Semester- III

Mobile Computing			
Course Code	**MMCE311A**	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:

- Define concepts of wireless communication.
- Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in mobile communication.
- Explain CDMA, GSM. Mobile IP, WiMAX and Different Mobile OS
- 4. Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, and security concerns

Module-1

Mobile Computing Architecture: Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks : Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications

Module-2

GPRS and Packet Data Network: GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices.

Module-3

Mobile OS and Computing Environment: Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators

Module-4

Building Wireless Internet Applications: Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, 10 Hours HTML, cHTML, XHTML, VoiceXML.

Module-5

J2ME: Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life-cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

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. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

Web links and Video Lectures (e-Resources):

- https://youtu.be/GT-tYP8RGIs?si=8fs7TgNVN8-ej-TU
- https://youtu.be/OxdUs9E8Aps?si=93ur91NnDVmtY5zS
- https://youtu.be/QWwLtCE_8cY?si=NIbSTijMEkcq7IgC

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain state of art techniques in wireless communication.	L1
CO2	Discover CDMA, GSM. Mobile IP, WImax	L2
CO3	Demonstrate program for CLDC, MIDP let model and security concerns	L3
CO4	Building Wireless Internet Applications	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2							
CO2	2						2	
CO3			2					
CO4	3	2	3		3			

Semester- III

Data Storage Technologies and Networks			
Course Code	**MMCE311B**	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:

- Learn to apply storage resource management tools for efficient system monitoring and resource allocation.
- Learn performance optimization techniques to enhance storage system efficiency and reliability.
- Explore data encryption methods and access control strategies to secure sensitive information and ensure compliance.
- Explore emerging trends in storage, including software-defined storage, NVMe technology, and the CompTIA Storage+ certification.

Module-1

Fundamentals of Data Storage

Direct Attached Storage (DAS), Network Attached Storage (NAS), Storage Area Networks (SAN), storage devices such as HDDs, SSDs, and tape drives, and RAID principles and configurations including various levels for data protection.

Module-2

Storage Area Networks (SAN)

SAN architecture, Fibre Channel SAN, iSCSI SAN, SAN topologies, zoning, Host Bus Adapters (HBAs), switches, cabling, performance tuning, and troubleshooting strategies for SAN environments.

Module-3

Networked and Cloud Storage

File-level storage systems with protocols such as NFS and SMB, object-based storage like S3, unified storage systems, cloud storage models including public, private, hybrid, and the integration of storage in virtualized environments.

Module-4

Data Services and Optimization

Data replication methods (local and remote), snapshot technologies, storage virtualization, deduplication, compression techniques, backup and recovery strategies, business continuity, and disaster recovery planning.

Module-5

Storage Management and Security

Storage resource management tools, monitoring, performance tuning, data encryption, access control mechanisms, audit trails, emerging trends such as software-defined storage, NVMe, and CompTIA Storage.

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. "Introduction to Storage Area Networks" by Jon Tate
2. Cloud Computing Concepts, Technology & Architecture Thomas Erl, Zaigham Mahmood, and Ricardo Puttini

Web links and Video Lectures (e-Resources):

- https://www.geeksforgeeks.org/storage-area-networks/
- https://www.youtube.com/watch?v=HP3Z48VnZjk&pp=ygUzZGF0YSBzdG9yYWdlIHRlY2hub2xvZ2llcyBhbmQgbmV0d29ya3MgZnVsbCBjb3Vyc2Ug
- https://youtu.be/4FJJGNnHOfc

Skill Development Activities Suggested

1. Hands-on Workshop: Setting Up a NAS (Network Attached Storage) System
2. Practical Task: Exploring Cloud Storage Services
3. Mini Project: RAID Configuration and Benchmarking
4. Case Study + Presentation: Modern Storage Technologies in Enterprise Networks

Course outcome (Course Skill Set)

Sl. No.	Description	Blooms Level
CO1	Develop the ability to explain the fundamentals of data storage technologies including DAS, NAS, SAN, HDDs, SSDs, tape drives, and RAID configurations.	L2
CO2	Demonstrate the configuration and performance tuning of SAN components like Fibre Channel, iSCSI, zoning, HBAs, and switche	L3
CO3	Demonstrate the working of file-based and object-based storage (NFS, SMB, S3) and analyze their use in virtualized and cloud environments.	L3,L4
CO4	Design data replication, backup, and disaster recovery strategies using snapshots, deduplication, and storage virtualization techniques.	L5
CO5	Demonstrate the ability to apply encryption, access control, and monitoring tools while exploring emerging trends in storage technologies.	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2							
CO2			3					
CO3	3		3					
CO4	3							
CO5	2	3		2	3			3

Semester- III

Design and Operation of Data Centres			
Course Code	**MMCE311C**	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:

- Understand the fundamental concepts of data centres, their types, and their roles in modern IT infrastructure.
- Learn the key components of a data centre, including servers**,** storage systems**,** networking**,** and power/cooling systems**.**
- Explain the importance of scalability**,** availability**,** and reliability in data centre design.
- Identify the industry standards and best practices for data centre design, including Uptime Institute classifications.
- Discuss the process of site selection**,** facility planning, and space optimization for efficient data centre operations.

Module-1

Overview of Data Centres: Architecture and Evolution: Introduction to Data Centres, Evolution of Data Centres, Data Centre Architecture, Data Centre Design and Implementation, Types of Data Centres **On-Premises, Cloud, and Hybrid On-Premises Data Centres**: Cloud Data Centres, Benefits of Cloud Data Centres, Challenges and Risks, Comparing Data Centre Types

Module-2

Data Centre Network Architecture: Introduction to Network Architecture in Data Centres, Data Centre Network Topologies, Network Virtualization in Data Centres, Redundancy and Fault Tolerance, Security in Data Centre Networks, Introduction to Power Systems in Data Centres, Disaster Recovery and Business Continuity

Module-3

Space Management and Physical Security: Space Management in Data Centres, Physical Security in Data Centres, Security and Compliance Standards, Redundancy in Data Centres, Redundant Cooling Systems, Scalability in Data Centres, Fault Tolerance in Data Centres, High Availability Models.

Module-4

Data Centre Operations and Management: Introduction to Data Centre Monitoring, Types of Monitoring Systems, Management Protocols and Tools, Incident Management and Troubleshooting, Data Centre Energy Management, Introduction to Automation in Data Centres, Automation Tools and Platforms, Virtualization Technologies in Data Centres, Virtualization Management and Monitoring.

Module-5

Security Management in Data Centres: Physical Security in Data Centres, Cybersecurity in Data Centres**,** Security Monitoring and Incident Response, Disaster Recovery Planning (DRP), Backup and Data Replication Strategies, Testing and Updating Disaster Recovery Plans.

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:

Textbook:

1. "Data Center Handbook" by **Hwaiyu Geng** (McGraw-Hill Professional, 2015)
2. Cloud Data Centers and Cost Modeling: A Complete Guide to Planning, Designing, and Building a Cloud Data Center" by Hwaiyu Geng

Web links and Video Lectures (e-Resources):

- https://youtu.be/wZzQBI628Hs?si=k3HAFHnalvDWF_Y4
- https://youtu.be/saQGWdOHfzM?si=1FRJoAbaclOdHooT

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand the fundamentals of data centre design, architecture, and operations.	L1
CO2	Analyze the various components involved in the infrastructure and environment of data centres.	L2
CO3	Explore best practices and technologies for maintaining data centre operations, security, and sustainability.	L3
CO4	Evaluate network architecture, power and cooling mechanisms in data centres.	L3
CO5	Security Management in Data Centres	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2						2	
CO2	2							
CO3			3		2	2		
CO4	3	3	3					
CO5								

Semester- III

Wireless and Mobile Communication			
Course Code	**MMCE311D**	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:

- **Explain** the fundamentals of wireless communication systems, propagation models, and the evolution from 1G to 5G technologies.
- **Analyze** wireless channel characteristics and apply appropriate modulation techniques for efficient data transmission.
- **Evaluate** the design principles of cellular systems, including frequency reuse, handoff, and interference management.
- **Compare** the architecture and protocols of major mobile communication systems like GSM, CDMA, LTE, and 5G.
- **Design** wireless networks considering MAC protocols, mobility management, and routing mechanisms in dynamic environments.

Module-1

Introduction to Wireless Communication Systems: Evolution of wireless communication: From 1G to 5G, characteristics of wireless communication vs. wired communication,Cellular networks (GSM, CDMA, LTE, 5G), Wireless LANs and PANs (Wi-Fi, Bluetooth, Zigbee), Satellite, Paging, and RFID systemsm, Basics of electromagnetic wave propagation, Propagation mechanisms, Types of propagation models, Empirical path loss models.

Module-2

Wireless Channel and Modulation: Fading,Types of Fading, Multipath Effects, Statistical Channel Models, **Channel Impulse Response (CIR),** Time and Frequency Selectivity, Overview of Modulation Schemes, Digital Modulation Techniques-BPSK,QPSK, Spread Spectrum Techniques- Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), Concept and relevance in LTE and 5G.

Module-3

Cellular System Design Fundamentals: Introduction to cells, cell clustering, and hexagonal cell structure, Reuse of frequencies and frequency planning, Cell Splitting and Sectoring, Handoff Techniques, Hard handoff vs. soft handoff, Handoff in GSM and CDMA systems, Interference in Cellular Systems and its types.

Module-4

GSM and CDMA Systems: GSM System Architecture, Mobile Station, Base Station Subsystem, Network and Switching Subsystem, Base Transceiver Station (BTS), Mobile Switching Center (MSC), GSM Services- Bearer services, teleservices, and supplementary services, Basic Concepts of CDMA- Spread spectrum and orthogonality, Use of pseudo-random codes, CDMA System Architecture, Channel Structure in CDMA.

Module-5

Wireless Networks and Mobility Management: WLAN, WLAN Architecture, MAC Layer Functionality, WLAN Frame Format and Types, Security in WLAN.PAN, Bluetooth protocol stack (L2CAP, RFCOMM), Piconets and Scatternets, Zigbee and Infrared, Mobility Management- Types of Mobility, Mobility Management Techniques, Challenges in Mobility Management, Routing in Mobile Networks, Mobile IP.

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.

Textbook:

1. **Theodore S. Rappaport**, *"Wireless Communications: Principles and Practice"*, 2nd Edition, Pearson Education, 2023 (latest reprint).

2. Wireless Communications" by Andrea Goldsmith, **Publisher:** Cambridge University Press

Web links and Video Lectures (e-Resources):

- https://youtu.be/8T7orRAQgic?si=ke1agkiLMSyPczLC
- https://youtu.be/PIfOY5z3HI4?si=QE37fJygRAUHCDrb

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Understand wireless communication systems and propagation models.	L1
CO2	Analyze wireless channel characteristics and modulation techniques.	L2
CO3	Evaluate cellular system design and interference management techniques.	L3
CO4	Compare mobile communication systems (GSM, CDMA, LTE, 5G) and their features.	L3
CO5	Design and analyze wireless networks and mobility management techniques.	L4

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3						
CO2	2							
CO3								
CO4	2	3	3			2		
CO5	2	3	3	2				

Semester- III

Software Defined Networks			
Course Code	**MMCE311E**	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:

- Apply the fundamentals of Software Defined Networks for the given problem
- Illustrate the basics of Software Defined Networks Operations and Data flow
- Apply different Software Defined Network Operations and Data Flow
- Analyse alternative definitions of Software Defined Networks
- Apply different Software Defined Network Operations in real world problem

Module-1

Introduction to SDN :Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

Module-2

Working of SDN:Evaluation of Switches and Control planes, SDN Implications, Data centre Needs, Forerunner of SDN, Software Defines Networks is Born, Sustain SDN interoperability, Open source contribution, Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods.

Module-3

The Open Flow Specifications:Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

Module-4

SDN via APIS, SDN via Hypervisor-Based Overlays, SDN via Opening up the device, Network function virtualization, Alternative Overlap and Ranking.

Module-5

Data centres: definition, Data centres demand, tunnelling technologies for Data centres Path technologies in data centres, Ethernet fabrics in Data centres, SDN use case in Data centres.

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. Software Defined Networking by Thomas D Nadeau and Ken Gray.
2. Software Define Networks, A Comprehensive Approach, Paul Goransson, Chuck Black. MK Publications.

References:

1. Software Defined Networking for Dummies brought you by cisco, Brian Underdahl and Gary Kinghorn.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=nUN40N91fJ4&list=PLJ6vZHpRUoJNn-3F918wKpAtr6gGUOixc
- https://youtu.be/WdTHHXOl8kg?si=3TjSR6p954i3Fm98
- https://youtu.be/_961s5WGkok?si=Zj6ejHH5SEQVk3TN

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Apply the fundamentals of Software Defined Networks for the given problem	L1
CO2	Illustrate the basics of Software Defined Networks Operations and Data flow	L2
CO3	Apply different Software Defined Network Operations and Data Flow	L3
CO4	Analyse alternative definitions of Software Defined Networks	L3
CO5	Apply different Software Defined Network Operations in real world problem	L3

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2						
CO2	2							
CO3			3		3		3	
CO4	3	2						
CO5	3	2						

Semester- III

Cloud Computing			
Course Code	**MMCE311F**	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:

- Explain the fundamentals of cloud computing
- Illustrate the cloud application programming and aneka platform
- Contrast different cloud platforms used in industry

Module-1

Introduction to Cloud Computing: Eras of computing, The vision of Cloud Computing, Defining a cloud, A closer look, Cloud computing reference model, Historical developments: Distributed systems, Virtualization, Web 2.0; Service oriented computing; Utility oriented computing.

Module-2

Architectures for parallel and distributed computing: Parallel Vs Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed computing.

Module-3

Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.

Module-4

Cloud computing architecture: Introduction, Cloud reference model: Architecture, IaaS, PaaS, SaaS, Types of Clouds: Public, Private, Hybrid and Community clouds, Economics of the cloud, Open challenges.

Module-5

Cloud Platforms in Industry : Amazon web services; Google AppEngine; Microsoft Azure; Cloud Applications. Scientific applications: Healthcare; Biology; Geo-Science, Business and Consumer applications: ARM & ERP; Productivity; Social networking.

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

Textbooks

1. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013

Reference Books

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)

2. Cloud Computing: A Practical Approach by J.Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill).

Web links and Video Lectures (e-Resources):

- https://youtu.be/dmGybCohHsw?si=9idoJWu5C8GI2Lr6
- https://youtu.be/2LaAJq1lB1Q?si=Hi4UWAJOw1fML0YV
- https://youtu.be/RmuVkB3siYY?si=MT6IqmW8p3PytQGF

Skill Development Activities Suggested

Skill Development Activity 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	Demonstrate the fundamental and core concepts of cloud computing	L1
CO2	Compare between parallel and distributed computing	L2
CO3	Investigate the system virtualization and outline its role in enabling the cloud computing system model	L3
CO4	Compare different deployment and service models of cloud to develop different variety of applications	L3

Mapping of COS and Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2							
CO2	2						2	
CO3					2			
CO4	2	3	3					