Rashtreeya Sikshana Samithi Trust

R.V. College of Engineering, Bengaluru

(Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)

Master of Technology (M. Tech.)

Information Technology

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 program, 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 Information Technology Program, Students will be able to:

PEO1: Identify and evaluate current and changing information system methodologies and assess their applicability in regulatory demands, strategic goals to address the clients' needs.

PEO2: Solve business-centered problems by analyzing, developing and implementing information system based solutions

PEO3: Configure and operate complex software systems, packages, tools and applications for sustainability in various domains like education, healthcare, business.

Program Outcomes (PO)

Student in M. Tech. in Information Technology will be able to attain :

PO1: **Scholarship of Knowledge-** Acquire in-depth knowledge of Information Technology, 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.

PO2: Critical Thinking - Analyse complex Information Technology related problems critically, 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 Information Technology, 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.

PO4: Research Skill - Extract information pertinent to unfamiliar problems in Information Technology 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 Information Technology, 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 Information Technology, 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 Information Technology 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 Information Technology 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 - Recognise the need for, and have the preparation and ability to engage in life-long learning independently in Information Technology 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 Information Technology 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 Information Technology Students will be able to:

PSO 1. Design, integrate and administer IT-based solutions for enterprize, develop mobile applications.

PSO 2. Synthesize and evaluate models for IT management with emphasis on storage management, data engineering & Security.

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Department of Information Science and Engineering

M.Tech. in Information Technology

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	16MIT12/ 16MSE12	Data Engineering	IS	4	0	1	0	5
3	16MIT13	Enterprise Application Development	IS	4	0	0	1	5
4	16MIT14	Information Storage and Management	IS	4	0	0	0	4
5	16MIT15X	Elective – 1	IS	4	0	0	0	4
6	16HSS16	Professional Skill Development		0	0	2	0	2
		Total		**19**	**1**	**3**	**1**	**24**

Elective -1			
16MIT151	Service Oriented Architecture	16MIT152/16MSE152	Human Computer Interaction

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Department of Information Science and Engineering

M.Tech. in Information Technology

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	16MEM21P	Project Management	IM	3	1	0	0	4
2	16MIT22/16MSE22	Cyber Security and Digital Forensics	IS	4	0	1	0	5
3	16MIT23X	Elective – 2	IS	4	0	0	0	4
4	16MIT24X	Elective – 3	IS	4	0	0	0	4
5	16MIT25X	Elective – 4	IS	4	0	0	0	4
6	16MIT26	Minor Project	IS	0	0	5	0	5
		Total		**19**	**1**	**6**	**0**	**26**

Elective -2			
16MIT231	Multimedia communications	16MIT232	Bio Informatics
Elective – 3			
16MCE241/16MIT241	Information Retrieval	16MIT242	Supply Chain Management
Elective – 4			
16MIT251/16MSE251	Advanced Computer Networks	16MIT252/16MSE252	Distributed Computing

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M.Tech. in Information Technology

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	16MIT31	Mobile Application Development	IS	4	0	1	0	5
2	16MIT32X	Elective – 5	IS	4	0	0	0	4
3	16MIT33X	Elective – 6	IS	4	0	0	0	4
4	16MIT34X	Elective – 7	IS	4	0	0	0	4
5	16MIT35	Internship / Industrial Training	IS	0	0	3	0	3
6	16MIT36	Technical Seminar	IS	0	0	2	0	2
		Total		**16**	**0**	**6**	**0**	**22**

Elective -5			
16MIT321/16MSE321	Soft Computing	16MIT322/16MSE322	Social Network Analysis
Elective – 6			
16MIT331/16MSE331	IoT and Cloud Computing	16MIT332/16MSE332	Big Data Analytics
Elective-7			
16MIT341	Machine Learning	16MCE342/16MIT342	Natural Language Processing &Text Mining

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FOURTH SEMESTER								
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**				**Total Credits**
				Lecture	**Tutorial**	**Practical**	**Experiential Learning/ Self Study**	
				L	**T**	**P**	**S**	
1	16MIT41	Major Project	IS	0	0	26	0	26
2	16MIT42	Seminar	IS	0	0	2	0	2
		Total		**0**	**0**	**28**	**0**	**28**

FIRST SEMESTER

Research Methodology						
Course Code	**:**	**16MEM11R**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S: 3:1:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives:

Students shall be able to

1. Understand of the underlying principles of quantitative and qualitative research
2. Perform the gap analysis and identify the overall process of designing a research study.
3. Choose the most appropriate research methodology to address a particular research problem
4. Gain a overview of a range of quantitative and qualitative approaches leading to data analysis and suggesting solution

Unit – I	10 Hrs

Overview of Research

Meaning of Research, Types of Research, Research and Scientific Method, Defining the Research Problem, Defining the Research Problem, Research Design, Different Research Designs.

Unit – II	09 Hrs

Methods of Data Collection

Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Unit – III	10 Hrs

Sampling Methods

Sampling process, Non-probability sampling, probability sampling: simple random sampling, stratified sampling, cluster sampling systematic random sampling, Determination of sample size, simple numerical problems.

Unit – IV	10 Hrs

Processing and analysis of Data

Processing Operations, Types of Analysis, Statistics in Research, Measures of: Central Tendency, Dispersion, Asymmetry and Relationship, correlation and regression, Testing of Hypotheses for single sampling: Parametric (t, z and F) Chi Square, ANOVA, and non-parametric tests, numerical problems.

Unit-V	09 Hrs

Essential of Report writing and Ethical issues:

Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Precautions for Writing Research Reports.

Syllabus includes 12 hours of tutorials in which:

- Faculty is expected to discuss research methodology for specializations under consideration.
- Numerical problems on statistical analysis as required for the domains in which students are studying must be discussed.
- Statistical analysis using MINITAB/ MatLab and such other softwares can be introduced.

Course Outcomes:

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

CO1: Adopt various principles and concepts of research methodology to their research problems.

CO2: Apply appropriate method of data collection and analyze using statistical methods.

CO3: Formulate research methodology for a given engineering and management problem situation.

CO4: Analyze research outputs in a structured manner and prepare report as per the technical and ethical standards.

Reference Books:

1. Kothari C.R., Research Methodology Methods and techniques by, New Age International, 2004, ISBN: 9788122415223 – Unit I, II, IV & V.
2. Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Pearson Education India, 2009, ISBN:9788177585636 – Unit III.
3. Levin, R.I. and Rubin, D.S., Statistics for Management, 7th Edition, Pearson Education: New Delhi, ISBN-13: 978-8177585841 – Unit III, IV.

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 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	H	L	M	L	H	M	L	L	M	M	--
CO2	H	M	M	M	H	L	M	L	M	M	--
CO3	M	H	H	H	L	M	M	L	H	M	--
CO4	M	H	M	M	L	M	H	L	H	M	--

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

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

Data Engineering						
Course Code	**:**	**16MIT12/16MSE12**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:1:0**		**SEE Marks**	**:**	**100+50**
Credits	**:**	**05**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives (CLO):

Students shall be able to

1. Explain and differentiate Parallel and Distributed databases and its applications
2. Apply the technology of OODBMS
3. Analyse the need for data warehousing systems and the technology for data warehousing
4. Adapt data mining techniques to real life applications to derive useful results

Unit – I	**10 Hrs**

Object DBMS: Object Oriented Databases – Introduction – Weakness of RDBMS – Object Oriented Concepts Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Object Oriented Database Management System Manifesto – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.

Unit – II	**09 Hrs**

Distributed Databases: Introduction, Functions and architectures of a DDBMS, Distributed Transaction Management, Distributed Concurrency Control, Distributed Deadlock Management, Distributed Database Recovery, Distributed query optimization

Replication and Mobile databases: Introduction to database replication, Benefits of database replication, Applications of replication, Basic components of database replication, database replication environments, Replication Servers, Introduction to mobile databases

Unit – III	**10 Hrs**

Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction

Unit – IV	**10 Hrs**

Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation. Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

Unit – V	**09 Hrs**

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Backpropagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

Cluster Analysis Introduction :Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Unit – VI (Guidelines for Minor Project)

For the Minor project students have a choice between a data mining project using and implementing a client/Server/web based database project based on Distributed databases or a project based on data mining method or a Project based on ODBMS. The topic of the minor project should be coordinated with the faculty

Project types

- Identify a suitable project under the following domains to implement the features specific to the type of DBMS. This should be an application-based project. Examples are given below but is not limited to the same.

- **Distributed Database Projects to exhibit the following**
  - Data partitioning experiments
  - Aggregation Operator
  - Implementing a special operator called shuffle to enable Simple DB to run joins in parallel.
  - Implement a Skewed Join
  - Implement a broadcast join
  - Implement a fuzzy join
  - Performance analysis

- **OODBMS Projects**
  - The project should demo the specific functionalities and applications that are salient to OODBMS, some examples are :
  - Encapsulation in OODBs, Object Versioning, Overloading in OODBs, Object Identity, Object Structure, Type Constructors etc.

- **Data mining Projects**
  - Decision support systems (DSS) Applications, on-line analytical processing (OLAP) Applications. Any application domain related to Banking, Retail, Insurance, Medical, Security etc to demo the following functionalities:

    - **pivoting** - rotating to display a different dimension (see cubes on right)
    - **rollup** - displaying a coarser level of data granularity, by combining or aggregating data
    - **drill-down** - showing more detail on some dimension, using finer granularity for the data; requires that the more detailed data be available

- **slicing** - examining a portion of the data cube using a selection with equality conditions for one or more dimensions; appears as if the user has cut through the cube in the selected directions
- **dicing**- specifying a range of values in a selection
- **Cross-tabulation** – displaying totals (or other statistics)for the rows and columns in a two-dimensional spreadsheet-style display

- Studying a data set that has not been thoroughly evaluated, or using a different approach. The analysis should not be trivial. Students are expected to study the dataset, determine the issues, address any preprocessing issues, try multiple modeling techniques, and perhaps take some creative steps to try to improve the predictive performance.

- **Implementation:** Identify an algorithm to implement. Implement the algorithm (preferable with an interface to a data mining environment (R, WEKA, MOA, etc.). Test/compare the implementation with a data set.

Project Report guidelines:

- The actual write-up of minor project should be double spaced. Everyone will be doing a presentation of their project. Students should be able to present their results during the last class/exam, the paper need not be organized exactly as described below, but this should be taken as a reasonable template.
- Abstract: summarizes the paper and the goals of the work (required)
- Introduction: Introduces the project and what is being done. May include some background.
- Background: Depending on the project, a separate background section, depending on how much background to include. For example, it may provide domain information for the domain that of study.
- Experiments: Describes the experiments and the experimental setup. May describe the data sets, the evaluation metrics, the data mining tools used, and any other details related to the experiments.
- Results: Includes the experiment results (which are typically not included in the experiments section). A discussion of the results may be included, or they could be included in a separate discussion section, which follows the results.
- Related Work: A brief description of related work, with citations to relevant papers. There should be a few references to data mining (e.g., a reference to the WEKA book or WEKA system) and there really should be a few references to similar work. If therelated work section is going to be very short, the same may be included in the background or introduction section

Course Outcomes:

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

CO1: define & explain the key related concepts & models in OODBMS to data science including data cleaning & integration, data intensive distributed computing, data mining algo and data visualization.

CO2: Design-implement & evaluate the core algorithms underlying on end to end data science work flow, including the experimental design data collection, mining, analysis and visualization of

information derived from large data set. CO3: Apply best practices in data science including facility with modern tools. CO4: Comprehend and write effective reports and design documentation by adhering to appropriate standards and make effective presentations.	
Reference Books	
1.	Database Systems – Thomas Connolly and Corolyn Begg, Pearson 4th edition ISBN :978-8131720257
2.	Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 3rd Ed ISBN 0123814804, 978-0123814807
3.	Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013 6th Ed ISBN :978-8131792476
4.	Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition, McGraw Hill, 2010. ISBN : 978-0073523323.

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.

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	-	-
CO2	H	H	M	M	-	-	M	M	M	H	M
CO3	H	-	M	-	H	-	-	L	M	H	M
CO4	-	-	-	-	-	M	L	H	-	L	-

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

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

Enterprise Application Development						
Course Code	**:**	**16MIT13**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:1**		**SEE Marks**	**:**	**100**
Credits	**:**	**5**		**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 Http servlet 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.

Self study

Use FOSS("Free and Open Source Software") for development of the following Applications.

1. Developing the profile management module
2. Developing the recruitment module
3. Developing the payroll module

Course Outcomes:

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

CO1: Comprehend WEB basics and their functionalities.
CO2: Identify and apply JAVA support and API skills for Enterprise Application Development.
CO3: Analyze and compare different WEB application frameworks.
CO4: Determine deployment configurations and implement Security mechanisms

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.	Peter A. Pilgrim , Digital Java EE 7 Web Application Development, Packt Publishing Limited,2015, ISBN-10: 1782176640

Scheme of Continuous Internal Evaluation (CIE)

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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	M	L	L	L	M	M	-	M	H	L	L
CO2	H	M	M	L	H	H	-	H	H	M	M
CO3	M	H	M	M	H	H	-	H	H	H	M
CO4	H	H	H	H	H	H	-	H	H	H	M

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

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

Information Storage and Management						
Course Code	**:**	**16MIT14**		**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 storage architectures and demonstrate the logical and physical components of a storage infrastructure including storage subsystems, RAID and Intelligent storage systems
2. Analyze storage networking technologies such as FC-SAN, NAS, IP-SAN, data archival solutions and virtualization technologies.
3. Apply and articulate business continuity solutions including backup technologies, local and remote replication solutions.
4. Identify security parameters for managing and monitoring storage infrastructure.

Unit – I	**10 Hrs**

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data center Infrastructure, Virtualization and cloud computing. **Data Center Environment**: Application, Database Management System(DBMS), Host(compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based On Application, Disk Native Command Queuing, Introduction to Flash Drives, Concept in Practice: VMware ESXi. **Data Protection: RAID:**RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. Standards - SNIA

Unit – II	**09 Hrs**

Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning, Types of intelligent Storage Systems, Concepts in Practice: EMC Symmetrix and VNX. Fibre Channel Storage Area Networks: **Fiber Channel: Overview,** The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, fabric Services, Switched fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN, Concepts in Practice: EMC Connectrix and EMC VPLEX.**IP SAN and FcoE**: iSCSI, FCIP, FcoE.

Unit – III	**10 Hrs**

Network-Attached Storage: General-purpose Servers versus NAS Devices, benefits of NAS, File Systems and network File Sharing. Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, factors Affecting NAS Performance, File-Level Virtualization, Concepts in Practice: EMC Isilon and EMC VNX gateway. **Object-Based and unified Storage:** Object-Based Storage Devices, Content-Addressed Storage, CAS use Cases, unified Storage, Concepts in Practice: EMC atoms, EMC VNX, and EMC centera. **Introduction to Business Continuity**. Information Availability, BC Terminology, BC Planning life Cycle, failure Analysis, Business Impact Analysis, BC Technology solutions.

Unit – IV	**10 Hrs**

Backup and Archive : Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operation, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Dedupulication for Backup, Backup in Virtualized Environments, Data Archive ,Archiving Solution Architecture, Concepts in

Practice :EMC Networker, EMC Avamar, and EMC Data domain. **Local Replication**: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas, Local Replication in Virtualized Environment, Concepts in Practice: EMC TimeFinder. **Remote Replication**: Modes of Remote Replication, Remote Replication Technologies, Three-Site Replication, Data Migration Solutions, Remote Replication and Migration in a Virtualized Environment, Concepts in Practice : EMC SRDF, EMC MirrorView, and EMC RecoverPoint

Unit – V	**09 Hrs**

Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Security implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments, Concepts in practice: RSA and VMware Security Products. **Managing the Storage Infrastructure**: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Information Lifecycle Management, Storage Tiering, Concepts in Practice: EMC Infrastructure.

Course Outcomes:

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

CO1: Identify the decisive role and key challenges in managing information and analyze different storage networking and virtualization technologies.

CO2: Analyze the SAN and NAS deployment for file and data sharing for a collaborative development environment of organizations.

CO3: Design Storage configurations that effectively meet scalability, security, resilience & availability requirements.

CO4: Develop & implement migration strategies for growing business storage needs & network capabilities keeping in mind interoperability.

Reference Books

1.	EMC Education Services, "EMC^2: Information Storage and Management", 2nd Edition, Willey India, 2013, ISBN-13: 978-1118094839.
2.	Robert Spalding, "Storage Networks: The Complete Reference", 1st Edition, Tata McGraw Hill India, 2003, ISBN: 9780070532922.
3.	Ulf Troppens, Rainer Erkens, Wolfgang Muller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained", 2nd Edition, Wiley India, 2009, ISBN: 978-0-470-74143-6
4.	Marc Farley, "Building Storage Networks", 2nd Edition, Tata McGraw Hill India, 2001, ISBN-13: 978-0070447455.

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	H	M	H	-	H	-	M	-	L	-	-
CO2	M	H	H	-	H	-	-	-	L	-	-
CO3	M	H	H	-	H	-	-	-	-	M	-
CO4	H	-	H	-	H	M	L	M	-	H	-

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

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

Service Oriented Architecture						
Course Code	**:**	**16MIT151**		**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 various architecture for application development.
2. Analyze the importance of SOA in Application Integration.
3. Apply web service and SOA related tools.
4. Implementation details of SOA with case studies.

Unit – I	**10 Hrs**

Understanding SOA: Realizing the Promise of SOA – Challenges of SOA, Best Practices of SOA Analysis & Design. SOA Architecture Fundaments – What is Architecture, What is service oriented Architecture, What is a service, SOA Reference Architecture.

Unit – II	**09 Hrs**

Getting Started with SOA: Overview of SOA implementation methodology, SOA reference Architecture, Business Architecture, Business Processes, Information Design, Service Identification, Service Specification, Service Realization , Service Life Cycle, The Service Design Process.

Unit – III	**10 Hrs**

Designing SOA: Starting with the Business – Business Architecture , Understarting the Business Motivation Model , Business Process Management & Modeling, How to create business Process Models, Conditional Business process models.

Unit – IV	**10 Hrs**

Service Context and Common Semantics: The Importance of Semantics in SOA, CORE Information Modelling, Structuring Information Models , Documents and XML, XML Patterns, Best Practices of SOA Architect, Designing service Interfaces.

Unit – V	**09 Hrs**

Designing Service Implementation: Implementing - Interface layer, Business layer, Resource Layer; Composing Services, Using services to Build Enterprise Solutions, SOA Security, SOA Governance. Expected

Course Outcomes:

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

CO1: Explain the basic Principles of SOA and apply these concepts to the simple applications.
CO2: Design the entities involved to develop architecture of web services.
CO3: Implement SOA using current technologies in particular to web services.
CO4: Evaluate emerging and proposed standards required to use SOA concepts in building cloud computing applications.

Reference Books

1.	Michael Rosen, Boris Lublinsky, Kevin T. Smith, Marc J. Balcer "Applied SOA: ServiceOriented Architecture and Design Strategies", Wiley publishing, Inc. 2012. ISBN-13: 9813143545090

2.	Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2010. ISBN-13: 978-8131709771
3.	Dan woods and Thomas Mattern, "Enterprise SOA designing IT for Business Innovation", O'REILLY, Second Edition, 2011. . ISBN-13: 968-1142709091
4.	Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services. An Architect's Guide", Pearson Education, 2005. ISBN-13: 978-2134509080

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	M	M	M	L	L	L	L	-	M	-	L
CO2	M	M	H	M	L	-	-	-	L	L	L
CO3	M	M	M	H	H	-	M	-	L	-	L
CO4	M	M	M	M	M	-	-	-	-	-	-

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

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

Human Computer Interaction						
Course Code	**:**	**16MIT152/16MSE152**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S 4:0:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3**

Course Learning Objectives (CLO):

Students shall be able to

1. Demonstrate knowledge of human computer interaction design concepts and related methodologies.
2. Recognize how a computer system may be modified to include human diversity and apply theories and concepts associated with effective work design to real-world application.
3. Improve quality and usability of their design, and will understand the theory behind what they do intuitively and design mock ups and carry out user and expert evaluation of interfaces
4. Conceptualise, design and evaluate interactive products systematically.

Unit – I **10 Hrs**

Usability of Interactive Systems: Introduction, Usability Measures, Usability Motivations, Universal Usability, Goals for Our Profession, **Guidelines, Principles, and Theories**: Introduction, Guidelines, Principles, Theories. **Development Processes : Managing Design Processes:** Introduction, Organizational Design to Support Usability, The Four Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, Social Impact Statement for Early Design Review, Legal Issues.

Unit – II **09 Hrs**

Evaluating Interface Designs: Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance Tests, Evaluation During Active Use Controlled Psychologically Oriented Experiments. **Interaction Styles, Direct Manipulation and Virtual Environment :** Introduction Examples of Direct Manipulation, Discussion of Direct Manipulation, 3D Interfaces Teleoperation, Virtual and Augmented Reality. **Menu Selection, Form Fill-in, and Dialog Boxes :** Introduction, Task-Related Menu Organization, Single Menus, Combinations of Multiple Menus, Content Organization Fast Movement through Menus, Data Entry with Menus: Form Fill-in, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays

Unit – III **10 Hrs**

Command and Natural Languages: Introduction, Command-Organization, Functionality, Strategies, and Structure, Naming and Abbreviations, Natural Language in Computing. **Interaction Devices:** Introduction, Keyboards and Keypads, Pointing Devices Speech and Auditory Interfaces, Displays – Small and Large. **Collaboration and Social Media Participation:** Introduction, Goals of Collaboration and Participation, Asynchronous Distributed Interfaces: Different Place, Different Time Synchronous Distributed Interfaces: Different Place, Same Time, Face-to-Face Interfaces: Same Place, Same Time.

Unit – IV **10 Hrs**

Design Issues, Quality of Service: Introduction, Models of Response Time Impacts Expectations and Attitudes, User Productivity, Variability in Response Time, Frustrating Experiences.

Balancing Function and Fashion: Introduction, Error Messages, Non anthropomorphic Design, Display Design, Web Page Design, Window Design, Color.

Unit – V	09 Hrs
User Documentation and Online Help: Introduction, Online versus Paper, Documentation, Reading from Paper versus from Displays, Shaping the Content of the Documentation, Accessing the Documentation, Online Tutorials and Animated Demonstrations, Online Communities for User Assistance, The Development Process. **Information Search:** Introduction, Searching in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and SearchInterface. **Information Visualization:** Introduction, Data Type by Task Taxonomy, Challenges for Information Visualization.	

Course Outcomes:

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

CO1: Explain fundamental design & evaluation methodologies of HCI.

CO2: Analyse & adopt classic design standards & patterns.

CO3: Apply Theories & concepts associated with effective work design for real world application.

CO4: demonstrate knowledge of HCI design concepts & related methodologies.

Reference Books

1.	Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition,2014, Pearson Publications, ISBN: 0321537351.
2.	Wilbert O Galitz, "The essential guide to user interface design", Wiley, 3rd Ed,2007, ISBN: 978-0-471-27139-0.
3.	Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, "Human – Computer Interaction", Pearson 3rd Edition,2004, ISBN 0-13-046109-1.
4.	Prece, Rogers, Sharps, "Interaction Design", 3rd Edition,2011, Wiley, ISBN: 978-1-119-02075-2.

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	M	L	-	-	-	-	-	L	-	-	-
CO2	M	M	M	-	M	-	-	-	-	L	-
CO3	M	L	L	-	-	-	-	L	H	-	-
CO4	H	-	-	-	H	-	-	-	-	-	-

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

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

Professional Skill Development						
Course Code	**:**	**16HSS16**		**CIE Marks**	**:**	**50**
Hrs/Week	**:**	**L:T:P:S**	**0:0:4:0**	**Credits**	**:**	**02**

Course Learning Objectives (CLO):

Student will be able to

1. Understand the importance of verbal and written communication
2. Improve qualitative and quantitative problem solving skills
3. Apply critical and logical think process to specific problems
4. Learn to manage stress by applying stress management skills

UNIT 1	**5 hours**

Communication Skills: Basics of Communication, Personal Skills & Presentation Skills, Attitudinal Development, Self Confidence, SWOC analysis.

Resume Writing: Understanding the basic essentials for a resume, Resume writing tips Guidelines for better presentation of facts.

UNIT 2	**6 hours**

Quantitative Aptitude and Data Analysis: Number Systems, Math Vocabulary, fraction decimals, digit places etc. Reasoning and Logical Aptitude, - Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. Verbal Analogies – introduction to different question types – analogies, sentence completions, sentence corrections, antonyms/synonyms, vocabulary building etc. Reading Comprehension, Prob**l**em Solving

UNIT 3	**4 hours**

Interview Skills : Questions asked & how to handle them, Body language in interview, Etiquette, Dress code in interview, Behavioral and technical interviews, Mock interviews - Mock interviews with different Panels. Practice on Stress Interviews, Technical Interviews, General HR int***e***rviews

UNIT 4	**5 hours**

Interpersonal and Managerial Skills: Optimal co-existence, cultural sensitivity, gender sensitivity; capability and maturity model, decision making ability and analysis for brain storming; Group discussion and presentation skills;

UNIT 5	**4 hours**

Motivation and Stress Management: Self motivation, group motivation, leadership abilities Stress clauses and stress busters to handle stress and de-stress; professional ethics, values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects**.**

Note: The respective departments should discuss case studies and standards pertaining to their domain

Course Outcome:

The Student will be able to :

CO1: Develop professional skill to suit the industry and life long learning requirements.

CO2: Solve quantitative and reasoning problems with confidence.

CO3: Demonstrate leadership and interpersonal working skills in various situations.

CO4: Display verbal communication skills with appropriate body language.

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in TWO Phases:

Phase	Activity	Weightage
I	After 5 weeks - Unit 1, 2 & Part of Unit 3	50%
II	After 10 weeks – Unit 3, 4, 5	50%

CIE Evaluation shall be done with weightage as follows:

Writing skills	10%
Logical Thinking	25%
Verbal Communication & Body Language	**35%**
Leadership, Interpersonal and Stress Bursting Skills	**30%**

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

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

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

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

SECOND SEMESTER

Project Management						
Course Code	**:**	**16MEM21P**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P: S: 3:1:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**4**		**SEE Duration**	**:**	**3 hrs**

Course Learning Objectives:

Student are able to

1. Understand the basic principles and components of project management
2. Appreciate the integrated approach to managing projects.
3. Apply the appropriate project management tools and techniques.
4. Prepare project schedules with reports.

Unit – I	10 Hrs

Introduction: Project, Project management, relationships among portfolio management, program management, project management, and organizational project management, relationship between project management, operations management and organizational strategy, business value, role of the project manager, project management body of knowledge.

Unit – II	10Hrs

Generation and Screening of Project Ideas: Generation of ideas, monitoring the environment, corporate appraisal, scouting for project ideas, preliminary screening, project rating index, sources of positive net present value. Project costing,

Project Scope Management: Project scope management, collect requirements define scope, create WBS, validate scope, control scope.

Organizational influences & Project life cycle: Organizational influences on project management, project state holders & governance, project team, project life cycle.

Unit – III	10 Hrs

Project Integration Management: Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.

Project Quality management: Plan quality management, perform quality assurance, control quality.

Unit – IV	08 Hrs

Project Risk Management: Plan risk management, identify risks, perform qualitative risk analysis, perform quantitative risk analysis, plan risk resources, control risk.

Project Scheduling: Project implementation scheduling, Effective time management, Different scheduling techniques, Resources allocation method, PLM concepts. Project life cycle costing.

Unit-V	10 Hrs

Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management.

Syllabus includes tutorials for one hour per week:

- Case discussions on project management
- Numerical problems on PERT & CPM
- Computerized project management exercises using M S Project Software

Course Outcomes:

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

CO1: Explain the concepts, tools and techniques for managing large projects.
CO2: Analyze various sub processes in the project management frameworks.
CO3: Evaluate risks in projects and economics analysis of project feasibility.
CO4: Develop project plans for various types of organizations.

Reference Books:

1. Project Management Institute, "A Guide to the Project Management Body of Knowledge (PMBOK Guide)", 5th Edition, 2013, ISBN: 978-1-935589-67-9
2. Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 7th Edition, 2010, ISBN 0-07-007793-2.
3. Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.
4. Rory Burke, "Project Management – Planning and Controlling Techniques", John Wiley & Sons, 4th Edition, 2004, ISBN: 9812-53-121-1

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	M	M	M	H	M	M	L	M	H	M	M
CO2	M	H	M	H	H	M	M	M	H	H	M
CO3	M	M	M	M	L	M	H	M	H	M	M
CO4	H	H	H	M	M	M	H	M	M	M	M

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

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

Cyber Security and Digital Forensics						
Course Code	**:**	**16MIT22/16MSE22**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:1:0**		**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Students shall be able to

1. Comprehend the impact of cybercrime and forensics.
2. Describe the motive and remedial measures for cybercrime, detection and handling
3. Analyze areas affected by cybercrime and identify Legal Perspectives in cyber security
4. Demonstrate and investigate the use of Tools used in cyber forensic

Unit – I	**10 Hrs**

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. **Cyberoffenses: How Criminals Plan Them**: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Unit – II	**09 Hrs**

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit – III	**10 Hrs**

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **Phishing and Identity Theft**: Introduction, Phishing, Identity Theft (ID Theft).

Unit – IV	**10 Hrs**

Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.

Unit – V	**09 Hrs**

Introduction to Security Policies and Cyber Laws: Need for An Information Security Policy, Information Security Standards – ISO, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property - Related Legislation in India, Patent, Copyright,

Law Related to Semiconductor Layout and Design, Software License.

Unit – VI (Lab Component)

Demonstrate the application of any two of the tools under each category to perform:

1. Systems Vulnerability Scanning

Netcat, Socat, Port and Services tools Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump Wireshark, Ettercap, Hping Kismet

2. Network Defense tools

Firewalls and Packet Filters, Network Address Translation (NAT) and Port Forwarding, , Linux Firewall, Windows Firewall, Snort: Intrusion Detection System

3. Web Application Tools

Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra

4. Introduction to Cyber Crime Investigation

Password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

Course Outcomes:

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

CO1: Interpret the basic concepts of cyber security, cyber law and their roles.

CO2: Articulate evidence collection and legal challenges

CO3: Discuss tool support for detection of various attacks.

CO4: Demonstrate through use of proper tools knowledge on the cyber security,Cybercrime and forensics.

Reference Books

1.	SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, 2013.
2.	Dr. Surya PrakashTripathi, RitendraGoyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dreamtech Press. ISBN: 9789351194736, 2015.
3.	Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 978 -1-118 84965 -1
4.	I. A. Dhotre , "Cyber Forensics , Technical Publications; 1st Edition edition (2016), ISBN-13: 978-9333211475

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.

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

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

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

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

Multimedia Communications						
Course Code	**:**	**16MIT231/16MDC322**		**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 different types of data such as image data, video data and audio data for processing
2. Illustrate the multimedia communication standards and compression techniques
3. Analyze and apply internet protocols
4. Apply multimedia communication across networks

Unit – I	**10 Hrs**

Multimedia Communications: multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS.

Unit – II	**09 Hrs**

Information Representation: text, images, audio and video.

Text and image compression: compression principles, text compression – Huffman coding, Arithmetic coding LZ, LZW coding, image compression – GIF, TIFF, Digitized documents and pictures, JPEG.

Unit – III	**10 Hrs**

Audio and video compression: audio compression- DPCM, Adaptive DPCM, Adaptive and linear predictive coding, CELP, MPEG and Dolby audio coders.video compression, video compression principles, video compression standards: H.261, H.263, MPEG 1, MPEG 2, and MPEG 4.

Unit – IV	**09 Hrs**

Synchronization: Notion of synchronization, presentation requirements, reference model for synchronization, Synchronization specification. Multimedia operating systems, Resource management, process management techniques.

Unit – V	**10 Hrs**

Multimedia Communication Across Networks: Layered video coding, error resilient video coding techniques, multimedia transport across IP networks and relevant protocols such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia in broadcast networks.

Course Outcomes:

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

CO1: Demonstrate Multimedia information representation, networks, coding, image Processing and compression techniques.

CO2: Apply the knowledge learnt about the various coding, image processing and compression techniques

CO3: Analyze and Justify the impact of multimedia communication on society through various applications like interpersonal communication, interactive applications over the internet and entertainment applications

CO4: Design and evaluate various coding processing and compression techniques.	
Reference Books	
1.	Fred Halsall :Multimedia Communications: Applications, Networks, Protocols and Standards, Pearson Education, Asia, 2007, ISBN - 978-81-317-0994-8.
2.	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2007 *ISBN*-10: 0-321-43693-8 ,*ISBN*-13: 978-0-321-43693-1.
3.	Raif steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002, ISBN - 8177584413, 9788177584417..

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	M	L	-	-	M	M	-	-	M	L	-
CO2	H	H	-	-	H	H	-	L	H	L	M
CO3	H	H	M	-	H	H	-	L	H	H	H
CO4	H	H	L	-	H	H	-	L	H	L	H

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

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

Bio Informatics						
Course Code	**:**	**16MIT232**		**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 Examine the techniques in the domain of bioinformatics
2 Experiment with the role of data warehousing and data mining in bioinformatics
3 Model bioinformatics based applications
4 Apply Perl for applications in Bioinformatics

Unit – I	**10 Hrs**

Introduction to Bioinformatics-Need for Bioinformatics technologies, Overview of Bioinformatics technologies , *Structural bioinformatics* , Organizing of Structural Bioinformatics, Protein Data Bank, Secondary resources and Applications, Using Structural Bioinformatics Approaches in Drug Design ,Role of Structural bioinformatics in Systems Biology

Unit – II	**09 Hrs**

Data ware housing and datamining in bioinformatics: Bioinformatics data and its transformation Data ware housing architecture , data quality , Biomedical data analysis , DNA data analysis , Protein data analysis , Machine learning , Artificial Neural network architecture ,Applications in bioinformatics , Genetic Algorithm.

Unit – III	**10 Hrs**

Modeling And Pattern Matching: Hidden Markov modeling for biological data analysis, Comparative modeling, Genomic modeling, Probabilistic modeling, Molecular modeling, Gene regulation, motif recognition and motif detection, strategies for motif detection, Single Gene, Multiple Species Approach, Multiple Gene, Multiple Species Approach.

Unit – IV	**10 Hrs**

Perl For Bioinformatics: The Basics- installation and running of Perl Programs, Iterations, Selections, Processing Data Files, Patterns, Arrays, Subroutines, I/O, Reading and Writing Files , Chopping and homping, Pattern Metacharacters, Anchors, Binding Operators, Pattern Delimiters, Substitutions, Finding a Sequence.

Unit – V	**09 Hrs**

Working With Tools And Applications: Tools and Datasets, Sequence Databases, General Concepts and Methods, Introducing Bioinformatics Tools, BLAST, Using BioPerl to fetch and Extract Sequences

Course Outcomes:

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

CO1: Deploy the data warehousing and data mining techniques in Bioinformatics
CO2: Model bioinformatics based applications
CO3: Analyze the protein sequences with the help of Perl
CO4:Apply various tools and Technologies to handle genomic data

Reference Books

1. Yi-Ping Phoebe Chen (Ed), "Bio Informatics Technologies", Springer Verlag, 2014. ISBN : 978-3-540-20873-0(Hardcover), 978-3-642-42202-7 (Softcover)

2.	Michael Moorhouse, Paul Barry, "Bioinformatics Biocomputing and Perl An Introduction to Bioinformatics Computing Skills and Practice" , Wiley, 2004. ISBN: 0470026456, 9780470026458
3.	Andreas D. Baxevanis, B.F. Francis Ouellette: Bio Informatics A Practical Guide to Analysis of Genes and Proteins, Willey India 2009. ISBN: 0-471-38391-0
4.	Harshawardhan Bal, Johnny Hujol," Java for Bioinformatics and Biomedical Applications ", Springer 2007 , ISBN : 987-0-387-37237-8

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	H	M	-	L	-	-	-	-	M	M	M
CO2	M	M	L	H	M	L	-	M	M	H	L
CO3	H	H	M	M	H	M	-	M	H	M	-
CO4	H	H	M	M	H	M	-	L	H	H	L

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

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

Information Retrieval						
Course Code	**:**	**16MIT241/16MCE241**		**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 Information Retrieval Techniques such as document indexing and retrieval, query processing, recommender systems, etc.
2. Extract relevant information from large collection of unstructured data or documents.
3. Evaluation of Information retrieval methods
4. Analyze performance of textual document indexing, relevance ranking, web search, etc
5. Gain knowledge about ranking principles and probabilistic retrieval methods.

Unit – I	**10 Hrs**

Boolean Retrieval: An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval

The term Vocabulary and Postings Lists: Document delineation and character sequence decoding, Obtaining the character sequence in a document, Choosing a document unit, Determining the vocabulary of terms, Tokenization, Dropping common terms: stop words, Normalization (equivalence classing of terms), Stemming and lemmatization, Faster postings list intersection via skip pointers, Positional postings and phrase queries, Bi-word indexes, Positional indexes, Combination schemes

Unit – II	**10 Hrs**

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, General wildcard queries, k-gram indexes for wildcard queries, Spelling correction, Implementing spelling correction, Forms of spelling correction, Edit distance, k-gram indexes for spelling correction, Context sensitive spelling correction, Phonetic correction

Index Construction*:* Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing and Other types of indexes.

Unit – III	**10 Hrs**

Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage.

Scoring, term weighting and the vector space model: Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight *g*, Term frequency and weighting, Inverse document frequency, TF-IDF weighting, The vector space model for scoring, Dot products, Queries as vectors, Computing vector scores.

Unit – IV	**10 Hrs**

Computing scores in a complete search system: Efficient scoring and ranking, Inexact top *K* document retrieval, Index elimination, Champion lists, Static quality scores and ordering, Impact ordering, Cluster pruning, Components of an information retrieval system, Tiered indexes, Query-term proximity, Designing parsing and scoring functions. Putting it all together**.**

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results.

Unit – V	10 Hrs
XML retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval. **Probabilistic information retrieval:** Review of basic probability theory, The Probability Ranking Principle, The Binary Independence Model.	

Course Outcomes:

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

CO1: Analyze and implement algorithms to extract relevant information from unstructured data using Information retrieval techniques.
CO2: Evaluate information retrieval algorithms for document indexing, relevance ranking, web search, query processing, recommender systems, etc.
CO3: Apply various information retrieval techniques to retrieve information.
CO4: Create information retrieval applications based on various ranking principles and retrieval methods.

Reference Books

1.	Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze: "An Introduction to Information Retrieval", Cambridge University Press, England, 2008, ISBN 13: 9780521865715.
2.	ChengXiang Zhai, "Statistical Language Models for Information Retrieval", Morgan & Claypool Publishers, 2009, ISBN: 9781598295900
3.	Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval", Addison Wesley Longman Publishing Co. Inc, 2009, ISBN-10: 0321416910.

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)

Mapping of COs with POs

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

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

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

Supply Chain Management						
Course Code	**:**	**16MIT242**		**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. Enable students understand the overview of Supply Chain Management
2. Understand the basic concepts and key elements of Supply Chain Management.
3. Gain the knowledge of Supply Chain Management performance.
4. Design models in order to achieve efficiency.

Unit – I **10 Hrs**

Understanding the Supply Chain: What is Supply Chain? Historical perspective; Objective of Supply Chain; The Importance of supply Chain Decisions; Decisions Phases in a Supply Chain; Process Views of a Supply Chain; Examples of Supply Chains. Supply Chain Performance: **Achieving Strategic Fit and Scope:** Competitive and supply Chain Strategies; Achieving Strategic Fit; Expanding Strategic Scope; Obstacles to Achieving Strategic Fit. Supply Chain Drivers and Metrics: Impellers of Supply Chain; Drivers of Supply chain performance; A framework for structuring Drivers; Facilities; Inventory; Transportation; Information; Sourcing; Pricing; Obstacles to Achieving Strategic Fit.

Unit – II **09 Hrs**

Designing Distribution Networks and Applications to e-Business: The role of Distribution in Supply Chain; Factors influencing Distribution Network Design; Design Options for a Distribution Network; Indian Distribution Channels; Distribution Networks in Practice.

Network Design in the Supply Chain: The Role of Network Design in the Supply Chain; Factors Influencing Network design decisions; A framework for Network design decisions; Models for Facility Location and Capacity Allocation; The role of information Technology in Network Design; Jaipur RugsNetworking Tradition with Modernity; Making Network Design Decisions in Practice; The impact of Uncertainty on Network Design.

Unit – III **10 Hrs**

Designing Global Supply Chain Networks: The impact of Globalization on Supply Chain Networks; The Off shoring Decision: Total Cost; Risk Management in Global Supply Chains; the Basic Aspects of Evaluating Global Supply Chain Design; Evaluating Network Design Decisions Using Decision Trees; Making Global Supply Chain Design Decisions Under uncertainty in Practice; Uncertainty in Global Supply Chain operations –An Indian Experience. Demand **Forecasting in a Supply Chain:** The Role of Demand Forecasting in the Supply Chain; Characteristics of forecasts; Components of Forecast and forecasting methods; Basic approach to demand forecasting; Time-series Forecasting Methods; Measures of Forecast Error; The Role of information Technology in Forecasting; Risk Management in Forecasting; Forecasting in Practice.

Unit – IV **10 Hrs**

Managing Economies of Scale in a Supply Chain: Cycle Inventory: The role of Cycle Inventory in a Supply Chain; Estimating Cycle inventory-Related Costs in Practice; Economies of scale to exploit fixed costs; Economies of scale to exploit Quantity Discounts; Short-Term Discounting: Trade Promotions; Managing Multiechelon Cycle Inventory; Cycle Inventory Optimization in Indian Distribution Channels.

Transportation in a Supply Chain: The role of transformation in a supply chain; Modes of transportation and their Performance Characteristics; Design options for a Transportation Network; Trade-offs in Transportation Design; Tailored Transportation; The Role of information Technology in Transportation; Risk Management in Transportation; Making Transportation Decisions in Practice; Transportation Network in Support of Indian Cooperative Endeavor-Milk Run for Milk.

Unit – V	**09 Hrs**

Information Technology in Supply Chain: The role of information Technology in a supply chain; The Supply Chain IT Framework; Customer Relationship Management; Internal Supply Chain Management; Supplier Relationship Management; The Transaction Management Foundation; The Future of IT in the Supply Chain; Risk Management in It; Supply Chain IT in Practice; IT System Selection Processes-Indian Approach and Experiences.

Coordination in a Supply Chain: Lack of supply chain coordination and the bullwhip effect; Effect of lack of coordination on performance; Obstacles to coordination in a supply chain; Managerial Levers to achieve coordination; Building strategic partnerships and trust within a supply chain; Continuous Replenishment and Vendor-Managed Inventories; Collaborative Planning, Forecasting, and Replenishment (CPFR); The Role of IT in Coordination; Achieving Coordination in Practice; coordination in Supply Chains-Multiechelon Models.

Course Outcomes:

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

CO1:Explain the basic principles of supply chain management & apply these concepts to the simple IT applications.

CO2:Design the network using the entities involved in supply chain management.

CO3:Implement the various inventory models and also third party logistics using current technologies.

CO4: Evaluate the proposed economics to build a strategic network in supply chain management with the help of IT .

Reference Books

1	Chopra & Meindl: Supply Chain Management: 4th Edition 2010: Pearson Education – Addison Wesley Longman,. ISBN-13: 978-0738206677
2	David Simchi Levi, Philip Kaminsky & Edith Simchi Levi :Designing and Managing the Supply Chain Concepts, Strategies and Case Studies -: 3rd Edition, 2008:Tata McGraw Hill,. ISBN-13: 978-1935182399
3	R P Mohanty, S G Deshmukh, Bizmantra: Supply Chain Management Theories and Practices 2005. ISBN-0957597118
4	M Martin Christopher : Logistics and Supply Chain Management , 4th Edition 2011 , Pearson Education,ISBN-13: 978-1493909827

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	H	H	L	L	L	L	M	M	L
CO2	L	H	H	M	M	M	M	M	H	L	M
CO3	L	M	H	M	H	H	M	H	H	L	M
CO4	L	M	H	M	M	M	M	H	H	L	L

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

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

Advanced Computer Networks						
Course Code	**:**	**16MIT251/16MSE251**		**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 the basic concepts of Computer Networks.
2. Apply the knowledge of advanced internetworking concepts to problem solving.
3. Evaluate the distributed networks and its security.
4. Design and implement the real world network problems.

Unit – I	**10 Hrs**

Foundation to Networks: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

Unit – II	**09 Hrs**

Advanced Internetworking- I: Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork? , Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

Unit – III	**10 Hrs**

Advanced Internetworking- II: Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP.

Unit – IV	**10 Hrs**

Distributed Network Intelligence and Systems: Cooperative Regression-Based Forecasting in Distributed Traffic Networks, A Sensor Data Aggregation System Using Mobile Agents, Underlay-Aware Distributed Service Discovery Architecture with Intelligent Message Routing, Self-Organizing Maps: The Hybrid SOM–NG Algorithm, A Semi-Supervised and Active Learning Method for Alternatives Ranking Functions.

Unit – V	**09 Hrs**

Distributed Network Security: Tackling Intruders in Wireless Mesh Networks, Semi-Supervised Learning BitTorrent Traffic Detection, Applications and Trends in Distributed Enterprises: User Activity Recognition through Software Sensors, Multi-Agent Framework for Distributed Leasing-Based Injection Mould Remanufacturing, The Smart Operating Room: smartOR, State of the Art of Service-Level Agreements in Cloud Computing, Used Products Return Service Based on Ambient Recommender Systems to Promote Sustainable Choices

Course Outcomes:

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

CO1: Classify network services, protocols and architectures, explain why they are layered.

CO2: Illustrate the advanced internetworking protocols and their operations.

CO3: Apply the concepts of distributed networks and tackle security issues.

CO4: Implement & design applications using advanced network concepts.

Reference Books

1.	Larry Peterson and Bruce S Davis "Computer Networks: A System Approach", 5th Edition, Elsevier -2014, ISBN-13: 978-0-12-370548-8.
2.	Qurban A. Memon, "Distributed Networks: Intelligence, Security, and Applications", CRC Press, 2013, ISBN:9781466559578.
3.	Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI – 2014, ISBN-10: 0130183806.
4.	Uyless Black "Computer Networks, Protocols , Standards and Intrfaces" 2nd Edition - PHI , ISBN-10: 8120310411.

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 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.

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

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

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

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

Distributed Computing						
Course Code	**:**	**16MIT252/16MSE252**		**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 and remember the basic concepts of distributed system management (DSM).
2. Apply the concepts of load balancing, process management, fault tolerance in DSM.
3. Evaluate and analyze the concepts of distributed file systems through case studies.
4. Implement and design the security concepts in distributed computing systems.

Unit – I	**10 Hrs**

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

Unit – II	**09 Hrs**

Distributed Shared Memory: Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous and Other DSM Systems, Case Studies.

Unit – III	**10 Hrs**

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Case studies.

Naming: Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names, Name caches, Naming and security, Case study: Domain name service.

Unit – IV	**10 Hrs**

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management, Case studies, Developing a Content Distribution System over a Secure Peer-to-Peer Middleware.

Unit – V	**09 Hrs**

Real-Time Distributed Operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling, Case study: Real-time communication in MARS, Distributed Online Safety Monitor Based on Multi-Agent System and AADL Safety Assessment Model. Emerging Trends in distributed Computing: Introduction to emerging trends, Grid Computing, SOA, Cloud computing, the future of emerging Trends.

Course Outcomes:

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

CO1: Understand distributed system and process management.

CO2: Comprehend load balancing, resource management, shared memory and hardware concepts.

CO3: Analyze advantages of DFS and its security issues.

CO4: Apply mechanisms to manage security in Distributed Systems through understanding of real time DoS.

Reference Books	
1.	Sunitha Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010 ,*ISBN*: 13: 9780198093480.
2.	Qurban A. Memon, "Distributed Networks: Intelligence, Security, and Applications", CRC Press, 2013, ISBN:9781466559578.
3.	George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems: Concepts and Design, 5th Edition, 2013, ISBN:13: 978-0132143011.
4.	Carlos A. Varela, Programming Distributed Computing Systems, A Foundational Approach, MIT Press, 2013, ISBN: 9780262018982.

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	H	H	H	M	H	-	-	-	H	-	-
CO2	H	H	H	H	H	M	-	-	H	-	L
CO3	H	H	M	H	H	-	-	-	H	M	L
CO4	H	H	H	H	H	-	-	-	H	M	M

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

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

Minor Project						
Course Code	**:**	**16MIT26**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**0:0:10:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**05**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Students are 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 the skills for good presentation and technical report writing skills.
4) Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Each project group will consist of maximum of two students.
2. Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey.
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 four.
5. The minor project would be performed in-house.
6. The implementation of the project must be preferably carried out using the resources available in the department/college.

Course Outcomes: After completion of the course the student will be able to:

CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports.
CO3: Apply resource managements skills for projects
CO4: Synthesize self-learning, team work and ethics.

Scheme of Continuous Internal Examination (CIE)

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

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic and Objectives formulation	20%
II	Mid-term seminar to review the progress of the work and documentation	40%
III	Oral presentation, demonstration and submission of project report	40%

****Phasewise rubrics to be prepared by the respective departments**

CIE Evaluation shall be done with weightage / distribution as follows:

- Selection of the topic & formulation of objectives 10%
- Design and simulation/ algorithm development/experimental setup 25%
- Conducting experiments / implementation / testing 25%
- Demonstration & Presentation 15%
- Report writing 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.

1. Brief writeup about the project 05%
2. Presentation / Demonstration of the project 20%
3. Methodology and Experimental 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	M	M	M	H	M	M	L	M	H	M	M
CO2	M	H	M	H	H	M	M	M	H	H	M
CO3	M	M	M	M	L	M	H	M	H	M	M
CO4	H	H	H	M	M	M	H	M	M	M	M

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

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

THIRD SEMESTER

Mobile Application Development						
Course Code	**:**	**16MIT31**		**CIE Marks**	**:**	**100+50**
Hrs/Week	**:**	**L:T:P:S 4:0:1:0**		**SEE Marks**	**:**	**100+50**
Credits	**:**	**5**		**SEE Duration**	**:**	**3**

Course Learning Objectives (CLO):

Students shall be able to

1 Comprehend the knowledge on essentials of android application development.

2 Demonstrate the basic and advanced features of android technology.

3 Develop the skills in designing and building mobile applications using android platform.

4 Create debug and publish innovative mobile applications using android Platform.

Unit – I	**10 Hrs**

ESSENTIALS FOR ANDROID APP DEVELOPMENT

Background about mobile technologies, Overview of Android, Android architecture, Android for mobile app development, Android development Framework – Android SDK, Emulators / Android AVD Android Project Framework , Setting up development environment, Running android app, Dalvik Virtual Machine & .apk file extension, android debug bridge. Fundamentals: Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers, UI Components - Views & notifications, Components for communication -Intents & Intent Filters, Android API levels (versions & version names)

Unit – II	**09 Hrs**

ANDROID UI ARCHITECTURE & UI WIDGETS

Application context, Intents, Activity life cycle, Supporting different devices, multiple screen sizes, Fundamental Android UI design – Layouts, Drawable resources, UI widgets, Notification, Toasts, Menu, Dialogs, Lists & Adapters, Building dynamic UI with fragments.

Unit – III	**10 Hrs**

DATA STORAGE, SERVICES & CONTENT PROVIDERS

Saving Data, Interacting with other Apps, Working with system permissions, Apps with content sharing, Shared Preferences, Preferences activity, Files access, SQLite database, Threads, Overview of services in Android, Implementing a Service, Service lifecycle, Inter Process Communication.

Unit – IV	**10 Hrs**

ADVANCED ANDROID

Building apps with Multimedia, Building apps with Graphics & Animations, Building apps with Location Based Services and Google maps, Building apps with Connectivity & Cloud, Sensors, Bluetooth, Camera, Telephony Services.

Unit – V	**09 Hrs**

TESTING, DEBUGGING & DEPLOYMENT OF ANDROID APPLICATION

Role and Use of Dalvik Debug Monitor Server (DDMS), adb tool, How to debug android application, Use of Step Filters, Breakpoints, Suspend and Resume, How to use LogCat, Preparing for publishing – Signing & Versioning of apps, Using Google Play to distribute & Monetize, Best practices for security & privacy.

Unit – VI (Lab Component)	

Exercise 1-Developing Simple Applications for Android
Exercise 2-Creating Applications with Multiple Activities and a Simple Menu using ListView
Exercise 3-Creating Activities for Menu Items and Parsing XML Files
Exercise 4-Writing Multi-Threaded Applications
Exercise 5-Using WebView and Using the Network
Exercise 6-Using Audio Functions in Android
Exercise 7-Graphics Support in Android
Exercise 8-Preferences and Content Providers
Exercise 9-Location Services and Google Maps in Android
Exercise 10-Simulating Sensors

1. Design and develop a Mobile App for smart phones The Easy Unit Converter using Android.
This application should have approximately 20 categories to be used in your daily life. It includes following units: Acceleration, Angle, Area, Circle, Capacitor , Cooking, Data Size, Density, Data Transfer rate, Electric Current, Energy, Flow Rate , Force

2. Design and develop a Mobile App for smart phones Currency Converter. .This applications should synchronize online as you run it and sends you back the latest and most reliable exchange rates possible. This application should support following conversions:
EUR->Euro, GBP->British Pound, USD->United States Dollar
AUD->Australian Dollar, CAD->Canadian Dollar, CHF->Swiss Franc
CNY->Chinese Yuan, HKD->Hong Kong Dollar, IDR->Indonesian Rupiah
INR->Indian Rupee, JPY->Japanese Yen, THB->Thai Baht

3. Design and develop a Mobile App game for smart phones The Tic Tac Toe using Android.

4. Design and develop an Mobile App for smart phones, The Health Monitoring System using Android. This App should record Biochemistry Lab Parameters and if abnormal should send a SMS to doctor for Medications.

5. Design and develop a Mobile App for smart phones The Expense Manager using Android. This is an application for managing your expenses and incomes: Tracking expenses and incomes by week, month and year as well as by categories, Multiple accounts in multiple currencies, Schedule the payments and recurring payments, Take a picture of receipt, Payment alerts, Budget by day, week, month and year, Search and reports, Import and export account activities in CSV for desktop software, Customize expense categories, payer/payer, payment methods, date format, white or black background, button style etc, Account transfer, Convenient tools such calculator, currency converter, tip calculator, sales and tax calculator and credit card calculator.

Mini Project

At this point, Students will be ready to create own app.
This project is about combining various ideas and skills which is being practiced throughout the course. They include:

- Planning app design before coding.
- Taking an app layout from drawing to XML code.
- Creating, positioning, and styling views.
- Creating interactivity through button clicks and Java code.
- Commenting and documenting your code.

Students will complete this project according to these steps:

1. Brainstorm about Target User of the app.
2. Gather Information.
3. Pick an App Idea/ innovative idea.
4. Design a Solution.
5. Read the Project Rubric.
6. Write Code to Build Your App.
7. Test & debug on real device.
8. Publish app.

Course Outcomes:

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

CO1: Comprehend the basic features of Android Platform and the Application Development Process. Acquire familiarity with basic building blocks of Android Application and its architecture.
CO2: Apply and explore the basic framework, usage of SDK to build apps incorporating android features in developing mobile applications.
CO3: Demonstrate proficiency in coding on a mobile programming platform using advanced android technologies like multimedia, involving the sensors and hardware features of the phone.
CO4: Understand the economics and features of the app, app marketplace by offering the app for download.

Reference Books

1	Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition - Big Nerd Ranch Guide;2015; ISBN-13 978-0134171494
2	Reto Meier; Professional Android 2 Application Development; Wiley India Pvt.ltd; 1st Edition; 2012; ISBN-13: 9788126525898
3	Mark Murphy; Beginning Android 3; Apress Springer India Pvt Ltd. ;1st Edition; 2011;ISBN-13: 978-1-4302-3297-1
4	Eric Hellman; Android Programming – Pushing the limits by Hellman; Wiley; 2013; ISBN 13: 978-1118717370

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.

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

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

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

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

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Soft Computing						
Course Code	**:**	**16MIT321/16MSE321**		**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 Analyse Fuzzy neuro systems.

4 Apply genetic algorithms to solve optimization problems

Unit – I	**10 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	**10 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, AddisonWesley, 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
CO1	L	-	-	H	-	-	-	M	M	-	-
CO2	M	M	-	H	-	-	-	-	-	-	-
CO3	M	M	-	H	-	-	M	-	-	-	-
CO4	-	-	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):

Students 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. Plan and execute network analytical computations

Unit – I	**10 Hrs**

Introduction to Social Network Analysis: Introduction to new science of networks. Networks examples. Graph theory basics. **Descriptive Network Analysis**: Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.

Unit – II	**09 Hrs**

Network structure: Nodes and edges, network diameter and average path length. **Node centralities and ranking on network:** Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS.

Unit – III	**10 Hrs**

Network communities: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. **Affiliation networks:** Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.

Unit – IV	**10 Hrs**

Information and influence propagation on networks: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. **Network visualization**: Network visualization and graph layouts. Graph sampling. Low -dimensional projections

Unit – V	**09 Hrs**

Social media mining: FB/VK and Twitter analysis: Natural language processing and sentiment mining. **SNA in real world: FK/VK and Twitter Analysis:** Properties of large social networks: friends, connections, likes, re-tweets

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 network elements

CO3: Analyze real world network

CO4: Evaluate the performance of network communities and social media mining

Reference Books

1.	Albert-Laszlo Barabasi. "Linked. The New Science of Networks", Edition- 2014, ISBN-13: 978-0738206677
2.	Robert Knell, Introductory R: A Beginner's Guide to Data Visualization, Statistical Analysis and Programming in R ,Kindle Edition, ISBN-0957597118
3.	Robert Kabacoff. "R in action. Data Analysis and graphics with R", Manning Publications,

	2011, ISBN-13: 978-1935182399
4.	Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, 2014, ISBN-13: 978-1493909827

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	H	M	H	-	M	M	-	M	M	M	M
CO2	H	H	H	H	H	M	M	M	H	-	M
CO3	M	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	-	H	H	M	H

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

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

IOT and Cloud Computing						
Course Code	**:**	**16MIT331/16MSE331**		**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
CO1	M	L	M	-	-	-	-	-	H	-	-
CO2	H	M	L	H	H	M	-	M	H	L	M
CO3	L	M	-	M	M	L	-	-	H	M	M
CO4	H	L	M	M	H	H	-	M	H	H	M

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

	PSO1	PSO2
CO1	-	M
CO2	H	M
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 big data for business intelligence.
2. Identify business case studies for big data analytics.
3. Defend big data Without SQL.
4. Discuss the process of data analytics using Hadoop and related tools.

Unit – I	**10 Hrs**

Understanding Big Data: Characteristics of Data, Introduction to Big Data and its importance, Evolution of Big Data, Challenges posed by Big Data, Big data analytics and its classification, Big data applications: big data and healthcare – big data in medicine – advertising and big data, big data technologies.

Unit – II	**09 Hrs**

Hadoop Distributed File System: Hadoop Ecosystem, Hadoop Architecture, Analyzing data with Hadoop, HDFS Concepts, Blocks, Namenodes and Datanodes, Hadoop FileSystems, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the FileSystem, Deleting Data, Anatomy of File Read and Write

Unit – III	**10 Hrs**

Hadoop Distributed File System: Hadoop Ecosystem, Hadoop Architecture, Analyzing data with Hadoop, HDFS Concepts, Blocks, Namenodes and Datanodes, Hadoop FileSystems, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the FileSystem, Deleting Data, Anatomy of File Read and Write.

Unit – IV	**10 Hrs**

NOSQL Data Management: Introduction to NOSQL – aggregate data models , aggregates key-value and document data models, relationships – graph databases, schema less databases , materialized views , distribution models , sharding - version – map reduce – partitioning and combining – composing map-reduce calculations.

Unit – V	**09 Hrs**

MapReduce and Yarn: Hadoop MapReduce paradigm, Map and Reduce tasks, Job and Task trackers, Writing a Unit Test with MRUnit, Mapper, Reducer, MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats

Course Outcomes:

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

CO1: Demonstrate big data and use cases from selected business domains.

CO2: Apply the knowledge of NoSQL big data management and experiment with Install, configure, and run Hadoop and HDFS.

CO3: Analyze map-reduce analytics using Hadoop.

CO4: Adapt Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics.	
Reference Books	
1.	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012, ISBN -13: 978-1449311520, ISBN-10: 1449311520
2.	Eric Sammer, "Hadoop Operations", O'Reilly, 2012, ISBN -13 978-1449327057, ISBN-10: 1449327052
3.	Vignesh Prajapati, Big data analytics with R and Hadoop, 2013, ISBN -13: 978-1782163282
4.	E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012, ISBN -13: 978-1449319335

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	H	H	H	H	H	M	M	-	H	L	L
CO2	-	M	H	M	H	M	M	-	H	H	L
CO3	M	H	M	M	H	M	L	L	H	M	M
CO4	M	M	H	M	H	M	-	-	H	-	M

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

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

Machine Learning						
Course Code	**:**	**16MIT341**		**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 Develop skills of using recent machine learning software for solving practical problems

2 Apply machine learning algorithms to solve problems of moderate complexity

3 Formulate machine learning problems corresponding to different applications

4 Evaluate different machine learning techniques (ex: robustness, sensitivity, specificity, advantages, limitation etc.) by comparing and assessing their computational results.

Unit – I	**10 Hrs**

Introduction, Concept Learning and Decision Trees: Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Decision Tree learning – Representation – Algorithm – Heuristic Space Search in Decision Tree learning

Unit – II	**09 Hrs**

Neural Networks and Genetic Algorithms: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.

Unit – III	**10 Hrs**

Bayesian and Computational Learning Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model

Unit – IV	**10 Hrs**

Instant Based Learning And Learning Set of Rules: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution

Unit – V	**09 Hrs**

Analytical Learning and Reinforced Learning: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Course Outcomes:

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

CO1: Identify and apply appropriate machine learning techniques to classification , pattern recognition, optimization and decision problems.

CO2: Compare and Apply appropriate algorithms for variety of problems.

CO3: Design hypothesis model for any real life problems

CO4: Evaluate and perform diagnosis of any machine learning system

Reference Books

1	Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013,

	ISBN:978-1-25-909695-2.
2	Ethem Alpaydin, "Introduction to Machine Learning", 3rd Ed., PHI Learning Pvt. Ltd., 2015, ISBN: 978-0262-02818-9
3	Trevor Hastie , Robert Tibshirani , Jerome Friedman , "The Elements of Statistical Learning", Springer; 2nd edition, 2009. Corr. 7th printing 2013 Edition , ISBN: 978-0387848570
4	Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, "Principles and Theory for Data Mining and Machine Learning ",Springer; 2009,ISBN : 978-0-387-98134-5

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

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

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

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 TextMining

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 – valuation Lexical 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