Rashtreeya Sikshana Samithi Trust

R.V. College of Engineering

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Computer Science and Engineering

Master of Technology (M.Tech.)
in
Computer Science and Engineering

Scheme and Syllabus of
Autonomous System w.e.f 2016

R. V. College of Engineering, Bengaluru – 59

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Computer Science and Engineering

Vision: To achieve leadership in the field of Computer Science and Engineering by strengthening fundamentals and facilitating interdisciplinary sustainable research to meet the ever growing needs of the society.

Mission:

- To evolve continually as a center of excellence in quality education in computers and allied fields.
- To develop state-of-the-art infrastructure and create environment capable for interdisciplinary research and skill enhancement.
- To collaborate with industries and institutions at national and international levels to enhance research in emerging areas.
- To develop professionals having social concern to become leaders in top-notch industries and/or become entrepreneurs with good ethics.

Program Educational Objectives (PEO)

M. Tech. in Computer Science and Engineering graduates will be able to:

PEO 1. Exhibit analytical and computational skills to solve problems of the real world in conventional and advanced areas of Computer Science and Engineering.

PEO 2. Learn, compete and adapt to constantly evolving technology to meet the challenging needs of the industries.

PEO 3. Conceptualize, innovate and collaborate for facilitating interdisciplinary research with focus on professional ethics and team work.

PEO 4. Apply skills acquired in Computer Science and Engineering domain to design solutions using sustainable and inclusive technology for career advancement and life-long learning.

Program Outcomes (PO)

The graduates of M.Tech in Computer Science and Engineering will be able to attain/accomplish:

PO 1. **Scholarship of Knowledge** - Acquire in-depth knowledge of Computer Science and Engineering to discriminate, evaluate, analyze and synthesize existing and new knowledge and to integrate the same for enhancement of knowledge with a global perspective.

PO 2. **Critical Thinking** - Analyze complex problems critically related to Computer Science and Engineering domain, apply independent judgment for synthesizing information to make intellectual and/or creative advances with a research perspective.

PO 3. **Problem Solving** - Conceptualize and solve Computer Science and Engineering problems effectively and arrive at feasible optimal solution, individually and in teams, to accomplish a common goal considering public health and safety, cultural, societal and environmental factors.

PO 4. **Research Skill** - Extract and analyze information through literature survey for solving problems by applying research methodologies, techniques, tools and design, conduct experiments, analyze and interpret data, demonstrate higher order skills and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in Computer Science and Engineering domain.

PO 5. **Usage of modern tools** - Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

PO 6. **Collaborative and Multidisciplinary work** - Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO 7. **Project Management and Finance** - Demonstrate knowledge and understanding of Computer Science and Engineering, management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economic and financial factors.

PO 8. **Communication**- Communicate with Computer Science and Engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend, make effective presentations and to write effective reports by adhering to appropriate standards.

PO 9. **Life-long Learning** - Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence

continuously.

PO 10. **Ethical Practices and Social Responsibility -** Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO 11. **Independent and Reflective Learning -** Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes with or without depending on external feedback.

Program Specific Criteria for M.Tech in Computer Science and Engineering

Professional Bodies: IEEE-CS, ACM

The M.Tech program in Computer Science and Engineering prepares the students for career in computer related courses that deal with design concepts with implementation. The program enables the students to acquire breadth and depth wise knowledge in computer science domain. The curriculum emphasizes courses on Mathematics and Statistics, Humanities, Ethics and Professional Practice, Computer Architecture, Analysis of Algorithms, Operating Systems, Computer Networks and Information Security, Computer Security along with elective courses. The program enables students in problems solving, critical thinking and communication skills with focus on team work.

Program Specific Outcomes (PSO)

The graduates of M. Tech. in Computer Science and Engineering Graduates will be able to:

PSO 1. Model, design and develop robust computer applications by applying relevant data structures with suitable algorithms, techniques and strategies to deliver quality software solutions.

PSO 2. Apply skills acquired for retrieving, analyzing and managing large data leading to effective decision making and application development using suitable engineering tools.

R. V. College of Engineering, Bengaluru – 59

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Computer Science and Engineering

M. Tech. in Computer Science and Engineering

FIRST SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Self-Study S**	
1.	16MEM11R	Research Methodology	IM	3	1	0	0	4
2.	16MAT12A	Probability Statistics and Queuing	MA	4	0	0	0	4
3.	16MCE13	Advances in Database Management System (Theory & Practice)	CS	4	0	1	0	5
4.	16MCE14	Operating System Internals and Design Principles	CS	4	0	0	1	5
5.	16MCE15x	Elective -1	CS	4	0	0	0	4
6.	16HSS16	Professional Skill Development	HSS	0	0	2	0	2
		Total		**19**	**1**	**3**	**1**	**24**

Elective -1			
16MCE151	Parallel Computer Architecture and Programming	16MCE152	Computer Network Technologies

R. V. College of Engineering, Bengaluru – 59

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Computer Science and Engineering

M. Tech. in Computer Science and Engineering

SECOND SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Self-Study S**	
1.	16MEM21P	Project Management	IM	3	1	0	0	4
2.	16MCE22	Advanced Algorithms (Theory & Practice)	CS	4	0	1	0	5
3.	16MCE23x	Elective-2	CS	4	0	0	0	4
4.	16MCE24x	Elective-3	CS	4	0	0	0	4
5.	16MCE25x	Elective-4	CS	4	0	0	0	4
6.	16MCE26	Minor Project	CS	0	0	5	0	5
		Total		**19**	**1**	**6**	**0**	**26**

Elective-2			
16MCE231/16MCN231	Cloud Computing Technology	16MCE232/16MSE232	Computer Systems Performance Analysis
Elective-3			
16MCE241/16MIT241	Information Retrieval	16MCE242	Computer Vision
Elective-4			
16MCE251	Web Services	16MCE252	Fuzzy Logic and Soft Computing

R. V. College of Engineering, Bengaluru – 59

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Computer Science and Engineering

M. Tech. in Computer Science and Engineering

THIRD SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Self-Study S**	
1	16MCE31	Data Science and Machine Learning Essentials (Theory and Practice)	CS	4	0	1	0	5
2	16MCE32x	Elective -5	CS	4	0	0	0	4
3	16MCE33x	Elective-6	CS	4	0	0	0	4
4	16MCE34x	Elective-7	CS/IS	4	0	0	0	4
5	16MCE35	Internship/ Industrial Training	CS	0	0	3	0	3
6	16MCE36	Technical Seminar	CS	0	0	2	0	2
		Total		**16**	**0**	**6**	**0**	**22**

Elective-5			
16MCE321	Cryptography and Network Security	16MCE322	Multimedia Computing
Elective-6			
16MCE331	Wireless Networks	16MCE332	Big Data Analytics and Applications
Elective-7			
16MCE341/16MCN341	Foundations for Internet of Things	16MCE342/16MIT342	Natural Language Processing and Text Mining

R. V. College of Engineering, Bengaluru – 59

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Department of Computer Science and Engineering

M. Tech. in Computer Science and Engineering

FOURTH SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Self-Study S**	
1	16MCE41	Major Project	CS	0	0	26	0	26
2	16MCE42	Seminar	CS	0	0	2	0	2
		Total		**0**	**0**	**28**	**0**	**28**

R. V COLLEGE OF ENGINEERING, Bengaluru – 560059.
(Autonomous Institution under VTU, Belagavi)

THIRD SEMESTER

Data Science and Machine Learning Essentials (Theory and Practice)						
Course Code	**:**	**16MCE31**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L: T: P: S**	**4:0:1:0**	**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 hours**

Course Learning Objectives (CLO):

Graduates shall be able to:

1. Explore key algorithms and theory that form the foundation of machine learning and computational intelligence.
2. Have practical knowledge of machine learning algorithms and methods so that they will be able to understand the principles, advantages, limitations and possible applications of machine learning.
3. Understand the principles, advantages, limitations and possible applications of machine learning.
4. Identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
5. Leverage interpersonal dynamics and leadership.

Unit – I	**8 Hrs**
Data mining and machine learning: Describing structural patterns, Machine learning, Data mining, Simple examples, Fielded applications, Machine learning and statistics, Generalization as search, Enumerating the concept space, Bias.	
Unit – II	**8 Hrs**
Input: **Concepts, instances, and attributes:** A concept, An example, An attribute, Preparing the input. **Output: Knowledge representation:** Decision tables, Decision trees, Classification rules, Association rules, Rules with exceptions, Rules involving relations, Trees for numeric prediction, Instance-based representation, Clusters.	
Unit – III	**12 Hrs**
Algorithms: The basic methods: Inferring rudimentary rules, Statistical modeling, Divide-and-conquer: Constructing decision trees, Covering algorithms: Constructing rules, Mining association rules, Linear Models, Instance-based learning, Clustering, Predicting performance: Cross-validation.	
Unit – IV	**12 Hrs**
Classification: Logistic regression, Linear Discriminant Analysis, Support Vector Machines, Unsupervised Learning.	
Unit – V	**8 Hrs**
Implementations: Real machine learning schemes: Extending linear models, Bayesian Networks, Combining multiple models. *Differentiation and Integration of Machine Learning Feature Vectors.	

Unit – VI (Lab Component)	2Hrs/week

Using Open source tools (R/Weka/Octave/ Scikit) design and execute for a given large dataset the following data mining concepts (open-ended lab problems)

1. Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, and K Nearest Neighbors.
2. Decision Trees: Fitting Classification and Regression Trees, Bagging and Random Forests, Boosting.
3. Support Vector Machines: Support Vector Classifier, ROC Curves, SVM with Multiple Classes
4. Principal Components Analysis
5. Clustering: K-Means and Hierarchical Clustering

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Explore and apply the fundamentals of Data Science and Machine Learning Techniques.

CO2: Evaluate different mathematical techniques to construct algorithms.

CO3: Analyze the strength and weakness of different machine learning models to solve real world problems.

CO4: Implement and apply different supervised and unsupervised machine learning algorithms.

References:

1.	Ian H. Witten& Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, second Edition, Elsevier Morgan Kaufmann Publishers, 2005, ISBN: 0-12-088407-0
2.	Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, ISSN 1431-875X,ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook), DOI 10.1007/978-1-4614-7138-7, 2015,Springer Publication**.**
3.	Zumel, N., & Mount, J. “Practical data science with R”, Manning Publications, 2014, ISBN 9781617291562.
4.	Jiawei Han and Micheline Kamber: Data Mining – Concepts and Techniques, Third Edition, Morgan Kaufmann, 2006, ISBN 1-55860-901-6
*5.	Related Technical Journal Papers, white papers, manuals.

Scheme of Continuous Internal Evaluation (CIE) for Theory

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Continuous Internal Evaluation (CIE) for Practical

CIE for the practical courses will be based on the performance of the student in the laboratory, every week. The laboratory records/reports will be evaluated for 40 marks. One test will be conducted for 10 marks. The total marks for CIE (Practical) will be for 50 marks.

Scheme of Semester End Examination (SEE) for Theory

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE) for Practical

SEE for the practical courses will be based on conducting experiments and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	L	L	M	-	-	-	L	L	L
CO2	L	L	L	M	M	-	-	-	L	L	L
CO3	M	M	M	M	M	-	L	L	L	M	L
CO4	M	H	M	M	H	-	L	L	M	M	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	-
CO2	M	L
CO3	M	L
CO4	M	M

Cryptography and Network Security
(ELECTIVE -5)

Course Code	**:**	**16MCE321**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives

Students are expected to be able to

1. Explore Block ciphers operations and RSA for data Encryption and Decryption.
2. Describe various authentication mechanisms used for authentication and key distribution.
3. Demonstrate use of modern tool to simulate cryptographic algorithms.
4. Illustrate Elliptic curve cryptosystem, network security protocols and existing/recent attacks on SSL

Unit – I	**10 Hrs**

Symmetric Key Cryptography: Advanced Encryption Standard (AES): Introduction, Transformation, Key Expansion.

Encipherment using modern Symmetric-key Ciphers: Use of modern block ciphers: Electronic Code Book (ECB) Mode, Cipher Block Chaining (CBC) Mode, Cipher Feedback (CFB) Mode, Output Feedback (OFB) Mode, Counter (CTR) mode. **Asymmetric-Key Cryptography:** Introduction, RSA Cryptosystems.

Unit – II	**08 Hrs**

Cryptographic Hash functions: Introduction, Description of MD hash family, SHA-512 **Message Integrity and Message Authentication:** Message Integrity, Message Authentication.

Unit – III	**10 Hrs**

Digital Signature: Comparison, Process, Services, Attacks on digital Signature, Digital Signature Schemes: RSA Digital Signature Scheme, Attacks on RSA Signature.

Key Management: Symmetric Key distribution, Kerberos, Symmetric Key agreement, Public-key Distribution, Hijacking.

Unit – IV	**8 Hrs**

Security at the Transport Layer: SSL and TLS: SSL Architecture, Four Protocols, SSL Message Formats, Transport layer security. **Security at Network Layer: IPSec** Internet Key Exchange (IKE)

Unit-V	**12 Hrs**

Elliptic Curve Cryptosystems: Elliptic curves over real numbers, Elliptic curves over GF(p), Elliptic curves over GF(2^n).

Case Study: CrypTool, Delta, Medusa, Metaspolit.

*__Attacks on SSL implementation__: HEARTBLEED, BREACH, CRIME, DROWN.

Course Outcomes:

After going through this course the student will be able to

CO1: Identify Block cipher operations and RSA cryptosystem for data encryption and decryption.

CO2: Analyse key distribution and authentication schemes to provide message authentication.

CO3: Identify Network security protocols and attacks on Secure Socket Layer.

CO4: Analyse Elliptic curve cryptosystem and modern tools used for network security.

References	
1.	Behrouz A. Forouzan, Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, McGraw-Hill, 2015, ISBN: 9789339220945.
2.	William Stallings, "Cryptography and Network Security", 6th Edition, ISBN-13: 978-0-13-335469-0, 2015.
3.	Joseph MiggaKizza, Computer Network Security, Springer International Edition, 2009, ISBN 978-1-84800-916-5.
4.	Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C", John Wiley & Sons, Inc, 2nd Edition, 1996, ISBN 978-1-119-09672-6.
*5.	Technical Papers from IEEE and ACM.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	L	H	-	-	M	M	L	L
CO2	M	L	M	L	L	-	-	L	L	L	L
CO3	M	H	M	H	M	-	-	M	H	L	L
CO4	H	M	L	M	H	-	-	L	H	L	M

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	L
CO2	L	M
CO3	M	H
CO4	M	M

MULTIMEDIA COMPUTING (Elective - 5)						
Course Code	**:**	**16MCE322**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Students shall be able to

1. Explore the various Multimedia features, its representation and computing techniques.
2. Gain knowledge of video signal representation and its transmission for conventional and high definition television.
3. Investigate the characteristics of multimedia synchronization systems for distributed environment.
4. Acquire knowledge of various compression techniques for text, audio and video.
5. Compare and contrast the features of traditional operating system and multimedia operating systems.

Unit – I	**08 Hrs**

Multimedia: Media and Data Streams: Medium, Main properties of a Multimedia system, Multimedia, Traditional data stream characteristics, Data stream characteristics for continuous media, Information units.

Sound and Audio: Music-MIDI concepts, MIDI devices, MIDI messages, MIDI and SMPTE Timing standards, MIDI Software

Unit – II	**10 Hrs**

Video

Video Signal Representation, Computer Video Format, Television, Conventional Systems Enhanced Definition Systems, High-Definition Systems, Transmission.

Data Compression

Storage Space, Coding Requirements, Source, Entropy and Hybrid Coding, Some Basic Compression Techniques, JPEG, Image Preparation, Lossy Sequential DCT-Based Mode, Expanded Lossy DCT-based Mode, Lossless Mode, Hierarchal Mode, H.261 (px64), Image Preparation, Coding Algorithms, Data Stream, MPEG, Video Encoding, Audio Encoding, Data Stream, MPEG-2, MPEG-4.

Unit – III	**12 Hrs**

Multimedia Operating Systems

Introduction, Real Time, The Notion of Real Time and Multimedia, Resource Management, Resources, Requirements, Components and Phases, Allocation Scheme, Continuous Media Resource Model, Process Management, Real Time Process Management in, Conventional Operating Systems: An Example, Real-Time Processing Requirements, Traditional Real-Time Scheduling, Real-Time Scheduling; System Model, Earliest Deadline First Algorithm, Rate Monotonic Algorithm, EDF and Rate Monotonic: Context Switches, EDF and Rate Monotonic : Processor Utilization

Unit – IV	**08 Hrs**

Multimedia Operating Systems Preemptive and Non-preemptive Task scheduling, File systems, Multimedia File systems, Disk Scheduling Algorithms-EDF, SCAN-EDF, Group Sweeping Scheduling.

Unit – V	12 Hrs
Synchronization: Synchronization Issues, Intra and Inter-object Synchronization, Live and Synthetic Synchronization, Presentation requirements. ***Case Study:** Working of Today's Digital Broadcast**,** Working of Internet Streaming**,** Video scaling, Video rate conversion, Deinterlacing algorithm, generating different audio tones. ***Usage of open source tools** such as FFmpeg, VLC.	

Course Outcomes:

After going through this course the student will be able to:

CO1: Differentiate the characteristics of different multimedia its representation, data formats for image, video and audio system.

CO2: Apply multimedia compression techniques and standards on text, images, audio and video data applicable for communication architecture.

CO3: Analyze the requirements for processing real time multimedia data for task scheduling and synchronization and apply real time scheduling algorithms for multimedia tasks

CO4: Design and apply multimedia based solution by applying algorithmic approaches and advanced architectural aspects of multimedia for various problem domains.

Reference Books:

1.	Ralf Steinmetz and Klara Nahrstedt, "Multimedia: Computing, Communication and Applications", Pearson Education, 1st Edition, 2014, ISBN 978-81-775-8441-7
2.	Jan Van der Meer, "Fundamentals and Evolution of MPEG-2 Systems: Paving the MPEG Road", 1st Edition, April 2014, ISBN: 978-0-470-97433-9
3.	Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia", Springer International Publishing, 2nd Edition, 2014, ISBN: 9783319052892
4.	Rao K R & Hwang J J, "Techniques & Standards for Image, Video & Audio Coding", PTR-PH Publishers, 1st Edition, 2001, *ISBN*-13: 978-3540239574
*5.	Technical Journal Papers, White Papers, Manuals.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	L	L	M	-	-	-	L	L	L
CO2	L	L	L	M	M	-	-	-	L	L	L
CO3	M	M	M	M	M	-	L	L	L	M	L
CO4	M	H	M	M	H	-	L	L	M	M	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	-
CO2	M	L
CO3	M	L
CO4	M	M

WIRELESS NETWORKS (ELECTIVE -6)						
Course Code	**:**	**16MCE331**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives:

At the end of the course the students should be able to:

- Explore the fundamental principles of wireless networks including Internet of Things
- Illustrate the design of cellular network with comparison between various types of technologies
- Analyze and choose the suitable wireless technology based on requirements.
- Investigate the upcoming innovations in the wireless industry and understand the forecast.

Unit-I	**10 Hrs**

Fundamentals of Wireless Communication: Limitations, Wireless Media, Frequency Spectrum- Radio and Infrared, Technologies in digital wireless communication- Modulation schemes, OFDM, Diversity techniques, MIMO, Channel specifications- Duplexing, Multiple access methods, OFDMA fundamentals, Wireless network architecture, Classification of wireless networks, Wireless communication problems

Unit-II	**10 Hrs**

Fundamentals of cellular communications: Introduction, Cellular systems, Hexagonal cell geometry, Co channel interference ratio, Frequency Reuse, Cellular system design in worst case scenario with omnidirectional antenna, Co-channel interference reduction, Directional antennas in seven cell reuse pattern, Cell splitting, Adjacent channel interference (ACI), Segmentation; **4G** vision, features and challenges, 4G technologies- Multicarrier modulation, smart antenna, OFDM-MIMO systems

Unit-III	**10 Hrs**

Wireless Local Area Network (WLAN): Network components, Design requirements, WLAN architecture, Standards, WLAN Protocols- Physical Layer and MAC Layer, IEEE 802.11p, Wi-Fi Protected Access (WPA)

Unit-IV	**10 Hrs**

Wireless Personal Area Network (WPAN): Network architecture and components, WPAN technologies and protocols, Application software; ZigBee (802.15.4): Stack architecture, components , topologies; Bluetooth (802.15.1): Protocol stack, Link types, security, Network connection establishment, error correction and topology;

Wireless Sensor networks (WSN): Usage and Network model, WSN protocol stack

Unit-V	**10 Hrs**

LTE architecture, Frequency bands and channel specifications, UL and DL channels, Essential innovation in Wireless industry

*mm wave and cm wave technologies, Backhaul technologies, Gigabit Wi-Fi (IEEE 802.11ac), VPN : PPTP, L2TP, Impact of cloud in wireless technologies, IoT Introduction, Smart city models, , 5G, Air Interface, OSS and BSS systems.

REFERENCES	
1.	Dr. Sunil Kumar S. Manvi & Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Network concepts and protocols", John Wiley India Pvt. Ltd, 1st Edition, 2010, *ISBN* 13: 9788126520695.
2.	Vijay K.Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers, 2009, First Edition, Indian Reprint ISBN: 978-81-312-1889-1
3.	Theodore S Rappaport, "Wireless Communications, Principles and Practice", 2nd Edition, Pearson Education Asia, 2009, ISBN: 9780133755367.
4.	William Stallings: Wireless Communications and Networks, 2nd Edition, Pearson Education Asia, 2005,ISBN13: 9780131918351
*5.	Technical Journal Papers, White Papers, Manuals.

Expected Course Outcomes:

After going through this course the student will be able to:

CO1: Explore the existing wireless networks and connectivity issues

CO2: Design suitable wireless network for various applications

CO3: Analyze the range of signals and path loss models for real world scenarios

CO4: Investigate the various security issues and energy management for the wireless devices

Scheme for Continuous Internal Evaluation (CIE):

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination(SEE):

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	M	-	-	L	-	-	M	M	M	-	L
CO 2	L	M	M	H	H	M	-	-	-	-	-
CO 3	-	M	M	M	-	M	-	-	M	-	-
CO 4	L	-	-	L	M	M	-	-	-	-	-

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	-	L
CO2	H	-
CO3	-	M
CO4	M	-

BIG DATA ANALYTICS AND APPLICATIONS (ELECTIVE -6)						
Course Code	**:**	**16MCE332**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives

Students are expected to be able to:

1. Explore the fundamental concepts of big data analytics
2. Learn to analyze the big data using intelligent techniques.
3. Determine and learn to use various techniques for mining data stream.
4. Understand the applications of data analytics using Map Reduce Concepts

Unit – I	**9 Hrs**

INTRODUCTION TO BIG DATA

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

Unit – II	**10 Hrs**

INTRODUCTION HADOOP

Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

Unit – III	**10 Hrs**

HADOOP ARCHITECTURE

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

Unit – IV	**10 Hrs**

HADOOP ECOSYSTEM AND YARN

Hadoop ecosystem components - SPARK, FLUME, Schedulers - Fair and Capacity, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

Unit-V	**10 Hrs**

HIVE AND HIVEQL, HBASE

Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries. HBase concepts- Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper. Performance Modelling and Predictive Analysis*-Distributed Processing Framework for Big Image Data.

Course Outcomes:

After going through this course the student will be able to:

CO1: Explore and apply the big data analytic techniques for business applications.

CO2: Apply non-relational databases, the techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.

CO3: Analyze methods and algorithms, to compare and evaluate them with respect to time and space requirements, and make appropriate design choices when solving problems.

CO4: Model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.

References:	
1	Boris Lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, 2nd edition, 2014, ISBN: 978-1-118-61193-7
2	Tom White, "HADOOP: The definitive Guide", 4th Edition, O Reilly, 2015, ISBN: 978-1-4493-610-7
3	Chris Eaton, Dirk deroos et al. , "Understanding Big data: Analytics for Enterprise Class Hadoop and Streaming Data", 1st edition, Tata McGraw Hill, 2015, ISBN 13: 9789339221270
4	Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packet Publishing Limited, 2nd edition ,2013, ISBN-13:9781782163282.
5*	Technical Journal Papers, white papers and manuals

Mapping of COs with Pos

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	-	L	-	-	-	-	L	-	-	-
CO2	L	H	M	-	M	-	-	-	-	-	-
CO3	-	M	M	-	-	-	-	-	-	-	L
CO4	M	-	-	-	M	-	-	-	-	-	-

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	-	M
CO2	-	M
CO3	M	-
CO4	M	-

FOUNDATIONS FOR INTERNET OF THINGS (ELECTIVE - 7)						
Course Code	**:**	**16MCE341/16MCN341**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**4:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Students should be able to:

1 Acquire knowledge on basic issues, policy and challenges in IoT
2 Illustrate mechanism and key technologies in IoT for different applications
3 Use appropriate technologies for efficient communication across smart devices
4 Explore connectivity mechanisms and application protocols in IoT

Unit – I	**08 Hrs**

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.

Unit – II	**10 Hrs**

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 Lowpower WPAN, Zigbee IP(ZIP), IPSO

Unit – III	**08 Hrs**

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 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.

Unit – IV	**12 Hrs**

Application Protocols - Common Protocols ,Web service protocols , MQ telemetry transport for sensor networks (MQTT-S) , ZigBee compact application protocol (CAP) , Service discovery , Simple Network Management Protocol(SNMP) ,Real-time transport and sessions , Industry-specific protocols.

Unit – V	**12 Hrs**

Wireless Embedded Internet - 6LoWPAN, 6LoWPAN history and standardization , Relation of 6LoWPAN to other trends , Applications of 6LoWPAN , Example: facility management , The 6LoWPAN Architecture , 6LoWPAN Introduction ,The protocol stack, Link layers for 6LoWPAN, Addressing , Header format , Bootstrapping , Mesh topologies , Internet integration

***6LoWPAN-based Wireless Home Automation:** Link Layer Coexistence, Routing Consideration, Security, Power Consumption, System Development, 6LoWPAN Home Automation Network, Home Gateway, Home Node, Evaluation and Management, Secure System , Energy Management.

Course Outcomes:

After going through this course the student will be able to

CO1: Acquire knowledge of different applications of IOT in real time scenarios

CO2: Apply key technology for efficient communication and connectivity

CO3: Analyze different applications and its role in IoT

CO4: Design applications for efficient resource utilization using key technologies.

Reference Books:

1	Daniel Minoli, ”Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications”, Wiley, 2013. ISBN: 978-1-118-47347-4.
2	Zach Shelby Sensinode , Carsten Bormann”6LoWPAN: The Wireless Embedded Internet”John Wiley & Sons Ltd,2009 , ISBN 9780470747995
3	Arshdeep Bahga, Vijay Madisetti, ”Internet of Things: A Hands on Approach” Universities Press., 2015. ISBN, : 978-81-7371-954-7
4	Michael Miller,” The Internet of Things”, First Edition, Pearson, 2015. ISBN-13: 978-0-7897-5400-4
5	Claire Rowland,Elizabeth Goodman.,” Designing Connected Products”, First Edition,O’Reilly, 2015. ISBN=0636920031109
6*	Technical Journal Papers, White papers and Manuals.

Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks

Scheme of Semester End Examination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	L	L	M	-	-	-	L	L	L
CO2	L	L	L	M	M	-	-	-	L	L	L
CO3	M	M	M	M	M	-	L	L	L	M	L
CO4	M	H	M	M	H	-	L	L	M	M	L

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	L	-
CO2	M	L
CO3	M	L
CO4	M	M

NATURAL LANGUAGE PROCESSING AND TEXT MINING						
Course Code	**:**	**16MIT342/16MCS342**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Students shall be able to

1. Demonstrate sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Train and evaluate empirical NLP systems.
3. Manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
4. Design, implement, and analyze NLP algorithms

Unit – I	**10 Hrs**

Overview and Language Modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications -Information Retrieval. Language Modeling: Various Grammar- based Language Models - Statistical Language Model

Unit – II	**09 Hrs**

Word Level and Syntactic Analysis: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.

Unit – III	**10 Hrs**

Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.

Unit – IV	**10 Hrs**

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems. Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.

Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically - Based Text Mining: Related Work, A Semantically Guided Model for Effective Text Mining

Unit – V	**09 Hrs**

Information Retrieval and Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval valuationLexical Resources: World Net-Frame Net- Stemmers-POS Tagger-Research Corpora.

Course Outcomes:
After going through this course the student will be able to:
CO1: Comprehend and compare different natural language models.
CO2: Analyse spelling errors and error detection techniques.
CO3: Extract dependency, semantics and relations from the text.
CO4: Differentiate various information retrieval models.

Reference Books

1	Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", OUP India, 2008, ISBN : 9780195692327
2	Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer, 2007, ISBN : 9781846281754
3	James Allen, "Natural Language Understanding", 2nd edition, Benjamin / Cummings publishing company, 1995, ISBN : 9788131708958
4	Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python," Publisher: O'Reilly Media, June 2009, ISBN : 9780596516499

Scheme of Continuous Internal Evaluation (CIE)
CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

Scheme of Semester End Examination (SEE)
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	M	-	-	-	-	-	M	-	-	-
CO2	M	H	M	H	-	-	-	L	M	M	M
CO3	H	L	L	M	H	-	-	M	L	-	M
CO4	L	L	-	L	-	-	-	L	L		-

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	M	M
CO2	M	M
CO3	L	H
CO4	M	H

INTERNSHIP / INDUSTRIAL TRAINING						
Course Code	**:**	**16MCE35**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:6:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**3**		**SEE Duration**	**:**	**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the process of applying engineering knowledge to produce product and provide services.

(2) Explain the importance of management and resource utilization

(3) Comprehend the importance of team work, protection of environment and sustainable solutions.

(4) Imbibe values, professional ethics for life-long learning.

1) The duration of the internship shall be for a period of 8 weeks on full time basis between II semester final exams and beginning of III semester.
2) The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
3) Internship must be related to the field of specialization or the M.Tech program in which the student has enrolled.
4) Students undergoing internship training are advised to use ICT tools such as skype to report their progress and submission of periodic progress reports to the faculty members.
5) Every student has to write and submit his/her own internship report to the designated faculty.
6) Students have to make a presentation on their internship activities in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the internship final report. However interim or periodic reports and reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
7) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
8) The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization – Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department -
    - Chapter 3 – Tasks Performed – summaries the tasks performed during 8 week period
    - Chapter 4 – Reflections – Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure

Course Outcomes:

After going through the internship the student will be able to:

CO1: Apply engineering and management principles

CO2: Analyze real-time problems and suggest alternate solutions

CO3: Communicate effectively and work in teams

CO4: Imbibe the practice of professional ethics and need for lifelong learning.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of the Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation of the application of engineering knowledge in industries 35%
(2) Ability to comprehend the functioning of the organization/ departments 20%
(3) Importance of resource management, environment and sustainability 25%
(4) Presentation Skills and Report 20%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		
CO4					L		H			M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	
CO2	L	L
CO3		M
CO4	M	H

GUIDELINES FOR INDUSTRIAL TRAINING

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the process of applying engineering knowledge to industrial products & processes
(2) Explain the importance of skilling, training and resource management.
(3) Comprehend the importance of team work, communication and sustainable solutions.
(4) Imbibe values, professional ethics for life-long learning.

1) The duration of industrial training must be for a minimum of 1 week and maximum of 8 weeks on full time basis.
2) Industrial Training in which students pays a fee to the organization / industry will not be considered.
3) He/she can undergo training in one or more industry /organization.
4) The student must submit letters from the industry clearly specifying his / her name and the duration of the training provided by the company with authorized signatures.

5) Industrial training must be related to the field of specialization or the M.Tech program in which the student has enrolled.
6) Students undergoing industrial training are advised to use ICT tools such as Skype to report their progress and submission of periodic progress reports to the faculty members.
7) Every student has to write and submit his/her own industrial training report to the designated faculty.
8) Students have to make a presentation on their industrial training in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.
9) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
10) The broad format of the industrial training report shall be as follows
    - Cover Page
    - Certificate from College
    - Training Certificate from Industry / Organization
    - Acknowledgement
    - Executive Summary
    - Table of Contents
    - Chapter 1 - Profile of the Organization –Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 2 – Details of the Training Modules
    - Chapter 3 – Reflections – Highlight specific technical and soft skills that you acquired
    - References & Annexure

Course Outcomes:

After going through the industrial training the student will be able to:

CO1: Understand the process of applying engineering knowledge to solve industrial problems

CO2: Develop skills through training relevant to industrial requirement

CO3: Communicate effectively and work in teams

CO4: Imbibe ethical practices and develop it as life skill.

Scheme of Continuous Internal Evaluation (CIE):
A committee comprising of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):
The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation on the application of engineering knowledge 25%
(2) Ability to comprehend the importance of skilling and training 25%
(3) Importance of communication, professional ethics, sustainability 20%
(4) Oral Presentation and Report 30%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		
CO4					L		H			M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	
CO2	L	L
CO3		M
CO4	M	H

GUIDELINES FOR INDUSTRIAL VISITS

Course Learning Objectives (CLO):
The students shall be able to:
(1) Understand the role of industries and service organization in meeting the demands of the society.
(2) Explain the working of different industries and organizations with an engineering perspective
(3) Comprehend the importance of team work, communication and sustainable solutions.
(4) Imbibe values, professional ethics for life -long learning.

1) Student must visit a minimum of THREE organizations/industry. The duration of the visit per organization must be for ONE full day, during which he/she must comprehend the importance of organization structure, function of various departments, application of engineering knowledge, resource management, importance to environment and safety, professional ethics.
2) It is mandatory to visit ONE private multi-national company or public sector industry / organization, ONE medium-small enterprise and ONE rural based or NG organization.
3) The student must submit letter from the industry clearly specifying his / her name and the date

of visit to the industry with authorized signatures.

4) Industrial visit must be related to the field of specialization or the M.Tech program in which the student has enrolled.
5) Every student has to write and submit his/her own report on each industrial visit and submit the report to the designated faculty advisor for evaluation.
6) A photograph outside the industry with the name and logo of the industry in the background along with the students and faculty members could be included in the report.
7) Students have to make a presentation on their industrial visit in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the final report.
8) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
9) The broad format of the industrial visit report shall be as follows
    - Cover Page
    - Certificate from College
    - Acknowledgement
    - Synopsis / Executive Summary
    - Table of Contents
    - Chapter 1 - Profile of the PSU or MNC – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 2 – Profile of the SME – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
    - Chapter 3 - Profile of the NGO – must include Organizational structure, services, Manpower, Societal Concerns, Professional Practices
    - Chapter 4 – Comparative Analysis of PSU/MNC – SME – NGO
    - References & Annexure (Permission letters from the organizations for the visit & photographs)

Course Outcomes:

After going through this course the student will be able to:

CO1: Classify the role of different industries and organization in addressing the needs of the society.

CO2: Explain the process of applying engineering knowledge in industries and organizations.

CO3: Describe the importance of communication and team work

CO4: Recognize the importance of practicing professional ethics and need for life skills.

Scheme of Continuous Internal Evaluation (CIE):
A committee comprising of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (SEE):
The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

(1) Explanation of the application of engineering knowledge in industries 25%
(2) Ability to comprehend the functioning of the organization/ departments 30%
(3) Importance of resource management, environment and sustainability 20%
(4) Presentation Skills and Report 25%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		
CO4					L		H			M	H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	
CO2	L	L
CO3		M
CO4	M	H

TECHNICAL SEMINAR						
Course Code	**:**	**16MCE36**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**SEE Marks**		**50**
Credits	**:**	**2**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):
The students shall be able to:
(1) Understand the technological developments in their chosen field of interest
(2) Explain the scope of work and challenges in the domain area
(3) Analyze these engineering developments in the context of sustainability and societal concerns.
(4) Improve his/her presentation skills and technical report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project

4) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
5) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

After going through this course the student will be able to:

CO1: Identify topics that are relevant to the present context of the world
CO2: Perform survey and review relevant information to the field of study.
CO3: Enhance presentation skills and report writing skills.
CO4: Develop alternative solutions which are sustainable

Scheme of Continuous Internal Evaluation (CIE):

Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide. The evaluation criteria shall be as per the rubrics given below:

Rubrics for Evaluation:

1) Topic – Technical Relevance, Sustainability and Societal Concerns 15%
2) Review of literature 25%
3) Presentation Skills 35%
4) Report 25%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		H	M	M	L	H	H	--	---	---	M
CO2	L	M								H	
CO3							L	M	H		
CO4		L	M		H	H					H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	L
CO2	M	H
CO3	M	L
CO4	H	L

FOURTH SEMESTER

MAJOR PROJECT						
Course Code	**:**	**16MCE41**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:52:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**26**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be done by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The number of projects that a faculty can guide would be limited to three.
5. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
6. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
7. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this course the students will be able to

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply project and resource managements skills, professional ethics, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase	Activity	Weightage
I 5th week	Synopsis, Preliminary report for the approval of selected topic along with literature survey, objectives and methodology.	20%
II 10th week	Mid-term progress review shall check the compliance with the objectives and methodology presented in Phase I, review the work performed.	40%
III 15th week	Oral presentation, demonstration and submission of project report. After this presentation, the student will have one week time to correct / modify his report to address the issues raised by the committee members.	40%

CIE Evaluation shall be done with marks distribution as follows:

- Selection of the topic & formulation of objectives 10%
- Design and simulation/ algorithm development/experimental setup 25%
- Conducting experiments / implementation / testing / analysis 25%
- Demonstration & Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Experiments / Analysis Performed; Results & Discussion 25%
4. Report 20%
5. Viva Voce 30%

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	M	L	M	L				
CO2				L				M	H		
CO3					L	M	M			H	
CO4					L	M	H	M			H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	L
CO2	L	H
CO3	M	H
CO4	H	H

SEMINAR						
Course Code	**:**	**16MCE42**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**SEE Marks**		**50**
Credits	**:**	**2**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

1) Understand the technological developments in their chosen field of interest
2) Explain the scope of work and challenges in the domain area
3) Analyze these engineering developments in the context of sustainability, societal concerns and project management.
4) Improve his/her verbal presentation and report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and

analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project topic.
4) Topics could be in multidisciplinary areas and strongly address the technical design issues.
5) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
6) The students must mandatorily address legal, ethical issues as related to the topic of study.
7) The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study.
8) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

After going through this course the student will be able to:

CO1: Identify topics that are relevant in the present context of the world and relate it to sustainability and societal relevance.

CO2: Perform literature/market/product survey and analyse information to the field of study.

CO3: Enhance presentation and report writing skills.

CO4: Develop creative thinking abilities.

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of TWO senior faculty members. The evaluation criteria shall be as per the rubrics given below:

Rubrics for Evaluation:

- Topic – Technical Relevance, Sustainability and Societal Concerns 15%
- Literature Review 25%
- Presentation Skills 35%
- Report 25%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		H	M	M	L	H	H	--	---	---	M
CO2	L	M								H	
CO3							L	M	H		
CO4		L	M		H	H					H

Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	L
CO2	M	H
CO3	M	L
CO4	H	L