Detailed Syllabus
Lecture-wise Breakup

Subject Code	17M11CS122	Semester: Even (specify Odd/Even)	Semester II Session 2023-2024 Month from Jan'24 to June'24
Subject Name	Performance Evaluation of Computing Systems		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Kavita Pandey
	Teacher(s) (Alphabetically)	Dr. Kavita Pandey

COURSE OUTCOMES		COGNITIVE LEVELS
C114.1	Outline the correct tools and techniques for computer system performance evaluation.	Understand (level 2)
C114.2	Identify the probability distribution in data reflecting system randomness.	Apply (level 3)
C114.3	Apply stochastic processes in various real-world problems.	Apply (level 3)
C114.4	Inspect the mathematical modeling techniques for analyzing any given system.	Analyze (level 4)
C114.5	Select the appropriate experiments and perform a simulation study of the given system.	Evaluate (level 5)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Overview of Performance Evaluation	Need for Performance Evaluation, Systematic approach to Performance Evaluation, Selection of evaluation techniques and performance metrics	5
2.	Random Variables and Probability distributions	Discrete and continuous random variable, Expectation and variance, Bernoulli random variable, Binomial distribution, Poisson distribution, Geometric distribution, Normal and Exponential distribution, Normal approximation and Poisson approximation to binomial distribution, hazard rate function, , Comparing systems using sample data, Confidence interval	10
3.	Markov Process	Introduction and classification of stochastic processes, Discrete time and Continuous time markov chains, Birth and death processes , Transition probabilities, Steady state solution, Performance measure in terms of time spent and expected reward	6
4.	Queuing models	Basics of Queuing theory, Kendall notation, Little's Law, Analysis of a single queue with one server and multiple servers, Analysis of finite buffers queuing systems	8

5.	Simulation modeling	Introduction to simulation, Types of simulation, Random number generation, a survey of random number generators, seed selection, testing random number generators, random variate generation	6
6.	Measurement techniques and tools	The art of data presentation, Ratio Games	2
7.	Experimental design and analysis	Types of Experimental designs, 2^2 factorial designs, General 2^K factorial designs, 2^{K-p} fractional factorial designs	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks	
T1	20	
T2	20	
End Semester Examination	35	
TA	25 (Attendance (10 Marks), Assignments / Quiz / Mini project (15 Marks)	
Total	**100**	

Project based Learning: Each student in a group of 2-3, study the research papers related to experimental designs and present their summary in the form of report. To make it application based, students select the recent articles which is applied on various contemporary domains. Understanding the research papers gives them the knowledge about applicability of experimental designs in identifying the important factors, their variations, etc.

Recommended Text books:

1.	Raj Jain, "The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation, and Modeling", Wiley, Reprint Edition, © 2014.
2.	K.S. Trivedi, "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd Edition, Reprint Edition, © 2018.

Recommended Reference books:

1.	Ross, Sheldon M. "A First Course in Probability". Upper Saddle River, N.J.: Pearson Prentice Hall, 10th Edition, ©2019
2.	Obaidat, Boudriga, "*Fundamentals of Performance Evaluation of Computer and Telecommunication Systems* ", 2010, Wiley, ISBN 978-0-471-26983
3.	Ross, Sheldon M. "Introduction to Probability Models". Amsterdam: Academic Press, 12th Edition, ©2019
4.	Fortier, Michel, "Computer Systems Performance Evaluation and Prediction", 2003, Elsevier, ISBN 1-55558-260-5

Detailed Syllabus
Lab-wise Breakup

Course Code	17M15CS121	Semester **Even 2024**	**Semester M.Tech CSE(2nd)**
			Session 2023-24
			Month from Jan to June, 2024

Course Name	**Cloud and Web Services Software Engineering**		
Credits	3-0-0	**Contact Hours**	3 Hours

Faculty (Names)	**Coordinator(s)**	Dr Sulabh Tyagi
	Teacher(s) **(Alphabetically)**	Dr. Sulabh Tyagi

COURSE OUTCOMES		COGNITIVE LEVELS
C113.1	Demonstrate role of Software engineering in combining cloud and web services computing paradigms for service development	Understand (level 2)
C113.2	Categorize various cloud services into compute, storage, database, application, analytics, network, and deployment.	Understand (level 2)
C113.3	Analyze the requirements for developing and migrating applications to Web and Cloud Services	Analyze (level 4)
C113.4	Evaluate different design patterns, reference architectures performance metrics, testing for Cloud and Web Services	Evaluate (level 5)
C113.5	Make use of web & cloud services and service engineering process to design, implement, and test, deploy and execute services.	Create Level (level 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Distributed Software Engineering	Software Engineering Meets Services and Cloud Computing, Distributed Systems, Models of Interaction, Client and Server Computing, Architectural Patterns for distributed systems, Software as Service.	3
2.	Service-oriented software engineering	Service-Oriented Computing, Service-Oriented Architecture (SOA), Service Engineering and Service Composition	4
3.	Modelling Service Composition	Business Process Modeling Notation (BPMN), block-structured process execution languages, including BPML and BPEL, Modelling tools like Bizagi,BPMN.io etc	5
4.	Introduction Web to Services	Brief of Web Services, Service Oriented Architectures, Core Functionality- SOAP, WSDL,UDDI, Microservices Architecture	4
5.	Designing and Implementing Services	Web Service Development Life Cycle, SOAP, Restful Services, Microservices – Domian Driven Design, Implementation, Deployment and Testing of Services	4

6.	Address SE in Web services	Web Services Design Pattern, Metrics to Measure Web Service Performance.	3
7.	Introduction to Cloud Services	Cloud Services, Cloud Deployment Models, Cloud Technologies and Open Source Software, Challenges - Scaling Computation, Scaling Storage, Multi-Tenancy, Availability, Limitations and Challenges in Cloud-Based Applications Development	3
8.	Cloud Services from Amazon	IAM services-users, groups, policy and roles, Elastic Compute Cloud, Databases on Amazon, Storage on Amazon services,	6
9.	Migrate, Secure and Consume Services	Migration of Application to Web or Cloud Service, Enabling SSL authentication and authorization, consuming services using another service or application.	4
10.	Address SE in Cloud services	Cloud Services Design Pattern, Metrics to Measure Cloud Service Availability, elasticity, Scalability, Load balancing, Auto scaling. Performance, Cloud Service Automation	6
		Total number of Lectures	**42**

Evaluation Criteria

Components Maximum Marks
T1 20
T2 20
End Semester Examination 35
TA 25
Attendance = 05
Internal assessment & Assignments in PBL mode = 20
(A Macro Assignment is given which will make the student conversant in design, creation and implementation of an application using Web Services and Cloud Services. This will make them industry ready in applying web and cloud services)

Total 100

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Mahmood Z, Saeed S (eds) (2013) Software Engineering Frameworks for the Cloud Computing Paradigm. Springer-Verlag, London
2.	Cloud Computing: A Hands-On Approach Book by Arshdeep Bahga and Vijay K. Madisetti, December 2013 CreateSpace Independent Publishing Platform7290 Investment Drive # B North Charleston SC United States
3.	Cloud Computing Design Patterns Book by Amin Naserpour, Robert Cope, and Thomas Erl, June 2015, Prentice Hall Press One Lake Street Upper Saddle River, NJ United States
4.	Software Engineering Book by Ian Sommerville Apil 2015, Pearson
5.	Amazon Web Services for Mobile Developers: Building Apps with AWS October 2017, Abhishek Mishra, SYBEX Inc. 2021 Challenger Drive Alameda, CA United States
6.	Web Services, Service-Oriented Architectures, and Cloud Computing, Second Edition: The Savvy Manager's GuideJanuary 2013, Douglas K. Barry, Morgan Kaufmann Publishers Inc. 340 Pine Street, Sixth Floor San Francisco CA United States

Reference Books

7.	XML, Web Services, and the Data Revolution Book by Frank P. Coyle , March 2002, Addison-WesleyLongman Publishing Co., Inc.75 Arlington Street, Suite 300 Boston, MA,United State
8.	Design Patterns: Elements of Reusable Object-Oriented Software with Applying UML and Patterns: AnIntroduction to Object-Oriented Analysis and Design and the Unified Process by Erich Gamma, RichardHelm, Ralph Johnson, and John Vlissides, 2003
9.	Cloud Computing and Software Services Theory and Techniques Syed A hson and Dr. Mohammad Ilyas July 2010, CRC Press, Inc. Subs. of Times Mirror 2000 Corporate Blvd. NW Boca Raton, FL, United State

Programme Outcomes: M.Tech (CSE)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program.

Programme Specific Outcomes: M.Tech (CSE)

PSO 1: Students should be able to develop and implement the solution of real life computing problems using contemporary technologies.

PSO 2: Students should be able to apply ethical principles and commit to professional and social responsibilities.

COs	PO 1	PO 2	PO 3	PSO1	PSO2
C113.1			2	3	**1**
C113.2	2	3	3	3	**1**
C113.3			2	2	
C113.4	3	3	3	3	**1**
C113.5	3	3	3	3	**1**
AVG.	2.7	3	2.6	2.8	1

1. **CO-PO and CO-PSO Mapping (M. Tech- CSE) II sem:**

COs	PO 1	PO 2	PO 3	PSO1	PSO2
C113.1			2 Analysis of Cloud Architecture and its association with service computing	3 Understanding of Virtualization Technology	1 API creation and its fair and ethical usage is demonstrated
C113.2	2 Basic principles and architectures of Service computing is demonstrated	3 Various Cloud Service types and deployment models are demonstrated	3 Various Virtualization techniques in Cloud Model are demonstrated	3 Designing and implementing various cloud solutions	1 Analysis of ethical policies related to privacy and fair usage of cloud
C113.3			2 Analysis of instances on AWS, Elastic Compute Cloud (EC2) etc.	2 Analysis of Simple Storage Service (S3)	
C113.4	3 Role of micro services in cloud computing	3 Evaluation of Services oriented architectures viz. SOSP, WSDL, UDDI	3 .Performance evaluation of microservices architecture	3 Performance Evaluation of services design patterns.	1 Analysis of different web services metrics.
C113.5	3 Creation of AWS,Elastic Compute Cloud (EC2) features	3 Creation of AWS storages and their features, namely, Simple Storage Service (S3),	3 Development of instances on AWS, EC2, storage and other services	3 Creation of micro services and its deployment over containers	1 Analysis of Docker architecture, and its secure deployment.
AVG.	2.7	3	2.6	2.8	1

Module Coordinator: Course Coordinator: Dr. Sulabh Tyagi

Course Code	17M15CS122	Semester Even	Session: 2023 - 2024
			Month from: Jan 24 to June 24
Course Name	Performance Engineering Lab		
Credits	2	Contact Hours	2 hrs

| Faculty (Names) | Coordinator(s) | Dr. Asmita Yadav |
| | Teacher(s) (Alphabetically) | Dr. Asmita Yadav
Dr. Kavita Pandey |

COURSE OUTCOMES		COGNITIVE LEVELS
C174.1	Experiment with profilers to calculate the performance and statistics of a program in terms of call counts and timing information of functions.	Apply (level 3)
C174.2	Calculate the performance of data mining algorithms on real world data sets using Weka, NetworkX tool.	Apply (level 3)
C174.3	Compare the performance of different protocols by simulating various wired and wireless network scenarios in Python, Wireshark, NS2 Simulator.	Analyze (level 4)
C174.4	Examine the performance of M/M/1, M/D/1 and D/M/1 Queuing models in NS2.	Analyze (level 4)
C174.5	Reframe the Model computer systems using Markov Chain Theory with Performance Evaluation Process Algebra (PEPA), and visualizing network performance	Evaluate (level 5)

Module No.	Title of the Module	List of Experiments	CO
1.	GNU Profiler	Use the Gprof (GNU Profiler) to analyze the performance and statistics of a program	1
2.	Data Science Tools	Data analysis using WEKA tool	2
3.	Network Simulation	Introduction to Network simulator (NS2) and its various utilities NAM, XGraph etc. Creation of Wired and Wireless Network Scenarios and simulation of various protocols Wired and Wireless Network Performance Analysis using AWK and Python	3
4.	Queuing Analysis	Simulation of various queues in NS2 and analyzing their performances on various performance metrics such as throughput, average delay and packet loss	4
5	Performance Evaluation Process Algebra	Model computer systems using Markov Chain Theory and Perform Steady State Analysis, and Visualizing network performance using Open Source Tools	5

Evaluation Criteria

Components   *Maximum Marks*

Evaluation-1:	15
Lab Test-1:	20
Lab Test-2:	20
Evaluation-2:	15
Project:	15
Attendance:	15
Total	**100**

Project based Learning: Each student in a group of 3-4 will study the research papers related to performance analysis of software systems. The articles should be recent and in relation with the subject contents. Understanding and implementing the research paper(s) enhances the student's working experience towards studied tools and concepts.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Unix and Shell Programming by B. M. Harwani, Oxford University Press, 2013
2.	Mastering Wireshark by Charit Mishra, Packt Publishing, 2016
3.	Mastering Linux Shell Scripting, A Practical Guide to Linux Command-line, Bash Scripting, and Shell Programming, 2nd Edition by Mokhtar Ebrahim, Andrew Mallett, Packt Publishing, 2018
4.	Modeling and Simulation in Python: An Introduction for Scientists and Engineers by Allen Downey, No Starch Press, 2023
5.	Practical Packet Analysis Using Wireshark to Solve Real-world Network Problems by Chris Sanders, No Starch Press, 2007
6.	Introduction to Network Simulator NS2 by Teerawat Issariyakul, Ekram Hossain, Springer, 2009
7.	Predictive Analytics Applications with WEKA by Shuzlina Abdul Rahman & Sofianita Mutalib, 2021
8.	Marc Greis Tutorial for the UCB/LBNL/VINT Network Simulator NS
9.	GPROF Tutorial – How to use Linux GNU GCC Profiling Tool
10.	The ns Manual, available at: isi.edu/nsnam/ns/doc/ns_doc.pdf

CO-PO and CO-PSO Mapping:

COs	PO1	PO2	PO3	PSO1	PSO2
C174.1	**2**	**1**	**1**		
C174.2	**2**	**2**	**2**		
C174.3	**2**	**2**	**2**	**2**	**2**
C174.4	**2**	**1**	**2**	**1**	**2**
C174.5	**2**	**2**	**2**	**2**	**2**
Avg.	2	2	2	2	2

Course Code	17M15CS123	Semester II	Semester ... Session 2023-2024
			Month from Jan to June, 2024

Course Name	IoT Systems Development Lab		
Credits	1	Contact Hours	2 Hours

Faculty (Names)	Coordinator(s)	Dr Vivek Kumar Singh
	Teacher(s) (Alphabetically)	Dr. Meenal Dr. Vivek Kumar Singh

	COURSE OUTCOMES	COGNITIVE LEVELS
C181.1	Explain Node-RED IDE platform for IoT application development and demonstrate I/O nodes, flows, third party palettes, import/export of flows in Node-RED.	Understand (level 2)
C181.2	Develop user defined functional nodes and deploy it in Node-Red.	Apply (level 3)
C181.3	Analyze various IoT Communication protocols using APIs with Arduino and Raspberry Pi along with sensors and actuators.	Analyze (level 4)
C181.4	Apply and evaluate the characteristics of different IoT devices.	Evaluate (level 5)
C181.5	Design and develop IoT based applications for various challenges and problems related to Sustainable Development, e.g., energy and waste management, water conservation, clean energy, improving public health, sustainable urbanization, smart agriculture etc.	Create (level 6)

Module No.	Title of the Module	List of Experiments	CO
1.	Node-Red Installation and Use	Setup and Install Node.js and Node-RED as IDE platform for IoT application development.	CO1
2.		Demonstrate I/O nodes, flows, third party palettes, import/export of flows in Node-RED	CO1
3.		Develop Java Script based IoT applications using functional nodes , flows and dashboard on Node-RED platform	CO2
4.		Developing and implementation of user defined nodes for creating flows in Node-Red.	CO2
5.	Study and use of Arduino and Raspberry Pi, sensors and actuators.	Study and interface of Arduino and Rasberry Pi with different types of sensors and actuators	CO2
6.		Creation of various IoT based applications using Arduino and Rasberry Pi	CO3, CO4
7.	Developing IoT based systems applications using Arduino and Raspberry Pi	Developing smart applications for various challenges and problems related to Sustainable Development, e.g., energy and waste management, water conservation, clean energy, improving public health, sustainable urbanization, smart agriculture etc.	CO5

Evaluation Criteria

Components	Maximum Marks
Lab Test# 1	20
Lab Test# 2	20
Attendance	15
D2D	30
IoT System Development PBA	10
Report of Project	5
Total	**100**

Project based learning: Students form group of size 2-3 members. Each group will identify several real life issues in various thrust areas like healthcare, industrial, education, smart city, logistics, environment, governance and etc. Once problem has been identified, the group will analyze the problem and synthesizeIoT system based solutions to the identified problem. Each group will apply different IoTbased approaches such as smart sensor and heterogeneous devices. This approach will enhance skills of each student and increase the understanding of IoT systems in distributed applications. Moreover, candidate will gain the enough knowledge to provide the IoT solution to enhance the quality of life in human/organization. After this course, a student will able to undertake any work in this area in the industry or research.	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Internet of Things: Architecture and Design Principles, Raj Kamal, McGrawHill.
2	"Internet of Things: A Hands-on Approach", by ArshdeepBahga and Vijay Madisetti
3	https://nodered.org/docs/getting-started
4.	https://www.arduino.cc/en/Tutorial/HomePage
5.	https://www.raspberrypi.org/documentation/

CO-PO and CO-PSO Mapping:

	PO1	PO2	PO3	PSO1	PSO2
C181 .1	2	1	1	2	
	Moderately related to principles of problem analysis and use of different tools.	Slightly related to the application knowledge of engineering problems related to IoT.	Slightly Mapped as understanding of fundamentals of the system components and demonstration of the basics.	Moderately Mapped as understanding of fundamentals of research problems and their application in real-life application.	
C181 .2	3	2	3	3	1
	Strongly Mapped as applying various functional requirement in different real-world applications	Moderately mapped in identifying and analyzing different function requirements for different problems and report it.	Strongly Mapped designing and developing solutions using user defined functional nodes to solve real -life problems.	Strongly Mapped as identifying suitable algorithms to develop real world applications using multiprocessing approaches	Slightly Mapped as interpretation of applicability of functional nodes for different social applications like Health-care etc.
C181 .3	2	3	2	2	1
	Moderately Mapped as implementing and analyzing various IoT protocols for different tasks.	Strongly Mapped in identifying and analyzing IoT protocols reporting specific requirement.	Moderately Mapped designing and developing solutions to implement real-life problems using analysis over communication protocol.	Moderately Mapped as identifying the best communication protocol for specific real-life problems.	Slightly Mapped as interpretation of applicability of different protocols in real-life applications of IoT.
C181 .4	3	3	2	2	1
	Strongly Mapped as evaluating the criterion for selecting various IoT devices as per the requirement of application.	Strongly Mapped as reporting the criterion for selecting various IoT devices as per the requirement of application.	Moderately Mapped in designing and developing the solution with the help of evaluated sensors to ensure correct and efficient operation.	Moderately Mapped as developing various IoT applications, using appropriate devices, programming languages and tools.	Slightly Mapped as Demonstrating problem-solving skills by analyzing and addressing the problem of selecting the correct and efficient devices.
C181 .5	3	3	3	3	2
	Strongly Mapped as Understanding and applying various state of art techniques to design and develop the sustainable solution of a real-life problem.	Strongly Mapped as creating the reports for various state of art techniques to design and develop the sustainable solution of a real-life problem.	Strongly Mapped in Applying critical thinking skills to demonstrate the strengths and weaknesses of different design prototypes, enabling the selection of the most suitable solutions for specific scenarios.	Strongly Mapped as Applying core knowledge of IoT and System development to design and analyze the Sustainable systems.	Moderately Mapped as interpretation of social problems by analyzing and optimizing the performance of various Sustainable systems.
NBA Code: C181	3	2	2	2	1

Detailed Syllabus
Lab-wise Breakup

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	17M15CS121	Semester	Semester M.Tech CSE(2ⁿᵈ)
		Even 2024	Session 2023-24
			Month from Jan to June, 2024

Course Name	Cloud and Web Services Software Engineering

Credits	3-0-0	Contact Hours	3 Hours

Faculty (Names)	Coordinator(s)	Dr Sulabh Tyagi
	Teacher(s) (Alphabetically)	Dr. Sulabh Tyagi

COURSE OUTCOMES		COGNITIVE LEVELS
C113.1	Demonstrate role of Software engineering in combining cloud and web services computing paradigms for service development	Understand (level 2)
C113.2	Categorize various cloud services into compute, storage, database, application, analytics, network, and deployment.	Understand (level 2)
C113.3	Analyze the requirements for developing and migrating applications to Web and Cloud Services	Analyze (level 4)
C113.4	Evaluate different design patterns, reference architectures performance metrics, testing for Cloud and Web Services	Evaluate (level 5)
C113.5	Make use of web & cloud services and service engineering process to design, implement, and test, deploy and execute services.	Create Level (level 6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Distributed Software Engineering	Software Engineering Meets Services and Cloud Computing, Distributed Systems, Models of Interaction, Client and Server Computing, Architectural Patterns for distributed systems, Software as Service.	3
2.	Service-oriented software engineering	Service-Oriented Computing, Service-Oriented Architecture (SOA), Service Engineering and Service Composition	4
3.	Modelling Service Composition	Business Process Modeling Notation (BPMN), block-structured process execution languages, including BPML and BPEL, Modelling tools like Bizagi,BPMN.io etc	5
4.	Introduction Web to Services	Brief of Web Services, Service Oriented Architectures, Core Functionality- SOAP, WSDL,UDDI, Microservices Architecture	4
5.	Designing and Implementing Services	Web Service Development Life Cycle, SOAP, Restful Services, Microservices – Domian Driven Design, Implementation, Deployment and Testing of Services	4

6	Address SE in Web services	Web Services Design Pattern, Metrics to Measure Web Service Performance.	3
7	Introduction to Cloud Services	Cloud Services, Cloud Deployment Models, Cloud Technologies and Open Source Software, Challenges - Scaling Computation, Scaling Storage, Multi-Tenancy, Availability, Limitations and Challenges in Cloud-Based Applications Development	3
8	Cloud Services from Amazon	IAM services-users, groups, policy and roles, Elastic Compute Cloud, Databases on Amazon, Storage on Amazon services,	6
9	Migrate, Secure and Consume Services	Migration of Application to Web or Cloud Service, Enabling SSL authentication and authorization, consuming services using another service or application.	4
10	Address SE in Cloud services	Cloud Services Design Pattern, Metrics to Measure Cloud Service Availability, elasticity, Scalability, Load balancing, Auto scaling. Performance, Cloud Service Automation	6
		Total number of lectures	**42**

Evaluation Criteria

Components Maximum Marks

T1 20
T2 20
End Semester Examination 35
TA 25
Attendance = 05
Internal assessment & Assignments in PBL mode = 20
(A Macro Assignment is given which will make the student conversant in design, creation and implementation of an application using Web Services and Cloud Services. This will make them industry ready in applying web and cloud services)

Total 10

Course Code	19M12CS112	Semester EVEN (specify Odd/Even)	Session 2023 -2024 Month from Jan to June	
Course Name	Meta-Heuristics Modelling and Optimization			
Credits	3		Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Ankita Verma
	Teacher(s) (Alphabetically)	Dr. Ankita Verma

COURSE OUTCOMES At the completion of the course, Students will be able to		COGNITIVE LEVELS
C131.1	Understand the concepts of Meta-heuristics based optimization and it's utility in a diverse range of applications.	Understand Level (L2)
C131.2	Apply a single solution and population based Meta-heuristic algorithms to solve a given optimization problem.	Apply Level (L3)
C131.3	Apply Meta-heuristic algorithms to solve Multi-objective optimization problems.	Apply Level (L3)
C131.4	Apply hybrid and quantum based Meta-heuristic algorithms to solve a given optimization problem.	Apply Level (L3)
C131.5	Analyze the performance of any Meta-heuristic algorithm for a real world problem.	Analyze Level (L4)

Module No.	Title of the Module	Topics in the Module	CO Mapping	No. of Lectures for the module
1.	Introduction	Optimization Models, Approximate Algorithms, When to use Meta-heuristics?, Methods and Application	CO1	3
2.	Fundamentals of Meta-heuristics	Representation, Objective Functions; Constraint Handling; Parameter Tuning; Performance Analysis.	CO1	3
3.	Single-Solution Based Meta-heuristics	Basic Concepts, Fitness Landscape Analysis; Local Search; Tabu Search; Iterated and Guided Local search;	CO2	6
4.	Population-Based Meta-heuristics Methods	Basic Concepts; Evolutionary Algorithms (Genetic Algorithm, Differential Evolution), Swarm Intelligence: Stochastic diffusion search (Ant Colony Optimization), Social cognitive optimization (Particle Swarm Optimization, GWO)	CO2	8
5.	Meta-heuristics for Multi-objective Optimization	Basic concepts; Multi-objective Continuous and Combinatorial Problems, Multi-criteria Decision Making; Many objectives and large scale optimization, Design Issues.	CO3	5
6.	Fitness Assignment Strategies and	Scalar approach, Criterion-Based Methods; Dominance-Based Approaches; Indicator based Approaches; Diversity Preservation; Performance Evaluation MOPSO, NSGA-2,	CO3, CO5	8

	Evaluation of Multi-objective Optimization	NSGA-3, SPEA, SPEA-2		
7.	Hybrid Meta-heuristics	Design and Implementation Issues; Mathematical Programming Approaches; Classical Hybrid Approaches; Hybrid Meta-heuristics with Machine Learning and Data Mining; Hybrid Meta-heuristics for Multi-objective Optimization. Understanding Quantum based multi-objective optimization and its applications.	CO4, CO5	9
		Total number of Lectures		**42**

	Evaluation Criteria
	Components **Maximum Marks** T1 20 T2 20 End Semester Examination 35 TA 25 (Attendance(10), Assignments/Project (15) **Total** **100**

Project based learning: Each group of 3-4 students will be assigned an optimization problem at the beginning. They are required to apply the meta-heuristic methods they study on the given problem.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
[1]	E.-G. Talbi, Meta-heuristics: From design to implementation. Hoboken, New Jersey, USA: John Wiley & Sons, 2009.
[2]	G. Z¨apfel, R. Braune, and M. B¨ogl, Meta-heuristic search concepts: A tutorial with applications to production and logistics. Heidelberg: Springer Science & Business Media, 2010.
[3]	M. Gendreau and J.-Y. Potvin, Handbook of meta-heuristics. New York, USA: Springer, 2010.
[4]	S. Luke, Essentials of Metaheuristics. Lulu, 2013. Available for free at http://cs.gmu.edu/~sean/book/meta-heuristics/.
[5]	C. C. Ribeiro and P. Hansen, Essays and surveys in metaheuristics. New York, USA: Springer Science & Business Media, 2012.
[6]	F. Glover and G. A. Kochenberger, Handbook of metaheuristics. Dordrecht: Kluwer Academic Publishers, 2003.
[7]	I. H. Osman and J. P. Kelly, Meta-heuristics: Theory and applications. Norwell, Massachusetts, USA: Kluwer Academic Publishers, 2012. 41
[8]	S. Voß, S. Martello, I. H. Osman, and C. Roucairol, Meta-heuristics: Advances and trends in local search paradigms for optimization. New York, USA: Springer Science & Business Media, 2012.
[9]	T. F. Gonzalez, Handbook of approximation algorithms and metaheuristics. Boca Raton, FL, USA: CRC Press, 2007.
[10]	J. Dr´eo, A. Petrowski, P. Siarry, and E. Taillard, Metaheuristics for hard optimization: Methods and case studies. Berlin Heidelberg: Springer Science & Business Media, 2006
[11]	P. Siarry and Z. Michalewicz, Advances in metaheuristics for hard optimization. Berlin Heidelberg: Springer Science & Business Media, 2007.
[12]	K. F. Doerner, M. Gendreau, P. Greistorfer, W. Gutjahr, R. F. Hartl, and M. Reimann, Metaheuristics: Progress in complex systems optimization. New York, USA: Springer Science & Business Media, 2007.
[13]	X.-S. Yang, Nature-inspired optimization algorithms. London, UK: Elsevier, 2014.

1. CO-PO and CO-PSO Mapping:

COs	PO1	PO2	PO3	PSO 1	PSO2
C131.1	**1** Basic concepts of meta-heurstics are introduced	**1** Explanation of terminologies used in algorithms	**1** Understanding utility of meta-heurtistic algorithms	**1** For applying meta-heuristic, basic terms are explained	
C131.2	**3** Apply algorithms to solve practical problems independently	**2** Understanding algorithm application to write a technical document	**2** Mastery over application of single and population based algorithms	**3** Apply algorithms to real life computing problems independently	**1** Follow the rules of comparing the algorithm's performance
C131.3	**3** Apply algorithms to solve practical problems independently	**2** Understanding algorithm application to write a technical document	**2** Mastery over application of multi-objective algorithms	**3** Apply algorithms to real life computing problems independently	**1** Follow the rules of comparing the algorithm's performance
C131.4	**3** Apply algorithms to solve practical problems independently	**2** Understanding algorithm application to write a technical document	**2** Mastery over application of hybrid and quantum based algorithms	**3** Apply algorithms to real life computing problems independently	**1** Follow the rules of comparing the algorithm's performance
C131.5	**3** Anlayze practical problems and apply suitable algorithms	**2** Analyze algorithm performance write a technical document	**3** Mastery over application of meta-heuristic algorithms by analyzing its performance	**3** Analyze algorithms on real life computing problems	
Avg.					

Programme Outcomes:

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.
PO2: An ability to write and present a substantial technical report/document.
PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program.

Programme Specific Outcomes: M.Tech (CSE)

PSO 1: Students should be able to develop and implement the solution of real life computing problems using contemporary technologies.
PSO 2: Students should be able to apply ethical principles and commit to professional and social responsibilities.

Course Code	21M21CS123	Semester :Even	Semester Session : EVEN 2024

Course Name	Essential Statistics for Data Science
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Megha Rathi
	Teacher(s) (Alphabetically)	Dr. Megha Rathi

COURSE OUTCOMES		COGNITIVE LEVELS
C184.1	Understand the basic principles of probability and statistics and its need in the context of data science	Understand Level (Level 2)
C184.2	Choose statistical analysis for applications and implement them with advanced statistical programming tools	Apply Level (Level 3)
C184.3	Compare the performance of multiple statistical models and articulate the limitations of formal inference and modeling.	Analyze Level (Level 4)
C184.4	Evaluate statistical techniques for constructing learning models and different measures of model fit.	Evaluate Level (Level 5)
C184.5	Create and test hypothesis for real world applications using statistical modeling techniques.	Create Level (Level 6)

	PO1: An ability to independently carry out research/ investigation and development work to solve practical problems	PO2: An ability to write and present a substantial technical report/document	PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program	PSO 1: Students should be able to develop and implement the solution of real life computing problems using contemporary technologies	PSO2: Students should be able to apply ethical principles and commit to professional and social responsibilities
COs					
C184.1	1 Understand the basic principle of probability and statistics and its need in the context of data science			1 Learn statistical concepts in data science to solve computing problems using advanced technologies	
C184.2	2 Develop own statistical analyses and implement them with advanced statistical programming tools	1 Students will submit a mini project report	2 Apply statistical techniques or packages to solve real time problems	2 Make use of statistical modeling to solve domain problems	
C184.3	2 Compare the performance of multiple statistical methods and models and articulate the	1 Students will submit a mini project report	2 Derive implications from statistical modeling	2 Students will submit a mini-project at the end of semester	

	limitations and abuses of formal inference and modeling.				
C184.4	2 Evaluate statistical techniques for constructing learning models and can use different measures of model fit and performance to assess models.	1 Students will submit a mini project report	3 Solve a domain specific problem and evaluate it's performance	3 Students will submit a mini-project at the end of semester	
C184.5	3 Create real world applications using statistical or data modeling techniques and test hypothesis.	1 Students will submit a mini project report	3 Students will develop applications by applying advanced statistical concepts.	2 Students will submit a mini-project at the end of semester	
AVG.	2	1	2	2	

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Probability and Statistical inference	Modern Statistics, Statistics and Engineering, Probability, Conditional Probability, The Axioms of Probability, Sampling, Randomness, Intro to Statistics: Mean and Variance, Covariance, Types of Convergence.	6
2.	Statistical Methods in Data Science	Data Distribution (Bernoulli, Uniform, Binomial, Normal, Poisson), Mathematical Statistics, Inferential Statistics, Descriptive Statistics, Random Variable, Gauss-Markov theorem, F-distribution	7
3	Hypothesis Testing	Hypothesis Testing, Difference of Means, Significance Level and P-Value, Z-test, ANOVA,T-Test, Redundancy Test, Chi-Square & F-test, Type-I and Type-II errors	7
4.	Data Modeling	Cross validation, Monte Carlo methods, Cluster analysis, Time Series Modeling	6
5.	Introduction to Bayesian Modeling	Bayes' Theorem, Conditional Statements, Bayesian Thinking: priors, posteriors, and Maximum Likelihood Estimation, Bayesian inference	5
6.	Correlation & Regression Models	Correlation Analysis, Linear regression methods, Ridge regression, LASSO Regression , Logistic regression	6
7.	Ensemble Learning	Bagging & Boosting, Random Forest, Adaboost	5
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (**Attendance and Tut Performance (10), Quiz/ Mini-Project/Assignment (15)**)
Total	**100**

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Arnold, T., Kane, M., & Lewis, B. W. (2019). A computational approach to statistical learning. CRC Press.
2.	James, G., Witten, D., Hastie, T., &Tibshirani, R. (2013). Statistical learning. In An Introduction to Statistical Learning (pp. 15-57). Springer, New York, NY.
3.	Gutierrez, D. D. (2015). Machine learning and data science: an introduction to statistical learning methods with R. Technics Publications.
4.	Lomax, R. G., &Hahs-Vaughn, D. L. (2013). An introduction to statistical concepts. Routledge.
5.	Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
6.	Chatfield, C., & Xing, H. (2019). The analysis of time series: an introduction with R. CRC press.
7.	Afifi, A., May, S., Donatello, R., & Clark, V. A. (2019). Practical multivariate analysis. CRC Press.
8.	Zumel, N., & Mount, J. (2014). Practical data science with R. Manning Publications Co..
9.	Saltz, J. S., & Stanton, J. M. (2017). An introduction to data science. SAGE Publications.

Course Code NBA Code	24M12CS122 C146	Semester: Even (Specify: Odd/Even)		Semester: II Session: 2023-24 Months: January to June 2024
Course Name	Deep Learning			
Credits	3		**Contact Hours**	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Tarun Agrawal
	Teacher(s) (Alphabetically)	Dr. Tarun Agrawal

COURSE OUTCOMES		COGNITIVE LEVELS
C146.1	Describe the various basic concept of deep learning concepts.	Understand (Level 2)
C146.2	Illustrate the different concept related to optimization of deep learning models.	Apply (Level 3)
C146.3	Illustrate the different neural network concepts for training of the deep learning models.	Apply (Level 3)
C146.4	Explain the various deep learning architectures for image classification.	Analyze (Level 4)
C146.5	Assess the architectures for detection, segmentation, and generative modelling.	Evaluate (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to deep learning, Supervised, Unsupervised and Semi-supervised learning, Linear and Logistic regression, Confusion matrix, Loss functions	4
2.	Optimization	Bias-variance trade-off, overfitting-underfitting, Activation functions, Gradient descent, Support vector machine, Decision trees and Random forests, Radial Basis Function Networks, Nearest neighbor, kNN classifier	8
3.	Artificial Neural Networks	Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Optimization Techniques, Second derivative test, Batch Optimization	6
4.	Deep neural network concepts	Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, building blocks of CNN, Transfer Learning, RNN, LSTM	8
5.	Architectures	Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Recent Trends in Deep Learning Architectures, Deep learning models	8
6.	Detection and Segmentation	Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc., LSTM Networks, Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network	8
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Tutorial/Quiz/Assignment (10), Mini Project (05))
Total	**100**

Project Based Learning: Students in a group of 3-4 will take some real-world problem and apply deep learning models to solve the problem in a meaning way. Students can able to understand the core logic about data handling and processing using deep learning models.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press
2.	Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.
3.	Deep Learning with Python – Francois Chollet- Manning Publication

Text Books

1.	Deep Learning from Scratch: Building with Python from First Principles by Seth Weidman
2.	Deep Learning: A Practitioner's Approach, by Adam Gibson and Josh Patterson
3.	Hands-On Deep Learning Algorithms with Python by Sudharsan Ravichandran

CO-PO-PSO Table

	PO 1	PO 2	PO 3	PSO 1	PSO 2
C146.1	**2** Moderately related to the basics of deep learning problem				
C146.2	**2** Moderately related to the optimization of deep learning models			**2** Moderately related to optimizing the implementation of deep learning model	
C146.3	**2** Moderately related to the basics of neural network			**2** Moderately related to the implementation of basic neural network	
C146.4	**2** Moderately related to the deep classification neural networks		**2** Moderately related to deep classification models in the artificial intelligence	**2** Moderately related to the implementation of classification model	
C146.5	**2** Moderately related to the deep detection and segmentation neural networks		**2** Moderately related to deep detection and segmentation models in the artificial intelligence.	**2** Moderately related to the implementation of detection and segmentation of deep learning model	
NBA Code: C146	**2.0**		**2.0**	**2.0**	

Detailed Syllabus
Lecture-wise Breakup

Course Code	24M12CS123	Semester: (specify Odd/Even)	Semester Even Session 2023-24 Month from Jan 24 to June 24
Course Name	Text Analytics (C147)		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Shikha Jain
	Teacher(s) (Alphabetically)	Shikha Jain

COURSE OUTCOMES		COGNITIVE LEVELS
C147.1	Discuss concepts of text processing and language models.	Understand Level [Level 2]
C147.2	Make use of different models for POS tagging and parsing techniques for Text analytics.	Apply Level [Level 3]
C147.3	Apply different approaches for Topic modeling for text processing.	Apply Level [Level 3]
C147.4	Compare different supervised and unsupervised language discovery models used for text analytics.	Analyze Level [Level 4]
C147.5	Develop solution by understanding concepts text analytics to solve real world problems	Create Level [Level 6]

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction & Foundations of text processing	Introduction to NLP & text analytics, Tokenization, Lemmatization, Stop word removal.	04
2.	Word embedding	Word embedding and language models: N-gram, Vector representations, Word Embedding, Advanced word vector representations	08
3	Part of Speech Tagging	Hidden Markov Models, Maximum Entropy Markov Models & Conditional Random Fields; Smoothing;	04
4	Syntactic Parsing	Context Free Grammars, Non-probabilistic Parsing, Probabilistic Parsing	05
5	Unsupervised Language Discovery	Statistical Models of Semantics and Unsupervised Language Discovery: resolving ambiguity; Language modeling and Naive Bayes	05
6	Supervised Language Discovery	Supervised Language Discovery: text classification, Sentiment Analysis, document classification	05
7	Topic Modeling	LSI, PLSI, LDA	05

8	Machine Translation	IBM model 1, 2 and 3	04
9	Question Answering Systems	Models: ELMo, BERT, GPT	02
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project based learning: Students in group of 3 to 4 students are required to develop mini-project based on the concepts taught in this course. Problem statements need to be formulated in various applications domains of text analytics, proposing the solution approach and implemented in Python/ Matlab.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Handbook of Natural Language Processing & Machine Translation by Olive, Joseph, Christianson, Caitlin, McCary, John (Eds.), Springer, Latest Edition
2.	Natural Language Understanding by James Allen, Benjamin Cummins Publisher, Latest Edition
3.	Foundations of Statistical NLP by Hinrich Schtze, Christopher D. Manning, Latest Edition
4.	Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (second edition) D. Jurafsky and J. Martin, Latest Edition
5.	Natural Language Processing with Python by Steven Bird, Ewan Klein, and Edward Loper, Latest Edition
6.	Christopher D. Manning, Prabhakar Raghavan, and HinrichSchutze, "An Introduction to Information Retrieval," Cambridge UP, 2009. Chap. 6,pp. 109–133

COs	PO1	PO2	PO3	PSO 1	PSO2
C147.1	1 Students will understand the various preprocessing algorithms and large language models.		1 Towards the end of the semester, students will submit a mini-project taken from the domain of Text Analytics		
C147.2	2 Students will apply algorithms to solve various open problems in the domain.	1 Students will submit a mini project report	2 Towards the end of the semester, students will submit a mini-project taken from the domain of Text Analytics	2 Various real-world problems in the domain will be discussed and given in assignments/exam	
C147.3	2 Students will apply algorithms to solve various open problems in the domain.	1 Students will submit a mini project report	2 Towards the end of the semester, students will submit a mini-project taken from the domain of Text Analytics	2 Various real-world problems in the domain will be discussed and given in assignments/exam	
C147.4	2 Students will analyze algorithms to solve various open problems in the domain.	1 Students will submit a mini project report	2 Towards the end of the semester, students will submit a mini-project taken from the domain of Text Analytics	2 Various real-world problems in the domain will be discussed and given in assignments/exam	1 Students will work on mini project to provide ethical solution to the real world problem
C147.5	2 Students will design solutions for various open problems in the domain.	2 Students will submit a mini project report	3 Towards the end of the semester, students will submit a mini-project taken from the domain of Text Analytics	3 Various real-world problems in the domain will be discussed and given in assignments/exam	1 Students will work on mini project to provide ethical solution to the real world problem
Avg.	1.8	1.25	2	2.25	1

Subject Code	24M12CS128	Semester: EVEN	Semester: 2nd Session: 2023 -2024
			Month from: Jan to June 2024

Subject Name	Digital Forensics	
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. P. Raghu Vamsi
	Teacher(s) (Alphabetically)	Dr. P. Raghu Vamsi

COURSE OUTCOMES		COGNITIVE LEVELS
C163.1	Explain the concept of Cyber crimes and summarize the legal frameworks of different types of Cyber crimes.	Understand (Level - 2)
C163.2	Demonstrate the different forms of digital forensic investigation and its life cycle.	Understand (Level - 2)
C163.3	Make use of various digital forensic tools in real-time scenarios for investigation procedures.	Apply (Level - 3)
C163.4	Examine network logs, cache, cookie, history recorded in web browsers, file systems of Windows, Linux, and Mac operating systems.	Analyze (Level - 4)
C163.5	Analyze email crime, dark web, and static and malware code.	Analyze (Level - 4)

Module No.	Subtitle of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Digital Forensics	Fundamentals of Digital Forensics,Digital Evidence, Forensic Readiness, Roles and Responsibilities of a Forensic Investigator, Legal Compliance in Computer Forensics, Commercial and open source tools for digital forensics, Setting up Kali Linux for digital forensics process, Anti-forensic tools.	05
2.	Computer Forensic Investigation Process	Forensic Investigation Process and its Importance, Pre-investigation, Investigation Phase, Post-investigation Phase, Indian IT Act 2000, IT Amendment Act 2008 and Indian Evidence Act.	05
3	Understanding File systems and Storage media	Understanding Hard Disks and File Systems, Different Types of Disk Drives and their Characteristics, Logical Structure of a Disk, Booting Process of Windows, Linux, and Mac Operating Systems, File Systems of Windows, Linux, and Mac Operating Systems, File System Examination	04
4	Incident Response and Data Acquisition	Data Acquisition and Duplication, Data Acquisition Fundamentals, Types of Data Acquisition, Data Acquisition Format, Data Acquisition Methodology, Data imaging and hashing, Evidence Acquisition and Preservation with DC3DDand Guymager, File Recovery and Data Carving with Foremost, Scalpel, and Bulk Extractor	04
5	Operating System Forensics	Windows Forensics, Volatile and Non-Volatile Information, Windows Memory and Registry Analysis, Cache, Cookie, and History Recorded in Web Browsers, Windows Files and Metadata, Linux and Mac Forensics, Volatile and Non-Volatile Data in Linux, Analyze File system Images Using The Sleuth Kit, Memory Forensics, Mac Forensics.	05
6	Network Forensics	Network Forensics Fundamentals, Event Correlation Concepts and Types, Identify Indicators of Compromise (IoCs) from Network Logs, Investigate Network Traffic, Network and Internet Capture Analysis with Xplico	05

7	**Investigating Web Attacks**	Web Application Forensics, IIS and Apache Web Server Logs, Investigating Web Attacks on Windows-based Servers, Detect and Investigate Attacks on Web Applications, Dark web forensics - Tor browser forensics	05
8	**Malware Forensics**	Malware, its Components and Distribution Methods, Malware Forensics Fundamentals and Recognize Types of Malware, Analysis, Static Malware Analysis, Analyze Suspicious Word Documents, Dynamic Malware Analysis.	05
9	**Investigating Email Crimes**	Email Basics, Email Crime Investigation, steps and tools.	02
10	**Defeating Anti-forensics Techniques**	Anti-forensics and its Techniques, Anti-forensics Countermeasures	02
		Total Lectures	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance-10, Class Test/ Quiz/Assignment-05, Project Based Learning - 10)
Total	100

Project Based Learning: The students are grouped into groups of size 2-3 and will be implementing various digital forensics tools. The student will analyze the requirements and select the required applications. This will help in the employ-ability of students in the Cyber security and forensics based industry and public sectors.

	Text Books:
1.	Digital Forensics Essentials, EC-Council Official Curricula, https://codered.eccouncil.org/course/digital-forensics-essentials (Register to download the study material)
2.	Shiva V.N. Parasaram, "Digital Forensics With Kali Linux", Packet publishing, 2017.
3.	Cyber Forensics by Murugan, S, Oxford University Press.
4.	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley.
	Reference Books:
5.	Cybercrime and Digital Forensics: An Introduction by Thomas J. Holt , Adam M. Bossler, Kathryn C. Seigfried-Spellar, Routledge; 2nd edition, 2017
6.	Digital Forensics and Incident Response: A practical guide to deploying digital forensic techniques in response to cyber security incidents by Gerard Johansen, Packt Publishing Limited, 2017
7.	The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics by John Sammons, Syngress; 2nd edition, 2014
8.	Brian Carrier, " File System Forensic Analysis", Person Education, 2005.

CO-PO-PSO Mapping

CO	PO1	PO2	PO3	PSO1	PSO2
C163.1	2	2	2		2
C163.2	2	2	2		2
C163.3	2	2	2	2	
C163.4	2	2	2	2	
C163.5	2	2	2	2	
C163	2	2	2	2	2

Detailed Syllabus
Lab-wise Breakup

Course Code	17M15CS121	Semester – M. Tech CSE/AIML	Semester II Session Even 2024 Month from: Jan-June, 2024
Course Name	**Cloud and Web Services Lab**		
Credits	1	**Contact Hours**	2Hrs/Week

Faculty (Names)	Coordinator(s)	Prakash Kumar
	Teacher(s) (Alphabetically)	1. Kashav Ajmera 2. Prakash Kumar

COURSE OUTCOMES		COGNITIVE LEVELS
C179.1	Demonstrate Cloud and Web based Services using web tools and technologies.	Understand (level 2)
C179.2	Develop web based applications on various Cloud Platforms viz. AWS, GCP etc.	Apply (level 3)
C179.3	Develop web services-based applications by using various web-based tools, viz. REST, SOAP etc.	Apply (level 3)
C179.4	Develop Cloud based applications by using and integrating different services offered on various Cloud Platforms, viz. AWS. GCP etc.	Create (level 6)

Module No.	Title of the Module	List of Experiments	CO
1.	Development of Web Service Applications	Demonstration of Web services and Service oriented Architectures with simple web service implementations.	CO1
2.		Development of web service applications by using various web based tools, like REST, JSON, SOAP etc.	CO2
3.	Development of Cloud and Web Services based application on Cloud Platforms	Develop Cloud based native applications on Amazon Web Services (AWS), Google Cloud Platform (GCP) available services.	CO3
4.		Develop Cloud based services and applications on various Cloud Platforms, viz. AWS. GCP, EC2, S3, RDS, Dockers, Containers, Compute etc.	CO4

Evaluation Criteria

Components	Maximum Marks
Lab Test# 1	20 marks
Lab Test# 2	20 marks
D2D work	60 (D2D: 40 marks, PBL: 20 marks)
Total	**100**

Project Based Learning: A group of maximum 2 students are formed. Each group chooses a Cloud and Web Services based project. The project shall be designed and/or modeled based on any Cloud and Web Services based Platform like AWS, Google cloud, SOAP, RESTful Services, UDDI, WSDL or any Cloud or Web Services based tools. The project shall function and run as per the objective of the project. Live demonstration of the project shall be shown during their presentation. The project evaluation shall be done based on the quality, innovation, relevance and creativity involved.

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Learning Amazon web services (AWS): a hands-on guide to the fundamentals of AWS cloud by Wilkins, Mark.
2	David Clinton, "Learn Amazon Web Services in a Month of Lunches", MANNING, 2017
3	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.
4.	K. Hwang, Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing- From Parallel Processing to the Internet of Things", Morgan Kauffman Publishers, Elsevier.
5.	Arshdeep Bahga, Vijay Madisetti, "Cloud Computing:A Hands-on Approach", Universities Press, 2014
6.	https://aws.amazon.com/
7.	https://cloud.google.com/appengine/docs/
8.	https://www.w3.org/XML/
9.	Building applications in the cloud: concepts, patterns, and projects
10.	Cloud computing bible by Sosinsky, Barrie	Shukla,G.D.

1. CO-PO and CO-PSO Mapping:

COs	PO 1	PO 2	PO 3	PSO1	PSO2
C179.1	1	1	2	2	1
C179.2	2	2	2	2	1
C179.3	2	1	2	2	2
C179.4	2	2	2	2	2
AVG.	**1.8**	**1.5**	**2.0**	**2.0**	**1.5**

2. CO-PO and CO-PSO Mapping (M. Tech- CSE) II sem:

COs	PO 1	PO 2	PO 3	PSO1	PSO2
C171.1	1 Basics of Cloud services demonstrated	1 Basic principles and architectures of Cloud model is demonstrated	2 Various Web Service types are demonstrated	2 Role of Web tools and Technologies are demonstrated	1 Various web based protocols are demonstrated
C171.2	2 Developing simple Web applications	2 Developing web applications using REST, SOAP etc.	2 Developing service oriented web applications using web service based tools.	2 Developing and Integrating real time applications using REST, SOAP, UDDI, WSDL etc.	1 Developing real life web service applications with updated protocols and tools.
C171.3	2 Developing simple applications on EC2 Instances on Amazon Web Services (AWS)	1 Developing and Integrating simple AWS based applications	2 Evaluation of instances on AWS, Elastic Compute Cloud (EC2) etc.	2 Developing Simple Storage Service (S3) based applications	2 Developing other AWS Service based applications, viz, Relational Database Service (RDS). Lamda etc.
C171.4	2 Developing Cloud Service applications on AWS, Elastic Compute Cloud (EC2), GCP	2 Creating and Developing AWS, Elastic Compute Cloud (EC2), GCP based simple real life applications	2 Creating Cloud based applications with database integration AWS and GCP Cloud platforms.	2 Creating more real life Cloud Service applications on AWS, EC2, GCP compute, platforms.	2 Developing Containers and Dockers based cloud service applications.
AVG.	**1.8**	**1.5**	**2.0**	**2.0**	**1.5**

(Prakash Kumar)

Course Coordinator

Course Code	24M12CS121	Semester: Even	Semester II Session 2023-2024
NBA Code	C145	(Specify Odd/Even)	Month: Jan 2024
Course Name	Security of e-Systems and Networks		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Amanpreet Kaur
	Teacher(s) (Alphabetically)	Dr. Amanpreet Kaur

COURSE OUTCOMES		COGNITIVE LEVELS
C145.1	Explain the fundamental concepts of e security, principles theories of cryptography and networks protocols	Understand Level (C2)
C145.2	Apply Cryptographic techniques on real world problems	Apply (C3)
C145.3	Apply proactive solutions to security like IDS and secure network protocols	Apply (C3)
C145.4	Analyze and assess the stability of existing secure applications	Analyze Level(C4)
C145.5	Evaluate Authentication and Digital signature schemes	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to contemporary e-Systems. Threats and Vulnerabilities, Common Attacks and Prevention, Security Principles and Policies, Protection of users and networks, Security Planning.	6
2.	Cryptography for E-Systems	Secret vs Public key cryptography, Public Key Cryptosystems (PKC) – RSA and Elliptic Curve cryptography, Public Key Cryptography Standard(PKCS), Cryptographic Hash and Applications	6
3.	Authentication and digital signatures for E-Systems	Types of Authentication Services, Modes of Digital Signatures, Authentication Protocols, Digital Signature Schemes, One Way, Mutual and Centralized Authentication Schemes, X.509 Digital Certificates, Public Key Infrastructure (PKI), Password Management	9
4.	Case Study of Secure Esystems	One case study, for example – Electronic Payment Systems – Cardholder present e transactions, payment over the Internet, Electronic cash	2

5.	Networking Primer	Local Area Network Protocols, Network Layer Protocols, Transport Layer and Application Layer Protocols	3
6.	Network Protocol Vulnerabilities	Denial of Service (DoS), Distributed DoS, Session Hijacking and Spoofing, Pharming, Frame Spoofing, DNSSEC	4
7.	Network Intrusion Detection and Prevention	Prevention vs Detection of Intrusions, Types of Intrusion Detection Systems, DDoS Attack Prevention, Detection and IP Traceback Methods	6
8.	Secure Network Protocols	OSI Security Architecture X.800, IPSec and Its Services & Policies, Secure Socket Layer/Transport Layer Security (SSL/TLS), Secure Shell (SSH)	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Assignment/Quiz (5), PBL (10))
Total	**100**

Project based learning:

Students form group of size 2-3 members. Each group will identify several security issues in e systems and networks. Once problem has been identified, the group will analyze the problem and synthesize system-based solutions to the identified problem. Each group will apply differentsecurity tools. Students will gain required knowledge to secure the e-systems of a real organization/company. After this course, the students will able to undertake any work in this area in the industry or research.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books:

1.	SeifedineKadry and Abdelkhalak El Hami. "E-Systems for the 21st Century-Concept, Developments, and Applications", ISBN: 9781774635254, Published March 31, 2021 by Apple Academic Press,
2.	Bongsik Shin, "A Practical Introduction to Enterprise Network and Security Management", Published on21 July 2021 by CRC Press, ISBN:9781000418163
3.	William Stallings, "Cryptography and Network Security: Principles and Practice", 8th Edition, Published by Pearson Press May 2022
4.	Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 2015, Mc Graw Hill Education(India) Private Limited, ISBN:9789339220945, 9339220943.

References:

1	Obaidat, Mohammad &Boudriga, N,"Security of e-Systems and Computer Networks", 2007. 10.1017/CBO9780511536700.
2.	Richard Bejtlich, "The Practice of Network Security Monitoring", July 2013, No Starch Press, ISBN: 9781593275099
3.	Chris Sanders, Jason Smith, Applied Network Security Monitoring, November 2013, Syngress, ISBN: 9780124172166

4.	Journal of Information Security and Applications, Elsevier
5.	ACM Transactions on Information and system security
6.	IEEE Press Computer Security and Privacy
7.	Computers & Security, Elsevier

	PO1	PO2	PO3	PSO1	PSO2
CO1	2	2	1	1	3
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2
CO	2.40	2.40	2.20	2.20	2.25