

## Key Indicator – 1.1 Curriculum Design and Development

### Metric No. 1.1.1 \*

#### Mukesh Patel School of Technology Management and Engineering

##### Vision

Play a distinct role in providing excellence in engineering and technology management education thereby creating human resources of value to industry and society both at national and international level.

##### Mission

1. Formulate relevant curriculum through strong industry linkages and interaction.
2. Ensure quality of education through pedagogical innovations
3. Undertake and promote relevant research
4. Ensure multifaceted development of students, faculty and staff through continuous introspection and inputs.
5. Set up the international linkages with Institutes /industry of repute

##### Program Outcomes (common to all programs)

**PO-1 Engineering Knowledge:** Graduates should demonstrate a solid understanding of engineering principles, mathematics, and relevant scientific disciplines.

**PO-2 Problem Analysis:** They should be able to analyze complex engineering problems and formulate solutions using fundamental principles.

**PO-3 Design/Development of Solutions:** Graduates should be capable of designing and developing solutions that meet specific requirements while considering societal, environmental, and economic factors.

**PO-4 Conduct Investigations of Complex Problems:** They should be able to conduct experiments, analyze data, and interpret results to solve engineering problems.

**PO-5 Modern Tool Usage:** Graduates should be proficient in using modern engineering tools, software, and equipment.

**PO-6 The Engineer and Society:** They should understand the impact of engineering solutions on society, including ethical, environmental, and safety considerations.

**PO-7 Environment and Sustainability:** Graduates should have knowledge of sustainable practices and their role in environmental preservation.

**PO-8 Ethics:** They should adhere to professional ethics and responsibilities.

**PO-9 Individual and Team Work:** Graduates should function effectively as individuals and as part of multidisciplinary teams.

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**PO-10 Communication Skills:** They should be able to communicate effectively in both written and oral forms.

**PO-11 Project Management and Finance:** Graduates should understand project management principles and financial aspects related to engineering projects.

**PO-12 Life-Long Learning:** They should recognize the importance of continuous learning and professional development throughout their careers.

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#### **Information Technology Department**

##### **Vision**

Department of IT will impart quality education and conduct research relevant to needs of the national and international community which will help to improve quality of human life.

##### **Mission**

To prepare human resource with technical and management skills to meet the contemporary Information Technology demands of the industry and society at large by delivering relevant curriculum, using the state of the art pedagogical innovations, and undertake relevant research.

##### **Program Educational Objectives (PEO)**

- A. Technical Growth - Graduates will be successful in modern engineering practice and entrepreneurship, integrate into the local and global workforce, and contribute to the economy of India.
- B. Professional Skills - Graduates will continue to acquire and demonstrate the professional skills necessary to be competent employees, assume leadership roles, and enjoy career success and satisfaction.
- C. Professional Attitude and Citizenship-Graduates will become productive citizens demonstrating high ethical and professional standards, make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth.

##### **Student Outcomes (SOs)**

Graduates of the 8 Tech. in Information Technology program will have an ability to:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

In addition to outcomes 1 through 5, graduates of the Information Technology program will also have an ability to:

6. Identify and analyze user needs and to take them into account in the selection, creation, integration, evaluation, and administration of computing-based systems.

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In addition to outcomes 1 through 5, graduates of the Cybersecurity program will also have an ability to:

6. Apply security principles and practices to maintain operations in the presence of risks and threats.

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#### Computer Engineering Department

##### Vision

Play a significant role in creating Computer Engineering Graduates with sound technical and managerial skills of value to industry and society both at national and international level.

##### Mission

The Computer Engineering Department endeavors for excellence in creating, applying and imparting knowledge in computer engineering through comprehensive curriculum and innovative teaching-learning process.

Provide a sound technical and managerial foundation and multifaceted development that prepares student to excel in higher education, research or technical/managerial profession that can adapt to rapidly changing technology in computer engineering.

##### Program Educational Objectives (PEO)

- A. Technical Growth - Graduates will be successful in modern engineering practice and entrepreneurship, integrate into the local and global workforce, and contribute to the economy of India.
- B. Professional Skills-Graduates will continue to acquire and demonstrate the professional skills necessary to be competent employees, assume leadership roles, and enjoy career success and satisfaction.
- C. Professional Attitude and Citizenship-Graduates will become productive citizens demonstrating high ethical and professional standards, make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth.

##### Student Outcomes (SOs)

Graduates of the B Tech. in Computer Engineering program will have an ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

\* Program Outcomes and Course Outcomes listed are for the faculty of Engineering and Technology



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6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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#### **Artificial Intelligence Department**

##### **Vision**

Play a significant role in nurturing young engineering graduates with sound technical and ethical skills to cater to the needs of fast growing multidisciplinary application areas of artificial intelligence to address industrial and societal needs both at national and international level.

##### **Mission**

1. To focus on efforts to create comprehensive curriculum to ensure multifaceted development of students to address challenges in application areas of Artificial Intelligence such as healthcare, education, agriculture, smart cities, infrastructure, including mobility and transportation.
2. To build a strong teaching and research environment fostering strong analytical and problem-solving skills to prepare students to excel in higher education, research or technical/managerial profession.
3. To promote project based learning by providing opportunity to work on real life challenging problems through collaborative projects with industry and academia.

##### **Program Educational Objectives (PEO)**

- A. Technical Growth - Graduates will be successful in modern engineering practice and entrepreneurship, integrate into the local and global workforce, and contribute to the economy of India.
- B. Professional Skills-Graduates will continue to acquire and demonstrate the professional skills necessary to be competent employees, assume leadership roles, and enjoy career success and satisfaction.
- C. Professional Attitude and Citizenship-Graduates will become productive citizens demonstrating high ethical and professional standards, make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth.

##### **Student Outcomes (SOs)**

Graduates of the B Tech in Artificial Intelligence program will have an ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.

\* Program Outcomes and Course Outcomes listed are for the faculty of Engineering and Technology



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### Metric No. 1.1.1 \*

4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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#### Data Science Department

##### Vision

Play a distinct role in providing excellence in Data Science, Artificial Intelligence, Machine Learning and Management fundamentals and concepts using scientific methods, processes, algorithms and systems to extract knowledge and insights, thereby creating human resources of value to industry and society both at national and international level.

##### Mission

1. To prepare human resource in the areas of technical and management domains with strong analytical aptitude and problem-solving skills to meet the contemporary Business Analytics demands of the industry and society by delivering relevant curriculum, using the state-of-the-art pedagogical innovations developed by strong industry linkages, and undertake relevant research and consultancy.
2. Ensure multifaceted development of students, faculty and staff in computational sciences to Work on real life challenging problems through continuous introspection and inputs.
3. Set up the international linkages with Institutes/Industry of repute.

##### Program Educational Objectives (PEOs)

The Program Educational Objectives of B. Tech Data Science, 8. Tech Integrated (Data Science), MBA Tech Data Science, M. Tech Data Science (Business Analytics) and M. Tech Artificial Intelligence Programs are to produce graduates and post graduates with the following objectives:

- A. Establish themselves as Data Scientists, Data Engineers, Artificial Intelligence and Machine Learning Engineers and Subject Matter Experts in various private and public sectors that are involved in the design, creation, maintenance and use of industrial and organization data and help nation building
- B. Solve real world problems by applying knowledge ethically that will benefit organizations and society at large.
- C. Adapt to changing trends in Data Science, Business Analytics, Artificial Intelligence and Machine Learning and become lifelong learners.

##### Student Outcomes (SOs)

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

\* Program Outcomes and Course Outcomes listed are for the faculty of Engineering and Technology

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### Metric No. 1.1.1 \*

3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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#### **Electronics and Telecommunication Department**

##### **Vision**

To build a strong teaching and research environment that caters to the needs of fast growing telecommunication domain.

##### **Mission**

1. Provide internationally recognized leaders in Electronics and Telecommunication, through a continuously improving educational program incorporating applied engineering aspects.
2. Create the knowledge of fundamental principles and innovative technologies through research in the area of Electronics and Telecommunication and hence teach the students the necessary research skills which satisfy the needs of growing economy.

##### **Program Educational Objectives (PEOs)**

- A. Technical Growth - Graduates will be successful in modern engineering practice and entrepreneurship, integrate into the local and global workforce, and contribute to the economy of India.
- B. Professional Skills - Graduates will continue to acquire and demonstrate the professional skills necessary to be competent employees, assume leadership roles, and enjoy career success and satisfaction.
- C. Professional Attitude and Citizenship - Graduates will become productive citizens demonstrating high ethical and professional standards, make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth.

##### **Student Outcomes (SOs)**

Graduates of the B. Tech. in Electronics and Telecommunication Engineering program will have an ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

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### Metric No. 1.1.1 \*

5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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#### Civil Engineering Department

##### Vision

Create competent Civil Engineering professionals and employable individuals with sound technical and management credentials to take part in state-of-the-art infrastructural development with global ensign for the benefit of the society.

##### Mission

1. Provide quality education in conformity with advancements in technology and management
2. Encourage relevant research, development and entrepreneurship qualities in students, faculty and staff through teamwork with learning.
3. Develop strong industry linkages to ascertain and resolve the socio-economic problems related to Civil Engineering, with due consideration to safety and economy in ethical manner.

##### Program Educational Objectives (PEOs)

- A. Technical Growth - Graduates will be successful in modern engineering practice and entrepreneurship, integrate into the local and global workforce, and contribute to the economy of India.
- B. Professional Skills - Graduates will continue to acquire and demonstrate the professional skills necessary to be competent employees, assume leadership roles, and enjoy career success and satisfaction.
- C. Professional Attitude and Citizenship - Graduates will become productive citizens demonstrating high ethical and professional standards, make sound engineering or managerial decisions and have enthusiasm for the profession and professional growth.

##### Student Outcomes (SOs)

Graduates of the B Tech. in Civil Engineering program will have the ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.



\* Program Outcomes and Course Outcomes listed are for the faculty of Engineering and Technology

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5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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#### **Mechanical Engineering Department**

##### **Vision**

To be center of excellence in Mechanical Engineering for education and research through creation of competent mechanical engineering graduates who can be employable in the industries and be a part of innovation, research, problem solving and entrepreneurship that prioritizes mankind in particular and society in general.

##### **Mission**

1. To impart quality education in the field of Mechanical Engineering to the students.
2. To provide state of the art facilities to the students to enable them to learn, understand and apply fundamentals of Mechanical Engineering in solving engineering problems.
3. Developing relevant curriculum of studies which will cater to the needs of industry and society.
4. Promotion of team culture amongst students, faculties and staff to create conducive environment for better interaction with industries and collaborative research and development activities.

##### **Program Educational Objectives (PEOs)**

- A. Technical Growth - Graduates will be successful in modern engineering practice and entrepreneurship, integrate into the local and global workforce, and contribute to the economy of India.
- B. Professional Skills - Graduates will continue to acquire and demonstrate the professional skills necessary to be competent employees, assume leadership roles, and enjoy career success and satisfaction.
- C. Professional Attitude and Citizenship - Graduates will become productive citizens demonstrating high ethical and professional standards, make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth.

##### **Student Outcomes (SOs)**

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

\* Program Outcomes and Course Outcomes listed are for the faculty of Engineering and Technology

## Key Indicator – 1.1 Curriculum Design and Development

### Metric No. 1.1.1 \*

5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.

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#### **Mechatronics Engineering Department**

##### **Vision**

To be one of the leading Mechatronics engineering program by providing high quality education to our students through extensive industrial research enabling them to use modern automation technologies to develop innovative solutions.

##### **Mission**

To offer multidisciplinary program that is the synergistic integration of electrical and electronics engineering, mechanical engineering, computational software, and hardware in the design of products and processes into the emerging field of mechatronics.

##### **Program Educational Objectives (PEOs)**

The B. Tech (Mechatronics Engineering) graduates will:

- A. Apply mechanical engineering and electrical and electronics engineering skills to solve problems in mechatronics engineering.
- B. Integrate and use systems or devices incorporating modern microelectronics, information technology and modern engineering tools for product design, development and manufacturing.
- C. Demonstrate professional skills to communicate effectively with team members and work effectively to achieve design and project objectives.
- D. Engage in lifelong learning in their profession and practice professional and ethical responsibility.

##### **Student Outcomes (SOs)**

Graduates of the B Tech. in Mechatronics Engineering program will have an ability to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.



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6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
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#### Technology Management Department

##### Vision

"Nurturing Young Minds to help them transform into Leaders who can leverage appropriate Technology for Business goals."

##### Mission

To develop the student as a multi-skilled person who will be able to solve real world problems holistically through:

1. A balance of appropriate Technology and Management inputs,
2. Substantial exposure to Industry and corporate work culture via twin Industry Internships in Technical and Management domains.
3. Imparting value based business practices by a mix of Academic and Industry experienced faculty.
4. Innovative and entrepreneurial mindset

##### Program Objectives of MBA Tech

The Program aims to create Business Leaders who can leverage appropriate technology for Business excellence in the company they serve or for their entrepreneurial venture, displaying ethical and socially responsible behavior.

##### PROGRAM LEARNING GOALS

The students should have

P Learning Goal 1: An understanding of global practices impacting organizations.

PLO I a- Demonstrate ability to understand management issues from a global perspective

PLO I b- Demonstrate ability to analyze cultural issues in a business organization

P Learning Goal 2: Critical thinking skills

PLO 2a -Analyze a business situation from multiple perspectives

PLO 2b- Apply models/frameworks to reflect critically on specific business contexts

P Learning Goal 3 - Understanding Business Domains and Integration with Technology

PLO 3a- Describe the concepts related to functional areas of decision making in an organization

PLO 3b - Analyze and connect functional areas of Business



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PLO 3c- Integrate functional areas of business to support an overall organizational strategy

P Learning Goal 4- Effective communication skills

PLO 4a-Demonstrate effective communication skills PLO4b- Organize written thoughts into a coherent narrative


P Learning Goal 5: An understanding of ethical business models

PLO Sa- Demonstrate understanding of the relevance of ethics, and its role in governance, in public, private and not-for- profit sectors.

PLO Sb- Identify the ethical concerns and consequences of a given business problem

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<b>Program:</b> B Tech All Program (except Data Science, Civil and Mechanical, CSE(DS) 311 (VT)] MBA Tech All Program (except Data Science), B Tech Integrated Computer				<b>Semester:</b> III /IV /V / VII	
<b>Course:</b> Discrete Mathematics				<b>Course Code:</b> 702BS0C047	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	0	1	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Linear Algebra and Ordinary Differential Equations					
<b>Course Objective</b> The principal objective of the course is to train the students in the construction and understanding of mathematical proofs and common mathematical arguments. It will instil sound knowledge of different topics of discrete mathematics which students will readily apply in the subsequent courses of their programme.					
<b>Course Outcomes</b> After completion of the course, students will be able to - <ol style="list-style-type: none"> <li>1. Define and relate basic notions of discrete mathematics</li> <li>2. Demonstrate the ability to understand mathematical logic, concepts in abstract algebra and mathematical proof techniques</li> <li>3. Solve problems based on combinatorics, graph theory and abstract algebra</li> <li>4. Demonstrate understanding of the applications of algebra, combinatorics and graph theory</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Set Theory, Relations and Functions</b> <i>Revision of prerequisite concepts - 'Sets, Venn diagrams, Operations on sets, Laws of set theory'.</i> Power set, The principle of Inclusion-Exclusion, Partitions of sets. Relations, Properties and types of binary relations, Equivalence relation. Functions, injective, surjective and bijective functions, Composition, inverse of a function.				06

  
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2.	<p><b>Logic</b> <i>Revision of prerequisite concepts - 'Propositions, Truth table, Laws of logic, Equivalence'.</i> Satisfiability, tautology, validity, disjunctive and conjunctive normal forms, Predicates and Quantifiers, Proof Techniques, Mathematical Induction.</p>	06
3.	<p><b>Combinatorics</b> Pigeonhole principle, Homogeneous and non-homogeneous linear recurrence relations with constant coefficients, Generating functions.</p>	04
4.	<p><b>Graphs and Trees</b> Graphs and their properties, Degree, Connectivity, Path, Cycle, Eulerian graph, Hamiltonian graph, Planar graphs, Graph Coloring. Trees, Rooted trees, Spanning tree and minimum spanning tree, Kruskal's and Prim's algorithms for minimal spanning trees.</p>	08
5.	<p><b>Abstract algebra</b> Definition and examples of groups, subgroups, cyclic groups, group homomorphism, group isomorphisms. Definitions and Examples of Rings and Fields.</p>	06
	<b>Total</b>	<b>30</b>

**Text Books**

1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, 8th Edition, Tata McGraw Hill, 2018.
2. Kolman, Busby and Ross, *Discrete Mathematical Structures*, 6th Edition, Prentice Hall India, 2015.

**Reference Books**

1. C. L. Liu, *Elements of Discrete Mathematics*, 4th Edition, McGraw Hill, New Delhi, 2017.
2. Seymour Lipschutz and Mark Lipson, *Discrete Mathematics*, 3rd Edition, McGraw Hill education, Schaum's Outline Series, 2017.
3. I. N. Herstein, *"Topics in Algebra"*, 2nd Edition, John Wiley and Sons, 1975.
4. Narsingh Deo, *Graph theory with Applications to Engineering and computer science*, 1st Edition, Prentice Hall India, 2016.

**Laboratory/ Tutorial Work**

8 to 10 tutorials based on the syllabus.

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SVKM's NMIMS Deemed-to-be University  
Mukesh Patel School of Technology Management and Engineering

<b>Program:</b> B Tech All Program [except CSBS and CSE(DS) 311 (VT)], MBA Tech All Program, B Tech Integrated Mechanical, Computer				<b>Semester:</b> III / VII	
<b>Course:</b> Technical Communication				<b>Code:</b> 702BS0C062	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE)</b>
0	0	1	1	Marks scaled to 50	-
<b>Pre-requisite:</b> Fundamentals of English Communication					
<b>Course Objective</b> The objective of the course is to develop students' proficiency in written technical communication so that they are able to produce documents of the kind required in the workplace, such as reports and letters, that are sound, effective, coherent and error-free					
<b>Course Outcomes</b> After completion of the course, the student will be able to -					
<ol style="list-style-type: none"> <li>1. Apply the fundamentals of written communication to create written documents that are coherent, error-free and well organized</li> <li>2. Develop the ability to create effective and persuasive business correspondence, such as letters and emails, that follow etiquette and are able to achieve the desired outcomes</li> <li>3. Create basic reports such as memo, letter and survey-based report, using their understanding of report writing</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Principles of Effective Writing</b> Salient features of sentence construction, Paragraph writing, 7 Cs of communication, Making outlines, Writing for the Web				02
2.	<b>Writing Skills</b> Note taking, Summarizing Fiction / Non-fiction				04
3.	<b>Business Correspondence</b> Business letter writing - principles and types, Business email writing - subject line, recipient design, language, structuring content, framing, etiquette, cultural sensitivity				04

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AY 2023-24



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4.	<b>Report Writing</b> Introduction - what is a report, types, and characteristics of reports, pre-writing, principles and of report writing, Ethics in Writing - plagiarism.  Survey-based reports Memo Report Letter Report Academic Report (with References and Citations)	05
	<b>Total</b>	15
<b>Text Books</b> 1. Meenakshi Raman and Sangeeta Sharma, <i>Technical Communication: Principles and Practice</i> , 3 <sup>rd</sup> ed. Oxford University Press, 2015		
<b>Reference Books</b> 1. Shirley Mathew, <i>Communication Skills</i> , Technical Publications, 2013 2. Sheryl Lindsell-Roberts, <i>Technical Writing for Dummies</i> , Hungry Minds Inc., 2001 3. Mike Markel, <i>Technical Communication</i> , Palgrave Macmillan, 2012		

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<b>Program: B Tech (EXTC/ Mechatronics/ Computer/ Information Technology / CSE -Cyber Security)</b> <b>MBA Tech (Information Technology / Computer)</b> <b>B Tech Integrated (Computer)</b>				<b>Semester: III / VII</b> <b>Common Course</b>	
<b>Course :</b> Digital Logic Design				<b>Code :</b> 702EX0C014	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks-50)</b>	<b>Term End Examinations (TEE) (Marks -100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Basic Electronics					
<b>Course Objective</b> This course introduces the fundamental concepts and techniques underlying the construction of digital systems. It further provides insight into designing digital logic circuits using basic building blocks and necessary techniques required in computer hardware design.					
<b>Course Outcomes</b> After completion of the course, students will be able to -					
<ol style="list-style-type: none"> <li>1. Explain the concept of digital system and logic simplification</li> <li>2. Develop combinational circuits for various applications</li> <li>3. Design sequential circuits for various application</li> <li>4. Implement basic digital logic circuits using EDA tools with the help of HDL</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Introduction to Digital Systems</b> Number Systems - Binary, Octal, Hexadecimal, BCD, Conversion from one system to another, Binary subtraction using 1's and 2's complement method. Weighted codes - BCD and Binary, Non-weighted codes - Grey and Excess 3, conversion from one code to another.				04
2.	<b>Logic Gates and Boolean Algebra</b> Logic gates, Concept of universal logic and implementation of digital logic using universal gates, Review of Boolean algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 4 variables.				06
3.	<b>Combinational logic circuit and its implementation</b> Combinational circuits - Adders, Subtractors (half and full), Multiplexers, DE-multiplexers, Decoders, Encoders, Design of digital logic using multiplexers.				07

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Electronics & Telecommunication (2023 - 2024)

4.	<b>Sequential Logic Circuits</b> Flip flops - SR, T, D, JK, master slave JK, converting one flip-flop to another, Registers - Serial input, serial output; serial input-parallel output; Parallel In-Parallel Out, Serial In -Serial Out, Bi-Directional Shift Registers, Counters -Synchronous Counters, Asynchronous (Ripple) Counters and asynchronous counter designing.	09
5.	<b>Introduction to VHDL</b> VLSI Design flow - Design entry, Schematic, Different modelling styles in VHDL - Dataflow, Behavioural and Structural Modelling, Data types and objects, Synthesis and Simulation of any basic digital logic circuits.	04
	<b>Total</b>	<b>30</b>
<b>Text Books</b> <ol style="list-style-type: none"> <li>Morris Mano, <i>Digital Design - With an Introduction to the Verilog HDL, VHDL, and System Verilog</i>, 6<sup>th</sup> ed., Pearson Education, 2018.</li> <li>R.P Jain, <i>Modern Digital Electronics</i>, 4<sup>th</sup> ed., Tata McGraw-Hill, 2013.</li> </ol>		
<b>Reference Books</b> <ol style="list-style-type: none"> <li>Kumar A. Anand, <i>Fundamental of digital circuits</i>, 4<sup>th</sup> Edition, 2016.</li> <li>D.P. Kothari and J.S. Dhillon, <i>Digital Circuits and Design</i>, Pearson Education, 2015.</li> <li>Roth and John, <i>Principles of Digital Systems Design</i>, 6<sup>th</sup> Edition, Ceneage Learning, 2011.</li> </ol>		
<b>Laboratory Work</b> 8 to 10 practical exercises (and a practicum) based on the syllabus.		



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<b>Program:</b> B Tech (EXTC/ Mechatronics/ Information Technology / CSE -Cyber Security) and MBA Tech (Information Technology)				<b>Semester:</b> III <b>Common Course</b>	
<b>Course:</b> Signals and Systems				<b>Code:</b> 702EX0C010	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Calculus					
<b>Course Objective</b> This course helps to develop and analyse continuous and discrete time signals and systems. It also forms the foundation for further studies in the areas such as speech/audio processing, image processing, and communication systems.					
<b>Course outcomes</b> After completion of the course, students will be able to - <ol style="list-style-type: none"> <li>1. Classify the continuous time and discrete time signals and systems</li> <li>2. Apply various mathematical operations to analyze signals and systems</li> <li>3. Analyze the continuous time signals and systems using various transforms</li> <li>4. Determine the frequency spectrum of discrete time signals and systems response</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Introduction to Signals and Systems</b> Signals - definitions, classification, elementary continuous and discrete time signals, operations on continuous and discrete time signals, system and its classification.				05
2.	<b>Linear Time Invariant System</b> Continuous and discrete time LTI systems, convolution integral and convolution sum, interconnection of systems, series, parallel and mixed.				05 <i>Amol</i>



3.	<b>Fourier Series Representation of Periodic Signals</b> Introduction to different types of Fourier series representation, Exponential Fourier Series representation of continuous time periodic signal, magnitude and phase spectrum.	<b>04</b>
4.	<b>Fourier Transform</b> Fourier transform of elementary signals and its frequency spectrum, properties of Fourier transform, inverse Fourier transform, analysis of LTI continuous time system in frequency domain.	<b>06</b>
5.	<b>Laplace Transform</b> Limitations of Fourier transform, introduction to Laplace transform, ROC and its properties, Laplace transform of elementary signals, properties of Laplace transform, inverse Laplace transform, solution of differential equation.	<b>05</b>
6.	<b>Z-transforms</b> Introduction to Z transform, Z transform of elementary signals, ROC, properties of Z transform, inverse Z transform, solution of difference equation.	<b>05</b>
	<b>Total</b>	<b>30</b>
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. Tarun Kumar Rawat, <i>Signals and Systems</i>, 1<sup>st</sup> Edition, Oxford University Press, 2010.</li> <li>2. Nagoor Kani, <i>Signals and Systems</i>, 1<sup>st</sup> Edition, McGraw-Hill publication, 2010.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. (Classic) Oppenheim &amp; Willsky, <i>Signal and Systems</i>, 2<sup>nd</sup> Edition, Prentice Hall of India publication, 2008.</li> <li>2. Simon Haykin &amp; Barry Van Veen, <i>Signal and Systems</i>, 2<sup>nd</sup> Edition, John Wiley publication, 2008.</li> </ol>		
<b>Laboratory Work</b>		
8 to 10 practical exercises (and a practicum) based on the syllabus.		



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<b>Program:</b> B Tech (Artificial Intelligence, Data Science, Computer Engineering, Information Technology, CSE (Cyber), AI and ML, AI and DS, CSBS, CSE (DS), Computer Science) MBA Tech All Programs				<b>Semester :</b> III/IV	
<b>Course:</b> Database Management Systems				<b>Code:</b> 702AI0C001	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA)  (Marks - 50)</b>	<b>Term End Examinations (TEE)  (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Nil					
<b>Course Objective</b> The objective of the course is to provide a comprehensive introduction to the fundamental concepts for design and development of database systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a database management system.					
<b>Course Outcomes</b> After completion of the course, student will be able to -					
<ol style="list-style-type: none"> <li>1. Describe core concepts of database and model a database management system through ER modelling</li> <li>2. Apply knowledge of relational algebra and structured query language to retrieve and manage data from relational database</li> <li>3. Demonstrate the use of normalization for database design</li> <li>4. Demonstrate the concept of transactions and use modern database techniques such as NoSQL</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction</b> Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Data Models, Database Users and Administrator				03
2	<b>Database Design and the E-R Model</b> Overview of the Design Process, The Entity-Relationship Model, Constraints, Entity Relationship Diagrams, Reduction to Relational Schemas, Schema Diagrams , Entity-Relationship Design Issues, Extended ER features				05
3	<b>Introduction to the Relational Model</b>				03



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	Structure of Relational Databases, Database Schema, Keys, Relational Algebra, Basic operators of Relational Algebra,	
4	<b>Structured Query Language</b> Overview of the SQL Query Language, SQL Data Definition, SQL Constraints, Basic Structure of SQL Queries, Additional Basic Operations, DML operations, Set operations, Aggregate Functions, Nested Sub-queries, Joins, views	06
5	<b>Relational Database Design</b> Features of Good Relational Designs, Problems with bad design, Decomposition using concept of functional dependencies, Armstrong's axioms, Closure of functional dependency, Closure of attribute, Introduction to process of Normalization and de-normalization, Normal Forms- 1NF, 2NF, 3NF, BCNF	05
6	<b>Transactions</b> What is Transactions? Properties of transaction, Transaction states, Issues with concurrent executions, Schedules, Serializability- Conflict and View	04
7	<b>Introduction to NoSQL</b> Overview of NoSQL, characteristics of NoSQL, Storage types of NoSQL, Implementing NoSQL in MongoDB - Managing Databases and Collections from the MongoDB shell, Finding Documents in MongoDB collection from the MongoDB shell.	04
	<b>Total</b>	<b>30</b>

**Text Books**

1. Henney Korth and Abraham Silberschatz, *Database System Concepts*, 7th Edition, McGraw Hill, 2019
2. Gaurav Vaish, *Getting Started with NoSQL*, 1<sup>st</sup> edition, Packt Publication, March 2013
3. Brad Daylel, *NoSQL with MongoDB in 24 Hours*, 1<sup>st</sup> edition, Sams Teach Yourself, January 2015

**Reference Books**

1. Elmarsi and Navathe, *Fundamentals of Database Design*, 7<sup>th</sup> Edition, Addison Wesley, 2019
2. Bob Bryla, Kevin Loney *Oracle Database 12C The Complete Reference*, 1<sup>st</sup> edition, Tata McGraw Hill, 2017

**Laboratory Work**

8 to 10 experiments (and a practicum where applicable) based on the syllabus

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<b>Course:</b> Computer Networks	<b>Code:</b> 702AI0C007

Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks - 100)
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Prerequisite:** NA

**Course Objective**

This course provides the fundamental knowledge of computer networks through understanding each layer of computer network architecture, and transmission systems to network applications. It also focuses on congestion control techniques, protocols, and application layer functions.

**Course Outcomes**

After completion of the course, students will be able to -

1. Explain the concepts of computer networks, topologies and data communication.
2. Analyze the various error detection and correction and medium access techniques.
3. Apply network layer addressing and routing techniques to different network topologies.
4. Analyze the different protocols of the layered architecture of computer networks.

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Introduction</b> Computer Network, Peer-to-peer and client-server communication, Classifications of computer networks, Network Topologies.	02
2	<b>Physical Layer</b> Introduction to OSI and TCP/IP model, Transmission Media.	02
3	<b>Data Link Layer and Medium Access Sub Layer</b> Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, Flow Control and Error control; error control mechanism - CRC; flow control protocols - Stop and Wait ARQ, Go-back-N ARQ, Selective Repeat ARQ, Multiple access protocols - Random Access - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.	07

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4	<b>Network Layer</b> Switching techniques, IPV4 addressing, subnet mask, classless inter-domain routing (CIDR), IPV6; Address mapping - ARP, RARP, and DHCP, shortest path algorithm- RIP, Bellman-ford algorithm, link state routing, Dijkstra's algorithm, Open shortest path first protocol (OSPF).	09
5	<b>Transport Layer</b> Process to Process Communication, User Datagram Protocol (UDP)-services, operation; Transmission Control Protocol (TCP) - features, 3-way handshaking, comparison of UDP and TCP, SCTP, Congestion Control - open loop and close-loop; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.	06
6	<b>Application Layer</b> HTTP, DNS, FTP, SMTP.	04
	<b>Total</b>	<b>30</b>

**Text Books**

1. A. S. Tanenbaum, *Computer Networks*, 5th edition, Pearson Prentice Hall, 2018
2. Behrouz A. Forouzan, *Data Communications and Networking*, 5th edition, McGraw-Hill Higher Education, 2017

**Reference Books**

1. W. Stallings, *Data and Computer Communications*, 8th edition, Pearson Prentice Hall, 2017
2. Behrouz A. Forouzan and Sophia Chung Fegan, *TCP/IP Protocol Suite*, 4th edition, McGraw-Hill Higher Education, 2019 (Re-print)
3. Alberto Leon-Garcia and Indra Widjaja, *Communication Networks: Fundamental Concepts and Key Architectures*, 2<sup>nd</sup> edition, McGraw-Hill, 2004 (Classic)
4. James F. Kurose and Keith W. Ross, *Computer Networking - A Top-down Approach*, 8<sup>th</sup> edition, Pearson, 2018 (Re-print)

**Laboratory Work**

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

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<b>Program:</b> B Tech (Artificial Intelligence, Computer Engineering, Information Technology, CSE (Cyber), AI and ML, AI and DS, CSE (DS), Computer Science) MBA Tech (Artificial Intelligence, Computer Engineering, Information Technology)				<b>Semester:</b> III/IV/V	
<b>Course:</b> Web Programming				<b>Code:</b> 702AI0E005	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA)  (Marks - 50)</b>	<b>Term End Examinations (TEE)  (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Computer Programming					
<b>Course Objective</b> The objective of this course is to develop modern web application by leveraging latest technologies. It helps them to learn new technologies by applying foundation paradigms, building strong expertise to develop end to end application - web frontend and backend development					
<b>Course Outcomes</b> After completion of the course, students will be able to - <ol style="list-style-type: none"> <li>1. Explain the fundamentals of web programming</li> <li>2. Design front end of a web application</li> <li>3. Establish database connectivity between front-end and back-end</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
<b>1.</b>	<b>Introduction</b> Concept of website, its need and purpose, Types of websites: Static and dynamic website, Introduction to HTML, XML, JSON, Web Browsers, – Web Servers, Uniform Resource Locator, Tools and Web Programming Languages, HTTP, Web Standards, Tiered Architecture: Client Server Model, Three Tier Model				<b>02</b>
<b>2.</b>	<b>Hyper Text Markup Language</b> Languages used for website development, HTML5: basic tags, formatting tags, Adding images, Lists, Embedding multimedia in Web pages, Inserting tables, Internal and External Linking, Frames, Forms				<b>05</b>



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3.	<b>Cascading Style Sheets (CSS3)</b> Basics of Cascading Style sheets, Advantages of CSS, External Style sheet, Internal style sheet, Inline style sheet, CSS Syntax, color, background, Font, images	05
4.	<b>Java Script</b> Features of JavaScript, extension of JavaScript, Syntax of JavaScript: data types, operators, variables, tag, Document Object Model (DOM) with JavaScript, Selection Statement using if and Switch, Iterative statement: for, for/in, while, do while, break and continue, Form Validation using JavaScript.	04
5.	<b>Angular JS</b> Introduction to Angular JS, Single Page Application, Angular features, Expressions, Modules, Directives, Model, controllers, Data bindings, Scopes, Tables, Angular JS Forms and validation, Services, HTTP, Dependency Injection, Events.	08
6.	<b>Node JS</b> Introduction, Modules, HTTP module, URL module, File system, NPM, Events and Event Emitter, Exception handling. <b>MYSQL database with Node.js</b> Introduction, Express.js, create database, create table, insert, update select, delete, where, order by, drop table.	06
<b>Total</b>		<b>30</b>

**Text Books**

1. DT Editorial Services, *HTML 5 Black Book*, Dreamtech Press, 2<sup>nd</sup> Edition, 2016
2. Ken Williamson, *Learning AngularJS – A Guide to AngularJS-Development*, Oreilly Media, 1<sup>st</sup> Edition, 2015
3. Basart Ali Syed, *Beginnig Node .js*, 1<sup>st</sup> edition, Apress, 2014

**Reference Books**

1. Laurence Svekis, *Modern Web Design with HTML5, CSS3, and JavaScript*, 3rd Edition, Packt Publishing, 2020
2. Achyut Godbole, *Web Technologies*, Tata McGraw-Hill, 3rd Edition, 2013.
3. Azat Mardan, *“Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB*, 2<sup>nd</sup> Edition, Apress, 2015

**Laboratory/ Tutorial Work**

8 to 10 experiments (and a practicum where applicable) based on the syllabus



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> V	
<b>Course:</b> Embedded Systems				<b>Code:</b> 702IT0C015	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks- 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Pre-requisite:** Programming for Problem Solving, Operating Systems

**Course Objective**

The objective of this course is to acquire knowledge about the development of embedded system architecture using RTOS and enable the students to understand embedded-system programming and use it for designing and developing embedded solutions.

**Course Outcomes**

After completion of the course, the student will be able to -

1. Explain embedded system architecture and RTOS
2. Identify how microprocessor, memory, peripheral components and buses interact in an embedded system design
3. Develop solutions for various real time applications using Embedded programming

**Detailed Syllabus**

<b>Unit</b>	<b>Description</b>	<b>Duration</b>
1.	<b>Introduction to Embedded Systems</b> Classification of Embedded System, Concept of Embedded System Design, and Design challenges: Processor technology, IC technology, Design technology and Trade-offs.	04
2.	<b>Architecture of Embedded System</b> Hardware Architecture, Software Architecture, Embedded System product Development Life cycle.	04
3.	<b>Real-Time Operating Systems (RTOS)</b> RTOS Architecture, Selecting Architecture, Architecture of the kernel, Tasks and Task Scheduler, Scheduling algorithms, Interrupt Service Routines, Semaphores, Mutex, Mailboxes, Message queues, Event Registers, Pipes, Signals, Timers, Memory management, Priority Inversion problem.	06
4.	<b>Processor and memory Organization</b> Classification and brief overview of microcontrollers, microprocessors and DSP's. Introduction and Architecture of PAL, PLA, CPLD, FPGA, ASIC, PSOC.	06
5.	<b>Overview of Hardware -Software co design</b> Fundamental Issues in Hardware-Software co-design, Computation models in Embedded system design, Introduction to Unified Modeling Language (UML), Hardware Software Trade-offs.	04
6.	<b>Embedded software development environments</b> Challenges and issues in embedded software development, Device drivers, System calls and Programming languages: assembly languages, high level	06

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	languages like C/C++, Source Code Engineering tool for Embedded C/C++. Introduction to Embedded Java.	
	<b>Total</b>	<b>30</b>
<b>Text Books</b> 1. Raj Kamal, <i>Embedded Systems Architecture, Programming, and Design</i> , 3 <sup>rd</sup> Edition, Tata McGraw Hill, 2019. 2. K.V. Shibu, <i>Introduction to Embedded Systems</i> , 2 <sup>nd</sup> Edition, Tata McGraw, 2016.		
<b>Reference Books</b> 1. Valvano, <i>Embedded Microcomputer Systems: A real time interfacing</i> , 3 <sup>rd</sup> Edition, Cengage Learning, 2013.		
<b>Laboratory Work</b> 8 to 10 programming exercises based on the syllabus.		



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<b>Program:</b> B Tech/MBA Tech Information Technology, B Tech/MBA Tech Computer Engineering, B Tech/MBA Tech Artificial Intelligence, B. Tech CSE- (Cybersecurity), B Tech CSBS					<b>Semester :</b> III, V, VI	
<b>Course :</b> Software Engineering					<b>Code :</b> 702IT0C016	
Teaching Scheme				Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks- 50)	Term End Examinations (TEE) (Marks- 100)	
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50	
<b>Prerequisite:</b> Programming for Problem Solving						
<b>Course Objective</b> The objective of the course is to familiarize the students with Software engineering principles, practices and standards required to develop a quality software. The course also intends to develop the ability and skills for the task of requirement analysis, design and modelling.						
<b>Course Outcomes</b> After completion of the course, the student will be able to -						
<ol style="list-style-type: none"> <li>1. Explain the characteristics of various process models used in the development of a Software project</li> <li>2. Demonstrate an understanding of various Analysis and Design models that provide a basis for the software development</li> <li>3. Apply UML concepts for modeling software functionality for a given scenario</li> <li>4. Create test cases for validating the working of the software developed</li> </ol>						
<b>Detailed Syllabus</b>						
Unit	Description					Duration
1.	<b>Importance of Software Engineering</b> Role of Software, Categories of Software, Legacy Software, Software Myth.					03
2.	<b>Prescriptive Process Models</b> Process Framework, Capability Maturity Model Integration, Waterfall Model, Incremental & RAD Models, Prototyping, Spiral Model, Concurrent Development Model. <b>Agile Process Models</b> Agility, Agile Process, Extreme Programming, Adaptive Software Development, SCRUM					07
3.	<b>UML Modeling</b> Visual modeling with UML, Use case model, Modeling with classes, Identifying classes and objects of real world problems, Defining events and attributes, process of creating class diagram. State diagram, Activity diagram, Modeling interaction and behaviour, Sequence and Collaboration Diagram.					08 <i>Arora</i>



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4.	<b>Requirement Analysis &amp; Design</b> Requirement Engineering tasks, Elements of Analysis Model, Data Modeling Concepts, Data Flow Model, and Control Flow Model.	03
5.	<b>Architectural Design</b> Software Architecture, Data Design, Architectural Styles, Representing System in Context, Refining Architecture into Components, Mapping Data Flow into a Software Architecture.	03
6.	<b>User Interface Design</b> Golden Rules for User Interface Design, Interface Analysis & Design, Interface Design Steps.	02
7.	<b>Testing Strategies &amp; Software Quality</b> Test Strategies for Software, Verification & Validation Testing, Unit Testing, Integration Testing, System Testing. McCall's Software Quality Factors, ISO 9126 Quality Factors, Process & Project Metrics, Metrics for Software Quality, SQA Activities, CMMI.	04
	<b>Total</b>	<b>30</b>

**Text Books**

1. Pressman and Roger S., *Software engineering: a practitioner's approach*, 9<sup>th</sup> Edition, McGraw Hill, 2019.

**Reference Books**

1. Sommerville and Ian., *Software engineering*, 10<sup>th</sup> Edition, Pearson Education, 2017.

**Laboratory Work**

8 to 10 programming exercises (and a practicum) based on the syllabus.



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<b>Program:</b> B Tech/MBA Tech Information Technology, B Tech CSE-Cybersecurity				<b>Semester:</b> V	
<b>Course:</b> Visual Analytics				<b>Code:</b> 702IT0C025	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
0	2	0	1	Marks scaled to 50	-

**Pre-requisite:** Basic computer knowledge, Data Warehousing and Mining

**Course Objective**

The objective of the course is to familiarize the students with tools and processes to analyze datasets using visual representations of the data. The course helps students to visualize the data in graphs, charts, maps etc., and thereby identify patterns and develop actionable insights that help one to make better, data-driven decisions.

**Course Outcomes**

After completion of the course, student would be able to-

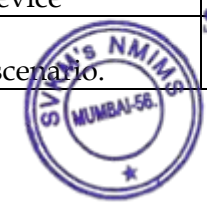
1. Demonstrate a working knowledge of data visualization
2. Create visualization charts appropriate for the underlying data
3. Apply modern statistical learning techniques on data visualizations
4. Design and implement interactive links between various objects in a data visualization report

**Detailed Syllabus**

Unit	Description	Duration
1.	<b>Getting Started with Visual analytics</b> What is data visualization, methodology for data visual analytics, Exploring Visual Analytics Concepts, Using Visual Analytics, Discussing the course environment and scenario.	2
2.	<b>Data investigation and preparation</b> Accessing data from local device/ server/social media. Data investigation to find common issues. Data preparation - cleaning, modifying the properties of data items, applying data source filter, creating new data items, joining tables/ columns, Data exploration with generated dataset.	3
3.	<b>Using Visual analytics Explorer</b> Examining the visual analytics explorations, selecting data and defining data items properties, creating visualizations, Enhancing visualization with advanced analytics.	5
4.	<b>Data visual analytics</b> Modern statistical learning techniques on data visualizations.	4
5.	<b>Designing Reports with Visual Analytics</b> Examining the Visual Analytics Designer, creating a simple report, working with graphs, working with filters and report sections, establishing interactions, working with gauges, working with tables, working with other objects.	8
6.	<b>Viewing Visual Analytics Reports</b> viewing reports on the Web, viewing reports on a mobile device	2
7.	<b>Case study</b> Create a visualization report and dash board on a business scenario.	6

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Total	30
<b>Text Books</b> 1. Kieran Healy, <i>Data Visualization: A Practical Introduction</i> , 1 <sup>st</sup> Edition, Princeton University Press, 2018. 2. Cole Nussbaumer Knaflic, <i>Storytelling with Data: A Data Visualization Guide for Business Professionals</i> , 1st Edition, Wiley; 2015.	
<b>Reference books</b> 1. <i>Visual Analytics 7.5: User's Guide</i> by SAS Institute (online SAS documents). 2. Trevor Hastie Robert Tibshirani Jerome Friedman, <i>The Elements of Statistical Learning: Data Mining, Inference, and Prediction</i> , 2 <sup>nd</sup> Edition, Springer, 2017.	
<b>Laboratory Work</b> 8 to 10 Programming exercises (and a practicum) based on the syllabus.	



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<b>Program:</b> B Tech IT/MBA Tech Information Technology				<b>Semester:</b> V	
<b>Course:</b> Advanced Data Structures				<b>Code:</b> 702IT0E009	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks scaled to 50
<b>Prerequisite:</b> Programming for Problem Solving					
<b>Course Objective</b> The objective of this course is to familiarize students with advanced data structures used to solve real world problems.					
<b>Course Outcomes</b> After completion of the course, student would be able to- <ol style="list-style-type: none"> <li>1. Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.</li> <li>2. Design and Implement solution for a given real time problem using hashing techniques</li> <li>3. Use and Implement red-black trees, B-trees and Splay trees</li> <li>4. Implement pattern matching algorithms for various text processing applications</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Dictionaries</b> Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.				3
2	<b>Hashing</b> Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.				8
3	<b>Trees</b> Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees				5
4	<b>Graphs</b> Introduction, search operation, Topological sorting, Bellman Ford Algorithm and Dijkstra's Single Source Shortest Path Algorithm.				4
5	<b>Text Processing</b> String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.				6
6	<b>Design Techniques</b> Divide and conquer, Greedy Algorithm; Dynamic Programming, Branch and Bound, Backtracking Techniques.				4
	<b>Total</b>				30

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**Text Books**

1. Thomas H. Cormen, Charles E. Leiserson, and R.L. Rivest. *Introduction to Algorithms*, 4<sup>th</sup> Edition, MIT Press, 2022
2. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*, 5<sup>th</sup> Edition, Careermonk Publications, 2016.

**Reference Books**

1. Seymour Lipschutz, *Data structures with C*, 1<sup>st</sup> Edition, Schaum's Outlines, 2017.
2. M T Goodrich, Roberto Tamassia, *Algorithm Design and Applications*, John Wiley, 2015.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman. *The Design and Analysis of Computer Algorithms*, Pearson Education (Singapore) 2008.

**Laboratory Work**

8 to 10 Programming exercises (and a practicum) based on the syllabus.



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> V	
<b>Course :</b> Management Information Systems				<b>Code:</b> 702IT0E008	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks- 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Prerequisite:** Database Management Systems

**Course Objective**

This course gives an introduction to Management Information Systems. It aims at explaining how Information Technology / Information Systems help organizations to achieve competitive advantage in the market.

**Course Outcomes**

After completion of the course, the student will be able to -

1. Explain the role of Information System in business environment
2. Analyze existing business applications in use and design a business application for a given scenario
3. Describe the implications of social media on organizations
4. Identify the challenges in the management of global information systems and assess the security and ethical concerns

**Detailed Syllabus**

Unit	Description	Duration
1.	<b>Foundations of Information systems and Management</b> Why Information systems? Fundamental behavioural, technical, business and managerial concepts about the components and roles of information systems, Types of information systems: Operations support systems and Management support systems, Definition, role and impact of MIS, MIS as a support to the management and a tool for management process.	03
2.	<b>Strategic Use of Information Systems</b> Fundamentals of strategic advantage -What is strategic advantage, brief overview of business strategy, organizational strategy and information systems strategy.  Porter's five forces model.	04
3.	<b>Using Information Technology for strategic advantage</b> Major concepts, developments, and management issues in information technology (hardware, software, networks, data resource management, and other information processing technologies such as the Internet).	04
4.	<b>Business Applications-I</b> Major uses of information systems for the operations, management, and competitive advantage of an e-business enterprise. Electronic Business Systems - Enterprise business systems, Functional business systems Enterprise Resource Planning (ERP) systems - What is ERP? Benefits, challenges and trends in ERP	06

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	Customer relationship Management (CRM) systems - What is CRM? Three phases of CRM, Benefits, challenges and trends in CRM Supply Chain Management (SCM) systems - What is SCM? Role of SCM, Benefits, challenges and trends in SCM.	
5.	<b>Business Applications-II</b> Decision support systems (DSS) – Introduction, DSS components, Decision and management, information quality, Reporting, Online analytical processing, Using DSS – what-if analysis, sensitivity analysis, Goal-seeking analysis, Optimization analysis, Data mining for decision support. Knowledge Management and Business Analytics - Data, information and Knowledge, What is knowledge Management, Managing Knowledge to Business Intelligence, Why manage knowledge, Knowledge management processes, Components of business analytics.	<b>05</b>
6.	<b>Social Media and Organizations</b> Leveraging social media for business, What to track in social media, Network effects for organizations, Social computing applications (Enterprise social computing) and implications on organizations.	<b>04</b>
7.	<b>Management Challenges</b> Security, Ethical and Societal Challenges Global Management of Information Systems – Cultural, political and geo-economic challenges, Global business/IT strategies and applications, Global data access issues.	<b>04</b>
	<b>Total</b>	<b>30</b>
<b>Textbooks</b>		
<ol style="list-style-type: none"> <li>1. Kenneth C.Laudon and Jane P. Laudon, <i>Management Information Systems – Managing the Digital firm</i>, 14<sup>th</sup> Edition, Pearson Education, 2016.</li> <li>2. James A O'Brien and George M Marakas, <i>Management Information Systems</i>, 11<sup>th</sup> Edition, Tata Mc-Graw-Hill, 2017.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. Effy Oz, <i>Management Information System</i>, 6<sup>th</sup> Edition, Cengage Learning, 2013.</li> </ol>		
<b>Laboratory Work</b>		
8 to 10 programming exercises based on the syllabus.		

  
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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> V	
<b>Course:</b> Service Oriented Architecture				<b>Code:</b> 702IT0E011	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks- 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Web Technology, Software engineering					
<b>Course Objective</b> To enable the students implement distributed web enterprise architectures using micro services.					
<b>Course Outcomes</b> After completion of the course, the student will be able to -					
<ol style="list-style-type: none"> <li>1. Design and implement web services for creating enterprise web applications</li> <li>2. Explore semantic web to create ontologies and to query RDFs</li> <li>3. Execute web service integration, deployment and Security of micro services</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Distributed web Architecture</b> Middleware, Messaging, Security and interoperability in web architectures. RPC and RMI for distributed web communication.				04
2	<b>Service Oriented Architecture</b> Introducing SOA- SOA triangle, layered architecture of SOA, Service messaging, service discovery, BPO - Business Process Outsourcing - Web service composition and coordination. Orchestration and Choreography.				07
3	<b>Building SOA</b> Web service creation and accessing -XML, JSON, WSDL, SOAP, UDDI, XML, Restful web services, BPEL.				06
4	<b>Semantic Web:</b> Mashup, Semantic Web Services, Metadata with RDFS Framework, Ontology, Owl, Logic for semantic web, SPARQL.				07
5	<b>Micro services:</b> Evolution, Modelling services, Integration, Deployment, Testing, Monitoring, Security. Implementation of micro services.				06
	<b>Total</b>				<b>30</b>
<b>Text Books</b>					
<ol style="list-style-type: none"> <li>1. Allemang, and James Hendler., <i>Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL</i>, 2<sup>nd</sup> Edition, Morgan Kaufmann, 2011.</li> <li>2. Sam Newman, <i>Building Micro Services</i>, 2<sup>nd</sup> Edition, O'Reilly, 2021.</li> </ol>					
<b>Reference Books</b>					
<ol style="list-style-type: none"> <li>1. Tarek Ziade, <i>Python Microservices Development</i>, 1<sup>st</sup> Edition, O'Reilly publication, 2017.</li> <li>2. Thomas Erl, <i>Service-OrientedArchitecture: Concepts,Technology, and Design</i>, 1st Edition, Pearson Education, 2005. (Classic Book)</li> </ol>					

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**Laboratory Work**

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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> V	
<b>Course:</b> AI and Robotics				<b>Code:</b> 702IT0E013	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks- 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Programming for Problem Solving					
<b>Course Objective</b> To enable students to build intelligent machines, software, or applications with a cutting-edge combination of machine learning and Robotics. This course discusses AI methods including search and Logical techniques, learning techniques and Robotics fundamental.					
<b>Course Outcomes</b> After completion of the course, the student will be able to -					
<ol style="list-style-type: none"> <li>1. Describe basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.</li> <li>2. Explain and implement advance AI learning techniques</li> <li>3. Apply knowledge of robotics, robot Kinematics, robotic programming and robot vision in developing solutions to real time problems</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Introduction to AI</b> History, Scope, agents, Environment, Automated Problem Solving, State Space Search, Heuristic Search, Game Tree Search.				04
2.	<b>Logic and Deduction</b> Propositional logic, Predicate Logic Fundamentals, Resolution Refutation, Constraint Satisfaction Problems.				05
3.	<b>Learning</b> Machine Learning Fundamentals, Learning Decision Trees, Neural Networks, Deep Learning Fundamentals, Reinforcement Learning Fundamentals.				06
4.	<b>Introduction of Robotics</b> Definition of a robot, types of robotic joints and motions, classifications of robot based on: Physical configurations, actuators and motion control; Terminologies used for robotics specification and selection for industrial applications.				04
5.	<b>Robot Kinematics and Dynamics</b> Homogeneous co-ordinates and co-ordinate transformations, kinematic parameters, use of Denavit-Hartenberg representation for finding arm equation of robotic arms, forward and inverse kinematics for basic industrial robotic configurations.				05
6.	<b>Robot Vision and Programming</b>				06

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	Sensing and digitization of vision data, image processing: image data reduction, segmentation, feature extraction, object recognition, and training of vision system, Robot programming methods, Robot Programming Languages.	
	<b>Total</b>	<b>30</b>
<b>Text Books</b> <ol style="list-style-type: none"><li>1. Stuart Russell and Peter Norvig, <i>Artificial intelligence: A Modern Approach</i>, 4<sup>th</sup> Edition, Prentice Hall, 2020.</li><li>2. Saha S K, <i>Introduction to Robotics</i>, 2<sup>nd</sup> Edition , McGraw Hill Higher Education, New Delhi, 2014.</li></ol>		
<b>Reference Books</b> <ol style="list-style-type: none"><li>1. M.P. Grover and N. G. Odrey, <i>Industrial Robotics: Technology, Programming and Applications</i>, 2<sup>nd</sup> Edition, TMH Edu. India, McGraw Hill India, 2017.</li><li>2. Kevin Warwick, <i>Artificial Intelligence: The Basics</i>, 1<sup>st</sup> Edition, Taylor and Francis, 2013.</li></ol>		
<b>Laboratory Work</b> <p>8 to 10 programming exercises based on the syllabus.</p>		



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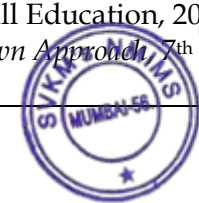


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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> V	
<b>Course :</b> Advanced Computer Networks				<b>Code :</b> 702IT0E015	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks- 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Computer Networks					
<b>Course Objective</b> The objective of this course is to familiarize students with the working of internetworks. This course focus on top-down approach, the Internet and a modern treatment of computer networking, its attention to both principles and practice, and its accessible style and approach toward learning about computer networking.					
<b>Course Outcomes</b> After completion of the course, the student will be able to -					
<ol style="list-style-type: none"> <li>1. Describe medium access layer protocols</li> <li>2. Design IP addressing scheme, analyze packet forwarding, and compare different routing protocols</li> <li>3. Compare and analyze transport protocols and other key protocols essential for networking</li> <li>4. Explain various multimedia protocols, internet security concepts and future networks</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Medium access layer</b> Channel allocation problem, hidden node and exposed node problem FDM, TDM, CDMA, MACA.				03
2.	<b>Internet protocol</b> IPv4, compare IPv4 and IPv6, IPv6 - (address, special address, transition from IPv4 to IPv6; subnetting classless addressing).				05
3.	<b>Network Layer</b> Routing tables and forwarding, Routing protocols - Open Shortest Path First and Border Gateway Protocol, DHCP, Mobile IP, AODV.				06
4.	<b>Transport layer</b> Transmission Control Protocol - Reno, SCTP, I-TCP, Snoop TCP and Mobile TCP.				06
5.	<b>Multimedia in the internet</b> SIP, QoS (flow classes, flow control to improve QoS - FIFO, Priority and WFQ).				03
6.	<b>Network security</b> Introduction to Internet security - application layer security, transport layer security (SSL and TLS), IPSec, VPN, Firewall, WPA2, WPA3.				05
7.	Introduction to Internet of Things and applications, software defined networks and 5G.				02
	<b>Total</b>				30
<b>Text Books</b>					
<ol style="list-style-type: none"> <li>1. Behrouz A. Forouzan, <i>TCP/IP Protocol suite</i>, 4<sup>th</sup> Edition, McGraw Hill Education, 2017.</li> <li>2. James F. Kurose and Keith W. Ross, <i>Computer Networking: A Top Down Approach</i>, 7<sup>th</sup> Edition, Pearson Education, 2017.</li> </ol>					

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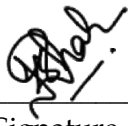
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**Reference Books**

1. Behrouz A. Forouzan and Firouz Mosharraf, *Computer Networks: A Top-down Approach*, Special Indian Edition, McGraw-Hill, 2012.
2. Jochen Schiller, *Mobile communication*, 2<sup>nd</sup> Edition, Pearson Education, 2008.
3. Comer D., *Internetworking with TCP/IP Volume-I*, 6<sup>th</sup> Edition, PHI, 2015.
4. Jonathan Rodriguez, *Fundamentals of 5G Mobile Networks*, 1<sup>st</sup> Edition, Wiley, 2015.

**Laboratory Work**

8 to 10 programming exercises based on the syllabus.



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> VII	
<b>Course :</b> Information Systems Security				<b>Code:</b> 702IT0C029	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50 )</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Basic Knowledge of Computer Network, Operating Systems and programming.					
<b>Course Objective</b> This course introduces students to the various elements of information systems security. Students will learn about various cybersecurity threats and their countermeasures. Students will learn about various aspects of cybersecurity.					
<b>Course Outcomes</b> After completion of the course, student would be able to- <ol style="list-style-type: none"> <li>1. Analyze various cybersecurity threats and countermeasures</li> <li>2. Explain various security technologies and mechanisms</li> <li>3. Describe various ethical and legal issues related to cybersecurity</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction</b> Basic Components of Cybersecurity, vulnerabilities, threats , Attacks and controls, goals of security, Security System development life cycle, NIST Cybersecurity Framework, MITRE ATT&CK® Matrix				4
2	<b>Design Principles</b> Various security threats and attacks (non-malicious program errors, malwares, APT, social engineering, etc.), threat actors, method of defence, design principles, security policies, types of security policies				4
3	<b>Cryptography</b> Cryptography basics, transposition and substitution ciphers, stream and block ciphers, cryptographic algorithms (AES and RSA), Diffie-Hellman, key management and distribution, digital signature, hash functions, Attacks on cryptosystems.				5
4	<b>Identity and access management(IAM)</b> Authentication basics, Passwords, authentication tokens, certificate based and biometric authentication, Kerberos, SSO approaches, Multi-Factor Authentication, attacks on authentication schemes, Access control principles, DAC, MAC, and Role based Access Control, Identify Federations, Access control models, identity and access provisioning lifecycle.				5
5	<b>Security Technologies</b> Firewalls, Kinds of Firewalls, Filtering Services, DMZ, Implementing policies (Default allow, Default Deny) on proxy, NAT, Intrusion Detection and Prevention Systems, types of IDPS, Virtual Private Network, SSH				5

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6	<b>Risk and Incidents Management</b> Overview of risk management, risk identification and assessment, risk control strategies, selecting risk control strategy, continuity strategies (Business continuity planning, Incident response planning, Disaster Recovery planning)	4
7	<b>Legal and Ethical issues</b> Cybercrimes and criminals, IP, privacy, legal and ethical issues.	3
	<b>Total</b>	<b>30</b>
<b>Text Books</b> 1. M. Whitman and H. Mattford, Principles of Information Security with MindTap, 6 <sup>th</sup> Edition, Cengage, 2018.		
<b>Reference Books</b> 1. C. Pfleeger, S. L. Pfleeger and J. Margulies, <i>Security in Computing</i> , 5 <sup>th</sup> Edition, Pearson Education, 2018. 2. B. Forouzan, D. Mukhopadhyaya, <i>Cryptography and Network Security</i> , 4 <sup>th</sup> Edition, McGraw Hill, 2019. 3. W. Stallings and L. Brown, <i>Computer Security: Principles and Practice</i> , 4 <sup>th</sup> Edition, Pearson Education, 2019.		
<b>Laboratory Work</b> 8 to 10 Programming exercises based on the syllabus.		



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Software Testing				<b>Code:</b> 702IT0E035	
Teaching Scheme			Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Pre-requisite:** Software engineering.

**Course Objective**

To learn traditional testing methods applied to develop robust software products and services. Quality and security of software products rests on early error detection and reporting throughout the development life cycle. It will enable the students implement manual and automated testing of software products.

**Course Outcomes**

After completion of the course, student would be able to-

1. Design and implement test cases for different levels and types of testing
2. Select appropriate manual and automatic testing for different modules of software
3. Apply test-driven development to improve testing and delivery in software development

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Introduction to Software Testing</b> Testing objectives and activities. Traditional and Agile testing process. Errors, Defects, Failures.	4
2	<b>Testing Techniques</b> Black-Box Testing Techniques- Equivalent Partitioning-Boundary Value Analysis (BVA)- State Transition Testing-Decision table based Testing - Cause-Effect Graphing Based Testing - Error Guessing White-Box Testing Techniques- Logic Coverage criteria-Basic path testing-Graph matrices-Loop testing-Data flow testing-Mutation testing	6
3	<b>Unit Testing &amp; Integration Testing</b> Unit testing framework, Naming and structuring Test Cases, Specification-based Testing Techniques. Integration test techniques, Data Requirement, Planning.	6
4	<b>System Testing, User acceptance Testing &amp; Regression Testing</b> Test techniques, Data Requirement, Planning	6
5	<b>Test &amp; Behavior Driven Development</b> Classic Style, Mockist Style <b>Contemporary issues:</b> Applications of Software Testing in industry	8
<b>Total</b>		<b>30</b>

**Text Books**

1. Paul C. Jorgensen, *Software Testing: A Craftsman's Approach*, 5<sup>th</sup> Edition, Auerbach Publications,, 2021
2. Alexander Tarlinder, *Developer Testing: Building Quality into Software*, 1<sup>st</sup> Edition, Addison Wesley, 2016.

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**Reference Books**

1. Richard Lawrence, Paul Rayner, *Behavior-Driven Development with Cucumber: Better Collaboration for Better Software*, 1<sup>st</sup> Edition, Addison-Wesley, 2019.
2. Jez Humble, David Farley, *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*, 1<sup>st</sup> Edition, Addison-Wesley, 2010.

**Laboratory Work**

8 to 10 Programming exercises based on the syllabus.



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<b>Program:</b> B Tech MBA/Tech Information Technology, B Tech/MBA Tech Computer Engineering				<b>Semester:</b> VII	
<b>Course:</b> Ethical Hacking				<b>Code:</b> 702IT0E028	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Computer Network, Operating Systems and programming					
<b>Course Objective</b> This course is an introduction to vulnerability assessment and penetration testing. Students will learn about various methods, tools and techniques to perform ethical hacking and will simulate various attacks in the lab environment.					
<b>Course Outcomes</b> After completion of the course, student would be able to- <ol style="list-style-type: none"> <li>1. Demonstrate hacking in a lab environment</li> <li>2. Describe various countermeasures</li> <li>3. Describe various professional, ethical and legal issues related to ethical hacking</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction</b> Need for adversarial thinking and penetration testing, ethics of hacking, hacking process, types of hackers, types of penetration testing, testing methodologies (OSSTMM, PTES, and OWASP Testing Guide), and Rules of engagement.				6
2	<b>Reconnaissance and scanning</b> Introduction, types of reconnaissance, various techniques of recon (social engineering, web based recon, DNS based recon, network based recon, Google hacking etc.), countermeasures, scanning, types of scanning (port scanning, network scanning, and vulnerability scanning), Sniffers				8
3	<b>Exploitation</b> Password cracking, spoofing, session hijacking, DoS / DDoS, Buffer Overflow, malware, evading firewall and IDS, SQL Injection, OWASP top 10 web application vulnerabilities, hacking wireless networks, metasploit, meterpreter, AV evasion, metasploit databases and tool integration, privilege escalation,				10
4	<b>Hacking Mobile platforms</b> Overview of android and iOS, OWASP mobile to 10 risks and mitigation.				2
5	<b>Legal, Professional and Ethical issues</b> Cyber laws in India, various ethical dilemma, professional conduct, and penetration testing report writing				2
6	<b>Case Study</b>				2
	<b>Total</b>				30
<b>Text Books</b> 1. R. Pillay, <i>Learn Penetration Testing</i> , 1 <sup>st</sup> Edition, Packt Publication, 2019.					

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2. M. Walker, *CEH Certified Ethical Hacker All-in-One Exam Guide*, 4<sup>th</sup> Edition, McGraw-Hill Education, 2019.

**Reference Books**

1. N. Jaswal, *Mastering Metasploit*, 4<sup>th</sup> Edition, Packt Publication, 2020.
2. S. Oriyano and M. Solomon, *Hacker Techniques, Tools, and Incident Handling*, 3<sup>rd</sup> Edition, J B Learning, 2020.
3. Gilberto Najera-Gutierrez, Juned Ansari, Daniel Teixeira, and Abhinav Singh, *Improving your Penetration Testing Skills*, 1<sup>st</sup> Edition, Packt Publication, 2019.

**Laboratory Work**

8 to 10 Programming exercises based on the syllabus.



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Network design				<b>Code:</b> 702IT0E036	
Teaching Scheme			Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Pre-requisite:** Computer Networks

**Course Objective**

The course focuses on designing, specification, and implement a modern, large scale network design using the latest technology and devices, while understanding how to secure the network. Understanding the sufficient Operations, Administration, Management, Provisioning, network resources can be learnt.

**Course Outcomes**

After completion of the course, student would be able to-

1. Explain the major application architectures and applicable standards of networks
2. Design and manage computer network systems
3. Demonstrate the logical design process for core, distribution, and access networks
4. Describe how network monitoring and alarm reporting influences the network design

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Introduction</b> Analyzing the technical goals of network, scalability, availability, network Performance definitions, making network design, tradeoffs characterizing the network traffic, understanding various standards.	3
2	<b>Characterizing the Existing Internetwork</b> Characterizing the network infrastructure, network map, large internetworks, logical architecture, network addressing and naming, analyzing network availability and network utilization, network accuracy, analyzing errors on switched Ethernet networks, analyzing network efficiency, analyzing delay and response time. <b>Characterizing Network Traffic</b> Terminal/host traffic flow, client/server traffic flow, peer-to-peer traffic flow, server/server traffic flow, distributed computing traffic flow, traffic flow in voice over IP networks, characterizing traffic load, characterizing Quality of Service requirements.	6
3	<b>Logical Network Design</b> Designing a network topology, hierarchical network design, flat WAN Topologies, flat LAN topologies, redundant network design topologies, Spanning tree protocol, virtual LANs, wireless LANs, redundant wireless access points, designing the enterprise edge topology, secure network design topologies.	6
4	<b>Designing Models for Addressing and Numbering</b>	6

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	Network layer addresses, IP dynamic addressing, IP version 6, zero configuration networking, hierarchical routing, route summarization (aggregation), discontinuous subnets, mobile hosts, link-local addresses, global unicast addresses	
5	<b>Selecting Switching and Routing Protocols</b> Portfast, uplinkfast and Backbonefast, Unidirectional link detection, dynamic trunk protocol, distance-vector routing protocols, hierarchical versus Non-hierarchical routing protocols, IP routing, border gateway protocol, integrated routing and bridging.	4
6	<b>Testing, and Optimizing the Network Design</b> Testing your network design, optimizing your network design.	2
7	<b>Developing Network Security Strategies</b> Network security design, security mechanisms, modularizing security design, securing wireless networks, authentication in wireless networks.	3
	<b>Total</b>	<b>30</b>
<b>Textbooks</b>		
<ol style="list-style-type: none"> <li>Behrouz A. Forouzan, <i>Data Communications and Networking</i>, 5<sup>th</sup> Edition, McGraw-Hill Education, 2017.</li> <li>Michel Thomatis, <i>Network Design Cookbook: Architecting Cisco Networks</i>, Version 10.2.8, 1<sup>st</sup> Edition, Cisco press, August 2016.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>Russ White, Denise Donohue, <i>Art of Network Architecture, The: Business-Driven Design (Networking Technology)</i> Cisco press, 1<sup>st</sup> Edition, 2014.</li> <li>Priscilla Oppenheimer, <i>Top-Down Network Design</i>, 3<sup>rd</sup> Edition, Cisco Press, 2011.</li> </ol>		
<b>Laboratory Work</b>		
8 to 10 Programming exercises based on the syllabus.		



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<b>Program:</b> B Tech/MBA Tech Information Technology, B Tech/MBA Tech (Computer Engineering), B Tech Artificial Intelligence, B Tech EXTC, MBA Tech EXTC	<b>Semester:</b> VII,VIII
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<b>Course :</b> Cloud Computing	<b>Code:</b> 702IT0C026
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Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Pre-requisite:** Computer Networks

**Course Objective**  
 The course is designed to enable students to understand state-of-the-art cloud computing technologies and applications. This course covers basic models, architecture, virtualisation. It also delves into concepts, processes and best practices needed to secure cloud information. It emphasises on business models, risk management and service management aspects of cloud

**Course Outcomes**  
 After completion of the course, student would be able to-

1. Classify the layers of cloud reference model based on their significance
2. Address security concerns and orchestration in cloud environment

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Introduction to Cloud</b> Essential Characteristics of Cloud, Cloud Service Models, Cloud Deployment Models, Cloud Service Brokerage, Cloud Reference Model, Considerations for building Cloud Infrastructure	5
2	<b>Physical Layer</b> Compute System, Storage System Architecture, Network Connectivity	5
3	<b>Virtual Layer</b> Virtual Layer Functions, Virtualization Software, Resource Pool and Virtual Resources	5
4	<b>Control Layer</b> Control Layer Functions, Control Software, Resource Optimization Techniques	5
5	<b>Cloud Security</b> Threats, Security Mechanisms, IAM solutions, Security Algorithms	5
6	<b>Orchestration</b> Container Approach, Docker Container, Items in a Dockerfile, Kubernetes Pods, Kubernetes Terminology, Kubernetes Cluster Model, Kubernetes Features	5
	<b>Total</b>	<b>30</b>

**Text Books**

1. Douglas E. Comer, *The Cloud Computing Book: The Future of Computing Explained*, 1<sup>st</sup> Edition, Taylor and Francis, 2021



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2. Tim Mather, *Security and Privacy Trends in Cloud Computing and Big Data*, 1<sup>st</sup> Edition, Taylor and Francis, 2022.

**Reference Books**

1. Umang Singh, San Murugesan and Ashish Seth, *Emerging Computing Paradigms Principles, Advances and Applications*, Wiley India, 2022.
2. Sanjiva Shankar Dubey, *Cloud Computing and Beyond: A Managerial Perspective*, 2<sup>nd</sup> Edition, Wiley, 2021.
3. John R. Vacca, *Cloud Computing Security Foundations and Challenges*, 2<sup>nd</sup> Edition, CRC Press, 2021.
4. Brij Gupta, Gregorio M, Dharma P Agarwal and Deepak Gupta, *Handbook of Computer Networks and Cyber Security*, 1<sup>st</sup> Edition, Springer, 2020.

**Laboratory Work**

8 to 10 Programming exercises based on the syllabus.



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Advanced Machine Learning				<b>Code:</b> 702IT0E037	
Teaching Scheme			Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
2	2	0	3	Marks Scaled to 50	Marks scaled to 50

**Pre-requisite:** Engineering Mathematics - III and IV

**Course Objective**

The objective of this course is to enable students to understand and apply advanced concepts in machine learning to real life problems.

**Course Outcomes**

After completion of the course, student would be able to-

1. Explain advanced concepts in machine learning
2. Map real world problems to a machine learning problem definition and select appropriate machine learning algorithm
3. Design applications using machine learning techniques
4. Evaluate the performance of the applications

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Overview of ML concepts</b> Supervised and unsupervised methods Probability theory, Decision theory, Information theory, Linear Algebra	4
2	Concept Learning, Minimum Description Length (MDL),Hidden Markov Models (HMM), Generalized Linear Models, extensions of linear models Polynomial regression, step functions, regression splines, smoothing splines, local regression, generalized additive models (GAMs)	6
3	<b>Graphical Models</b> Bayesian Belief Networks, PAC Learning, SOM, VC-Dimension and Monte Carlo Simulation	4
4	<b>Genetic Algorithms</b> Hypothesis space search, Genetic programming, Models of evaluation & learning	5
5	<b>Reinforcement Learning</b> Q Learning, Non-deterministic rewards & actions, Temporal difference learning, Generalization, Active Learning, Metric Learning	5
6	<b>Deep Learning overview</b> Single and multi-layer neural networks, convolutional neural networks, recurrent neural networks, when to use deep learning	3
7	<b>ML cybersecurity application</b>	3

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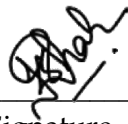
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	When to use anomaly detection versus supervised learning, intrusion detection with heuristics, data-driven methods, feature engineering for anomaly detection, anomaly detection with data and algorithms, challenges of using machine learning in anomaly detection, response and mitigation, practical system design concerns	
	<b>Total</b>	<b>30</b>
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. Andreas C. Müller &amp; Sarah Guido, <i>Introduction to Machine Learning with Python: A Guide for Data Scientists</i>, 1<sup>st</sup> Edition, O'Reilly Media Inc, 2017.</li> <li>2. James, G., Witten, D., Hastie, T., &amp; Tibshirani, R. <i>An Introduction to Statistical Learning.</i> , 2<sup>nd</sup> Edition, New York: Springer, 2021.</li> <li>3. Stuart Russel and Peter Norvig, <i>Artificial Intelligence A Modern Approach</i>, Pearson Education, 4th Edition, 2010.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. Alpaydin, Ethem. <i>Introduction to Machine Learning</i>, 4<sup>th</sup> Edition, MIT press, 2020.</li> <li>2. Aurélien Géron. <i>Hands-On Machine Learning with Scikit-Learn and TensorFlow</i>, 2<sup>nd</sup> Edition, O'Reilly Media, 2019.</li> <li>3. Winder, Phil. <i>Reinforcement Learning</i>. O'Reilly Media, 2020.</li> <li>4. Vasilev, Ivan. <i>Advanced Deep Learning with Python: Design and implement advanced next-generation AI solutions using TensorFlow and PyTorch</i>. 1<sup>st</sup> Edition, Packt Publishing Ltd, 2020.</li> <li>5. Tom Mitchell, <i>Machine Learning</i>, 1<sup>st</sup> Indian Edition, McGraw Hill, 2017.</li> </ol>		
<b>Laboratory Work</b>		
8 to 10 Programming exercises based on the syllabus.		



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Visual Analytics				<b>Code:</b> 702IT0E039	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Practical examination Marks Scaled to 50

**Pre-requisite:** Basic computer knowledge, Data Warehousing and Mining

**Course Objective**

The objective of the course is to familiarize the students with tools and processes to analyze datasets using visual representations of the data. The course helps students to visualize the data in graphs, charts, maps etc., and thereby identify patterns and develop actionable insights that help one to make better, data-driven decisions.

**Course Outcomes**

After completion of the course, student would be able to-

1. Demonstrate a working knowledge of data visualization
2. Create visualization charts appropriate for the underlying data
3. Apply modern statistical learning techniques on data visualizations
4. Design and implement interactive links between various objects in a data visualization report

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Getting Started with Visual analytics</b> What is data visualization, methodology for data visual analytics, Exploring Visual Analytics Concepts, Using Visual Analytics, Discussing the course environment and scenario.	2
2	<b>Data investigation and preparation</b> Accessing data from local device/ server/ social media. Data investigation to find common issues. Data preparation - cleaning, modifying the properties of data items, applying data source filter, creating new data items, joining tables/ columns, Data exploration with generated dataset.	3
3	<b>Using Visual analytics Explorer</b> Examining the visual analytics explorations, selecting data and defining data items properties, creating visualizations, Enhancing visualization with advanced analytics.	5
4	<b>Data visual analytics</b> Modern statistical learning techniques on data visualizations.	4
5	<b>Designing Reports with Visual Analytics</b> Examining the Visual Analytics Designer, creating a simple report, working with graphs, working with filters and report sections, establishing interactions, working with gauges, working with tables, working with other objects.	8
6	<b>Viewing Visual Analytics Reports</b> Viewing reports on the Web, viewing reports on a mobile device.	2
7	<b>Case study</b> Create a visualization report and dashboard on a business scenario.	6

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Total	30
<b>Text Books</b> <ol style="list-style-type: none"><li>1. Kieran Healy, <i>Data Visualization: A Practical Introduction</i>, 1<sup>st</sup> Edition, Princeton University Press, 2018.</li><li>2. Cole Nussbaumer Knaflic, <i>Storytelling with Data: A Data Visualization Guide for Business Professionals</i>, 1st Edition, Wiley, 2015.</li></ol>	
<b>Reference books</b> <ol style="list-style-type: none"><li>1. <i>Visual Analytics 7.5: User's Guide</i> by SAS Institute (online SAS documents).</li><li>2. Trevor Hastie Robert Tibshirani Jerome Friedman, <i>The Elements of Statistical Learning: Data Mining, Inference, and Prediction</i>, 2nd Edition, Springer, 2017.</li></ol>	
<b>Laboratory Work</b> 8 to 10 Programming exercises (and a practicum) based on the syllabus.	



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Database Administration				<b>Code:</b> 702IT0E038	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Database Management System					
<b>Course Objective</b> This course is designed to provide knowledge for enabling database development, design, and implementation. At the end of the course, students would be able to implement information systems using DBMS technology.					
<b>Course Outcomes</b> After completion of the course, student would be able to- <ol style="list-style-type: none"> <li>1. Describe the fundamentals of Database Administration</li> <li>2. Analyze the Network Architecture and implement Database security</li> <li>3. Design Database backup and recovery procedures, apply performance tuning operations</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
<b>1</b>	<b>Database Overview and Architecture</b> Introduction to database administration, Database memory structures, DBA tasks, types of DBA, Impact of newer technology on DBA, DB installation				4
<b>2</b>	<b>Managing the database Instance</b> Access database instance, Modify database initialization parameters , stages of database startup, alert log ,repository and data dictionary				2
<b>3</b>	<b>User Access and Database Security</b> Managing user accounts, Granting and revoking privileges, Managing user groups ,managing roles and privileges, querying role information				4
<b>4</b>	<b>Database File Management</b> Managing control files, Maintaining and monitoring redo log files, storing data (create, alter, analyzing, querying table information), Managing indexes and constraints, managing schema objects				4
<b>5</b>	<b>Introduction to Network Administration</b> Network design considerations, network responsibilities for the DBA, Network configuration, Oracle Net features, Oracle Net Stack Architecture. Oracle shared server Infrastructure, additional listeners.				4

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6	<b>Backup and Recovery</b> Backup terminology , instance recovery , control file, checkpoints , redo log files, archived log files , performing database backup, Oracle RMAN.	4
7	<b>Performing Database Recovery</b> Types of Database failure, types of recovery, Performing recovery operations, Backing the database, full vs incremental backups.	4
8	<b>Performance Tuning</b> Tuning methodology overview, General tuning concepts, Case Study: Remote Databases & Virtual DBA	4
	<b>Total</b>	<b>30</b>

**Text Books**

1. Craig S Mullins, *Database Administration: The Complete Guide to DBA Practices and Procedures*, 2<sup>nd</sup> Edition, Addison Wesley Professional, 2013.

**Reference Books**

1. Abraham Silberschatz, Henry Korth, S Sudarshan, "Database System Concepts, 7<sup>th</sup> Edition, McGraw-Hill, 2019.
2. Brian Peasland, *Oracle DBA Mentor Succeeding as an Oracle Database Administrator*, 1<sup>st</sup> Edition, 2019.
3. Bob Bryla , Kevin Loney , *Oracle Database 12c The Complete Reference* , Oracle Press, 2013.

**Laboratory Work**

8 to 10 Programming exercises based on the syllabus.



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<b>Program:</b> B Tech Information Technology, B Tech CSE-Cybersecurity				<b>Semester:</b> VII	
<b>Course:</b> Capstone Project				<b>Code :</b> 702EE0C002	
Teaching Scheme				Evaluation Scheme	
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks -50)	Term End Examinations (TEE) (Marks - 50)
0	8	0	4	Marks Scaled to 50	Presentation and Viva Marks Scaled to 50
<b>*Practical exam will be conducted at school level (Non-University Examination)</b>					
<b>Pre-requisite:</b> Knowledge of all core and elective courses completed till 3rd year.					
<b>Course Objective</b> The capstone project is designed to provide a culminating design experience to the final-year students' learning with essentially required hands-on experience to ensure that they graduate with the required practical and soft skills. The course aims to encourage students to think critically, solve challenging problems, do a feasibility study and develop written and oral communication skills, teamwork and planning. The students may also work in interdisciplinary areas which will help broaden their scope and learning in different domains.					
<b>Course Outcomes</b> After completion of the course, students will be able to - <ol style="list-style-type: none"> <li>1. Select an appropriate problem statement after reviewing the literature and identifying the research gaps.</li> <li>2. Formulate the different use cases/feasible design model.</li> <li>3. Implement the prototype/proof of concept, test and validate the results.</li> <li>4. Manage a team project.</li> <li>5. Summarize the topic into a technical report.</li> </ol>					
<b>Syllabus</b> A student is required to carry out elaborated project work. The project may be either design and fabrication work or a simulation and synthesis of a problem/system, and develop algorithms and verify feasibility of implementation. At the end of the semester students will be required to submit a report detailing the literature review, design problem formulation, analysis functional simulation and synthesis, work plan and work done and present his/her work carried out before examiners.					



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<b>Program:</b> B Tech / MBA Tech (Computer Engineering, Information Technology, Artificial Intelligence)				<b>Semester:</b> VI /VII /V	
<b>Course:</b> Distributed Computing				<b>Code:</b> 702CO0C034	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Operating Systems					
<b>Course Objective</b> To introduce the concepts and design of distributed computing and algorithms that support distributed computing.					
<b>Course Outcomes</b> After completion of the course, student will be able to -					
<ol style="list-style-type: none"> <li>1. Explain the basic concepts of distributed computing</li> <li>2. Apply the concepts of distributed computing to implement various mechanisms of communication</li> <li>3. Analyze various approaches of synchronization, mutual exclusion, election algorithms and fault tolerant services</li> <li>4. Recognize different kinds of naming and their implementation</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction to Distributed System</b> Definition, Goals, Examples of Distributed System-Internet. System architectures-centralized architecture, decentralized architecture, hybrid architecture, Client-Server Model, Servers-general design issues, server clusters, managing server clusters.				05
2	<b>Communication</b> Basic RPC operation, RPC implementation, RPC semantics in presence of failures, RMI- Basics, Implementation, Case study-Java RMI, Message oriented communication-: transient and persistent communication.				06

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	Stream oriented communication- support for continuous media, streams and QoS, stream synchronization.	
3	<b>Synchronization</b> Introduction, Physical Clock synchronization algorithms, Logical clocks, event ordering, implementation of Logical clocks, Lamport's logical clock algorithm, Vector clocks, Mutual exclusion: Centralized, distributed and token ring mutual exclusion algorithms, comparison of these algorithms. Traditional election algorithm- Bully and Ring election algorithm.	06
4	<b>Fault Tolerance</b> Introduction, Process resilience, Reliable group communication.	08
5	<b>Naming</b> Names, identifiers, and addresses, Flat naming , Structured naming: name spaces and resolution, implementation of name space, Case study- Domain Name System, Attributed based naming- Directory services.	05
	<b>Total</b>	<b>30</b>

**Text Books**

1. Andrew S. Tanenbaum, *Distributed System: Principles and Paradigms*, 3<sup>rd</sup> Edition, Pearson Prentice Hall, 2017.

**Reference Books**

1. George Couloris, *Distributed System: Concept and Design*, 5<sup>th</sup> edition, Pearson Education, 2009.
2. Pradeep K. Sinha, *Distributed Operating System*, IEEE Press, Prentice Hall of India Ltd, 1998.
3. Mei-Ling L. Liu, *Distributed Computing: Principles and Applications*, Addison - Wesley, 2004.

**Laboratory / Tutorial work:**

8 to 10 experiments (and a practicum where applicable) based on the syllabus.

*Seema Shah*



*Arvind*

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<b>Program:</b> B Tech (Artificial Intelligence, Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, AI and ML) MBA Tech (Artificial Intelligence, Computer Engineering, Information Technology)				<b>Semester:</b> V/VII	
<b>Course:</b> Deep Learning				<b>Code:</b> 702AI0C008	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Machine Learning, Statistical Methods					
<b>Course Objective</b> This course focuses on the fundamentals of neural networks along with a practical perspective of advanced topics such as convolutional neural networks, recurrent neural networks, and long short-term memory with their real-world applications.					
<b>Course Outcomes</b> After completion of the course, students will be able to -					
<ol style="list-style-type: none"> <li>1. Explain the fundamentals of deep learning.</li> <li>2. Apply optimization and regularization for tuning the parameters of deep neural networks.</li> <li>3. Build convolutional neural networks architectures for various applications.</li> <li>4. Apply recurrent neural networks architectures for various applications.</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction to Deep Learning</b> What is deep learning, motivation for using deep learning, Applications of deep learning in various domains.				02
2	<b>Neural Networks</b> Basics of Neural network, Perceptron, Multilayer perceptron, Feedforward neural network, back-propagation, Activation functions, Loss functions, Gradient descent for neural networks.				08
3	<b>Optimization and Regularization for Deep Learning</b> Stochastic GD, Mini Batch SGD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, RMSProp, Adam, L1 and L2 Regularization, Early stopping, drop out.				05
4	<b>Convolutional Neural Networks</b> Convolution operation, pooling, striding, convolution over volume, parameters of CNN, Fully connected networks v/s CNN, Deep				08



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	convolutional architectures: AlexNet, Inception Network, ResNet. Transfer learning using CNN, Applications of CNN.	
5	<b>Recurrent Neural Networks</b> Vanilla RNN, Back-propagation through time, Vanishing and Exploding gradients, Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Applications of RNN.	07
	<b>Total</b>	<b>30</b>
<b>Text Books</b>		
1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, <i>Deep Learning</i> , 1 <sup>st</sup> Edition, MIT Press Book, 2017		
2. Charu Agarwal, <i>Neural Networks and Deep Learning: A Textbook</i> , 1 <sup>st</sup> Edition, Springer, 2018		
<b>Reference Books</b>		
1. François Chollet, <i>Deep Learning with Python</i> , 1 <sup>st</sup> Edition, Manning Publication, 2017		
2. Aurelien Geron, <i>Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow</i> , 2 <sup>nd</sup> Edition, O'Reilly, 2019.		
<b>Laboratory/ Tutorial Work</b>		
8 to 10 experiments (and a practicum where applicable) / based on the syllabus		

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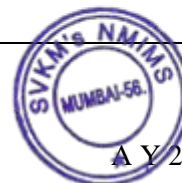
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<b>Program : B Tech / MBA Tech [EXTC/ Information Technology/ Computer Engineering/ Computer Science/ CSE(DS)-311(VT)]</b>				<b>Semester : V / VI / VII</b>	
<b>Course : Image and Video Processing</b>				<b>Code : 702EX0E004</b>	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Signals and Systems, Discrete Time Signal Processing					
<b>Course Objective</b> This course introduces concepts, methodologies and performance metrics for still image and motion picture processing. It also helps to develop a foundation for further study and research in the signal processing domain.					
<b>Course Outcomes</b> After completion of the course, students will be able to - <ol style="list-style-type: none"> <li>1. Apply spatial domain enhancement techniques on grey images</li> <li>2. Analyze various frequency domain transforms to process an image</li> <li>3. Interpret the use of various morphological operations on images</li> <li>4. Evaluate segmentation techniques for object detection</li> <li>5. Illustrate video processing</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1.	<b>Image fundamentals</b> Basics of sampling and quantization, representing digital image, spatial and gray level resolution, basic relationships between pixels.				02
2.	<b>Image enhancement</b> Point processing techniques - digital negative, contrast stretching, thresholding, gray level slicing, bit plane slicing, log transformation, power law transformation, neighborhood processing-smoothing spatial filters, sharpening spatial filters, histogram processing-histogram equalization.				06
3.	<b>Image transforms</b> Walsh transform, Hadamard transform, discrete cosine transform.				06
4.	<b>Morphological image processing</b> Dilation, erosion, opening, closing, Hit-or-Miss transformation, basic morphological algorithms- boundary extraction on binary images, skeletonization, thinning, thickening.				05
5.	<b>Image segmentation</b> Detection of discontinuities- point, line and edge detection, edge linking and boundary detection using local processing, segmentation using thresholding, region based segmentation- region growing, region splitting and merging.				06



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6.	<b>Fundamentals of digital video</b> Video representation- digital video sampling, temporal correlation, video frame classifications, I, P and B frames, digital video quality measure.	02
7.	<b>Digital video processing techniques</b> Fundamentals of motion estimation, motion estimation algorithms- exhaustive search block matching, 2D-log search method and 3 step search method.	03
	<b>Total</b>	<b>30</b>
<b>Text Books</b> 1. R.C Gonzalez and Richard Woods, <i>Digital Image Processing</i> , Pearson publication, 4 <sup>th</sup> Edition, 2018. 2. Ling Guan, <i>Multimedia Image and Video Processing</i> , CRC Press, 3 <sup>rd</sup> Edition, 2017.		
<b>Reference Books</b> 1. Bernd Jehne, <i>Digital Image Processing and Image Formation</i> , Springer, 6 <sup>th</sup> Edition, 2022. 2. Wilhelm Burger and Mark J. Burge, <i>Digital Image Processing: An Algorithmic Introduction</i> , Springer publications, 2 <sup>nd</sup> Edition, 2022.		
<b>Laboratory Work</b> 8 to 10 practical exercises (and a practicum) based on the syllabus.		



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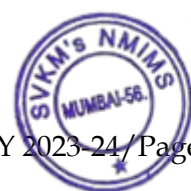


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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester :</b> VII	
<b>Course :</b> Information Systems Security				<b>Code:</b> 702IT0C029	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50 )</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Basic Knowledge of Computer Network, Operating Systems and programming.					
<b>Course Objective</b> This course introduces students to the various elements of information systems security. Students will learn about various cybersecurity threats and their countermeasures. Students will learn about various aspects of cybersecurity.					
<b>Course Outcomes</b> After completion of the course, student would be able to- <ol style="list-style-type: none"> <li>1. Analyze various cybersecurity threats and countermeasures</li> <li>2. Explain various security technologies and mechanisms</li> <li>3. Describe various ethical and legal issues related to cybersecurity</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction</b> Basic Components of Cybersecurity, vulnerabilities, threats , Attacks and controls, goals of security, Security System development life cycle, NIST Cybersecurity Framework, MITRE ATT&CK® Matrix				4
2	<b>Design Principles</b> Various security threats and attacks (non-malicious program errors, malwares, APT, social engineering, etc.), threat actors, method of defence, design principles, security policies, types of security policies				4
3	<b>Cryptography</b> Cryptography basics, transposition and substitution ciphers, stream and block ciphers, cryptographic algorithms (AES and RSA), Diffie-Hellman, key management and distribution, digital signature, hash functions, Attacks on cryptosystems.				5
4	<b>Identity and access management(IAM)</b> Authentication basics, Passwords, authentication tokens, certificate based and biometric authentication, Kerberos, SSO approaches, Multi-Factor Authentication, attacks on authentication schemes, Access control principles, DAC, MAC, and Role based Access Control, Identify Federations, Access control models, identity and access provisioning lifecycle.				5
5	<b>Security Technologies</b> Firewalls, Kinds of Firewalls, Filtering Services, DMZ, Implementing policies (Default allow, Default Deny) on proxy, NAT, Intrusion Detection and Prevention Systems, types of IDPS, Virtual Private Network, SSH				5

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6	<b>Risk and Incidents Management</b> Overview of risk management, risk identification and assessment, risk control strategies, selecting risk control strategy, continuity strategies (Business continuity planning, Incident response planning, Disaster Recovery planning)	4
7	<b>Legal and Ethical issues</b> Cybercrimes and criminals, IP, privacy, legal and ethical issues.	3
	<b>Total</b>	<b>30</b>
<b>Text Books</b> 1. M. Whitman and H. Mattford, Principles of Information Security with MindTap, 6 <sup>th</sup> Edition, Cengage, 2018.		
<b>Reference Books</b> 1. C. Pfleeger, S. L. Pfleeger and J. Margulies, <i>Security in Computing</i> , 5 <sup>th</sup> Edition, Pearson Education, 2018. 2. B. Forouzan, D. Mukhopadhyaya, <i>Cryptography and Network Security</i> , 4 <sup>th</sup> Edition, McGraw Hill, 2019. 3. W. Stallings and L. Brown, <i>Computer Security: Principles and Practice</i> , 4 <sup>th</sup> Edition, Pearson Education, 2019.		
<b>Laboratory Work</b> 8 to 10 Programming exercises based on the syllabus.		



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Software Testing				<b>Code:</b> 702IT0E035	
Teaching Scheme			Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Pre-requisite:** Software engineering.

**Course Objective**

To learn traditional testing methods applied to develop robust software products and services. Quality and security of software products rests on early error detection and reporting throughout the development life cycle. It will enable the students implement manual and automated testing of software products.

**Course Outcomes**

After completion of the course, student would be able to-

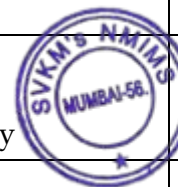
1. Design and implement test cases for different levels and types of testing
2. Select appropriate manual and automatic testing for different modules of software
3. Apply test-driven development to improve testing and delivery in software development

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Introduction to Software Testing</b> Testing objectives and activities. Traditional and Agile testing process. Errors, Defects, Failures.	4
2	<b>Testing Techniques</b> Black-Box Testing Techniques- Equivalent Partitioning-Boundary Value Analysis (BVA)- State Transition Testing-Decision table based Testing - Cause-Effect Graphing Based Testing - Error Guessing White-Box Testing Techniques- Logic Coverage criteria-Basic path testing-Graph matrices-Loop testing-Data flow testing-Mutation testing	6
3	<b>Unit Testing &amp; Integration Testing</b> Unit testing framework, Naming and structuring Test Cases, Specification-based Testing Techniques. Integration test techniques, Data Requirement, Planning.	6
4	<b>System Testing, User acceptance Testing &amp; Regression Testing</b> Test techniques, Data Requirement, Planning	6
5	<b>Test &amp; Behavior Driven Development</b> Classic Style, Mockist Style <b>Contemporary issues:</b> Applications of Software Testing in industry	6
<b>Total</b>		<b>30</b>

**Text Books**

1. Paul C. Jorgensen, *Software Testing: A Craftsman's Approach*, 5<sup>th</sup> Edition, Auerbach Publications,, 2021
2. Alexander Tarlinder, *Developer Testing: Building Quality into Software*, 1<sup>st</sup> Edition, Addison-Wesley, 2016.



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**Reference Books**

1. Richard Lawrence, Paul Rayner, *Behavior-Driven Development with Cucumber: Better Collaboration for Better Software*, 1<sup>st</sup> Edition, Addison-Wesley, 2019.
2. Jez Humble, David Farley, *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*, 1<sup>st</sup> Edition, Addison-Wesley, 2010.

**Laboratory Work**

8 to 10 Programming exercises based on the syllabus.



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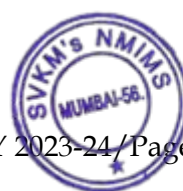


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<b>Program:</b> B Tech MBA/Tech Information Technology, B Tech/MBA Tech Computer Engineering				<b>Semester:</b> VII	
<b>Course:</b> Ethical Hacking				<b>Code:</b> 702IT0E028	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks- 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Pre-requisite:</b> Computer Network, Operating Systems and programming					
<b>Course Objective</b> This course is an introduction to vulnerability assessment and penetration testing. Students will learn about various methods, tools and techniques to perform ethical hacking and will simulate various attacks in the lab environment.					
<b>Course Outcomes</b> After completion of the course, student would be able to- <ol style="list-style-type: none"> <li>1. Demonstrate hacking in a lab environment</li> <li>2. Describe various countermeasures</li> <li>3. Describe various professional, ethical and legal issues related to ethical hacking</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction</b> Need for adversarial thinking and penetration testing, ethics of hacking, hacking process, types of hackers, types of penetration testing, testing methodologies (OSSTMM, PTES, and OWASP Testing Guide), and Rules of engagement.				6
2	<b>Reconnaissance and scanning</b> Introduction, types of reconnaissance, various techniques of recon (social engineering, web based recon, DNS based recon, network based recon, Google hacking etc.), countermeasures, scanning, types of scanning (port scanning, network scanning, and vulnerability scanning), Sniffers				8
3	<b>Exploitation</b> Password cracking, spoofing, session hijacking, DoS / DDoS, Buffer Overflow, malware, evading firewall and IDS, SQL Injection, OWASP top 10 web application vulnerabilities, hacking wireless networks, metasploit, meterpreter, AV evasion, metasploit databases and tool integration, privilege escalation,				10
4	<b>Hacking Mobile platforms</b> Overview of android and iOS, OWASP mobile to 10 risks and mitigation.				2
5	<b>Legal, Professional and Ethical issues</b> Cyber laws in India, various ethical dilemma, professional conduct, and penetration testing report writing				2
6	<b>Case Study</b>				2
	<b>Total</b>				<b>30</b>
<b>Text Books</b> 1. R. Pillay, <i>Learn Penetration Testing</i> , 1 <sup>st</sup> Edition, Packt Publication, 2019.					

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2. M. Walker, *CEH Certified Ethical Hacker All-in-One Exam Guide*, 4<sup>th</sup> Edition, McGraw-Hill Education, 2019.

**Reference Books**

1. N. Jaswal, *Mastering Metasploit*, 4<sup>th</sup> Edition, Packt Publication, 2020.
2. S. Oriyano and M. Solomon, *Hacker Techniques, Tools, and Incident Handling*, 3<sup>rd</sup> Edition, J B Learning, 2020.
3. Gilberto Najera-Gutierrez, Juned Ansari, Daniel Teixeira, and Abhinav Singh, *Improving your Penetration Testing Skills*, 1<sup>st</sup> Edition, Packt Publication, 2019.

**Laboratory Work**

8 to 10 Programming exercises based on the syllabus.



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<b>Program:</b> B Tech/MBA Tech Information Technology				<b>Semester:</b> VII	
<b>Course:</b> Network design				<b>Code:</b> 702IT0E036	
Teaching Scheme			Evaluation Scheme		
Lecture (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Internal Continuous Assessment (ICA) (Marks - 50)	Term End Examinations (TEE) (Marks- 100)
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50

**Pre-requisite:** Computer Networks

**Course Objective**

The course focuses on designing, specification, and implement a modern, large scale network design using the latest technology and devices, while understanding how to secure the network. Understanding the sufficient Operations, Administration, Management, Provisioning, network resources can be learnt.

**Course Outcomes**

After completion of the course, student would be able to-

1. Explain the major application architectures and applicable standards of networks
2. Design and manage computer network systems
3. Demonstrate the logical design process for core, distribution, and access networks
4. Describe how network monitoring and alarm reporting influences the network design

**Detailed Syllabus**

Unit	Description	Duration
1	<b>Introduction</b> Analyzing the technical goals of network, scalability, availability, network Performance definitions, making network design, tradeoffs characterizing the network traffic, understanding various standards.	3
2	<b>Characterizing the Existing Internetwork</b> Characterizing the network infrastructure, network map, large internetworks, logical architecture, network addressing and naming, analyzing network availability and network utilization, network accuracy, analyzing errors on switched Ethernet networks, analyzing network efficiency, analyzing delay and response time. <b>Characterizing Network Traffic</b> Terminal/host traffic flow, client/server traffic flow, peer-to-peer traffic flow, server/server traffic flow, distributed computing traffic flow, traffic flow in voice over IP networks, characterizing traffic load, characterizing Quality of Service requirements.	6
3	<b>Logical Network Design</b> Designing a network topology, hierarchical network design, flat WAN Topologies, flat LAN topologies, redundant network design topologies, Spanning tree protocol, virtual LANs, wireless LANs, redundant wireless access points, designing the enterprise edge topology, secure network design topologies.	6
4	<b>Designing Models for Addressing and Numbering</b>	6

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	Network layer addresses, IP dynamic addressing, IP version 6, zero configuration networking, hierarchical routing, route summarization (aggregation), discontinuous subnets, mobile hosts, link-local addresses, global unicast addresses	
5	<b>Selecting Switching and Routing Protocols</b> Portfast, uplinkfast and Backbonefast, Unidirectional link detection, dynamic trunk protocol, distance-vector routing protocols, hierarchical versus Non-hierarchical routing protocols, IP routing, border gateway protocol, integrated routing and bridging.	4
6	<b>Testing, and Optimizing the Network Design</b> Testing your network design, optimizing your network design.	2
7	<b>Developing Network Security Strategies</b> Network security design, security mechanisms, modularizing security design, securing wireless networks, authentication in wireless networks.	3
	<b>Total</b>	<b>30</b>
<b>Textbooks</b>		
<ol style="list-style-type: none"> <li>Behrouz A. Forouzan, <i>Data Communications and Networking</i>, 5<sup>th</sup> Edition, McGraw-Hill Education, 2017.</li> <li>Michel Thomatis, <i>Network Design Cookbook: Architecting Cisco Networks</i>, Version 10.2.8, 1<sup>st</sup> Edition, Cisco press, August 2016.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>Russ White, Denise Donohue, <i>Art of Network Architecture, The: Business-Driven Design (Networking Technology)</i> Cisco press, 1<sup>st</sup> Edition, 2014.</li> <li>Priscilla Oppenheimer, <i>Top-Down Network Design</i>, 3<sup>rd</sup> Edition, Cisco Press, 2011.</li> </ol>		
<b>Laboratory Work</b>		
8 to 10 Programming exercises based on the syllabus.		



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<b>Program:</b> B Tech / MBA Tech (Computer Engineering, Information Technology, Artificial Intelligence)				<b>Semester:</b> VI /VII /V	
<b>Course:</b> Distributed Computing				<b>Code:</b> 702CO0C034	
<b>Teaching Scheme</b>			<b>Evaluation Scheme</b>		
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Operating Systems					
<b>Course Objective</b> To introduce the concepts and design of distributed computing and algorithms that support distributed computing.					
<b>Course Outcomes</b> After completion of the course, student will be able to -					
<ol style="list-style-type: none"> <li>1. Explain the basic concepts of distributed computing</li> <li>2. Apply the concepts of distributed computing to implement various mechanisms of communication</li> <li>3. Analyze various approaches of synchronization, mutual exclusion, election algorithms and fault tolerant services</li> <li>4. Recognize different kinds of naming and their implementation</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction to Distributed System</b> Definition, Goals, Examples of Distributed System-Internet. System architectures-centralized architecture, decentralized architecture, hybrid architecture, Client-Server Model, Servers-general design issues, server clusters, managing server clusters.				05
2	<b>Communication</b> Basic RPC operation, RPC implementation, RPC semantics in presence of failures, RMI- Basics, Implementation, Case study-Java RMI, Message oriented communication-: transient and persistent communication.				06

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	Stream oriented communication- support for continuous media, streams and QoS, stream synchronization.	
3	<b>Synchronization</b> Introduction, Physical Clock synchronization algorithms, Logical clocks, event ordering, implementation of Logical clocks, Lamport's logical clock algorithm, Vector clocks, Mutual exclusion: Centralized, distributed and token ring mutual exclusion algorithms, comparison of these algorithms. Traditional election algorithm- Bully and Ring election algorithm.	06
4	<b>Fault Tolerance</b> Introduction, Process resilience, Reliable group communication.	08
5	<b>Naming</b> Names, identifiers, and addresses, Flat naming , Structured naming: name spaces and resolution, implementation of name space, Case study- Domain Name System, Attributed based naming- Directory services.	05
	<b>Total</b>	<b>30</b>
<b>Text Books</b>		
1. Andrew S. Tanenbaum, <i>Distributed System: Principles and Paradigms</i> , 3 <sup>rd</sup> Edition, Pearson Prentice Hall, 2017.		
<b>Reference Books</b>		
1. George Coulouris, <i>Distributed System: Concept and Design</i> , 5 <sup>th</sup> edition, Pearson Education, 2009.		
2. Pradeep K. Sinha, <i>Distributed Operating System</i> , IEEE Press, Prentice Hall of India Ltd, 1998.		
3. Mei-Ling L. Liu, <i>Distributed Computing: Principles and Applications</i> , Addison - Wesley, 2004.		
<b>Laboratory / Tutorial work:</b>		
8 to 10 experiments (and a practicum where applicable) based on the syllabus.		

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<b>Program:</b> B Tech (Artificial Intelligence, Computer Engineering, Information Technology, Electronics & Telecommunication Engineering, AI and ML) MBA Tech (Artificial Intelligence, Computer Engineering, Information Technology)				<b>Semester:</b> V/VII	
<b>Course:</b> Deep Learning				<b>Code:</b> 702AI0C008	
<b>Teaching Scheme</b>				<b>Evaluation Scheme</b>	
<b>Lecture (Hours per week)</b>	<b>Practical (Hours per week)</b>	<b>Tutorial (Hours per week)</b>	<b>Credit</b>	<b>Internal Continuous Assessment (ICA) (Marks - 50)</b>	<b>Term End Examinations (TEE) (Marks - 100)</b>
2	2	0	3	Marks Scaled to 50	Marks Scaled to 50
<b>Prerequisite:</b> Machine Learning, Statistical Methods					
<b>Course Objective</b> This course focuses on the fundamentals of neural networks along with a practical perspective of advanced topics such as convolutional neural networks, recurrent neural networks, and long short-term memory with their real-world applications.					
<b>Course Outcomes</b> After completion of the course, students will be able to -					
<ol style="list-style-type: none"> <li>1. Explain the fundamentals of deep learning.</li> <li>2. Apply optimization and regularization for tuning the parameters of deep neural networks.</li> <li>3. Build convolutional neural networks architectures for various applications.</li> <li>4. Apply recurrent neural networks architectures for various applications.</li> </ol>					
<b>Detailed Syllabus</b>					
<b>Unit</b>	<b>Description</b>				<b>Duration</b>
1	<b>Introduction to Deep Learning</b> What is deep learning, motivation for using deep learning, Applications of deep learning in various domains.				02
2	<b>Neural Networks</b> Basics of Neural network, Perceptron, Multilayer perceptron, Feedforward neural network, back-propagation, Activation functions, Loss functions, Gradient descent for neural networks.				08
3	<b>Optimization and Regularization for Deep Learning</b> Stochastic GD, Mini Batch SGD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, RMSProp, Adam, L1 and L2 Regularization, Early stopping, drop out.				05
4	<b>Convolutional Neural Networks</b> Convolution operation, pooling, striding, convolution over volume, parameters of CNN, Fully connected networks v/s CNN, Deep				08



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	convolutional architectures: AlexNet, Inception Network, ResNet. Transfer learning using CNN, Applications of CNN.	
5	<b>Recurrent Neural Networks</b> Vanilla RNN, Back-propagation through time, Vanishing and Exploding gradients, Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), Applications of RNN.	07
	<b>Total</b>	<b>30</b>
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, <i>Deep Learning</i>, 1<sup>st</sup> Edition, MIT Press Book, 2017</li> <li>2. Charu Agarwal, <i>Neural Networks and Deep Learning: A Textbook</i>, 1<sup>st</sup> Edition, Springer, 2018</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. François Chollet, <i>Deep Learning with Python</i>, 1<sup>st</sup> Edition, Manning Publication, 2017</li> <li>2. Aurelien Geron, <i>Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow</i>, 2<sup>nd</sup> Edition, O'Reilly, 2019.</li> </ol>		
<b>Laboratory/ Tutorial Work</b>		
8 to 10 experiments (and a practicum where applicable) / based on the syllabus		

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