PAC learning – noise – learning multiple classes – regression – model selection and generalization – Bayesian Decision Theory – Classification – losses and risks – Discriminant Functions.		**CO1**
UNIT-II	**MACHINE LEARNING MODELS**	**Periods: 12**
Bernoulli Density – Multinomial Density – Gaussian Density – Bias – Variance – Parametric classification – Multivariate Methods – Multivariate Data – Parameter Estimation – Estimation of Missing Values – Multivariate Normal Distribution – Multivariate Classification – Multivariate Regression - Dimensionality Reduction – Subset Selection – Principal Component Analysis – Factor Analysis – Dimensionality Scaling – Linear Discriminant Analysis.		**CO2**
UNIT-III	**CLUSTER TECHNOLOGIES**	**Periods: 12**
Clustering – Mixture Densities – K Means Clustering – Expectation Maximization – Mixtures of Latent Variable Models – Supervised Learning after clustering – Hierarchical Clustering – Non-Parametric Methods – Histogram Estimator – Kernel Estimator – K-Nearest Neighbor Estimator.		**CO3**
UNIT-IV	**LINEAR AND BOOLEAN FUNCTIONS**	**Periods: 12**
Linear Discrimination – Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination - Introduction – Perceptron – Training a Perceptron – Learning Boolean Functions – Multilayer Perceptrons – Backpropagation Algorithm		**CO4**
UNIT-V	**KERNAL ANALYSIS**	**Periods: 12**
Kernel Machines – Optimal Separating Hyperplane – kernel trick – vectorial kernels – multiple kernel learning – multiclass kernel machines – Hidden Markov Models - Finding the State Sequence – Learning Model Parameters – Generating Diverse Learners – Model Combination schemes – Voting – Error Correcting Output Codes – Bagging – Boosting		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. EthemAlpaydin, Introduction to Machine Learning, Second Edition, PHI,2010.
2. Machine Learning, An Algorithmic Perspective, Stephen Marsland, Chapman & Hall Machine Learning and Pattern Recognition Series, Second Edition, CRC Press,2009.

Reference Books

1. Machine Learning, The Art and Science of Algorithms that Make Sense of Data, Peter Flasch,

Cambridge University Press.
2. Machine Learning, Tom M. Mitchell, Mc Graw Hill,2003

Web References

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.ibm.com/topics/machine-learning
3. https://www.coursera.org/articles/what-is-machine-learning
4. https://developers.google.com/machine-learning/crash-course/
5. https://cloud.google.com/learn/what-is-machine-learning

``* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	2	2	2
2	2	3	2	3	2	3	2	2
3	3	2	3	3	2	3	3	2
4	3	2	2	2	2	3	2	3
5	2	2	2	3	3	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computational Studies**	Programme: **B.Sc DATA SCIENCE AND ANALYTICS**						
Semester	**Fifth**	Course Category Code: **DSC**			*End Semester Exam Type: **LE**			
Course Code	**A20DAT510**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IOT Cloud and Data Analytics**	**4**	**0**	**0**	**4**	**25**	**75**	**100**

Prerequisite	Basic knowledge in IOT Cloud and Data moduels	
Course Objectives	• To understand IOT theory. • To implement Data Analytics models. • To implement Web of things techniques. • To build various network. • To apply cloud techniques to create real time applications.	
Course Outcome	*After the completion of this course, the students will be able to:*	BT Mapping (Highest Level)
	CO1 To impart knowledge on the Internet of Things	**K2**
	CO2 To analyze, design and develop IoT solutions	**K3**
	CO3 To apply the concept of IOT in the real world apps.	**K3**
	CO4 To use various techniques of data storage and analytics in IoT	**K4**
	CO5 To understand APIs to connect IoT related technologies	**K4**

UNIT-I	**INTRODUCTION TO FUNDAMENTALS OF IOT**	**Periods: 12**
Introduction - Definitions & Characteristics of IoT - IoT Architectures - Physical & Logical Design of IoT - Enabling Technologies in IoT - History of IoT - About Things in IoT - The Identifiers in IoT About the Internet in IoT - IoT frameworks - IoT and M2M.		**CO1**
UNIT-II	**DATA ANALYTICS**	**Periods: 12**
Introduction to elastic analytics - Decouple key components - Cloud security and analytics - Designing data processing for analytics - Applying big data technology to Storage		**CO2**
UNIT-III	**IOT TO WOT**	**Periods: 12**
The Future Web of Things – Set up cloud environment –Cloud access from sensors- Rest Architectures- The web of Things Resource Identification - Identifier Richardson Maturity Model		**CO3**
UNIT-IV	**IOT PROTOCALS AND NETWORKS**	**Periods: 12**
Control Units – Communication modules – Bluetooth – Zigbee – Wifi – GPS- IOT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc..) – MQTT - Wired Communication - Power Sources		**CO4**
UNIT-V	**APPLICATIONS OF IOT WITH CLOUD**	**Periods: 12**
Home Automation - Smart Cities – Energy - Retail Management – Logistics – Agriculture - Health and Lifestyle - Industrial IoT - Legal challenges - IoT design Ethics - IoT in Environmental Protection.		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
2. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 1 st edition, Wiley Publications, 2019.
3. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications

Reference Books

1. Vermesan, Ovidiu, and Peter Friess, eds. Internet of things-from research and innovation to market deployment, 1st edition, Aalborg: River publishers, 2014.
2. 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
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases"

Web References

1. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
2. https://cloud.google.com/discover/what-is-cloud-analytics
3. https://www.javatpoint.com/iot-internet-of-things
4. https://developer.ibm.com/articles/cl-cloudintro/
5. https://www.tutorialspoint.com/iot-network-protocols

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	2	3	3	2	2	2	2	3
2	3	2	2	3	3	3	2	2	2
3	2	2	2	2	3	3	3	2	2
4	3	3	2	2	2	2	2	2	3
5	2	3	2	2	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computational Studies**	Programme: **B.Sc Data Science and Analytics**						
Semester	**Fifth**	Course Category Code: **DSC**			*End Semester Exam Type: **TE**			
Course Code	**A20DAT511**	Periods / Week			Credit	Maximum Marks		
		L	**T**	**P**	**C**	**CAM**	**ESE**	**TM**
Course Name	**Software Project Management**	4	0	0	4	25	75	100
Prerequisite								

Course Objectives

- To understand the machine learning theory.
- To implement linear and non-linear learning models.
- To implement distance-based clustering techniques.
- To build tree and rule based models.

Course Outcome	After the completion of this course, the students will be able to:	BT Mapping (Highest Level)
CO1	Understand the Software Project Management concepts.	**K2**
CO2	Design and apply cost estimation	**K3**
CO3	Understand and evaluate software quality management	**K3**
CO4	Design and create software management and metrics	**K4**
CO5	Analyze the role of project evaluation	**K4**

UNIT-I	**Project Concepts and Its Management**	**Periods: 12**

Project life cycle models-ISO 9001 model - Capability Maturity Model - Project, Planning-Project tracking-Project closure - Evolution of Software Economics – Software Management Process Framework: Phases, Artifacts, Workflows, Checkpoints – Software Management Disciplines: Planning / Project Organization and Responsibilities . **CO1**

UNIT-II	**Cost Estimation**	**Periods: 12**

Problems in Software Estimation – Algorithmic Cost Estimation Process, Function, Points, SLIM (Software Life cycle Management), COCOMO II (Constructive Cost Model) – Estimating Web Application Development – Concepts of Finance, Activity Based Costing and Economic Value Added (EVA) – Balanced Score Card. **CO2**

UNIT-III	**Software Quality Management**	**Periods: 12**

Software Quality Factors – Software Quality Components – Software Quality Plan– Software Quality Metrics – Software Quality Costs – Software Quality Assurance-Standard – Certification – Assessment. **CO3**

UNIT-IV	**Software Management and Metrics**	**Periods: 12**

Software Configuration Management – Risk Management: Risk Assessment: Identification / Analysis / Prioritization – Risk Control: Planning / Resolution /Monitoring – Failure Mode and Effects Analysis (FMEA) –Defect Management-Cost Management. Software Metrics – Classification of Software Metrics. **CO4**

UNIT-V	**Project Evaluation and Emerging Trends**	**Periods: 12**

Strategic Assessment–Technical Assessment–Cost Benefit Analysis–Cash Flow Forecasting–Cost Benefit Evaluation Technique–Risk Evaluation–Software Effort Estimation. Emerging Trends: Import of the internet on project Management –people Focused Process Models. **CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. Ramesh Gopalaswamy, Managing and Global Software Projects, Tata McGraw Hill, 2017.
2. Neal Whitten, Managing Software Development Projects, John Wiley & Sons, Inc., 2nd Ed., 1995.
3. Kaplan, R.S., Norton, D.P. The Balanced Scorecard: Translating Strategy into Action, Harvard Business School Press, 1996.
4. Boehm, B. W. Software Risk Management: Principles and Practices in IEEE Software, January 1991, pp32-41. 6. Grant, J.L. Foundations of Economic Value Added, John Wiley & Sons, 1997.

Reference Books

1. Demarco, T. and Lister, T. Peopleware: Productive Projects and Teams, 2nd Ed., Dorset House, 1999.
2. Royce, W. Software Project Management: A Unified Framework, Addison-Wesley, 1998. Demarco, T. and Lister, T. Peopleware: Productive Projects and Teams, 2ndEd., Dorset House,1999.
3. Fenton, N.E., and Pfleeger, S.L. Software Metrics: A Rigorous and Practical Approach, Revised Brooks Cole, 1998.

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
1	2	2	3	3	3	2	2	2
2	2	3	2	3	2	3	2	2
3	3	2	3	3	2	3	3	2
4	3	2	2	2	2	3	2	3
5	2	2	2	3	3	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computational Studies**		Programme: **B.Sc DATA SCIENCE AND ANALYTICS**					
Semester	**Fifth**		Course Category Code: **DSC**			*End Semester Exam Type: **TE**		
Course Code	**A20DAE507**		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CAM	ESE	TM
Course Name	**WIRELESS SENSOR NETWORK**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Basic knowledge about wireless sensor network								
Course Objectives	• To understand the wireless sensors network • To implement WSN communication • To implement MAC and routing protocal • To understand network topology. • To apply reinforcement learning techniques								
Course Outcome	*After the completion of this course, the students will be able to:*							BT Mapping (Highest Level)	
	CO1	To understand the fundamentals of wireless sensor network						**K2**	
	CO2	To gain knowledge on the MAC and Routing Protocols of WSN						**K3**	
	CO3	To get exposed to networking sensors technology						**K3**	
	CO4	To acquire knowledge on the protocols required for developing real time applications using network toplogy						**K4**	
	CO5	To acqire sensor network platforms						**K4**	
UNIT-I	**OVERVIEW OF WIRELESS SENSOR NETWORKS**							**Periods: 9**	
Introduction Single-Node Architecture - Hardware Components - Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks - Types of wireless sensor networks.								**CO1**	
UNIT-II	**ARCHITECTURES**							**Periods: 9**	
Network Architecture - Sensor Networks-Scenarios - Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments - introduction to Tiny OS and C - Internet to WSN Communication.								**CO2**	
UNIT-III	**NETWORKING SENSORS**							**Periods: 9**	
MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing								**CO3**	
UNIT-IV	**INFRASTRUCTURE ESTABLISHMENT**							**Periods: 9**	
Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.								**CO4**	
UNIT-V	**SENSOR NETWORK PLATFORMS AND TOOLS**							**Periods: 9**	
Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms,Node- level Simulators, State-centric programming.								**CO5**	
Lecture Periods: 45		**Tutorial Periods: -**		**Practical Periods: -**			**Total Periods: 45**		
Text Books									
1.Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John									

Wiley, 2005.
2. Feng Zhao & Leonidas J.Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Waltenegus Dargie , Christian Poellabauer, “Fundamentals of Wireless Sensor Networks - Theory and Practice”, John Wiley & Sons Publications, 2011

Reference Books

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

Web References

6. https://www.geeksforgeeks.org/wireless sensor network/
7. https://www.ibm.com/Wireless sensor network/
8. https://www.coursera.org/articles/what-is-wireless sensor network

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	2	2	2	3	3	3	3	2	2	2
2	3	3	2	3	2	3	3	2	3	2	3	2	3	3	2
3	2	2	3	3	2	3	3	2	2	3	3	2	3	3	2
4	3	3	2	2	2	3	3	3	3	2	2	2	3	3	3
5	2	2	2	3	3	3	2	2	2	2	3	3	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Assessment Pattern as per Bloom’s Taxonomy

Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
ESE	10	30	60	-	-	-	100
* ±3% may be varied							

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computational Studies**	Programme: **B.Sc DATA SCIENCE AND ANALYTICS**						
Semester	**Fifth**	Course Category Code: **DSE**			*End Semester Exam Type: **TE**			
Course Code	**A20DAE508**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Science using R**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Basic knowledge in Data Science using R							

Course Objectives

- To understand the Data Science.
- To understand the basic of R language.
- To implement data frame techniques.
- To implement function and data visualization.
- To apply inferential statics with R.

Course Outcome

	After the completion of this course, the students will be able to:	BT Mapping (Highest Level)
CO1	Recognize various disciplines that contribute to a successful data science effort.	**K2**
CO2	Understand the processes of data science	**K3**
CO3	Be aware of the challenges that arise in data sciences.	**K3**
CO4	Develop and appreciate various techniques for data modelling and mining.	**K4**
CO5	Be cognizant of ethical issues in many data science tasks.	**K4**

UNIT-I	**INTRODUCTION TO DATA SCIENCE**	**Periods: 09**
Introduction- Definition - Data Science in various fields -Types of Data: Numeric – Categorical – Graphical – High Dimensional Data – Classification of digital Data: Structured, Semi-Structured and Un-Structured - Example Applications. Sources of Data: Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data – Data Evolution.		**CO1**
UNIT-II	**INTRODUCTION TO R**	**Periods: 09**
Introduction - Features of R - Environment - R Studio. Basics of R-Assignment - Modes - Operators - special numbers - Logical values - Basic Functions - R help functions - R Data Structures - Control Structures. Vectors: Definition- Declaration - Generating - Indexing - Naming - Adding & Removing elements - Operations on Vectors - Recycling – Special Operators - Vectorized if- then else-Vector Equality – Functions for vectors - Missing values - NULL values - Filtering & Subsetting.		**CO2**
UNIT-III	**LIST AND DATA FRAMES USING R**	**Periods: 09**
Matrices - Creating Matrices - Adding or Removing rows/columns - Reshaping - Operations - Special functions on Matrices. Lists - Creating List – General List Operations – Special Functions - Recursive Lists. Data Frames - Creating Data Frames - Naming - Accessing - Adding - Removing - Applying Special functions to Data Frames - Merging Data Frames- Factors and Tables.		**CO3**
UNIT-IV	**DATA VISUALIZATION**	**Periods: 09**
Functions - Creating User- defined functions - Functions on Function Object - Scope of Variables - Accessing Global, Environment - Closures - Recursion. Data Visualization in R: Types of visualizations - packages for visualizations - Basic Visualizations, Advanced Visualizations and Creating 3D plots.		**CO4**
UNIT-V	**INFERENTIAL STATICS WITH R**	**Periods: 09**
Types of Learning - Linear Regression- Simple Linear Regression - Implementation in R - functions on lm() - predict() - plotting and fitting regression line. Multiple Linear Regression. Introduction - comparison with simple linear regression - Correlation Matrix - F-Statistic - Target variables Vs Predictors - Identification of significant features - Implementation of Multiple Linear Regression.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R",2013.
2. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
3. Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", Wiley, 2011.

Reference Books

1. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
2. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014.
3. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.

Web References

9. https://www.rdocumentation.org/
10. https://www.geeksforgeeks.org/r-programming-for-data-science/
11. https://onlinecourses.nptel.ac.in/noc21_cs23/preview
12. https://archive.nptel.ac.in/courses/111/104/111104147/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	2	2	2	3	3	3	3	2	2	2
2	3	3	2	3	2	3	3	2	3	2	3	2	3	3	2
3	2	2	3	3	2	3	3	2	2	3	3	2	3	3	2
4	3	3	2	2	2	3	3	3	3	2	2	2	3	3	3
5	2	2	2	3	3	3	2	2	2	2	3	3	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Assessment Pattern as per Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
ESE	10	30	60	-	-	-	100
* ±3% may be varied							

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment *	Attendance		

Marks	10	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computational Studies**	Programme: **B.Sc DATA SCIENCE AND ANALYTICS**						
Semester	**Fifth**	Course Category Code: **DSC**			*End Semester Exam Type: **TE**			
Course Code	**A20DAE509**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**VIRUTALIZATION USING CLOUD**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Prerequisite	Basic knowledge about virtualization using cloud							

Course Objectives

- To understand the virtualization concepts
- To understand virtualization infrastructures.
- To implement virtualization solution
- To understand the cloud concepts
- To apply the concepts of cloud security

Course Outcome	*After the completion of this course, the students will be able to:*	BT Mapping (Highest Level)
	CO1 To understand the concepts of virtualization and virtual macines.	**K2**
	CO2 To gain expertise in server , network and storage virtualization	**K3**
	CO3 To gain the knowledge on the concept of virtualization solutions.	**K3**
	CO4 To understand the cloud platform architectures.	**K4**
	CO5 To understand the security issues in the grid and the cloud environment.	**K4**

UNIT-I	**VIRTUALIZATION**	**Periods: 9**
Basic Of Virtual Machines –Process Virtual Machines-System Virtual Machines-Emulation-Interpretation-Binary Translation-Taxonomy Of Virtual Machines.-Virtualization-Management Virtualization-Hardware Maximization-Architectures-Virtualizations Management-Storage Virtualization.		**CO1**
UNIT-II	**VIRTUALIZATION INFRASTRUCTURE**	**Periods: 9**
Comprehensive Analysis-Resources Pool-Testing Environment-Server Virtualization-Virtual Workloads-Provision Virtual Machines-Desktop Virtualization-Application Virtualization-Implementation Levels Of Virtualization- Virtualization Structure- Virtualization Of CPU,Memory And I/O Devices-Virtual Clusters And Resoures Management – Virtualization For Data Center Automation.		**CO2**
UNIT-III	**VIRTUALIZATION SOLUTION**	**Periods: 9**
Understanding Microsofts Virtualization Solutions:Microsoft Infrastructures Optimization Model-Virtualization And The Infrastructure Optimization Model-Benefits Of Virtualization-Achieving The Benefits Of Datacenter Virtualization-Achieving The Benefits Of Client Virtualization-Achieving The Benefits Of Cloud Virtualization.		**CO3**
UNIT-IV	**CLOUD PLATFORM ARCHITECTURE**	**Periods: 9**
Cloud Deployment Models:Public,Private,Hybrid,Community-Categories Of Cloud Computing:Everything As A Service:Infrastructures,Platform,Software –A Generic Cloud Architecture Design-Layered Cloud Architectural Development-Virtualization Support And Disaster Recovery-Architectural Design Challenges –Public Cloud Platform:GAE,AWS-Inter-Cloud Resoures Management.		**CO4**
UNIT-V	**CLOUD SECURITY**	**Periods: 9**
Cloud Infrastructures Security:Network,Ost And Application Level-Aspects Of Data Security,Provider Data And Its Security,Identity And Access Management Architecture,IAM Practices In The Cloud,Saas,Paas,Iaas Availabity In The Cloud-Key Privacy Issues In The Cloud		**CO5**

–Cloud Security And Trust Management.			
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Danielle Ruest, Nelson Ruest ,- Virtualization: A Beginner"S Guidel, Mcgrew-Ill Osborne Media.2009
2 .Jim Smith,Ravi Nair," Virtualization Machines: Versatile Platform For System An Processes".
3.John W. Rittinghouse And James F. Ransome."Cloud Computing: Implementation, Management ,And Security",CRC Press,2010.

Reference Books

1.Publication,2006.Cloud Computing (Principles And Paradigms),Edited by Rajkumar Buyya,James Brobreg ,Andrzej Goscinski,John Wiley &Sons,Inc.2011.
2.Cloud Computing A Practical Approaches –Anthiny T.Velte,Toby J.Velte Robert Elsenpeter TATA Mcgraw-Hill,New Delhi-2010

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13. https://www.geeksforgeeks.org/virtualization using cloud/
14. https://www.ibm.com/topics/virtualization using cloud
15. https://www.coursera.org/articles/what-is-cloud security

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	2	2	2	3	3	3	3	2	2	2
2	3	3	2	3	2	3	3	2	3	2	3	2	3	3	2
3	2	2	3	3	2	3	3	2	2	3	3	2	3	3	2
4	3	3	2	2	2	3	3	3	3	2	2	2	3	3	3
5	2	2	2	3	3	3	2	2	2	2	3	3	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Assessment Pattern as per Bloom's Taxonomy

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
ESE	10	30	60	-	-	-	100
* ±3% may be varied							

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		

Marks	10	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus**.**

Department	**Computational Studies**		Programme: **B.Sc DATA SCIENCE AND ANALYTICS**					
Semester	**Fifth**		Course Category Code: **DSC**			*End Semester Exam Type: **LE**		
Course Code	**A20DAL509**		Periods / Week			Credit	Maximum Marks		
			L	T	P	C	IM	ESE	TM
Course Name	**MACHINE LEARNING LAB**		**0**	**0**	**4**	**2**	**50**	**50**	**100**
(common to B.Sc (CS) & BCA)									
Prerequisite	Basic Knowledge in Machine Learning								
Course Objectives	• To Learn the basics of machine learning algorithms. • To study about the decision and rule based Learning Concepts. • To Learn the Equvalence class trasfromation Algorithm. • To Understand the CSV concepts using python. • To study the neural Network concepts.								
Course Outcome	*After completion of the course, the students will be able to*								BT Mapping (Highest Level)
	CO1	get the knowledge on various Machine Learning							**K3**
	CO2	to identify the appropriate Machine Learning based on the real-world problem							**K3**
	CO3	design the applications using various Machine Learning							**K3**
	CO4	effectively as an individual to understand the concept							**K4**
	CO5	design the applications using Python							**K4**

List of Experiment

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.
2. Extract the data from database using python
3. Implement k-nearest neighbours classification using python
4. Implement Equivalence Class Transformation Algorithm.
5. Implement linear regression using python.
6. Implement Naive Bayes theorem to classify the English text
7. Implement an algorithm to demonstrate the significance of genetic algorithm
8. Implement and demonstrate the FIND-S algorithm finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
9. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Text Books

1. Andreas C. Mueller and Sarah Guido, "Introduction to Machine Learning with Python", O'Reilly Media, Inc. First Edition, 2016.
2. Charu C. Aggarwal "Data Classfication algorithms and applications" Chapman & Hall/CRC Data mining and Knowledge series.

Reference Books

1. Machine Learning, Tom M. Mitchell, Mc Graw Hill,2003
2. John Hearty "Advanced Machine Learning with python", Pack Publishing Ltd., 2016.

Web References

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.ibm.com/topics/machine-learning
3. https://www.coursera.org/articles/what-is-machine-learning
4. https://developers.google.com/machine-learning/crash-course/
5. https://cloud.google.com/learn/what-is-machine-learning

*LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)					Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3
1	3	2	3	3	2	2	2	2
2	2	2	2	3	2	3	2	2
3	2	2	2	2	2	3	3	2
4	3	3	2	2	2	2	2	2
5	3	2	2	2	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Internal Marks			End Semester Examination (ESE) Marks	Total Marks
	Model Exam	Record	Attendance	50	100
Marks	30	10	10		

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Computational Studies**	Programme: **B.Sc Data Science and Analytics**						
Semester	**Fifth**	Course Category Code: **DSC**			*End Semester Exam Type: **TE**			
Course Code	**A20DAP501**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Mini Project**	**4**	**0**	**0**	**2**	**50**	**50**	**100**

Domains:

- Social Network Analysis
- Business Analysis
- E-Commerce Analysis
- Banking Analysis
- Digital Marketing Analysis

Sl.no	Description			Weightage
1	Continuous Assessment Marks			
a	Review 1	Review Committee	5	10
		Guide	5	
b	Review 2	Review Committee	5	10
		Guide	5	
c	Review 3	Review Committee	15	30
		Guide	15	
Total CAM				50
2	End Semester Marks			
a	Evaluation of Mini Project report	Internal Examiner	20	40
		External Examiner	20	
b	Outcome	Publication of Papers/ Conference Presentations/ Patents/ Prototypes etc.	10	10
			Total ESM	50
			Total Marks	100

Department	**Computational Studies**	Programme: **B.Sc DATA SCIENCE AND ANALYTICS**						
Semester	**Fifth**	Course Category Code: **SEC**			*End Semester Exam Type: **TE**			
Course Code	**A20DAS505**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**R Programming Lab**	**0**	**0**	**4**	**2**	**25**	**75**	**100**
Prerequisite	Basic knowledge in R Language.							

Course Objectives

- To understand the Data Science.
- To understand the basic of R language.
- To implement statistics techniques.
- To implement function and Regression.
- To apply Nonlinear Models and Non-Linear with R.

Course Outcome

	After the completion of this course, the students will be able to:	BT Mapping (Highest Level)
CO1	Recognize various disciplines that contribute to a successful data science effort.	**K2**
CO2	Understand the processes of data science	**K3**
CO3	Be aware of the challenges that arise in data sciences.	**K3**
CO4	Develop and appreciate various techniques for data modelling and mining.	**K4**
CO5	Be cognizant of ethical issues in many data science tasks.	**K4**

UNIT-I	**GETTING STARTED WITH R**	**Periods: 06**
Installing R - The R environment - R packages - Basics of R - Data Structures - Reading data into R - Graphics in R.		**CO1**
UNIT-II	**FUNCTIONS AND STATEMENTS**	**Periods: 06**
Writing R functions - Control Statements (if and else, switch, if else, compound tests) - Loops in R (for, while, controlling loops) - Applications using the functions and loops.		**CO2**
UNIT-III	**DATA MANIPULATION AND ANALYSIS**	**Periods: 06**
NGroup manipulation - Data Reshaping - Manipulating Strings - Basic Statistics using R (Summaries, Correlation, t-tests, ANOVA)		**CO3**
UNIT-IV	**LINEAR MODELS USING R**	**Periods: 06**
Linear Models - Simple and Multiple regression, GLM - Logit Regression, Model diagnostics - Residuals, Cross validation, Boot strapping.		**CO4**
UNIT-V	**IN NON-LINEAR MODELS, TIME SERIES AND CLUSTERING USING R FERENTIAL STATICS WITH R**	**Periods: 06**
Nonlinear Models - Non-Linear least square, Splines, Generalised Additive Models, Decision trees, Random forests. Time Series - Autoregressive moving average, VAR, GARCH. Clustering - K means, PAM and Hierarchical Clustering.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

4. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R",2013.
5. Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data Science Cookbook", Packt Publishing Ltd., 2014.
6. Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", Wiley, 2011.

Reference Books

4. Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014.
5. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, "Mining of Massive Datasets", Cambridge

University Press, 2014.
6. Mark Gardener, “Beginning R - The Statistical Programming Language”, John Wiley & Sons, Inc., 2012.

Web References

16. https://www.rdocumentation.org/
17. https://www.geeksforgeeks.org/r-programming-for-data-science/
18. https://onlinecourses.nptel.ac.in/noc21_cs23/preview
19. https://archive.nptel.ac.in/courses/111/104/111104147/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	2	2	2	3	3	3	3	2	2	2
2	3	3	2	3	2	3	3	2	3	2	3	2	3	3	2
3	2	2	3	3	2	3	3	2	2	3	3	2	3	3	2
4	3	3	2	2	2	3	3	3	3	2	2	2	3	3	3
5	2	2	2	3	3	3	2	2	2	2	3	3	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Assessment Pattern as per Bloom’s Taxonomy

Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
ESE	10	30	60	-	-	-	100
* ±3% may be varied							

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus