Rashtreeya Sikshana Samithi Trust

R.V. College of Engineering, Bengaluru

(Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Master of Technology (M. Tech.)

Software Engineering

Scheme and Syllabus

Autonomous System w.e.f 2016

R.V. College of Engineering, Bengaluru – 59

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

Department of Information Science and Engineering

Vision:

To be the hub for innovation in Information Science & Engineering through Teaching, Research, Development and Consultancy; thus make the department a global resource center in advanced, sustainable and inclusive technology.

Mission:

1. To enable students to become responsible professionals, strong in fundamentals of information science and engineering through experiential learning
2. To bring research and entrepreneurship into class rooms by continuous design of innovative solutions through research publications and dynamic development oriented curriculum.
3. To facilitate continuous interaction with the outside world through student internship, faculty consultancy, workshops, faculty development programmes, industry collaboration and association with the professional societies.
4. To create a new generation of entrepreneurial problem solvers for a sustainable future through green technology with an emphasis on ethical practices, inclusive societal concerns and environment
5. To promote team work through inter-disciplinary projects, co-curricular and social activities.

Program Educational Objectives (PEO)

M. Tech. in Software Engineering Program, Students will be able to:

PEO1: Design, build and evaluate software systems of varying complexity based on client's requirements.

PEO2: Apply the knowledge of Software Engineering to configure, package and deliver solutions for different sectors like ERP, Web technology.

PEO3: Apply the skills in clear communication, responsible teamwork, and time management for working on multidisciplinary project.

Program Outcomes (PO)

M. Tech. in Software Engineering Students will be able to:

PO 1: Scholarship of Knowledge -Acquire in-depth knowledge of Software Engineering process, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO 2: Critical Thinking - Analyse complex Software Engineering related problems, apply independent judgement for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO 3 : Problem Solving - Think laterally and originally, conceptualise and solve issues related to Software Engineering, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO 4: Research Skill - Extract information pertinent to unfamiliar problems in Software Engineering domain through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

PO 5: Usage of modern tools - Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools of Software Engineering, 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, recognise opportunities and contribute positively to collaborative-multidisciplinary scientific research in Software Engineering,

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 Software Engineering 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 economical and financial factors.

PO 8: Communication - Communicate with the Software Engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO 9: Life-long Learning - Recognize the need for, and have the preparation and ability to engage in life-long learning independently in Software Engineering domain, 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 using Software Engineering solutions.

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 in project and professional practice without depending on external feedback.

Program Specific Outcomes (PSO)

M. Tech. in Software Engineering Students will be able to:

PSO 1. Design, develop and deliver complex, scalable and cost effective software systems by applying Software Engineering principles, tools and processes.

PSO 2. Comprehend the role and responsibilities of the professional software engineer with importance to quality and management issues involved in software construction

R. V. College of Engineering, Bengaluru – 59.

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

Department of Information Science and Engineering

M.Tech. in Software Engineering

FIRST SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture **L**	**Tutorial** **T**	**Practical** **P**	**Experiential Learning/ Self Study** **S**	
1	16MEM11R	Research Methodology	IM	3	1	0	0	4
2	16MSE12 / 16MIT12	Data Engineering	IS	4	0	1	0	5
3	16MSE13	Advanced Data Structure and Algorithm	IS	4	0	0	1	5
4	16MSE14	Software Architecture and Design	IS	4	0	0	0	4
5	16MSE15X	Elective – 1	IS	4	0	0	0	4
6	16HSS16	Professional Skill Development		0	0	2	0	2
		Total		**19**	**1**	**3**	**1**	**24**
		Number of contact hours		19	2	2	4	27

Elective -1			
16MSE151	Advanced Web Programming	16MSE152/16MIT152	Human Computer Interaction

R. V. College of Engineering, Bengaluru – 59.

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

Department of Information Science and Engineering

M.Tech. in Software Engineering

SECOND SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture **L**	**Tutorial** **T**	**Practical** **P**	**Experiential Learning / Self Study** **S**	
1	16MSE21P	Project Management	IM	3	1	0	0	4
2	16MSE22/16MIT22	Cyber security and Digital Forensics	IS	4	0	1	0	5
3	16MSE23X	Elective – 2	IS	4	0	0	0	4
4	16MSE24X	Elective – 3	IS	4	0	0	0	4
5	16MSE25X	Elective – 4	IS	4	0	0	0	4
6	16MSE26	Minor Project	IS	0	0	5	0	5
		Total		**19**	**1**	**6**	**0**	**26**
		Number of contact hours		19	2	2	0	**23**

Elective -2			
16MSE231	Simulation and Modelling	16MCE232/16MSE232	Computer Systems Performance Analysis
Elective – 3			
16MSE241	Software Reliability and Fault Tolerant Systems	16MSE242	Metrics and Models in Software Engineering
Elective – 4			
16MSE251/16MIT25	Advanced Computer Networks	16MSE252/16MIT252	Distributed Computing

1			

R. V. College of Engineering, Bengaluru – 59.

(An Autonomous Institution affiliated to VTU, Belagavi)

Department of Information Science and Engineering

M.Tech in Software Engineering

THIRD SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	**Experiential Learning/ Self Study S**	
1	16MSE31	Software Quality Assurance and Testing	ISE	4	0	1	0	5
2	16MSE32X	Elective – 5	ISE	4	0	0	0	4
3	16MSE33X	Elective – 6	ISE	4	0	0	0	4
4	16MSE34X	Elective – 7	ISE	4	0	0	0	4
5	16MSE35	Internship / Industrial Training	ISE	0	0	3	0	3
6	16MSE36	Technical Seminar	ISE	0	0	2	0	2
		Total		**16**	**0**	**6**	**0**	**22**
		Number of Contact Hours		16	0	6	0	22

Elective -5			
16MSE321/16MIT321	Soft Computing	16MSE322/16MIT322	Social Network Analysis
Elective – 6			
16MSE331/16MIT331	IoT and Cloud Computing	16MSE332/16MIT332	Big Data Analytics
Elective-7			
16MSE341	Enterprise Application Programming	16MSE342	Agile Methodology

R. V. College of Engineering, Bengaluru – 59.

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

Department of Information Science and Engineering

M.Tech. in Software Engineering

FOURTH SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture **L**	**Tutorial** **T**	**Practical** **P**	**Experiential Learning/ Self Study** **S**	
1	16MSE41	Major Project	IS	0	0	26	0	26
2	16MSE42	Seminar	IS	0	0	2	0	2
		Total		**0**	**0**	**28**	**0**	**28**

THIRD SEMISTER

Course Title : Software Quality Assurance and Testing (Theory and Practice)		
Course Code: 16MSE31		**CIE Marks: 100 + 50**
Hrs/Week: L:T:P:S: 4-0-1-0		**SEE Marks: 100 + 50**
Credits:05		**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	Interpret the goals of software testing.
2	Analyze and design various tools which can be used for automating the testing process
3	Apply various concept of software quality standards for establishing quality environment.
4	Demonstrate and evaluate the procedures for improving the quality Models.

UNIT-I	
Introduction: Meeting People's Quality Expectations, Dependency and Suggested Usage, Problems. What Is Software Quality? Quality: Perspectives and Expectations, Quality Frameworks and ISO-9126,Correctness and Defects: Definitions, Properties, and Measurements, A Historical Perspective of Quality, Problems. Quality Assurance: Classification: Defect Prevention, Defect Containment.	**09 Hrs**
UNIT-II	
Quality Assurance in Context: Handling Discovered Defect During QA Activities, QA Activities in Software Processes. Verification and Validation Perspectives. Reconciling the Two Views. Concluding Remarks. Problems. **Quality Engineering.** Quality Engineering: Activities and Process. Quality Planning: Goal Setting and Strategy Formation. Quality Assessment and Improvement. Quality Engineering in Software Processes. Problems. **Testing: Concepts, Issues, and Techniques:** Purposes, Activities, Processes, and Context. Functional vs. Structural Testing, Coverage-Based vs. Usage-Based Testing: Problems. **Test activities, Management and Automation:** Test planning and preparation, Test Execution, Result Checking, and Measurement, Analysis and Follow-up. Activities, People, and Management. Test Automation.	**09 Hrs**
UNIT-III	
A Perspective on Testing: Basic Definitions , Test Cases, Insights from a Venn Diagram , Identifying Test Cases , Errors and Fault Taxonomies , Levels of Testing, **Generalized Pseudocode**, The Triangle Problem , The NextDate Function, The Commission Problem , The SATM System, The Currency Converter, Saturn Windshield Wiper Controller, **Boundary Value Testing** , Normal Boundary Value Testing, Robust Boundary Value Testing , Worst-Case Boundary Value Testing , Special Value Testing, Examples.	**09 Hrs**
UNIT-IV	

Equivalence Class Testing: Equivalence Classes, Equivalence Class Test Cases for the Triangle Problem , Equivalence Class Test Cases for the NextDate Function, Equivalence Class Test Cases, Equivalence Class Test Cases for the Commission Problem, **Decision Table–Based Testing**: Decision Tables, Test Cases for the Triangle Problem , Test Cases for the NextDate Function, Test Cases for the Commission Problem, **Path Testing :** Du-paths for Stocks, Test Coverage Metrics , Basis path testing .	**09 Hrs**
UNIT-V	
Data Flow Testing :, Use Testing , Slice Testing ,Model-Based Testing , **Levels of Testing**: Traditional view of testing levels, Alternative life cycle model, The SATM system, Separating integration and system Testing.	**09 Hrs**

Expected Course Outcomes: After completing the course, the students will be able to	
CO 1	Analyze the importance of software quality assurance & testing in software development.
CO 2	Evaluate the concepts of software quality assurance techniques and find their relevance of use.
CO 3	Implement the concepts of software testing and appraise the most appropriate testing approaches for a given situation.
CO 4	Use the principles of testing and develop the necessary test cases in problem solution.
Reference Books	
1	Jeff Tian : Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Wiley-IEEE Computer Society Press, February 2005, ISBN: 978-0-471-71345-6.
2	Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2013, ISBN: 9670201785602
3	Aditya P Mathur: Foundations of Software Testing, Pearson, 2008. ISBN 9780201515602
4	Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, John Wiley & Sons, 2008, ISBN: 978-81-203-1351-4
5	Stephen H Khan: Metrics and Models in Software Quality Engineering, Pearson 2nd edition 2013, ISBN: 978-81-203-1136-7

Laboratory Component:
Students are expected to analyze the following problems with respect to software testing and identify all necessary test cases.

1. Design, develop, code and run the program in any suitable language to solve the **commission problem**. Analyze it from the perspective of dataflow testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
2. Design, develop, code and run the program in any suitable language to solve the **NextDate problem**. Analyze it from the perspective of decision table-based testing, derive at least 10 different test cases, execute these test cases and discuss the test results.

3. Design, develop, code and run the program in any suitable object-oriented language to solve the **calendar problem**. Analyze it from the perspective of OO testing, derive test cases to test the method that increment the date and the method that increments the month., execute these test cases and discuss the test results.
4. Design, develop, code and run the program in any suitable object-oriented language to solve the **currency converter problem**. Analyze it from the perspective of use case-based system testing, derive appropriate system test cases., execute these test cases and discuss the test results.

A report of these problem solutions need to be prepared for realizing the importance of software testing.

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

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	M	L	M	-	-	-	-	-	-	-	-	M
CO2	M	-	-	-	-	L	-	-	-	-	-	M
CO3	M	L	M	-	M	-	M	-	-	M	M	M
CO4	H	H	H	H	H	-	M	-	L	H	-	H

High-3: Medium-2: low-1

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

Soft Computing						
Course Code	**:**	**16MSE321/16MIT321**		**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. Design learning algorithms using neural networks.
2. Apply fuzzy logic to solve real world problems.
3. Analyze fuzzy neuro systems
4. Apply genetic algorithm to solve optimization problems

Unit – I	**08 Hrs**

Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture

Unit – II	**09 Hrs**

Learning Processes: Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

Unit – III	**08 Hrs**

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

Unit – IV	**10 Hrs**

Operations on Fuzzy Sets: Fuzzy Arithmetic, Fuzzy Logic, Uncertainty based Information Complement, Intersections, Unions, Combinations of Operations, Aggregation Operations. Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Information & Uncertainty, Non specificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

Unit – V	**09 Hrs**

Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks, Applications of Fuzzy Logic: Medicine, Economics etc.
Genetic Algorithms: An Overview, Genetic Algorithms in problem solving, Implementation of Genetic Algorithms

Course Outcomes:
After going through this course the student will be able to:
CO1: Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
CO2: Analyze genetic algorithms to combinatorial optimization problems
CO3: Effectively use existing software tools to solve real problems using a soft computing approach

CO4: Evaluate and compare solutions by various soft computing approaches for a given problem.

Reference Books		
	1.	Anderson, James a., An Introduction to Neural Networks, ISBN: 978-81-203-1351-4,PHI, 2008
2.		Hertz J. Krogh, R.G. Palmer - Introduction to the Theory of Neural Computation, Addison-Wesley, 1991, ISBN: 9780201515602
3.		G.J. Klir& B. Yuan - Fuzzy Sets & Fuzzy Logic, PHI, 2006, ISBN: 978-81-203-1136-7
4.		Melanie Mitchell - An Introduction to Genetic Algorithm, PHI, 2006 ISBN: 9670201785602

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**
CO 1	L	-	-	H	-	-	-	M	M	-	-
CO 2	M	M	-	H	-	-	-	-	-	-	-
CO 3	M	M	-	H	-	-	M	-	-	-	-
CO 4	-	-	M	H	H	-	-	-	-	-	-

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

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

Social Network Analysis						
Course Code	**:**	**16MSE322/16MIT322**		**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):

Graduates shall be able to

1. List basic principles behind network analysis algorithms
2. Acquire essential knowledge of network analysis
3. Apply real world data with examples from today's most popular social networks.
4. Engage in critical thinking regarding the applicability of social network theory to various sociological phenomena

Unit – I	**10 Hrs**

Introduction : Overview, Analyzing Social Network, Securing Social Networks . **Social Networks:** Introduction, Survey of Social Networks, Details of Four Popular Social Networks **Analyzing and Securing Social Networks:** Introduction, Applications in Social Media Analytics, Data Mining Techniques for SNA, Security and Privacy .**Semantic Web-Based Social Network Representation and Analysis** : Introduction, Social Network Representation, An approach to Social Network Analysis

Unit – II	**09 Hrs**

Developments and Challenges in Location Mining : Key Aspects of Location Mining, Efforts in Location Mining, Challenges in Location Mining, Geospatial Proximity and Friendship. **TweetHood:** A Social Media Analytics Tool: TweetHood, Experiments and Results. **Tweecalization:** Location Mining Using Semisupervised Learning : Tweecalization., Trustworthiness and Similarity Measure, Experiments and Results .**Tweeque: Identifying Social Cliques for Location Mining :** Effect of Migration, Temporal Data Mining, Social Clique Identification, Experiments and Results, Location Prediction, Agglomerative Hierarchical Clustering, MapIt: Location Mining from Unstructured Text

Unit – III	**10 Hrs**

Classification of Social Networks Incorporating Link Types : Related Work, Learning Methods, Experiments. **Extending Classification of Social Networks through Indirect Friendships:** Introduction., Related Work, Definitions, Approach used, Experiments and Results. **Social Network Classification through Data Partitioning :** Introduction., Related Work, Metrics, Distributed Social Network Classification, Experiments. **Implementation of an Access Control System for Social Networks :** Security in Online Social Networks, Framework Architecture.

Unit – IV	**10 Hrs**

Social Media Integration and Analytics Systems : Introduction, Entity Extraction and Integration, Ontology-Based Heuristic Reasoning .**Semantic Web-Based Social Network Integration**: Information Integration in Social Networks, Jena–HBase: A Distributed, Scalable, and Efficient RDF Triple Store, StormRider: Harnessing Storm for Social Networks.	
Unit – V	**09 Hrs**
Data Security and Privacy: Security Policies, Policy Enforcement and Related Issues, Data Privacy .**Confidentiality, Privacy, and Trust for Social Media Data :** Trust, Privacy, and Confidentiality, CPT Framework, Privacy for Social Networks, Trust for Social Networks, CPT within the Context of Social Networks. **Attacks on Social Media and Data Analytics Solutions:** Malware and Attacks, Attacks on Social Media, Data Analytics Solutions.	
Course Outcomes: After going through this course the student will be able to: CO1: Comprehend basic notation and terminology used in network science. CO2: Visualize, summarize and compare different networks and its security. CO3: Use tools to analyze real world networks. CO4: Use advanced network analysis methods to perform empirical investigations of network data.	
Reference Books	
1.	Bhavani Thuraisingham, Satyen Abrol, Raymond Heatherly, Vaibhav Khadilka, “Analyzing and Securing Social Networks” , CRC Press, ISBN: 9781482243277
2.	Albert-Laszlo Barabasi. “Linked. The New Science of Networks”, Edition- 2014, ISBN-13: 978-0738206677
3.	Charu C Aggarwal, “ Social Network Data Analytics”, Springer, 2011, ISBN: 13:9781441984616
4.	Robert Kabacoff. “R in action. Data Analysis and graphics with R”, Manning Publications, 2011, ISBN-13: 978-1935182399

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
CO 1	H	M	L	L	L	L	-	-	M	M	M
CO 2	H	M	M	M	L	L	-	L	M	-	H
CO	H	H	M	M	H	M	-	L	M	H	H

3											
CO 4	H	H	M	H	M	M	L	L	M	M	H

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

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

IOT and Cloud Computing						
Course Code	**:**	**16MSE331/16MIT331**		**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. Interpret the fundamentals of Internet of Things.
2. Analyze and design a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
3. Apply the concept of Internet of Things in the real world scenario
4. Demonstrate the application of cloud technologies to the world of IoT

Unit – I	**10 Hrs**

Fundamentals of IoT: Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoTvs M2M

Unit – II	**09 Hrs**

IoT Design Methodology: IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

Unit – III	**10 Hrs**

IoT Physical Devices & Endpoints: What is an IoT Device , Basic building blocks of an IoT Device Exemplary Device: Raspberry Pi- About the Board Linux on Raspberry Pi Raspberry Pi Interfaces -Serial SPI , I2C, Programming Raspberry Pi with Python , Controlling LED with Raspberry Pi, Interfacing an LED and Switch with Raspberry Pi , Interfacing a Light Sensor (LDR) with Raspberry Pi Other IoT Devices -BeagleBone Black.

Unit – IV	**10 Hrs**

IoT Physical Servers & Cloud Offerings: Designing a RESTful Web API , Amazon Web Services for IoT-Amazon EC2 , Amazon AutoScaling, Amazon S3 , Amazon RDS , Amazon DynamoDB , Amazon Kinesis, Amazon SQS , Amazon EMR, SkyNetIoT Messaging Platform **.**

Unit – V	**09 Hrs**

Case Studies- IoT Design and Cloud incorporation: Introduction to IOT Design, Home Automation, Smart Lighting , Home Intrusion Detection, Cities , Smart Parking , Environment , Weather Monitoring System , Weather Reporting Bot , Air Pollution Monitoring , Forest Fire Detection, Agriculture, Smart Irrigation, Productivity Applications , IoT Printer.

Course Outcomes:

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

CO1: Interpret the essentials of IOT

CO2: Design a portable IoT using Arduino/ equivalent boards using relevant protocols

CO3: Describe the concept of web services to access/control IoT devices

CO4: Identify physical devices required to deploy an IoT application and connect to the cloud for real time scenarios.

Reference Books	
1.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015, ISBN: 978-81-7371-954-7.
2.	Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
3.	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective" ,CRC Press 2013, ISBN : 978-1-4398-9299-2.
4.	Soyata, Tolga, "Enabling Real-Time Mobile Cloud Computing through Emerging Technologies", IGI Global, 2015, ISBN: 978-1-4666-8662-5.

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**
CO 1	M	-	M	-	-	-	-	-	H	-	-
CO 2	H	M	L	H	H	M	-	M	H	L	M
CO 3	L	M	-	M	M	L	-	-	H	M	M
CO 4	H	L	M	M	H	H	-	M	H	H	M

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

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

Big Data Analytics						
Course Code	**:**	**16MIT332/16MSE332**		**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. Understand handling huge amount of data using distributed environment.
2. Analyse large sets of data to gain insights of the underlying patterns.
3. Apply techniques to process data streams using in memory operations.
4. Adapt data mining techniques to process massive datasets..

Unit – I	**10 Hrs**

Introduction to Big Data Analytics: Characteristics of Big Data, Importance of Big Data Analytics, Different levels of parallelization, Hadoop architecture, data blocks, speculative execution, HDFS daemons, Hadoop ecosystem, HDFS containers, Introduction to MapReduce, concepts of YARN, MapReduce phases, combiners, Partitioners, program examples.

Unit – II	**09 Hrs**

Introduction to: Introduction to Hive, Hive configuration, HiveQL, Partitions and buckets, user defined functions in Hive.

Introduction to Pig, Pig Latin, execution modes, user defined functions in Pig, data processing operators.

Concepts of NOSQL databases.

Unit – III	**10 Hrs**

Introduction to Scala: Basics of programming with Scala, classes, collections, options and types, implicits, loops, functions.

Unit – IV	**10 Hrs**

SPARK - I: Programming with RDD's, creating RDD's, RDD operations, passing functions to SPARK, transformations and actions, working of pair RDD's, data partitioning, SPARK SQL.

Unit – V	**09 Hrs**

Machine Learning with SPARK-ML2: Basics of machine learning, working with vectors, feature extraction, regression, classification, clustering, collaborative filtering and recommendation, dimensionality reduction, model evaluation.

Course Outcomes:

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

CO1: Handle data manipulations for massive datasets using distributed environment.

CO2: Gain insights into the patterns by processing massive datasets.

CO3: Implement techniques for real time processing of data streams.

CO4: Extract value out of the data to make important business decisions and accurate predictions.

Reference Books

1.	Tom White, Hadoop: The Definitive Guide, O'Reilly Publications, 4th edition, 2015, ISBN-10: 9352130677, ISBN-13: 978-9352130672
2.	Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, Learning Spark,

	O'Reilly Publications, 1st edition, 2015, ISBN-10: 9351109941, ISBN-13: 978-9351109945
3.	Jason Swartz, Learning Scala, O'Reilly Publications, 1st edition, 2014, ISBN-10: 9352132564, ISBN-13: 978-9352132560
4.	Seema Acharya, Subhashini Chellappan, Big Data and analytics, Wiley Publications, 2015, ISBN-10: 8126554789, ISBN-13: 978-8126554782

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
CO 1	H	H	M	H	M	-	-	L	M	H	M
CO 2	M	M	-	H	M	-	-	-	M	-	M
CO 3	M	M	-	M	H	L	-	-	M	-	M
CO 4	M	M	H	H	H	M	L	-	M	M	M

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

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

Enterprise Application Programming						
Course Code	**:**	**16MSE341**		**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. Comprehend the metrics in Web Application Development and related terminologies
2. Apply the knowledge of frameworks and Enterprise Application Development Tools
3. Analyze the Web frameworks.
4. Develop EA solutions using Design Patterns

Unit – I	**10 Hrs**

Web application and java EE 6: Exploring the HTTP Protocol, Introducing web applications, describing web containers, exploring web architecture models, exploring the MVC architecture. Working with servlets 3.0Exploring the features of java servlet, Exploring new features in servlet 3.0, Exploring the servlet API, explaining the servlet life cycle, creating a sample servlet, creating a servlet by using annotation, working with servlet config and servlet context objects, working with the Http servlet request and Http Httpservlet response interfaces, Exploring request delegation and request scope, implementing servlet collaboration.

Unit – II	**09 Hrs**

Handling sessions in servlet 3.0: Describing a session, introducing session tracking, Exploring the session tracking, mechanisms, using the java servlet API for session tracking, creating login application using session tracking. Implementing event handling Introducing events, Introducing event handling, working with the servlet events, developing the online shop web application. Working with java server pages: Introducing JSP technology, Exploring new features of JSP2.1, listing advantages of JSP over java servlet, Exploring the architecture of a JSP page, Describing the life cycle of a JSP page, working with JSP basic tags and implicit objects, working with the action tags in JSP, exploring the JSP unified EL, using functions with EL.

Unit – III	**10 Hrs**

Implementing JSP tag extensions: Exploring the elements of tag extensions, Working with classic tag handlers, Exploring the tag extensions, Working with simple tag handlers. Implementing java server pages standard tag library 1.2: Introducing JSTL, Exploring the tag libraries JSTL, working with the core tag library. Implementing filters: Exploring the need of filters, exploring the working of filters, exploring filters API, configuring a filter, creating a web application using filters, using initializing parameter in filters.

Unit – IV	**10 Hrs**

Persistence Management and Design Patterns: Implementing java persistence using hibernate Introducing hibernate, exploring the architecture of hibernate, downloading hibernate, exploring HQL, understanding hibernate O/R mapping, working with hibernate, Implementing O/R mapping with hibernate. Java EE design patterns: Describing the java EE application architecture, Introducing a design patterns, discussing the role of design patterns, exploring types of patterns.

Unit – V	**09 Hrs**

Web Frameworks: Working with struts 2 Introducing struts 2, understanding actions in struts 2.Working with java server faces 2.0: Introducing JSF, Explaining the features of JSF, Exploring the JSF architecture, describing JSF elements, Exploring the JSF request processing life cycle. Working with spring 3.0: Introducing features of the spring framework, exploring the spring framework architecture, exploring dependency injection & inversion of control, exploring AOP with spring, managing transactions. Securing java EE 6 applications: Introducing security in java EE 6, exploring security mechanisms, implementing security on an application server.

Course Outcomes:

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

CO1. **Enabling knowledge** : Explain the protocols and systems used on the Web (such as XHTML,HTTP, URLs, CSS, SSI, XML) and the functions of clients and servers on the Web for internet application concepts, relevant alternatives.

CO2. Develop project management skills related to web development, such as:
Gather data to identify customer requirements, Define scope work, Select programming languages and tools, Evaluate web technologies and standards, Define security measures, Review technical considerations and constraints of projects.

CO3. **Critical analysis**: Analyse and model requirements and constraints for the design of client-server internet applications.

CO4. **Problem solving**: Design and implement client-server internet applications using Servlets, JSPs and JSFs to build a web application for the enterprise, performing unit, integration testing and Manage deployment configurations

CO5. Communicate effectively to a wide variety of audiences, verbally, in writing, and electronically by:
Documenting application/website changes, Preparing and presenting functional and technical specifications, Evaluating and recommending web hardware, software and third party solutions, Providing quality customer service.

Reference Books

	1.	Kogent learning solution, Java Server Programming Java Ee7 J2ee 1.7, Dreamtech press, 2015. ISBN-13: 9789351194170
2.		Cary E. Umrysh, Khawar Zaman Ahmed, Developing Enterprise Java Applications With J2EE(TM) And UML - Best Practices And Design Strategies, Addison-Wesley Professional, ISBN-13: 9780201738292
3.		John Brock Arun Gupta, Greertan Wielenga, Java Ee & Html5 Enterprise Application Development, Tata Mcgraw Hill Publishing Co Ltd, 2015-06. ISBN-13: 9789339222321
4.		Gerald Gierer ," Enterprise Application Development with Ext JS and Spring ", Packt Publishing 2013 ISBN-13: 97823401738292

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
CO 1	H	M									
CO 2	H			M	H	M	M			H	H
CO 3	H	H									
CO 4	H		H								
CO 5								H	M	M	

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

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

Agile Methodology						
Course Code	**:**	**16MSE342**		**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. Comprehend an iterative, incremental development process leads to faster delivery of more useful software.
2. Apply the principles and practices of extreme programming.
3. Analyze the essence of agile development methods.
4. Develop prototyping in the software process.

Unit – I	**10 Hrs**

The Agile Movement - A Five Minute Primer, What is Agile Development? The Agile Methodologies Agile Values, Agile Practices, Agile Principles **Agile Characteristics**-The Characteristics of an Agile Project, The Development Team Project Management, The Customer, Processes and Tools The Contract, What Projects Can Benefit from Agile Development?	
Unit – II	**09 Hrs**
The Agile Methodologies: Common Themes, Methodology Descriptions, Extreme Programming, Scrum, Feature Driven Development, The Crystal Methodologies, Adaptive Software Development, Dynamic Systems Development Method, Lean Software Development, Starting Monday: Investigate Further **Selecting an Approach that Fits:** Choosing between an Agile or Traditional Approach, Selecting the Right Agile Approach	
Unit – III	**10 Hrs**
Going Agile: Is the Team Ready? Announcing the Team's Intention to Go Agile, Encountering, Addressing and Overcoming Resistance, Start with the Bare Minimum, Altering the Project Environment, Iteration Zero, Discontinue a Process Once its Served its Purpose, False Agile, Practitioners and Projects, Starting Monday: Measuring The Team's Progress.	
Unit – IV	**10 Hrs**
Agile Practices: Getting Started, Agile Practices Explained, Selecting the Next Practice, Rejecting a Practice, Adopt Practices before Tools Learn Programming Practices in Pairs, Agile Practices in this Book Agile Practices Explained, Why these Practices were Chosen	
Unit – V	**09 Hrs**
Testing : An Agile Approach to Testing, The Good Enough Approach Testing as the Best Defense, Sharing a Code Base with another Project Team, Sharing Common Components with another Project Team, Depending upon Code or Components Produced by Another Project Team	
Course Outcomes: After going through this course the student will be able to: CO1: Comprehend the common characteristics of an agile development process. CO2: Identify and contrast state of the practice agile methodologies. CO3: Analyze and contrast agile software development process models and plan driven process models. CO4: Determine software project characteristics that would be suitable for an agile process	
Reference Books	
1	Ken Schwaber And Mike Beedle, Agile Software Development With Scrum, Pearson Education, 2015. ISBN-13: 9780132074896
2	Peter Schuh, Integrating Agile Development In The Real World (Charles River Media Programming), 2004 Cengage Learning, ISBN-13: 9781584503644
3	Alistair Cockburn, Agile Software Development: The Cooperative Game, Pearson Education, 2015. ISBN-13: 9780321482754
4	Mike Cohn, Succeeding With Agile : Software Development Using Scrum, Pearson Education Limited, 2016, ISBN-13: 9789332547964

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
CO 1	M	H	M	L	-	-	-	-	-	-	-
CO 2	M	H	H	M	-	-	-	M	L	-	L
CO 3	H	M	H	M	-	-	L	L	-	-	-
CO 4	L	H	H	H	-	-	M	L	-	-	-

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

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

INTERNSHIP / INDUSTRIAL TRAINING						
Course Code	**:**	**16MSE35**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:6:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**3**		**SEE Duration**	**:**	**30 mins**
GUIDELINES FOR INTERNSHIP						

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	**:**	**16MSE36**		**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:

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.

Rubrics for Evaluation:

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

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

IV SEMESTER

MAJOR PROJECT						
Course Code	**:**	**16MSE41**		**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
CO 1	H	H	H	M	L	M	L				
CO 2				L				M	H		
CO 3					L	M	M			H	
CO 4					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	**:**	**16MSE42**		**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:

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.

Rubrics for Evaluation:

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

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