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JSS Mahavidyapeetha
JSS Science And Technology University
(Established Under JSS Science and Technology University Act No. 43 of 2013)

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MYSURU

Course Title: AI and Machine Learning	*Course Code: CS610*
Credits (L: T: P): 4:0:0	*Contact Hours (L: T: P): 52:0:0*
Type of Course: Lecture	*Category: Professional Core Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: Linear Algebra, Probability Theory

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

CO-1	Apply the AI knowledge to solve problem on search algorithm.
CO-2	Compare and contrast various Machine learning techniques to realize AI
CO-3	Apply Machine learning techniques to solve real-world problems.

Unit No.	Course Content	No. of Hours
1.	**Artificial Intelligence:** The AI Problems, the underlying Assumption, AI technique, Model levels, Criteria for Success. **Problems, Problem Spaces, and Search:** Defining the Problem as a State Space Search, Production Systems.	10
2.	**Problem Characteristics**: Production System Characteristics, Issues in the Design of Search Programs. **Heuristic Search Techniques:** Generate-and-Test, Hill Climbing, Best-first Search, Problem Reduction, Constraint Satisfaction, Means-ends Analysis.	10
3.	**Introduction to Machine Learning**: Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning, Reinforcement Learning. **Supervised Learning:** Learning a Class from Examples, Vapnik-Chervonenkis Dimension, Probably Approximately Correct Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm. The Perceptron, Training a Perceptron, Multilayer Perceptron.	10
4.	**Parametric Methods:** Introduction, Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures **Multivariate Methods:** Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression.	10
5.	**Multilayer Perceptron:** Introduction, The Perceptron, training a Perceptron, Learning Boolean Functions, Multilayer Perceptron, MLP as a Universal Approximator, Back-propagation Algorithm, Training Procedures, Tuning the	12

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Network Size, Bayesian View of Learning, Dimensionality Reduction, Learning Time, Deep Learning and applications.

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	Elaine Rich, Kevin Knight, Shivashankar B Nair	Artificial Intelligence	McGraw Hill Education, 3rd Edition, 2016.
2	EthemAlpaydin,.	Introduction to Machine Learning	PHI Learning,3rd Edition,2018

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Eugene Charnik, Drew McDermott,	Introduction to Artificial Intelligence	Pearson EducationIndia, 1st edition, 2016.
2	Stuart J. Russell and Peter Norvig,	Artificial Intelligence: A Modern Approach	Fourth Edition, Pearson, 2020.
3	Tom M. Mitchell	Machine Learning	India Edition, McGraw Hill Education, 2017.
4	Vinod Chandra	Machine Learning A Practitioners Approach	2021 Edition, PHI Learning

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/105/106105077/
2	https://nptel.ac.in/courses/106/106/106106202/

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	2	2	2	3	1	1	1	1	1	1	2	3	3	3	3
CO-2	3	2	2	2	3	1	1	1	1	1	1	2	3	3	3	3
CO-3	3	2	2	2	3	1	1	1	1	1	1	2	3	3	3	3

0 -- No association 1---Low association, 2--- Moderate association, 3---High association

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Course Title: Big Data Analytics	*Course Code: CS620*
Credits(L:T:P): 3:0:0	*Contact Hours (L: T: P):39:0:0*
Type of Course: Lecture	*Category: Professional Core Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: Database Management System

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

CO-1	Comprehend the significance, structure and standards of big data.
CO-2	Evaluate analytical scalability, methods & tools of data analytics.
CO-3	Apply data stream computing techniques.
CO-4	Analyze frequent item sets and different clustering techniques.
CO-5	Comprehend different Frame works and Visualization tools

Unit No.	Course Content	No. of Hours
1.	Introduction To Big Data: Big data definition, Is The "Big" Part or the "Data" Art More Important, Big Data Different from other databases, Big Data is More of the Same, Risks of Big Data –Why you need to tame Big Data –The Structure of Big Data- Exploring Big Data, Most Big Data Doesn't Matter- Filtering Big Data Effectively –Mixing Big Data with Traditional Data- The need For Standards Today's Big Data Is Not Tomorrow's Big Data. Web Data: The Original Big Data –Web Data Overview –What Web Data Reveals –Web Data in Action? A Cross-Section of Big Data Sources and The Value They Hold.	8
2.	Data Analysis: Evolution of Analytic Scalability, Convergence, Parallel Processing Systems, Cloud Computing, Grid Computing, Map Reduce, Enterprise Analytic Sand Box, Analytic Data Sets, Analytic Methods, Analytic Tools: Cognos – MicroStrategy – Pentaho. Analysis Approaches, Statistical Significance, Business Approaches, Analytic Innovation, Traditional Approaches, Iterative.	8
3	Mining Data Streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in A Stream, Filtering Streams, Counting Distinct Elements in A Stream, Estimating Moments, Counting Oneness in A Window, Decaying Window, Real Time Analytics Platform (RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Predictions.	8
4.	Frequent Itemsets and Clustering: Mining Frequent Itemsets, Market Based Model, Apriori Algorithm, Handling Large Data Sets in Main Memory, Limited Pass Algorithm, Counting Frequent Itemsets in A Stream, Clustering Techniques, Hierarchical, K-Means, Clustering	8

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	High Dimensional Data, CLIQUE And PROCLUS, Frequent Pattern Based Clustering Methods, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.	
5.	Frameworks And Visualization: Map-reduce, Hadoop, Hive, Mapr Sharding, Nosql Databases, S3- Hadoop Distributed File Systems, Visualizations: Visual Data Analysis Techniques, Interaction Techniques; Systems and Applications.	7

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	Bill Franks	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics	John Wiley & sons, 2017
2	Anand Rajaraman and Jeffrey David Ullman	Mining of Massive Datasets	Cambridge University Press, 2016

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Paul Zikopoulos and Chris Eaton	Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data: Analytics for Enterprise Class Hadoop and Streaming Data	McGraw Hill Professional, 2015
2	Michael Berthold and David J. Hand	Intelligent Data Analysis	Springer, 2017
3	Alex Holmes	Hadoop in Practice	Manning Press, 2016
4	Dan McCreary and Ann Kelly	Making Sense of NoSQL: A guide for managers and the rest of us	Manning Press, 2016

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/104/106104189/
2	https://nptel.ac.in/courses/106/106/106106142/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	3	3	3	2	2	2	0	1	2	3	3	2	1	2	2
CO-2	3	3	3	2	2	2	2	0	1	2	3	2	3	1	3	3
CO-3	3	3	2	3	3	2	2	1	1	2	3	2	3	1	3	3
CO-4	3	3	2	3	3	2	1	1	2	0	3	2	2	1	2	2
CO-5	3	3	3	2	3	2	1	1	2	1	2	2	2	1	2	2

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Course Title: Internet of Things	*Course Code: CS630*
Credits (L: T: P): 4:0:0	*Contact Hours: 52:0:0*
Type of Course: Lecture	*Category: Professional Core Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: Data Communication, Computer Networks.

Course Outcomes: After completion of the course, students are able to:

CO-1	Interpret the impact and challenges posed by IoT networks leading to new architectural Models.
CO-2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.
CO-3	Appraise the role of IoT protocols for efficient network communication.
CO-4	Elaborate the need for Data Analytics and Security in IoT.
CO-5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

Unit No.	Course Content	No. of Hours
1	What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	10
2	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	10
3	IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	10
4	Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.	10
5	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints – Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring	12

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Raspberry Pi, Programming Raspberry Pi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to Raspberry Pi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.	

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN:978-9386873743),2017
2	Srinivasa K G	Internet of Things	CENGAGE Leaning India, 2018.

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Vijay Madisetti and ArshdeepBahga	Internet of Things (A Hands-on-Approach)	1ST Edition, VPT, 2014. (ISBN:978-8173719547)
2	Raj Kamal	Internet of Things: Architecture and Design Principles	1ST Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224) publisher.
3	Cuno Pfister	Getting Started with the Internet of Things	O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1.
4	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle,	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	1st Edition, Academic Press, 2014

Web resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/105/106105195/
2	https://nptel.ac.in/courses/106/105/106105166/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	3	2	2	3	1	1	2	2	3	3	3	2	3	3	2
CO-2	3	3	3	3	3	2	2	2	2	3	3	3	2	3	2	2
CO-3	3	2	3	3	3	2	2	2	3	3	2	3	3	3	3	2
CO-4	3	3	3	3	3	2	3	2	2	3	2	3	3	3	2	2
CO-5	3	3	3	3	3	2	2	2	3	3	2	2	3	3	3	2

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Course Title: Computer System Security	*Course Code: CS640*
Credits (L: T: P): 3:0:0	*Contact Hours: 39:0:0*
Type of Course: Lecture	*Category: Professional Core Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: Data Communication.

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

CO-1	Analyze common computer security vulnerabilities/attacks.
CO-2	Analyze security issues in computer systems.
CO-3	Apply various security mechanisms to computer systems.
CO-4	Comprehend the different security policies.

Unit No.	Course Content	No. of Hours
1	**Introduction**: Computer Security Concepts, Threats, Attacks and Assets, Security functional requirements, Fundamental security design principles, Attack surfaces and attack trees, Computer security strategy.	08
2	**Cryptographic Tools:** Confidentiality with symmetric encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data.	08
3	**Buffer Overflow:** Stack Overflows, Defending Against Buffer Overflows, **Software security:** Software Security Issues, Handling Program Input.	07
4	**Operating Systems Security:** Introduction to Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security.	08
5	**Physical Security:** Overview, Physical Security Threats, Physical Security Prevention and Mitigation Measures, Recovery from Physical Security Breaches, Example: A Corporate Physical Security Policy. **Human Resources Security:** Security Awareness, Training, and Education, Employment Practices and Policies, E-Mail and Internet Use Policies,	08

Text Book:

Sl. No.	Author/s	Title	Publisher Details
1	William Stallings and Lawrie Brown	Computer Security: Principles and Practice	PHI, 2008, Reprint 2020

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	David Salomon	Foundations of computer security	British Library Cataloguing in Publications springer,2006
2	Michael Goodrich, Roberto Tamassia	Introduction to Computer Security	International Edition, Pearson Publishing,2013
3	William Stallings	Cryptography and Network Security	4rdEdition, Prentice Hall, 2006, reprint 2019

Web Resources:

Sl. No.	Web link
1	www.williamstallings.com/Security2e.html
2	https://nptel.ac.in/courses/106/106/106106199/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	2	2	2	0	0	1	0	0	0	1	0	1	1	1	0
CO-2	2	1	2	2	0	1	0	0	1	0	0	0	2	2	1	1
CO-3	2	2	2	2	0	1	0	0	1	0	0	0	1	1	1	1
CO-4	2	1	1	1	0	0	1	0	0	1	0	0	1	1	0	1

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Course Title: Wireless Communication	*Course Code: CS651*
Credits (L: T: P): 4:0:0	*Contact Hours (L: T:P): 52:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-Requisite: Data Communication

Course Outcomes: After completion of the course, students are able to:

CO-1	Analyze Cellular System.
CO-2	Analyze GSM system of wireless communication.
CO-3	Establish the difference between GSM and CDMA technology.
CO-4	Analyze wireless LAN.

Unit No.	Course Content	No. of Hours
1	Introduction to wireless telecommunication systems and Networks, History and Evolution Different generations of wireless cellular networks 1G, 2g,3G and 4G networks. Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components, Cellular component identification Call establishment.	12
2	Wireless network architecture and operation, Cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security GSM and TDMA techniques, GSM system overview, GSM Network and system Architecture, GSM channel concepts, GSM identifiers	10
3	GSM system operation, Traffic cases, Cal handoff, Roaming, GSM protocol architecture. TDMA systems. CDMA technology, CDMA overview, CDMA channel concept CDMA operations	10
4	Wireless Modulation techniques and Hardware, Characteristics of air interface, Path loss models, wireless coding techniques, Digital modulation techniques, OFDM, UWB radio techniques, Diversity techniques, Typical GSM Hardware	10
5	Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN Introduction to 802.15X technologies in PAN Application and architecture Bluetooth Introduction to Broadband wireless MAN, 802.16X technologies.	10

Text Book:

Sl. No.	Author/s	Title	Publisher Details
1	Gary J.Mullet	Wireless Telecommunication Systems and Networks	Thomson Leaning,13th edition, 2016

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Lee W. C. Y	Mobile Cellular Telecommunication	2nd edition, MGHPress,2009
2	D P Agrawal	Wireless communication	2nd Edition Thomson learning 2007
3	David Tse, Pramod Viswanath	Fundamentals of Wireless Communication	1st Edition, Cambridge 2005.
4	S. S. Manvi, M. S. Kakkasageri	Wireless and Mobile Network concepts and protocols	1st edition, John Wiley India Pvt. Ltd, 2010.

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/117/102/117102062
2	https://swayam.gov.in/nd1_noc19_ee48/preview

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	2	2	3	2	3	2	0	2	0	1	1	3	2	1	3
CO-2	3	2	2	2	2	3	1	1	1	2	1	2	2	2	1	2
CO-3	3	2	2	2	2	3	1	1	2	2	1	2	2	2	1	2
CO-4	2	3	2	2	2	3	1	1	1	0	2	2	2	2	1	3

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Course Title: Natural Language Processing	*Course Code:CS652*
Credits (L: T: P): 4:0:0	*Contact Hours (L: T: P): 52:0:0*
Type of Course: Lecture	*Category: Professional Elective course*
CIE Marks: 50	*SEE Marks: 100*

Pre-Requisite: Theory of Computation.

Course outcomes: After completing this course, students should be able to:

CO-1	Understand the importance of natural language and concepts of text mining.
CO-2	Analyze the natural language text.
CO-3	Illustrate information retrieval techniques.0
CO-4	Apply conventional techniques in NLP.

Unit No.	Course Content	No. of Hours
1	**Overview and language modeling:** Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. **Language Modeling**: Various Grammar- based Language Models-Statistical Language Model.	10
2	**Word level and syntactic analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word Classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency-Parsing-Probabilistic Parsing.	10
3	**Semantic Analysis:** Introduction, Meaning representation, Lexical semantics, Ambiguity, Word sense disambiguation **Discourse Processing:** Introduction, Cohesion, Reference resolution, Discourse coherence and Structure **Natural Language Generation:** Introduction, Architecture of NLG systems, Generation Task and representation, application of NLG	10
4	**Information Retrieval-1:** Introduction, Design features of Information retrieval systems, Information retrieval models, classical Information retrieval models, non-classical model of IR, Alternative models of IR, Evaluation of IR system	12
5	**Information Retrieval-2:** Introduction, Natural language processing IR, relation matching, knowledge-based approaches, conceptual graphs in IR, Cross lingual information retrieval. **Other application:** Introduction, Information extraction, Automatic text summarization, Question and answering system.	10

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Text Book:

Sl. No.	Author/s	Title	Publisher Details
1.	TanveerSiddiqui, U.S. Tiwary	"Natural Language Processing and Information Retrieval"	1st Edition, Oxford University Press, 2008.

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1.	Anne Kao and Stephen R. Poteet (Eds)	Natural Language Processing and Text Mining	Springer-Verlag London Limited 2007
2.	Daniel Jurafsky and James H Martin	Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition	2nd Edition, Prentice Hall, 2008
3.	Gerald J. Kowalski and Mark.T. Maybury	Information Storage and Retrieval systems	Kluweracademic Publishers, 2000.
4.	Manning, Christopher and Heinrich,Schutze,	Foundations of Statistical Natural Language Processing,	MIT Press, 1999.

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/101/106101007/
2	https://nptel.ac.in/courses/106/105/106105158/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	2	2	2	2	1	1	1	2	2	1	2	2	2	2	2
CO-2	3	3	3	2	3	1	1	1	3	3	1	3	3	3	3	3
CO-3	2	3	3	2	3	2	1	1	2	3	1	3	3	3	3	3
CO-4	2	3	3	3	3	2	1	1	3	3	1	3	3	2	3	2

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Course Title: Embedded Systems	*Course Code: CS653*
Credits (L:T:P): 4:0:0	*Contact Hours(L:T:P): 52:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: Computer Organization and Architecture.

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

CO-1	Explore embedded system applications and importance of Real time systems.
CO-2	Get an insight into the hardware aspects of the embedded computing systems.
CO-3	Analyze the performance of embedded systems program and power optimizations.
CO-4	Realize the importance of Real time operating systems and its functionality.
CO-5	Experiment with embedded systems IDE and development procedures.

Unit No.	Course Content	Hours
1.	Embedded Computing, Instruction Sets: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process, Formalism for System design, Design Example: Model Train Controller. Preliminaries, ARM Processor.	10
2.	CPUs, Bus-Based Computer Systems: Programming Input and Output, Supervisor mode, Exceptions, Traps, Coprocessors, Memory Systems Mechanisms, CPU Performance, CPU Power Consumption. Design Example: Data Compressor. Basic Computing Platforms, CPU Bus, Memory Devices and systems, Designing with computing platforms, Consumer Electronic architecture, Platform level performance analysis, Design Example: Alarm Clock.	10
3	Program Design and Analysis: Components for embedded programs, Models of programs, Assembly, Linking and Loading, Compilation Techniques, Program level performance analysis, Software performance optimization, Program-Level energy and power analysis and optimization, Analysis and optimization of program size, Program validation and testing. Design Example: Software modem.	10
4.	Real Time Operating System (RTOS) Based Design: Basics of OS, Kernel, types of OSs, tasks, processes, Threads, Multitasking and Multiprocessing, Context switching, Scheduling Policies, Task Communication, Task Synchronization. Inter process Communication mechanisms, Evaluating OS performance, Choice of RTOS, Power Optimization. Design Example: Telephone Answering machine	12

| 5. | Embedded Systems Development Environment: The Integrated Development Environment, Types of File generated on Cross Compilation, Dis-assembler/Decompiler, Simulators, Emulators, and Debugging, Target Hardware Debugging. | 10 |

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	Marilyn Wolf	Computers as Components, Principles of Embedded Computing Systems Design	4th Edition, Elsevier, 2017
2	Shibu K V	Introduction to Embedded Systems	2nd Edition, McGraw Hill, 2016

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	James K. Peckol	Embedded Systems, A Contemporary Design Tool	2nd Edition, Wiley India, 2019.
2	Raj Kamal	Embedded Systems: Architecture, Programming and Design	*2nd Edition, Tata McGrawHill* Education, 2013
3	Joseph Yiu	The Definitive Guide to the ARM Cortex-M3	2nd Edition, Newnes, (Elsevier), 2010.
4	Furber S	ARM System on chip Architecture	2nd Edition, Addison Wiley 2008

Web Resources:

Sl. No.	Web link
1	http://nptel.ac.in/courses/108102045
2	http://swayam.gov.in/course/3573

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	3	2	3	2	3	2	0	2	0	1	1	3	2	1	3
CO-2	3	2	3	2	2	3	1	1	1	2	1	2	2	2	1	2
CO-3	3	2	2	2	2	3	1	0	2	2	1	2	2	2	1	2
CO-4	2	3	2	2	2	3	1	1	1	0	2	2	2	2	1	3
CO-5	3	2	2	2	2	3	1	0	1	0	2	2	2	2	2	1

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Course title: Cloud Computing	*Course Code: CS654*
Credits (L: T: P): 4:0:0	*Total Contact Hours: 52:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: Operating Systems, Computer Network.

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

CO-1	Illustrate the fundamentals and essentials of cloud computing.
CO-2	Identify appropriate design choices for solving cloud computing problems and manage the various aspects of cloud system.
CO-3	Describe cloud virtualization technologies and achieve complex solutions driven by Service Oriented Architecture.

Unit No.	Course Content	No. of Hours
1.	**Introduction:** Business and IT Perspective, Cloud and virtualization, Cloud services requirements, Dynamic cloud infrastructure, Cloud computing characteristics, Cloud adoption. Cloud Rudiments, Cloud models: Cloud characteristics, Measured Service Accounting, Cloud models, Security in a public cloud, public verses private clouds, Cloud infrastructure self-service.	10
2.	**Cloud as a service:** Gamut of cloud solutions, Principal technologies, Cloud strategy, Cloud design and implementation using SOA, Conceptual cloud model, Cloud service defined. Cloud solutions: Cloud ecosystem, Cloud business process management, Cloud service management, Cloud stack, Computing on demand, Cloud sourcing.	10
3	**Cloud offerings:** Cloud analytics, Testing under cloud, Information security, Virtual desktop infrastructure, Storage cloud. Cloud management: Resiliency, Provisioning, Asset management, Cloud governance, High availability and disaster recovery, Charging models, usage reporting, billing and metering.	12
4.	**Cloud virtualization technology:** Virtualization defined, Virtualization benefits, Server virtualization, Virtualization for x86 architecture, Hypervisor management software, Virtual infrastructure requirements. Storage virtualization, Storage area networks, Network attached storage, Cloud server virtualization.	10
5.	**Cloud and SOA:** SOA journey to infrastructure, SOA and the cloud, SOA defined, SOA and IAAS, SOA based cloud infrastructure steps, SOA business and IT services.	10

Text Book:

Sl. No.	Author/s	Title	Publisher Details
1	Dr. Kumar Saurabh	Cloud Computing	4thedition, Wiley India, 2017.

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	RajkumarBuyya, James Broberg, Andrzej M. Goscinski	Cloud Computing: Principles and Paradigms	Wile, 2011
2	Barrie Sosinsky	Cloud Computing Bible	Wiley India. 2011
3	Nikos Antonopoulos, Lee Gillam	Cloud Computing: Principles, Systems and Applications	Springer, 2012
4	Ronald L. Krutz, Russell Dean Vines	Cloud Security: A Comprehensive Guide to Secure Cloud Computing	Wiley-India, 2010

Web Resources:

Sl. No.	Web link
1	http://nptel.ac.in/courses/106105167/
2	https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	0	2	2	2	2	2	1	2	3	1	2	2	1	3	3	3
CO-2	1	2	2	1	2	2	2	2	2	2	1	2	1	3	3	3
CO-3	2	2	3	3	2	3	3	2	1	3	3	3	1	3	3	3

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Course title: System Simulation and Modeling	*Course Code:CS655*
Credits (L: T: P): 4:0:0	*Contact Hours (L: T: P): 52:0:0*
Type of Course: Lecture	*Category: Professional Elective course*
CIE Marks: 50	*SEE Marks: 100*

Pre-requisite: NIL

Course Outcomes: After completion of the course, students are able to:

CO-1	Comprehend about System and its Environments.
CO-2	Analyze the applications using distribution methods.
CO-3	Implementation of random number and Variate Generations using various techniques.
CO-4	Analyze system responsiveness, scalability etc. for input modeling.
CO-5	Develop performance models for simple real-world systems and solve those models to obtain meaningful performance measures.

Unit No.	Course Content	No. of Hours
1.	Introduction to Simulation: System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation. Simulation Examples: Simulation of Queuing systems, other examples of simulation, Queuing Models: Characteristics of Queuing systems, Queuing notations, long run measures of performance of Queuing systems, Steady state behavior of infinite population.	10
2.	General Principles: Concepts of discrete event simulation, List processing, Statistical Models in Simulation: Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution.	10
3	Random Number Generation: Properties of random numbers, Generation of pseudo random numbers, Techniques for generating Random numbers, Tests for random numbers Random variate Generation: Inverse transform technique, Convolution method, Acceptance rejection techniques	10
4.	Input Modeling: Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models. Verification and Validation of Simulation Model: Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models	10
5.	Output Analysis for a Single Model: Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation, Comparison and Evaluation of Alternative System Design: Comparison of two system design,	12

	Comparison of several system design, Meta modeling, Optimization via simulation.	

Text Book:

Sl. No.	Author/s	Title	Publisher Details
1.	Jerry Banks, John Carson, Barry Nelson, David Nicol	Discrete Event System Simulation	5th Edition, PHI, 2016.

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1.	Gefrey Gordon	System Simulation	PHI, 2nd edition, 2000.
2.	Bernard Zeigler, Herbert Praehofer, Tag Gon Kim	Theory of Modeling and Simulation	Academic Press, 2nd edition, 2001.
3.	Donald W.Body	System Analysis and Modeling	3rd edition, Pearson Education, 2001
4.	Averill M. Law	Simulation Modeling and Analysis	4th Edition, Tata McGraw- Hill, 2007

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/112107220/
2	https://nptel.ac.in/courses/Ej26SZrcPAg

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	2	1	1	1	1	2	1	2	1	1	2	2	2	2	2
CO-2	3	3	3	3	3	1	2	1	3	2	1	3	3	2	2	2
CO-3	3	3	3	3	3	1	2	1	2	2	1	3	3	2	2	2
CO-4	3	3	3	3	3	1	2	1	3	2	1	3	3	2	3	2
CO-5	3	2	3	3	3	1	2	1	3	3	3	3	3	2	3	2

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Course Title: Social media Analytics and Data Driven Innovation	Course Code: CS661
Credits (L: T: P): 2:0:0	Contact Hours (L: T: P): 26:0:0
Type of Course: Lecture	Category: Elective
CIE Marks: 25	SEE Marks: 50

Prerequisite: Nil.

Course Outcomes: After completion of the course, students are able to:

CO-1	Comprehend social media analytics and its significance.
CO-2	Utilize analytics tools' skills required for analysing the effectiveness of social media.
CO-3	Identify the innovation potential and impact of social media data in organizations.

Unit No.	Course Content	No. of Hours
1	**Introduction:** Analysing the social web. A brief history of the social web. The diversity of user activities, Need for SMA, Applications of SMA. **Network Structure and Measures:** Describing nodes and edges. Describing networks-Types and properties of social networks, Network Visualization-Layouts, Visualizing network features. Tie Strength - Measuring Tie Strength. Capturing Correlations-Triangle, Clustering and Assortativity.	8
2	**Content in social media:** Social Data: Where and Why? Defining Content-Focus on Text and Unstructured data. Finding the Right Data, using content feature to identify topics. **Social Media Data Analysis:** Data identification, Data Analysis, The Social Analytics Process, Customizing and Modifying Tools, Visually Representing Unstructured Data, Topic Modelling.	9
3	**Information Interpretation:** Social information filtering, social media in public sector, Business use of social media, Common Visualizations, Visualization as an Aid to analytics, creating features from text: NLP, Identifying opinion. **Data-Driven Innovation:** Healthcare, Policy makers, small, medium and large businesses, Social Media services online, Privacy.	9

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	Jennifer Golbeck	Analyzing the Social Web	Elsevier, 2013
2	Matthew Ganis, Avinash Kohirkar	Social Media Analytics: Techniques and Insights for Extracting Business Value Out of social media	Pearson, 2016

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Azizi Othman	Media Web Mining and Analysis	Willey, 2019
2	Jim Sterne	Social Media Metrics: How to Measure and Optimize Your Marketing Investment	Wiley, Latest Edition

Web Resources:

Sl. No.	Web link
1	https://ssir.org/articles/entry/big_data_for_social_innovation
2	https://www.siia.net/Divisions/Public-Policy-Advocacy-Services/Priorities/Data-Driven-Innovation

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	3	3	3	2	2	2	0	1	2	3	3	2	1	2	2
CO-2	3	3	3	2	2	2	2	0	1	2	3	2	3	1	3	3
CO-3	3	3	2	3	3	2	2	1	1	2	3	2	3	1	3	3

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Course Title: Ethical Hacking	*Course Code: CS662*
Credits (L: T: P): 2:0:0	*Contact Hours (L: T: P): 26:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks: 25	*SEE Marks: 50*

Pre-requisite: Computer Networks.

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

CO-1	Understanding the basics of hacking and ethical hacking.
CO-2	Demonstrate how intruders escalate privileges.
CO-3	Analyze tools and techniques to carry out testing.

Unit No.	Course Content	No. of Hours
1	Introduction to hacking and ethical hacking, Distinguish between hacking and ethical hacking, Phases of ethical hacking, Ethical hacking importance, Different types of hackers. Casing the Establishment: What is foot printing, Internet Foot printing, Scanning: Scan Types, Identifying TCP and UDP Services Running, Windows-Based Port Scanners, Port Scanning Breakdown, Active and passive stack fingerprinting.	9
2	Enumeration, basic banner grabbing, Enumerating Common Network services. Case study: Network Security Monitoring. Hacking the Unix: The Quest for Root, Remote Access vs Local access, Remote access, Local access, after hacking root.	8
3	Dial-up, PBX, Voicemail and VPN hacking, preparing to dial up, War-Dialing, Brute Force Scripting PBX hacking, Voice mail hacking, VPN hacking, Network Devices: Discovery Autonomous System Lookup, Public Newsgroups, Service Detection, Network Vulnerability, Detecting Layer 2 Media.	9

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	Stuart McClure, Joel Scambray and Goerge Kurtz	Hacking Exposed 7: Network Security Secrets& Solutions	Tata Mc Graw Hill Publishers, 2010

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Patrick Engebretson	The Basics of Hacking and Penetration Testing: Ethical	Syngress, Kindle Edition 2011

		Hacking and Penetration Testing Made Easy	
2	Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle	Gray Hat Hacking the Ethical Hackers Handbook	3rd Edition, McGraw-Hill Osborne Media Paperback, 2011
3	Rafay Baloch	Ethical Hacking and penetrating testing: A Beginners Guide to Ethical Hacking	CRC Press, Auerbach Publications; 1st edition, 2014
4	Ben Smith and Brian Komar	Microsoft windows security: Resource kit	Microsoft Press; 2nd edition, 2005

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106105217/
2	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	3	2	2	2	2	2	3	2	2	1	3	3	2	2	2
CO-2	3	3	2	2	3	1	2	2	3	2	1	3	3	3	2	2
CO-3	3	2	2	3	3	2	1	3	3	2	2	3	3	3	3	3

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Course Title: Industry 4.0	*Course Code: CS663*
Credits (L: T: P): 2:0:0	*Contact Hours (L: T: P): 26:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks:25	*SEE Marks: 50*

Pre-requisite: NIL

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

CO-1	Remember, Understand and Apply IoT concepts in developing smart services.
CO-2	Apply Cloud computing with the Smart devices.
CO-3	Analyze the Scope of Automation in Industries for making them Industry 4.0 ready.

Unit No.	Course Content	No. of Hours
1	**INTRODUCTION TO INDUSTRY 4.0** The Various Industrial Revolutions - Digitalization and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - The Journey so far: Developments in USA, Europe, China and other countries - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.	9
2	**ROAD TO INDUSTRY 4.0** Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics.	9
3	**TECHNOLOGIES FOR INDUSTRY 4.0** Cyber physical Systems - Robotic Automation and Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Related Disciplines - Cyber Security.	8

Text Book:

Sl. No	Author/s	Title	Publisher Details
1	Alasdair Gilchrist	Industry 4.0: The Industrial Internet of Things	A press publisher 2016

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Reference Books:

Sl. No	Author/s	Title	Publisher Details
1	Koh Colin	Industry 4.0	Independently Published
2	Pascual D G	Handbook Of Industry 4.0 And Smart Systems	Taylor & Francis Ltd, 2020 Edition
3	Sudip Misra (Author), Chandana roy (Author), Anandarup Mukherjee (Author)	Introduction to Industrial Internet of Things and Industry 4.0 Paperback	CRC Press, 1st edition, January 2021
4	Fernandez Mario	INDUSTRY 4.0: Technologies and Management in the Digital Transformation of the Industry	Independently Published

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/105/106105195/
2	https://www.youtube.com/watch?v=as5kJagB6co

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	2	3	1	2	1	1	1	2	2	2	1	2	3	1	1
CO-2	3	1	2	2	1	1	1	1	2	2	2	2	2	3	1	1
CO-3	2	2	2	2	1	1	1	1	2	2	2	3	2	2	1	1

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Course Title: Bioinformatics and Computational Genomics	*Course Code: CS664*
Credits (L: T: P): 2:0:0	*Contact Hours (L: T: P): 26:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks: 25	*SEE Marks: 50*

Prerequisites: Nil.

Course Outcomes: After completion of the course, students are able to:

CO-1	Understand the fundamental concepts of sequence data from biological databases.
CO-2	Analyze sequence alignment methods using similarity finding tools.
CO-3	Comprehend the concepts of gene identification, finding, prediction and genome studies.

Unit No.	Course Content	No. of Hours
1	**Biological Databases:** Introduction to Bioinformatics, overview of history, scope, databases, types of databases, bibliographic databases, Biological databases, Information flow in bioinformatics, curation, annotation and quality control, flat file formats in different databases, Primary and secondary databases, nucleotide and protein sequence databases, structural databases, specialized databases, expression and proteomics databases, databases of metabolic pathways, genome databases, gene databases, RNA databases, medical databases, integrated retrieval systems.	08
2	**Sequence Alignment Methods:** Methods of pairwise sequence alignment, Dot matrix, pair wise sequence comparison, low complexity regions, repetitive elements Global and local alignment, significance of these alignments, dynamic programming method, scoring matrices HSP, look up table method and gap penalties in sequence alignment, statistical significance of alignments, PAM and BLOSUM matrices, their comparison, database similarity searching, homology versus similarity, FASTA and BLAST, different flavors of BLAST.	09
3	**Gene Predictive Methods and Genome Mapping:** Introduction to genes, gene signals, computationally predicting genes, locating ORFs, binding sites and promoters, regulatory region finding, transcription prediction,transcription start prediction, splice site prediction programs, translation initiation sites,gene-finding strategies, gene-finding methods, gene prediction in prokaryotes, eukaryotic gene prediction, gene expression analysis,gene prediction using neural networks, assessing gene prediction programs, Performance evaluation,gene finders, software programs used in gene finding, Introduction to genome	09

| | mapping, HGP, genome sequencing, genome analysis and annotation, genome sequence assembly, comparative genomics, Functional genomics: sequence-based approaches, utility of EST database in sequencing, SAGE, microarray-based approaches, comparison of SAGE and DNA microarrays, SNPs and their relevance. | |

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	Jin Xiong	Essential Bioinformatics	Cambridge University Press, 2016
2	Baxevanis A. D. and B. F. Francis Ouellette	Bioinformatics a practical guide to the analysis of genes and proteins	Third edition, John Wiley and Sons, 2015

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	David W. Mount	Bioinformatics sequence and Genome analysis	Second Edition, CBS publishers and Distributors, 2014
2	Shun Oing Ye	Bioinformatics- A practical approach	Chapman and Hall, 2016
3	Lesk, A. K	Introduction to Bioinformatics	4th Edition, Oxford University Press, 2013
4	Mount, D.W.	Bioinformatics Sequence and Genome Analysis	2nd Edition, Cold Spring Harbor Laboratory Press, 2014

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/102/103/102103044/
2	https://onlinecourses.nptel.ac.in/noc20_bt40/preview

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	3	1	3	2	2	0	0	1	1	3	3	2	1	2	2
CO-2	3	0	1	2	2	2	0	0	1	1	1	2	3	1	3	3
CO-3	2	3	2	3	2	1	0	0	1	2	1	2	3	1	3	3

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Course Title: Forensics and Cyber Law	*Course Code: CS665*
Credits (L: T: P): 2:0:0	*Lecture Hours (L: T: P): 26:0:0*
Type of Course: Lecture	*Category: Professional Elective Course*
CIE Marks: 25	*SEE Marks: 50*

Pre-requisite: Nil

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

CO-1	Understand the concepts of computer forensics.
CO-2	Analyze various types of evidences and its collection methods.
CO-3	Comprehend the legal perspectives of cybercrimes and cybersecurity.

Unit No.	Course Content	No. of Hours
1	**Computer Forensics Fundamentals:** Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of professional Forensics Methodology, Steps taken by Computer Forensics Specialists. **Types of Computer Forensics Technology:** Types of Military Computer Forensic Technology, Types of Law Enforcement, Computer Forensic Technology, Types of Business Computer Forensic Technology.	8
2	**Computer Forensics Evidence and capture:** Data Recovery Defined, Data Back-up and Recovery, The Role of Back-up in Data Recovery, The Data-Recovery Solution. **Evidence Collection and Data Seizure:** Evidence Collection Need, Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The chain of custody. **Computer Image Verification and Authentication:** Special Needs of Evidential Authentication, Practical Considerations, Practical Implementation, Safe Boxes and the Vault, Security Considerations.	9
3	**Cybercrimes and Cybersecurity: The Legal Perspectives** Introduction, Need of Cyber laws: The Indian Context, The Indian IT Act: Admissibility of Electronic Records: Amendments made in the Indian ITA 2000, Positive Aspects of the ITA 2000, The Weak Areas of the ITA 2000, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act. Amendments to the Indian ITA 2008: Overview of	9

| | Changes Made to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario. | |

Text Books:

Sl. No.	Author/s	Title	Publisher Details
1	John R, Vacca	Computer Forensics: Computer Crime Scene Investigation	2nd edition, Charles River Media, Inc, New Delhi, 2014
2	Nina Godbole, Sunit Belapur	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives	Wiley 2017

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Robert C. Newman	Computer Forensics: Evidence Collection and Management	Taylor and Francis Group 2016.
2	Vivek Sood	Cyber Law simplified	Mc-Graw Hill, 2013
3	Bill Nelson, Amelia Phillips and Christopher Steuart	Guide to Computer Forensics and Investigations	4th Edition, Cengage Learning, 2015.
4	K. Jaishankar	Cyber Criminology: Exploring Internet Crimes and Criminal Behavior	Taylor and Francis Group 2017.

Web Resources:

Sl. No.	Web link
1	https://onlinecourses.swayam2.ac.in/ugc19_hs25/
2	https://nptel.ac.in/courses/106/106/106106178/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	2	1	1	1	1	0	2	0	1	1	2	1	2	1	2	2
CO-2	0	2	2	2	2	0	1	0	1	2	1	1	3	1	3	3
CO-3	2	3	3	3	3	0	2	0	3	3	2	2	3	1	3	3

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Course Title: IoT Laboratory	*Course Code: CS67L*
Credits (L: T: P): 0:0:1.5	*Contact Hours: 0:0:39*
Type of Course: Practical	*Category: Professional Core Course*
CIE Marks: 50	*SEE Marks: 50*

Pre-requisite: NIL

Course Outcomes: After completion of course, the students are able to:

CO-1	Design and develop sensor and control-based applications using Arduino, MSP 430 microcontroller.
CO-2	Design and develop sensor and interfacing based applications using Raspberry PI and Ordroid Xu4 SOCs.
CO-3	Should be able to address real life IOT applications using the knowledge acquired using above experiments.

Lab Session No.	Course Content

1.	**Microcontroller Experiments using Arduino and TI MSP430:**
	Sensor based Experiments
	  a. Testing Temperature sensors
	  b. FIRE SENSOR
	  c. HEART BEAT SENSOR

2.	**Microcontroller Experiments using Arduino and TI MSP430:**
	  a. Digital/Analog Temperature sensor
	  b. Humidity sensor
	  c. Flame sensor
	  d. Big sound/small sound sensor

3.	**Microcontroller Experiments using Arduino and TI MSP430:**
	  a. Touch sensor
	  b. Tracking sensor
	  c. Tap sensor

4.	**Microcontroller Experiments using Arduino and TI MSP430:**
	Control and communication Experiments
	  a. Mercury tilt switch
	  b. Laser emitter
	  c. Ball switch

5.	**Microcontroller Experiments using Arduino and TI MSP430:**
	  a. Button
	  b. IR emitter
	  c. Shock sensor
	  d. Rotary encoder

6.	**Microcontroller Experiments using Arduino and TI MSP430:** Display and I/O interfacing

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	a. LED flash light b. 7-segmented display c. Joystick d. RGB LED
7.	**Microcontroller Experiments using Arduino and TI MSP430:** a. SMD RGB LED b. 7-color LED c. Two color LED d. Active/Passive Buzzer e. IR receiver
8.	**SOC Experiments using Raspberry PI or Ordroid Xu4:** Sensor based Experiments a. Testing Temperature sensors b. FIRE SENSOR c. HEART BEAT SENSOR
9.	**SOC Experiments using Raspberry PI or Ordroid Xu4:** a. Digital/Analog Temperature sensor b. Humidity sensor c. Flame sensor d. Big sound/small sound sensor
10.	**SOC Experiments using Raspberry PI or Ordroid Xu4:** a. Touch sensor b. Tracking sensor c. Tap sensor
11.	**SOC Experiments using Raspberry PI or Ordroid Xu4:** Control and communication Experiments a. Mercury tilt switch b. Laser emitter c. Ball switch
12.	**SOC Experiments using Raspberry PI or Ordroid Xu4:** a. Button b. IR emitter c. Shock sensor **d.** Rotary encoder
13	**Lab Test/Event**

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Vijay Madisetti and Arshdeep Bahga	Internet of Things (A Hands-on-Approach)	1ST Edition, VPT, 2014. (ISBN: 978-8173719547)
2	Raj Kamal	Internet of Things: Architecture and Design Principles	1ST Edition, McGraw Hill Education, 2017. (ISBN: 978-352605224) publisher.
3	Cuno Pfister	Getting Started with the Internet of Things	O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1.
4	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence	1st Edition, Academic Press, 2014.

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/105/106105195/
2	https://nptel.ac.in/courses/106/105/106105166/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	3	2	2	3	1	1	2	2	3	3	3	2	3	3	2
CO-2	3	3	3	3	3	2	2	2	2	3	3	3	2	3	2	2
CO-3	3	2	3	3	3	2	2	2	3	3	2	3	3	3	3	2

0 -- No association 1---Low association, 2--- Moderate association, 3---High association

Educate Elevate Enlighten

JSS Mahavidyapeetha
JSS Science And Technology University
(Established Under JSS Science and Technology University Act No. 43 of 2013)

Course Title: Machine Learning Laboratory	*Course Code: CS68L*
Credits (L: T: P): 0:0:1.5	*Contact Hours (L: T: P): 0:0:39*
Type of Course: Lecture	*Category: Professional Core Course*
CIE Marks: 50	*SEE: 50*

Pre-requisite: Linear Algebra, Probability Theory

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

CO-1	Analyze the Linear Algebraic operations on the data representation and manipulation
CO-2	Generate and model the various data analysis visualizations and plots using statistical function
CO-3	Design and develop various clustering algorithms
CO-4	Apply various Regression and Classification methods on any real-world datasets
CO-5	Apply and analyze the working of Simple Neural Networks and DNN in performing machine learning tasks

Unit No.	Course Content
1	Simple Programs using conditional statements, looping, arrays and functions.
2	Visualization of Linear algebraic models using Geogebra/Python both 2-D and 3-D Visualize Vector/Matrix space representation, Vector operation
3	Visualize the Schwarz Inequality, Triangular Inequality
4	Visualize Ax=y transformation as projections using set of simultaneous equations to find the vector x.
5	Write Python scripts for handling multivariate csv dataset using Pandas/Numpy arrays
6	Plotting functions using Python Matplotlib and Seaborn packages Plot histograms of various data distributions such as Normal, poison, chi-square.
7	a) Represent the n-d data using Scatter plots, box plot, heat maps, contour plots, 3d surface plots b) Represent the mean, Standard deviation, variance and other statistical measure using various distributions
8	Write Python scripts to perform unsupervised clustering techniques K-means E-M clustering
9	Write Python scripts to develop following Machine learning tasks on any chosen dataset a. Linear Regression b. Logistic Regression
10	Write Python scripts to develop following Machine learning tasks on any chosen dataset a. Bayesian Classifiers

	b. Adaboost classifiers	
	c. decision tree classifier	
11	Write Python script to develop Simple Multilayer Perceptron Neural Network model for classification on any chosen dataset	
12	Write Python script to develop Deep Neural Networks (CNN/RNN) model for classification on any chosen dataset	
13	**Lab Test/Event**	

Reference Books:

Sl. No.	Author/s	Title	Publisher Details
1	Andreas C. Müller, Sarah Guido	**Introduction to Machine Learning with Python: A Guide for Data Scientists**	1st Edition, O'Reilly Publication
2	Ethem Alpaydin	Introduction to Machine Learning	PHI Learning,3rd Edition,2018
3	Mark Lutz	Programming Python	4th Edition, O'Reilly Publication
4	Tom M. Mitchell	Machine Learning	India Edition, McGraw Hill Education, 2017.

Web Resources:

Sl. No.	Web link
1	https://nptel.ac.in/courses/106/105/106105077/
2	https://nptel.ac.in/courses/106/106/106106202/

Course Outcomes	Program Outcomes												PSO's			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2	PSO3	PSO4
CO-1	3	2	2	2	3	2	1	1	0	0	2	2	3	3	3	3
CO-2	3	2	2	2	3	2	1	1	0	0	2	2	3	3	3	3
CO-3	3	2	2	2	3	2	1	1	0	0	2	2	3	3	3	3
CO-4	3	2	2	2	3	2	1	1	0	0	2	2	3	3	3	3
CO-5	3	2	2	2	3	2	1	1	0	0	2	2	3	3	3	3

0 -- No association 1---Low association, 2--- Moderate association, 3---High association