

Semester- II

ADVANCES IN OPERATING SYSTEMS			
Course Code	MSCS201	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> Analyze the characteristics of operating systems for multiprocessor and multicomputer architectures. Understand and address the challenges related to designing operating systems. Explore the latest trends in developing mobile operating systems. Evaluate the implications of these trends on performance and user experience. 			
Module-1			
Multiprocessor Operating Systems: System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- Memory Management.			
Teaching-Learning Process	Chalk and board and PPT		
Module-2			
Distributed Operating Systems: System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection.			
Teaching-Learning Process	Chalk and board and PPT		
Module-3			
Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement – Caching.			
Teaching-Learning Process	Chalk and board and PPT		
Module-4			
Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms.			
Teaching-Learning Process	Chalk and board and PPT		
Module-5			
Mobile Operating Systems: ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management.			
Teaching-Learning Process	Chalk and board and PPT		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

1. M Singhal and NG Shivaratri , Advanced Concepts in Operating Systems, Tata McGraw Hill Inc, 2001

Reference Book

1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001
2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010

Skill Development Activities Suggested

The students, with the help of the course teacher can take up relevant technical activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl.No.	Description	Blooms Level
CO1	Analyze the characteristics of operating systems for multiprocessor and multicomputer architectures.	L2
CO2	Understand and address the challenges related to designing operating systems and their implications.	L3
CO3	Explore the latest trends in developing mobile operating systems and evaluate their impact on performance.	L4

Program Outcome of this course :

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	Po1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x		x									
CO2	x	x		x	x		x					
CO3	x		x	x								

DEEP LEARNING

Course Code	MSAM202	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Figure out the context of neural networks and deep learning
- Know how to use a neural network
- Explore the data needs of deep learning
- Have a working knowledge of neural networks and deep learning
- Explore the parameters for neural networks

MODULE-1

Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

Teaching-Learning Process	Chalk and board and PPT
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MODULE-2

Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.

Teaching-Learning Process	Chalk and board and PPT
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MODULE-3

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. **Convolutional Networks:** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

Teaching-Learning Process	Chalk and board and PPT
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MODULE-4

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory.

Teaching-Learning Process	Chalk and board and PPT
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MODULE 5

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech

**Teaching-
Learning
Process**

Chalk and board and PPT

PRACTICAL COMPONENT OF IPCC (*May cover all / major modules*)

Sl.NO	Experiments
1	Build Machine Learning model to solve real world regression problems.
2	Build machine learning model to real world binary classification problems.
3	Build simple model to understand overfitting and underfitting conditions.
4	Build simple convolution network to identify hard written character recognition.
5	Analyze performance metrics of the machine learning model.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Unit Tests each of 25 Marks
 2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and P
- The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

Suggested Learning Resources:**Text Books:**

1. *Deep Learning*, Ian Good fellow and Yoshua Bengio MIT Press
<https://www.deeplearningbook.org/> 2016.

Reference Books:

2. *Neural Networks: Systematic Introduction*, Raúl Rojas 1996.
3. *Pattern Recognition and machine Learning*, Chirstopher Bishop 2007.

Web links and Video Lectures (e-Resources):

- <https://www.simplilearn.com/tutorials/deep-learning-tutorial>
- <https://www.kaggle.com/learn/intro-to-deep-learning>
- <https://www.javatpoint.com/deep-learning>

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.	L1
CO2	Implement deep learning algorithms and solve real-world problems.(can be attained through assignment and CIE)	L4
CO3	Execute performance metrics of Deep Learning Techniques. (can be attained through assignment and CIE)	L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x		x									
CO2	x	x										
CO3	x		x									

INTERNET OF THINGS AND APPLICATIONS			
Course Code	MSAM203	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:1	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	04	Exam Hours	03
Course Learning objectives:			
<ul style="list-style-type: none"> • Able to interpret the application areas of IOT . • Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks . • Able to interpret building blocks of Internet of Things and characteristics. 			
Module-1			
What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks- IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over. The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity:IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities,IPv6 Protocol Overview, IPv6 Tunnelling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			
Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1

PO: The sum of all tests, the assignments and development activities, will be based on the following

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Text Books:**

1. Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, Daniel Minoli, Wiley, 2013.
2. Internet of Things: A Hands on Approach, Arshdeep Bahga, Vijay Madi Setti, Universities Press, 2015.

Reference Books:

1. The Internet of Things, Michael Miller, Pearson, 2015 First Edition
2. Designing Connected Products, Claire Rowland, Elizabeth Goodman et.al, O'Reilly, First Edition, 2015

Web links and Video Lectures (e-Resources):

- <https://www.coursera.org/specializations/internet-of-things>
- <https://www.youtube.com/watch?v=Ic63-yf-zuc&list=PL3uLubnzL2Tm5PAw88N1jR9MLTJpuPEnX>

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Develop schemes for the applications of IOT in real time scenarios	L3
CO2	Manage the Internet resources	L1
CO3	Model the Internet of things to business	L2
CO4	Interpret data sets received through IoT devices and tools used for analysis	L1

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			x							x		
CO2							x					x
CO3			x			x						
CO4	x	x			x							

HIGH-PERFORMANCE COMPUTING			
Course Code	MSAM214A	CIE Marks	50
Teaching Hours/Week(L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives:			
<ul style="list-style-type: none"> • Explore the design, analysis, and implementation, of high-performance computational science and engineering applications. • Illustrate advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing. 			
Module-1			
Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.			
Teaching-Learning Process	Chalk and board, PPT		
Module-2			
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Contain in interaction Overheads, Parallel Algorithm Models Basic Communication Operations: One-to- All Broadcast and All-to-One Reduction, Alto-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations ,Scatter and Gather, All-to- All Personalized Communication, Circular Shift.			
Teaching-Learning Process	Chalk and board, PPT		
Module-3			
Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs Section 5.7. Other Scalability Metrics, Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators			
Teaching-Learning Process	Chalk and board, PPT		
Module-4			

Programming Shared Address Space Platforms: Thread Basics, Why Threads?, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling thread and synchronization attributes, Thread cancellation, composites synchronization Constructs, Tips for designing a synchronous programs, Open MP: A standard for directive based Parallel programming dense matrix algorithms: Matrix-Vector multiplication, Matrix-Matrix multiplication, Solving a system of linear equations sorting: Issues in sorting on parallel Computers, Sorting Networks, Bubble sort And its variants, Quicksort, Bucket and sample sort.

Teaching- Learning Process	Chalk and board, PPT
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Module-5

Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs, Search Algorithms for Discrete Optimization Problems: Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup, Anomalies in Parallel Search Algorithms

Teaching- Learning Process	Chalk and board, PPT
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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of 25 Marks
2. Two assignments each of 25 Marks Or one Skill Development Activity of 50 marks to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks:

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Wesley, 2003.

Reference Books:

1. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.

2. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press, 2003.

Weblinks and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=1jYOBr-orp&list=PL2F82ECDF8BB71B0C>

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE mark.

Course outcome(Course Skillset)

Sl.No.	Description	Bloom sLevel
CO1	Illustrate the key factors affecting the performance of CSE applications	L1
CO2	Illustrate mapping of applications to high-performance computing systems	L2
	L2CO3 Apply hardware/software co-design for achieving performance on real-	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	x		x		x					
CO2		x							x	
CO3	x	x	x				x			x

COMPUTER VISION			
Course Code	MSAM214B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none"> • Explore the fundamentals of computer vision. • Build skills to perform shape analysis and other computer vision operations. 			
Module-1			
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.			
Teaching - Learning Process	Chalk and board / Web Content / PPT		
Module-2			
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.			
Teaching - Learning Process	Chalk and board / Web Content / PPT		
Module-3			
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,			
Teaching - Learning Process	Chalk and board / Web Content / PPT		
Module-4			
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.			

Teaching - Learning Process	Chalk and board / Web Content / PPT
Module-5	

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

Teaching-Learning Process	Chalk and board / Web Content / PPT
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Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

1. Two Unit Tests each of 25 Marks
 2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs
- The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. *Computer Vision – A Modern Approach*, David A. Forsyth and Jean Ponce PHI Learning 2009

Reference Books:

2. *Computer and Machine Vision – Theory, Algorithms and Practicalities*, E. R. Davies Elsevier 4th edition, 2013

Web links and Video Lectures (e-Resources):

- <https://www.projectpro.io/data-science-in-python-tutorial/computer-vision-tutorial-for-beginners>
- <https://www.javatpoint.com/computer-vision>

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Le
CO1	Implement fundamental image processing techniques required for computer vision	L3
CO2	Perform shape analysis	L2
CO3	Implement boundary tracking techniques	L3
CO4	Apply chain codes and other region descriptors	L3
CO5	Apply Hough Transform for line, circle, and ellipse detections.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	x		x									
CO2	x	x										
CO3	x		x									
CO4	x		x									
CO5	x	x										

Program Outcome of this course

Program Outcome of this course :

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

CLOUD COMPUTING				
Course Code	MSAM214C		CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0		SEE Marks	50
Total Hours of Pedagogy	40		Total Marks	100
Credits	03		Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none"> • Discuss the concepts, characteristics, delivery models and benefits of cloud computing. • Explore the key technical, organizational and compliance challenges of cloud computing. • Grasp the concepts of virtualization efficiently. • Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services. 				
Module-1				
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open- source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.				
Teaching - Learning Process	Chalk and talk/PPT			
Module-2				
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High- performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.				
Teaching- Learning Process	Chalk and talk/PPT			
Module-3				
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems				
Teaching Learning Process	Chalk and talk/PPT			
Module-4				

	<p>Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two- level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems</p>
Teaching-Learning Process	Chalk and talk/PPT
Module-5	
	<p>Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.</p>
Teaching - Learning Process	Chalk and talk/PPT
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> Two Unit Tests each of 25 Marks Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs <p>The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module. Each full question will have a sub-question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module 	

Suggested Learning Resources:**Text Books**

1. *Cloud Computing: Theory and Practice*, Dan C Marinescu Elsevier (MK), 2013.
2. *Computing Principles and Paradigms*, RajkumarBuyya , James Broberg, Andrzej Goscinski, Wiley, 2014.
3. *Cloud Computing Implementation, Management and Security* John W Rittinghouse, James F Ransome, CRC Press, 2013.

Web links and Video Lectures (e-Resources):

- <https://www.javatpoint.com/cloud-computing-tutorial>
- https://www.tutorialspoint.com/cloud_computing/index.htm
- <https://www.digimat.in/nptel/courses/video/106105167/L01.html> (**Video Lectures**)

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Le
CO1	Compare the strengths and limitations of cloud computing	L2
CO2	Identify the architecture, infrastructure and delivery models of cloud computing	L2
CO3	Demonstrate the working of VM and VMM on any cloud platforms(public/private), and run a software service on that.	L3
CO4	Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud based IT services.	L2

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1		x				x						
CO2		x									x	
CO3	x											x
CO4							x					

ARTIFICIAL INTELLIGENCE IN CYBER SECURITY			
Course Code	MSAM214D	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives:			
<ul style="list-style-type: none"> • Explore cyber threats and limitations of machine learning in security. • Apply supervised learning algorithms for anomaly detection. • Explore feature generation and the theory of network defense. • Explore types of web abuse and supervised learning for abuse problems. 			
Module-1			
Cyber threats and landscape, The cyber attack's economy, What is Machine learning?, Real-world uses of Machine learning in Security, Spam fighting: an iterative approach, Limitations of machine learning in Security, Training algorithms to learn.			
Teaching - Learning Process	Chalk and talk, PPT		
Module-2			
Supervised classification algorithms, Practical consideration in classification, Clustering, When to use anomaly detection versus supervised learning, Intrusion detection with Heuristics, data-driven methods, feature engineering for anomaly detection, anomaly detection with data and algorithms, Challenges of using machine learning in anomaly detection.			
Teaching - Learning Process	Chalk and talk, PPT		
Module-3			
Understanding malware, feature generation, from features to classification, Theory of Network defense, machine learning and network security, building a predictive model to classify network attacks.			
Teaching-Learning Process	Chalk and talk, PPT		
Module-4			
Monetizing the consumer web, types of abuse and the data that can stop them, Supervised learning for abuse problems, clustering abuse, further direction in clustering, defining machine learning system maturity and scalability.			
Teaching - Learning Process	Chalk and talk, PPT		
Module-5			
Data quality, model quality, performance, maintainability, monitoring and alerting, Security and reliability, feedback and usability.			

Teaching - Learning Process	Chalk and talk, PPT
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Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of 25 Marks
2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks. CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books:

1. Machine Learning and Security by Clarence Chio, David Freeman, Released February 2018
Publisher(s): O'Reilly Media, Inc.

References:

1. Hands-On Artificial Intelligence for Cybersecurity by Alessandro Parisi Released August 2019
Publisher(s): Packt Publishing.

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=lpa8uy4DyMo&list=PL9ooVrP1hQOGPQVeapGsJCKtzlO4DtI4>
- https://www.youtube.com/watch?v=4jmsHaJ7xEA&list=PL9ooVrP1hQOGHNaCT7_fwe9AabjZI1RjI

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Identify cyber threats and limitations of machine learning in security.	L1
CO2	Apply machine learning methods to detect anomalies.	L3
CO3	Apply feature generation and the theory of network defense.	L2
CO4	Apply supervised learning for abuse problems.	L3

Program Outcome of this course		
Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	x		x	x			x			
CO2	x	x								
CO3	x		x		x					
CO4	x	x		x						

DECISION SUPPORT SYSTEM			
Course Code	MSAM215A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives:			
<ul style="list-style-type: none"> Recognize the relationship between business information needs and decision making Select appropriate modeling techniques Able to Analyze, design and implement a DSS 			
Module-1			
Introduction to decision support systems: DSS Defined, History of decision support systems, Ingredients of a DSS, Data and model management, DSS Knowledge base, User interfaces, User interfaces, The DSS user, Categories and classes of DSSs, Chapter Summary. Decisions and decision makers Decision makers: who are they, Decision styles, Decision effectiveness, How can a DSS help?, A Typology of decisions, Decision theory and simon's model of problem solving, Bounded decision making, The process of choice, Cognitive processes, Biases and heuristics in decision making,			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Decisions in the organization: Understanding the organization, Organizational culture. Modelling decision processes: Defining the problem and its structures, Decision models, Types of probability, Techniques for forecasting probabilities, Calibration and sensitivity			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Group decision support and groupware technologies: Group Decision making, the problem with groups, MDM support technologies, Managing MDM activities, the virtual workspace, chapter summary. Executive information systems: What exactly is an EIS, Some EIS history, Why area top executives so different?, EIS components, Making the EIS work, The future of executive decision making and the EIS.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Designing and building decision support systems: Strategies for DSS analysis and design, The DSS developer, DSS user interface issues, chapter summary. Implementing and integrating decision support systems: DSS implementation, System evaluation, The importance of integration, chapter summary.			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		

	Module-5	
	Creative decision making and problem solving What is creativity?, Creativity defined, The occurrence of creativity, Creative problem solving techniques, Creativity and the role of technology, chapter summary.	
	Teaching - Learning Process	Chalk and talk/PPT/case study/web content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of 25 Marks
2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

1. *Decision support system*, George M. Marakas, PHI, 2011.
2. *Decision Support Systems*, Marakas, 2nd Edition, Pearson India, 2015.

Web links and Video Lectures (e-Resources):

<https://www.coursera.org/lecture/business-intelligence-tools/decision-support-systems-video-lecture-E8P9x>

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Lev	el
CO1	Appraise issues related to the development of DSS	L1	
CO2	Select appropriate modeling techniques	L2	
CO3	Analyze and implement a DSS	L3	
CO4	Demonstrate qualitative and quantitative skills and critical thinking to proficiencies in the application of theory surrounding the DSS.	L3	

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	x											x
C02		x				x						
C03		x	x									
C04			x				x					x

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	Po1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11

12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	x											x
CO2		x				x						
CO3		x	x									
CO4			x				x					x

BUSINESS INTELLIGENCE AND ANALYTICS			
Course Code	MSAM215B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none"> ● Be exposed with the basic rudiments of business intelligence system. ● Explore the modelling aspects behind Business Intelligence. ● Perceive the business intelligence life cycle and the techniques used in it. ● Be exposed with different data analysis tools and techniques. 			
Module-1			
BUSINESS INTELLIGENCE Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.			
Teaching - Learning Process	Chalk and board / PPT / Web Content		
Module-2			
KNOWLEDGE DELIVERY The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.			
Teaching-Learning Process	Chalk and board / PPT / Web Content		
Module-3			
EFFICIENCY Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis			
Teaching - Learning Process	Chalk and board / PPT / Web Content		
Module-4			
BUSINESS INTELLIGENCE APPLICATIONS Marketing models – Logistic and Production models – Case studies.			
Teaching - Learning Process	Chalk and board / PPT / Web Content		
Module-5			
FUTURE OF BUSINESS INTELLIGENCE: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report,			

	Future beyond Technology.
Teaching - Learning Process	Chalk and board / PPT / Web Content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Two Unit Tests each of 25 Marks
- Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

- Decision Support and Business Intelligence Systems*, Efraim Turban, Ramesh Sharda, Dursun Delen, , 9th Edition, Pearson 2013.
- Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making*, Larissa T. Moss, S. Atre, Addison Wesley, 2003.

Reference Books:

- Business Intelligence: Data Mining and Optimization for Decision Making*, Carlo Verzellis, Wiley Publications, 2009.
- Business Intelligence: The Savvy Manager's Guide*, David Loshin Morgan, Kaufman Second Edition, 2012.
- Successful Business Intelligence: Secrets to Making BI a Killer App*, Cindi Howson, McGraw- Hill, 2007.
- The Data Warehouse Lifecycle Toolkit*, Ralph Kimball, Margy Ross, Warren Thornthwaite, Joy Mundy, Bob Becker, , Wiley Publication Inc., 2007

Web links and Video Lectures (e-Resources):

- <https://data-flair.training/blogs/business-intelligence/>
- https://www.tutorialspoint.com/management_information_system/business_intelligence_system.htm

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Le
CO1	Explain the fundamentals of business intelligence and Link data mining with business intelligence.	L1
CO2	Apply various modelling techniques. (can be attained through assignment and CIE)	L3
CO3	Explain the data analysis and knowledge delivery stages.	L2
CO4	Apply business intelligence methods to various situations. (can be attained through assignment and CIE)	L3
CO5	Decide on appropriate technique.	L2

Program Outcome of this course		
Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
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7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	x											
CO2	x				x							
CO3			x		x							
CO4	x				x							
CO5	x		x									

Blockchain Technology			
Course Code	MSAM215C	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives:			
<ul style="list-style-type: none"> To explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization, 			
Module-1			
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAPtheorem and blockchain, Benefits and limitations of blockchain.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-5			
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Two Unit Tests each of 25 Marks
2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks. CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Text Books:**

1. *Bitcoin and Cryptocurrency Technologies*, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016

Reference Books:

1. *Blockchain Basics: A Non-Technical Introduction in 25 Steps*, Daniel Drescher, Apress, First Edition, 2017
2. *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/106105184>
- https://ocw.mit.edu/courses/15-s12-blockchain-and-money-fall-2018/video_galleries/video-lectures/

Skill Development Activities Suggested

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Interpret the types, benefits and limitation of blockchain.	L1
CO2	Explore the blockchain decentralization and cryptography concepts.	L2
CO3	Enumerate the Bitcoin features and its alternative options.	L1

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6
7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		x		x			x					
CO2	x			x								
CO3		x								x		

AGILE TECHNOLOGIES			
Course Code	MSAM215D	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning objectives: <ul style="list-style-type: none"> • Discuss the fundamental principles and practices associated with each of the agile development methods. • To apply Rapid Application Development method on a project of interest. • To speed up the process through proper tools and techniques for managing projects. 			
Module-1			
Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		
Module-2			
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility			
Teaching - Learning Process	Chalk and talk/PPT/case study/web content		
Module-3			
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, Releasing: "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, TestDriven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing			
Teaching-Learning Process	Chalk and talk/PPT/case study/web content		
Module-4			

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste :Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	
Teaching - Learning Process	Chalk and talk/PPT/case study/web content
Module-5	
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence :Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	
Teaching - Learning Process	Chalk and talk/PPT/case study/web content
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <p>Two Unit Tests each of 25 Marks</p> <p>2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs</p> <p>The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. The question paper will have ten full questions carrying equal marks. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. Each full question will have a sub-question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module 	
<p>Suggested Learning Resources:</p> <p>Books</p> <ol style="list-style-type: none"> <i>The Art of Agile Development</i>, James shore, Chromatic, O'Reilly, 2007. <i>Agile Software Development: Principles Patterns and Practices</i>, Robert C. Martin, Prentice Hall, 1st edition, 2002. <i>Agile and Iterative Development: A Manger's Guide</i>, Craig Larman, Pearson Education, First Edition, India, 2004. 	

Web links and Video Lectures (e-Resources):

- <https://www.tutorialspoint.com/agile/index.htm>
- <https://www.javatpoint.com/agile>
- <https://www.udemy.com/topic/agile/free/>

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Lev	el
CO1	Define XP Lifecycle, XP Concepts, Adopting XP	L1	
CO2	Explain project planning activities that accurately forecast project costs, timelines, and quality	L1	
CO3	Demonstrate Agile concepts to Eliminate Waste	L3	
CO4	Illustrate project management practices to meet the needs of Domain specific stakeholders.	L3	

Mapping of COS and POs

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	x	x										
CO2				x					x			
CO3		x				x						
CO4	x											x

Program Outcome of this course

Sl. No.	Description	POs
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems.	PO1
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	PO2
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	PO3
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	PO4
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	PO5
6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices.	PO6

7	Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	PO7
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices.	PO8
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	PO9
10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	PO10
11	Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	PO11
12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	PO12

MINI PROJECT WITH SEMINAR

Course Code	MSAM206	CIE Marks	50
Number of contact Hours/Week	3	SEE Marks	50
Credits	03	Exam Hours/Batch	03

Course objectives:

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes:

At the end of the course the student will be able to:

- Present the mini-project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

CIE procedure for Mini - Project:

The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. The marks awarded for Mini - Project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

Internet of Things Laboratory			
Course Code	MSAML207	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0	SEE Marks	50
Credits	02	Exam Hours	03
Course objectives:			
<ul style="list-style-type: none"> • Describe what IoT is and how it works today • Design and program IoT devices • Use real IoT protocols for communication 			
Sl.NO	Experiments		
1	Transmit a string using UART		
2	Point-to-Point communication of two Motes over the radio frequency		
3	Multi-point to single point communication of Motes over the radio frequency. AN (Subnetting).		
4	I2C protocol study		
5	Reading Temperature and Relative Humidity value from the sensor		
6	Study of Connectivity and Configuration of Raspberry-Pi/ Beagle Board circuit with basic peripherals, LEDs, Understanding GPIO and its use in program.		
7	Study of different operating systems for Raspberry Pi / Beagle board. Understanding the process of Os installation on Raspberry – Pi/ Beagle board.		
8	Familiarization with the concept of IOT, Arduino / Raspberry Pi and perform necessary software installation.		
Course outcomes (Course Skill Set):			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Apply key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. • Design and evaluate application layer protocol • Analyze the vulnerabilities in any computing system and hence be able to design a security solution. • Identify the security issues in the network and resolve it. • Evaluate security mechanisms using rigorous approaches, including theoretical. 			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

Two Unit Tests each of 25 Marks

2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks. CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in - 60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

SKILL ENHANCEMENT FOR RESEARCH EXCELLENCE-I			
Course Code	MSCS258	CIE Marks	50
Number of contact Hours/Week	2	SEE Marks	50
Credits	01	Exam Hours/Batch	03
<p>The M.Tech Research Skills Development program equips students with essential skills for successful research and publication, including understanding research fundamentals, conducting literature reviews, selecting appropriate methodologies, writing proposals and papers, analyzing data, presenting findings, adhering to ethical standards, and engaging in networking and collaboration, culminating in the effective publication of only 1 research article to Scopus-indexed conferences.</p> <p>Course objectives:</p> <ul style="list-style-type: none"> • To produce high-quality research papers that meet the standards of international conferences or peer-reviewed journals. • To effectively identify suitable journals for publication based on the scope and impact of research findings. • To demonstrate proficiency in writing and structuring research papers according to academic conventions. • To engage in the peer review process, providing and receiving constructive feedback to enhance research quality. • To develop skills for presenting research at conferences, including crafting effective abstracts and posters. • To cultivate a strong understanding of ethical considerations in research and publication practices. • To utilize citation management tools to organize references and ensure proper attribution in publications. • To enhance collaboration skills for co-authoring papers and working within research teams. • To stay informed about current trends and advancements in the field to ensure relevance in publications. • To refine the ability to respond to reviewer comments and revise manuscripts effectively. • To understand the importance of open access and alternative publication models in disseminating research. • To build a professional network that supports research collaborations and publication opportunities. 			

Guidelines for Research paper preparation: Each student in a group of two members shall actively participate in carrying out the research work jointly, in constant consultation with the internal guide, mentors or co-guide, and external guide. They must prepare the project report as per the prescribed norms while ensuring plagiarism is avoided. A research group can have a maximum of two members.

1. Understanding Research Fundamentals

- **Definition of Research:** Understand what constitutes research and its significance in technology and engineering.
- **Types of Research:**

Basic Research: Focused on gaining comprehensive knowledge without immediate applications.

Applied Research: Aimed at solving specific problems.

Literature Review

- **Conducting a Literature Survey:**
Identify relevant academic papers, journals, and conference proceedings.
Summarize key findings and methodologies from existing literature.
- **Critical Analysis:**
Evaluate the strengths and weaknesses of existing research.
Identify gaps in the literature that your research can address.

2. Research Methodology

- **Selecting a Research Topic:**
Choose a topic that aligns with your interests and current trends in technology.
- **Research Design:**
Decide on qualitative, quantitative, or mixed methods based on your research objectives.
- **Data Collection Techniques:**
Surveys, interviews, experiments, and simulations.

3. Writing Research Proposals

- **Structure of a Proposal:**
Introduction, Literature Review, Methodology, Expected Outcomes, and References.
- **Proposal Presentation:**
Practice presenting your proposal to peers and faculty for feedback.

4. Data Analysis

- **Statistical Tools:**
Familiarize yourself with tools like MATLAB, R, or Python for data analysis.
- **Interpreting Results:**
Learn to draw meaningful conclusions from your data and relate them back to your research questions.

5. Writing Research Papers

- **Structure of a Research Paper:**
Abstract, Introduction, Methodology, Results, Discussion, Conclusion, and References.
- **Academic Writing Skills:**
Focus on clarity, coherence, and proper citation of sources.
- **Peer Review Process:**
Understand the importance of peer review and how to respond to reviewers' comments.

6. Presentation Skills

- **Effective Communication:**
Develop skills to present your research findings clearly and confidently.
- **Use of Visual Aids:**
Incorporate slides, charts, and graphs to enhance your presentations.

7. Ethical Considerations in Research

- **Understanding Ethics:**
Familiarize yourself with ethical guidelines related to research involving human subjects, data privacy, and plagiarism.
- **Responsible Conduct of Research:**
Promote integrity and accountability in your research practices.

Submitting Manuscripts to Scopus-Indexed Conferences or Web of Science or Proceedings /Book Chapters

1. Identify Relevant Conferences

- **Research Scopus-Indexed Conferences:**
Use platforms like Conference Alerts, IEEE Xplore, or the Scopus website to find conferences in your field.
- **Check Conference Indexing:**
Ensure that the conference is indexed in Scopus by checking its official website or the Scopus database.

2. Prepare Your Manuscript

- **Follow Conference Guidelines:**
Each conference has specific formatting and submission guidelines. Adhere to these requirements.
- **Structure of the Manuscript:**
Title, Abstract, Introduction, Methodology, Results, Discussion, Conclusion, and References.
- **Language and Clarity:**
Use clear and concise language. Consider having your manuscript proofread by peers or professionals.
- **Submission of manuscript, Registration and Presentation finally Publication**

Course outcomes:

- At the end of the course the student will be able to:
- **Produce High-Quality Research Papers:** Create research papers that meet international conference and peer-reviewed journal standards.
- **Identify Suitable Journals:** Effectively select appropriate journals for publication based on research scope and impact.
- **Proficiency in Writing:** Demonstrate skill in writing and structuring research papers according to academic conventions.
- **Engage in Peer Review:** Actively participate in the peer review process by providing and receiving constructive feedback.
- **Develop Presentation Skills:** Acquire skills for presenting research at conferences, including crafting effective abstracts and posters.
- **Understand Ethical Considerations:** Cultivate a strong understanding of ethical issues in research and publication practices.
- **Utilize Citation Management Tools:** Use citation management tools to organize references and ensure proper attribution.
- **Respond to Reviewer Comments:** Refine the ability to address reviewer comments and revise manuscripts effectively.

The assessment for **Skill Enhancement for Research Excellence** will be divided into **Continuous Internal Evaluation (CIE)** and **Semester End Examination (SEE)**, each carrying **50 marks**.

Continuous Internal Evaluation (CIE) – 50 Marks

CIE shall be conducted **weekly** and will be assessed based on:

- **Base Papers Referred & Review** – 10 Marks
- **Presentations on Proposed Concepts** – 15 Marks
- **Preparation of Conference Papers (Preferably Scopus Indexed or Reputed Conferences)** – 25 Marks

Semester End Examination (SEE) – 50 Marks

- The SEE examiner may be appointed from the same college for evaluation.
- The candidate must **present their research work** before the examiner.
- **Mandatory requirement:** The candidate must have **submitted a paper to a conference or accepted or presented** at a reputed conference.
- Marks will be awarded based on:
 - **Research Presentation Quality** – 25 Marks
 - **Clarity of Concept & Methodology** – 15 Marks
 - **Conference Submission & Acceptance/Presentation** – 10 Marks

