Mahatma Education Society's

# Pillai College of Engineering

## *(Autonomous)*

## Affiliated to University of Mumbai

Dr. K. M. Vasudevan Pillai's Campus , Sector 16, New Panvel – 410 206.

## Department of Information Technology

**Syllabus**

*of*

## M.Tech. inInformation Technology

*for*

**The Admission Batch of AY 2022-23**

**First Year -** Effective from Academic Year **2022-23**

**Second Year -** Effective from Academic Year **2023-24**

*as per*

**Choice Based Credit and Grading System**

Mahatma Education Society's

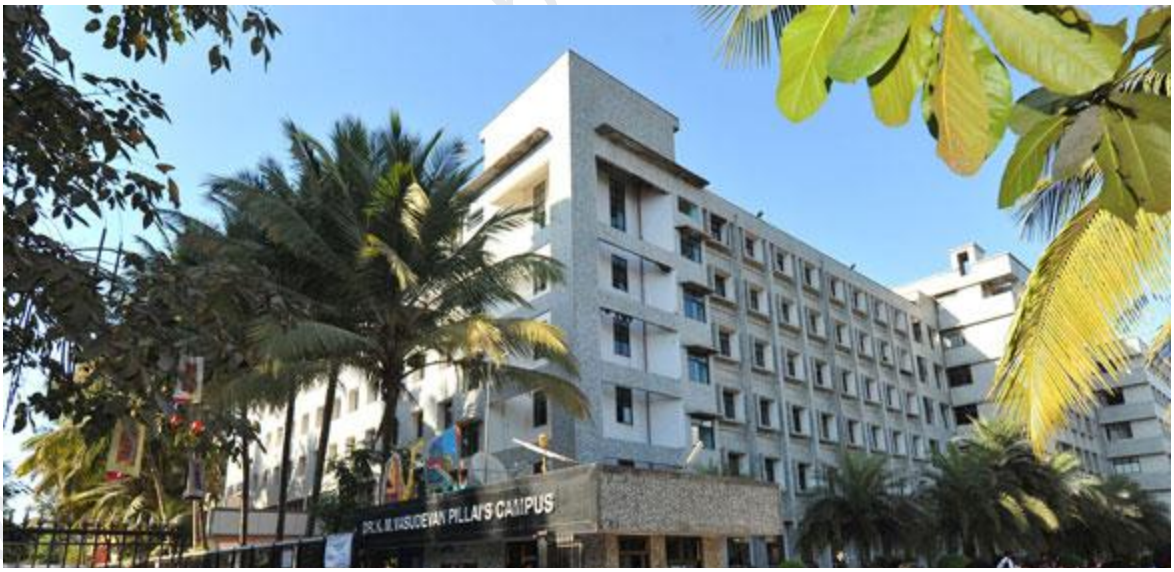
# Pillai College of Engineering

## Vision

Pillai College of Engineering (PCE) will admit, educate and train a diverse population of students who are academically prepared to benefit from the Institute's infrastructure and faculty experience, to become responsible professionals or entrepreneurs in a technical arena. It will further attract, develop and retain, dedicated, excellent teachers, scholars and professionals from diverse backgrounds whose work gives them knowledge beyond the classroom and who are committed to making a significant difference in the lives of their students and the community.

## Mission

To develop professional engineers with respect for the environment and make them responsible citizens in technological development both from an Indian and global perspective. This objective is fulfilled through quality education, practical training and interaction with industries and social organizations.




Dr. K. M. Vasudevan Pillai's Campus , Sector - 16, New Panvel – 410 206

# Department of Information Technology

## Vision

To become a reputable world-class institution that is responsive to national, regional and global development needs through engagement in dynamic knowledge creation, innovation and application.

## Mission

To expand the frontiers of knowledge through provision of excellent conditions for teaching-learning and research. To produce graduates who are worthy in character and sound judgments. To contribute to the transformation of society through creativity and innovation. To serve as a dynamic custodian of society's salutary values and thus sustain its integrity.

## Program Educational Objectives (PEOs):

Within four years after graduation, the graduates are expected to apply their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are expertise, engagement, learning, leadership and teamwork.

I. Graduates should be able to demonstrate peer- recognized expertise together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evaluation of computer and software systems, including system integration and implementation.
II. Graduates should be able to demonstrate engagement in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
III. Graduates should be able to demonstrate sustained learning and adapting to a constantly changing field through graduate work, professional development, and self study.
IV. Graduates should be able to demonstrate leadership and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
V. Graduates should be able to demonstrate a commitment to teamwork while working with others of diverse cultural and interdisciplinary backgrounds.

## Program Outcomes:

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Program Specific Outcomes (PSOs):

PSOs are statements that describe what the graduates of a specific engineering program should be able

1. To analyze and appropriately design for developing and deploying the tested system and application softwares to deliver quality products for business success and societal peace.

2. To apply the knowledge of techniques and technologies, ethics, engineering and management principles and soft skills to pursue higher education and become successful entrepreneurs to provide world-wide solutions to real world problems in diverse environments.
3. To provide a safe and healthy tomorrow by researching, evaluating, forecasting and communicating the current and new technologies for an individual or organization for performing tasks related to E-governance, E-Learning, and Training.

The Autonomous status of the institute has given an opportunity to design and frame the curriculum in such a way that it incorporates all the needs and requirements of recent developments in all fields within the scope of the technical education. This curriculum will help postgraduates to attain excellence in their respective field. The curriculum has a blend of basic and advanced courses along with provision of imparting practical knowledge to students through minor and major projects. The syllabus has been approved and passed by the Board of Studies.

Outcome based education is implemented in the academics and every necessary step is undertaken to attain the requirements. Every course has its objectives and outcomes defined in the syllabus which are met through continuous assessment and end semester examinations. Evaluation is done on the basis of Choice Based Credit and Grading System (CBCGS). Optional courses are offered at department level.

Every learner/student will be assessed for each course through (i) an Internal/Continuous assessment during the semester in the form of either Practical Performance, Presentation, Demonstration or written examination and (ii) End Semester Examination (ESE), in the form of either theory or viva voce or practical, as prescribed by the respective Board Studies and mentioned in the assessment scheme of the course content/syllabus. This system involves the Continuous Evaluation of students' progress Semester wise. The number of credits assigned with a course is based on the number of contact hours of instruction per week for the course. The credit allocation is available in the syllabus scheme of each semester.

The performance of a learner in a semester is indicated by a number called Semester Grade Performance Index (SGPI). The SGPI is the weighted average of the grade points obtained in all the courses by the learner during the semester. For example, if a learner passes five courses (Theory/labs./Projects/ Seminar etc.) in a semester with credits C1, C2, C3, C4 and C5 and learners grade points in these courses are G1, G2, G3, G4 and G5 respectively, then learners SGPI is equal to:

$$SGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The learner's up to date assessment of the overall performance from the time s/he entered for the programme is obtained by calculating a number called the Cumulative Grade Performance Index (CGPI), in a manner similar to the calculation of SGPI. The CGPI therefore considers all the courses mentioned in the scheme of instructions and examinations, towards the minimum requirement of the degree learners have enrolled for. The CGPI at the end of this semester is calculated as,

$$CGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + \ldots + C_i * G_i + \ldots + C_nG_n}{C_1 + C_2 + C_3 + \cdots + C_i + \ldots + C_n}$$

The Department of Information Technology offers a M. Tech. programme in Information Technology. This is a four semester course. The complete course is a **64 credit** course which comprises core courses and department level elective courses. There are 3 department level optional course choices for semester I and II separately. The students have to select one course from each DLOC course list.

**Program Structure for**
**Master of Technology in Information Technology**
**Semester I**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Practical | Total |
| IT500T | Computer Programming Paradigms | 3 | -- | 3 | -- | 3 |
| IT501T | Business Communication and Intellectual Property | 3 | -- | 3 | -- | 3 |
| IT50xT | Department Level Optional Course-I | 3 | -- | 3 | -- | 3 |
| IT50xT | Department Level Optional Course-II | 3 | -- | 3 | -- | 3 |
| IT50xT | Department Level Optional Course-III | 3 | -- | 3 | -- | 3 |
| IT515L | DLOC Lab-I | -- | 2 | -- | 1 | 1 |
| IT516L | Dissertation-I | -- | 2 | -- | 1 | 1 |
| TOTAL | | **15** | **4** | **15** | 2 | 17 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Oral/ Pract | Total |
| | | IA 1 | IA 2 | Avg | | | | | |
| IT500T | Computer Programming Paradigms | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| IT501T | Business Communication and Intellectual Property | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| IT50xT | Department Level Optional Course-I | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| IT50xT | Department Level Optional Course-II | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| IT50xT | Department Level Optional Course-III | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| IT515L | Course Lab-I | -- | -- | -- | -- | -- | 25 | 25 | 50 |
| IT516L | Dissertation-I | -- | -- | -- | -- | -- | 25 | 25 | 50 |
| TOTAL | | **200** | **200** | **200** | **300** | **15** | **50** | **50** | **600** |

| SN | DLOC -I | DLOC-II | DLOC-III |
|---|---|---|---|
| **1** | Image and Video Processing | Wireless Technology | Information Retrieval |
| **2** | Evolutionary Computing and Fuzzy systems | Data Science | Cyber Crime and IT acts |
| **3** | Natural Language Processing | Prediction and Estimation Modelling | Cloud Computing |

**Program Structure for**
**Master of Technology in Information Technology**
**Semester II**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Pract | Total |
| IT517T | Deep Learning | 3 | -- | 3 | -- | 3 |
| IT518T | User Experience Design | 3 | -- | 3 | -- | 3 |
| IT5xxT | Department Level Optional Course-IV | 3 | -- | 3 | -- | 3 |
| IT5xxT | Department Level Optional Course-V | 3 | -- | 3 | -- | 3 |
| IT5xxT | Department Level Optional Course-VI | 3 | -- | 3 | -- | 3 |
| IT532L | Course Lab-II | -- | 2 | -- | 1 | 1 |
| IT533L | Dissertation-II | -- | 2 | -- | 1 | 1 |
| **TOTAL** | | **15** | **4** | **15** | 2 | 17 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Oral/ Pract | Total |
| | | IA 1 | IA 2 | Avg | | | | | |
| IT517T | Deep Learning | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT518T | User Experience Design | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT5xxT | Department Level Optional Course-IV | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT5xxT | Department Level Optional Course-V | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT5xxT | Department Level Optional Course-VI | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT532L | DLOC Lab-II | -- | -- | -- | -- | -- | 25 | 25 | 50 |
| IT533L | Dissertation-II | -- | -- | -- | -- | -- | 25 | 25 | 50 |
| **TOTAL** | | **200** | **200** | **200** | **300** | **15** | **50** | **50** | **600** |

## Department Level Optional Course (DLOC)

| SN | DLOC - IV | DLOC - V | DLOC -VI |
|---|---|---|---|
| 1 | Computer Vision | Internet of Everything | Cyber Security |
| 2 | Big Data Analytics | Blockchain Technology | Ethical Hacking |
| 3 | ACN and SDN | Robotic Process Automation | Secured Application Design |

**Program Structure for**
**Master of Technology in Information Technology**
**Semester III**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Pract | Total |
| CE600LC | Internship / Relevant Certification | - | - | - | 03 | 03 |
| CE601LC | Dissertation-III | - | - | - | 12 | 12 |
| **TOTAL** | | - | - | - | 15 | **15** |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | | | |
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract /Oral | Total |
| | | IA 1 | IA 2 | Avg | | | | | |
| CE600LC | Internship / Relevant Certification | - | - | - | - | - | 50 | 50 | 100 |
| CE601LC | Dissertation-III | - | - | - | - | - | 100 | - | 100 |
| **TOTAL** | | - | - | - | - | - | 150 | 50 | 200 |

**Program Structure for**
**Master of Technology in Information Technology**
**Semester IV**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Pract | Total |
| CE603LC | Dissertation-IV | - | 30 | - | 15 | 15 |
| | | - | 30 | - | 15 | 15 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | | | |
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract/Oral | Total |
| | | IA 1 | IA 2 | Avg | | | | | |
| CE603LC | Dissertation-IV | - | - | - | - | - | 100 | 100 | 200 |
| **TOTAL** | | - | - | - | - | - | 100 | 100 | 200 |

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT500T | Computer Programming Paradigms | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT500T | Computer Programming Paradigms | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives:**

1. To Introduce students to functional, logic and concurrent programming paradigms.
2. To Enable students to formulate newer abstractions in the above paradigms.
3. To Familiarize students with writing functional and Object oriented programs.
4. To Prepare students to solve real-world problems using appropriate programming paradigms.

**2. Course Outcomes:** On successful completion of course learner/student will be able to:

1. Understand and apply the concepts that form the basis of functional, logic and object oriented programming paradigms.
2. Formulate abstractions with procedures and data in different programming paradigms.
3. Write programs in different programming paradigms especially functional, logic and object oriented paradigms.
4. Formulate, implement and solve a given problem scenario using appropriate programming paradigm

**3. Detailed Theory Syllabus:**

| ModuleNo | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1 | **Introduction** | **Overview of different programming paradigms** – Imperative,logical, functional and object-oriented Programming. | **2** |
| 2 | **Java Programming** | **Introduction:** Principles of OOP, Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism, Message passing Features of Java Language , Data Types, Operators.<br>**Control Statements:** If-Statement, If-else, Nested-if, Switch Statement, break, continue.<br>**Iteration Statements:** for-loop, while-loop, and do-while-loop. | **8** |
| 3 | **Python Programming** | **Introduction:** Features, Identifiers, Keywords, Indention, Variables and Comments, Basic data types: Numeric, Boolean, Compound.<br>**Operators:** Arithmetic, comparison, relational, assignment, logical, bitwise, membership, identity operators, operator precedence. **Control flow statements:** Conditional statements (if, if…else, nested if. Looping in Python: while-loop, for-loop, nested-loops, Loop manipulation using continue, pass, break.<br>**Functions:** Introduction to Functions, Decorators, Iterators and Generators. | **8** |
| 4 | **R Programming** | **Introduction:** Basic functionalities of R , data types and operations: numbers, characters and composites, Numeric variables, strings and factors,R packages.<br>**Data structures:** vectors, matrices, lists and data frames.Grouping, loops and conditional execution, Functions. | **8** |

| | | | |
|---|---|---|---|
| | | **Exploratory data analysis:** Range, summary, mean, variance, median, standard deviation, histogram, box plot, scatterplot,Graphics and tables , Visualizations and interpretation of results. | |
| 5 | **Matlab programming** | **Introduction:** Features, Interface, File Types, Array, Matrix Operation. Arithmetic Operator Logical, Relational.<br>**Branch and Loop:** If-statement, If-else statement, Else-if statement<br>Pause, Break, Continue, Switch-case, try-catch, Return Statement, For Loop,While Loop. Types of Function, Return Types.<br>**Interface and Graphics:** Plotting, Multiple Plot, 2-D Plot, Introduction to Graphical User Interface, GUI Function, Property, GUI Component Design. | **8** |
| 6 | **Metaverse Technology** | History, Features, Metaverse value chain, Technologies Involved in the Metaverse. Blockchain Adoption in Metaverse, AR, VR, MR in Metaverse, NFT (non-fungible token) for Metaverse.<br>Financial and Economics of Metaverse, Benefits of Metaverse, Use-cases. | **5** |

**4. Theory Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/Assignments /Quiz/Case studies/Seminar presentation of 40 Marks.

**End Semester Examination: 60 Marks**

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum

**5. Books and References:**

**A. Books:**


1. Scott M L, Programming Language Pragmatics, 4th Edn., Morgan Kaufmann Publishers, 2015
2. E. Balaguruswamy, “Programming with Java A primer”, Fifth edition, Tata McGraw Hill Publication
3. Dr. R. Nageswara Rao, ”Core Python Programming” , Dreamtech Press, Wiley Publication
4. Metaverse: Introduction to The Virtual Reality, Augmented Reality,ISBN-13 : 978-1806030484
5. Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications
6. Peter I. Kattan, MATLAB for Beginners: A Gentle Approach, 2008. ISBN: 9781438203096


**B. References:**


1. Programming Languages: Concepts and Constructs; 2nd Edition, Ravi Sethi, Pearson Education Asia, 1996.
2. Herbert Schildt, “Java-The Complete Reference”, Tenth Edition, Oracle Press, Tata McGraw Hill Education.
3. Navigating the Metaverse by Cathy Hackl, Dirk Lueth, Tommaso Di Bartolo, John Arkontaky, Yat Siu Released May 2022 Publisher(s): Wiley ISBN: 9781119898993
4. Hands-On Programming with R by Grolemund, O Reilly Publications
5. Stormy Attaway, "MATLAB: A Practical Introduction to Programming and Problem Solving," 2018, Butterworth-Heinemann, ISBN: 978-0128154793


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT501T | Business Communication and Intellectual Property | Contact Hours | 2 | - | 1 | 3 |
| | | Credits | 2 | - | 1 | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT501T | Business Communication and Intellectual Property | 20 | 20 | 20 | 60 | 20 | - | - | 100 |

1. **Course Objectives:**
   1. To provide an outline to effective organisational communication.
   2. To enable learners to formulate professional documents in a structured manner that meets the corporate requirements.
   3. To foster a comprehensive understanding of marketing strategies for establishing the brand of the business using digital technologies and aim at better customer experience
   4. To develop creative and impactful presentation skills
   5. To acquaint learners with the procedure of obtaining Patents, Copyrights, Trademarks and Industrial designs
   6. To inculcate the ethical code of conduct and corporate etiquettes.

**2. Course Outcomes:**

1. Apply business communication strategies and principles to prepare effective communication for developing and presenting business messages.
2. Acquire the writing skills necessary for professional documents to meet the corporate requirement.
3. Understand existing and emerging social media tools to execute a comprehensive communication plan.
4. Able to illustrate effective presentation, research, organisational and creative skills necessary for lifelong learning.
5. Recognize the crucial role of IP in organisations of different industrial sectors for the purposes of product and technology development.
6. Able to determine the importance of ethics and etiquettes in social and professional situations

3. **Prerequisite:** Basic programming language skills

4. **DETAILED SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 1 | BUSINESS COMMUNICATION | 1.1 Role of communication in business organisation<br>1.2 Relevance of communication<br>1.3 Types- Verbal Non-verbal<br>1.4 Channels- Vertical, Horizontal and Lateral | 2 | CO1 |
| 2 | BUSINESS WRITING | 2.1 Business Proposals ( SWOT analysis)<br>2.2 Grant / Research Proposals<br>2.3 1.2 Memos<br>2.4 1.3 Press Releases<br>2.5 1.4 Business Plans | 8 | CO2 |

| | | | | |
|---|---|---|---|---|
| 3 | DIGITAL SOCIAL MEDIA | 3.1 Communicating via Social Media<br>3.2 Social Media and Public Relations, Social Media strategy and Planning<br>3.3. Content Strategy. Web Content, Organisation and Distribution<br>3.4 Social Networking Sites (LinkedIn, Twitter), Photo sharing Sites ( Instagram, Snapchat, Pinterest<br>3.5 News Writing and Community Management<br>3.6. Facebook and business<br>3.7. YouTube and Live Streaming | 6 | CO3 |
| 4 | SPEAKING SKILLS | 4.1 Speaking on Panels, Moderating Panels, Speaking as keynote or Individual Talk<br>4.2 Introducing speakers, Summarising speeches and Meeting conference content<br>4.3 Presentation Skills-<br>Visually present relationship between two or more data sets<br>Data Presentation Methods- Line graph, Column chart, Vertical bar, scatter plot<br>Presentation style- Audience analysis, Care and concern for the audience, effective use of transitions and animations, slide design and content. | 7 | CO4 |
| 5 | INTELLECTUAL PROPERTY FOR BUSINESS | 5.1. Meaning, Relevance, Business Impact, Protection of Intellectual Property<br>5.2. Types of Intellectual Property<br><br>**Copyrights** – Introduction, Nature of copyright, Indian copyright law, copyright works, Author and ownership of copyright, Licensing of copyrights, Infringement of copyrights, Remedies and actions, Copyright for digital media, Software/ Internet<br>**Patents-** Concept of patent, Product/Process Patents, Patent Law, Patentable subject matter, Patentability criteria, Duration of patent, Procedure for filing Patent Application, Types of Applications, Procedure of Opposition, Revocation of Patents, Ownership and Maintenance of Patents, Compulsory licensing, Qualification and registration Procedure<br>**Trademarks-** Introduction, Rationale of protection of trademark as (a) an aspect of commercial and (b) of consumer rights, Kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Indian Trademarks Law, Procedure for Registration of Trademarks, Non Registrable Trademarks, Infringement of Trademarks and Right of Goodwill, Offences and Penalties<br><br>**Trade secrets**<br>**Designs-** Need for Protection of Industrial designs, Procedure and Infringement<br>**Geographical Indications –** Concept, Procedure of Registration, duration of protection, Infringement, Penalties and Remedies | 8 | CO5 |
| 6 | ETHICS AND ETHICAL CODE OF CONDUCT | 6.1 Writing Resume and statement of purpose<br>6.2 Business and corporate activities(special emphasis on business meetings, emails, blogs and web pages)<br>6.3 Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions. | 4 | CO6 |

## 5. Suggested List of Assignments:

| SN | Details of Assignments | Details of Activities | Hours | CO Mapping |
|---|---|---|---|---|
| I | Written assignment on summarising a research proposal<br>4 page grant proposal (to be included as part of term work) | Example of summarising techniques to be demonstrated. | 4 | CO1, CO2 |
| II | Written assignment on blog posts, web content | NA | 4 | CO1, CO3, CO4 |
| III | Presentation skills | Mock Presentation | 6 | CO1, CO4 |
| IV | Written Assignment on Resume writing/Statement of Purpose. | NA | 2 | CO2, CO6 |
| V | Written Assignment on Intellectual Property | NA | 4 | CO5 |

**6. Theory Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 20 Marks
2. Continuous evaluation: Class Test/Assignments /Quiz/Case studies/Seminar presentation of 20 Marks.

**End Semester Examination: 60 Marks**

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum

**Term work:** Assignments: 10 marks, Grant Proposal: 10 marks, Attendance: 5 marks, Presentation: 15 marks.

**7. Text Books:**

**References:**


1. Raman Meenakshi & Singh Prakash, Business Communication Second edition, Oxford University Press, Paperback, 2012.
2. Jeremy Harris Lipschultz, Social Media Communication: Concepts, Practices, Data, Law and Ethics Third edition, Paperback, 2020
3. V. K. Ahuja, Intellectual Property Rights In India, Hardcover, 2015


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X1T | Image and Video Processing | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X1T | Image and Video Processing | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1.Prerequisite:** Fundamentals of Matrix, Matrix Operations.

**2. Course Objectives:** The course/instructor aims to

1. Define image and list application of image processing and discuss major research domains in this field.
2. Describe point, mask and histogram based enhancement techniques for improving the quality of an image, and discuss the forward and reverse discrete image transforms and discuss the usefulness in enhancement, compression, representation and description.
3. List and explain how the lossy and lossless image compression techniques are useful for storage and retrieval.
4. Demonstrate how the image object can be described using image representation techniques and illustrate how to shape and reshape a given object in an image using morphological techniques.
5. Explain formation of video and list application of video processing and discuss major research domains in this field.
6. Show motion estimation using pixel, mesh, and region technique and discuss video matching algorithms and introduce the video coding standards.

**3.Course Outcomes:** On successful completion of this course, learner/student will be able to

1. List application, define image and explain formation of image, and recall its types and calculate image parameters by reading images using a programming language.
2. Differentiate point, mask and histogram processing techniques and choose suitable techniques for enhancing images required for an application and identify discrete image transforms and apply to calculate transformed coefficients and use it for enhancement, compression and representation.
3. Classify and distinguish between lossy and lossless compression techniques and recall ratio and fidelity criteria to evaluate and compare method efficiency.
4. Apply the segmentation techniques to segment RoI and represent objects using chain code and shape number and apply morphological operations to find a suitable shape for an object in the image.
5. Define video and explain formation of video, classify I, P, B Frames and enhance video.
6. Estimate motion using pixel, mesh, and region technique and perform video matching and know the video coding standards.

**4. DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 1 | Image Processing Fundamentals | Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Image Resolution, Basic Relationships between Pixels, Color Models (RGB, CMYK, YIQ, YCbCr). | 5 | CO1 |

| | | | | |
|---|---|---|---|---|
| 2 | Image Transforms and Image Enhancement | **2D Transforms:** Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, KLT (Hotelling Transform).<br>**Image Enhancement:** Point Processing, Histogram Processing, Filtering in Spatial Domain and Frequency Domain. | 10 | CO2 |
| 3 | Image Segmentation and Image Morphology | **Image Segmentation:** Point, Line and Edge detections, Hough Transform, Thresholding, Region Based Segmentation.<br>**Image Morphology:** Dilation, Erosion, Opening, Closing, Hit or Miss Transform, Boundary Extraction, Thinning. Skeletonization. | 8 | CO3 |
| 4 | Image Compression | **Image compression:** Redundancy, Compression Ratio, Fidelity Criteria.<br>**Lossless Compression:** Run-Length Coding, Huffman Coding, Arithmetic Coding, LZW Coding, Bit-Plane Coding.<br>**Lossy Compression:** Predictive Coding, Transform Coding, JPEG Compression Standard. | 8 | CO4 |
| 5 | Video Processing Fundamentals | Analog Video, Digital Video, 3D Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video Signals, Frame Classification (I, P, B Frames), Smoothing and Sharpening of Video. | 4 | CO5 |
| 6 | 2D Motion Estimation and Coding | **Motion Estimation:** Optical Flow, Pixel, Mesh, and Region Based Motion Estimation, Multi-Resolution Motion Estimation.<br>**Coding:** Video Encoder and Decoder, Block Matching Algorithm, Video Coding Standards – MPEG and H.26X. | 5 | CO6 |

**5. Suggested List of Experiments:** Software Requirements: Python/ Matlab/ Scilab

| Sr. No. | Module Name | Detailed Lab Description | Hrs |
|---|---|---|---|
| I | Image Processing Fundamentals | i) Read Image and find attributes of the given image. | 2 |
| II | Image Transforms and Image Enhancement | i)Implementation of Histogram Processing<br>ii)Implementation of Image Smoothing/ Sharpening<br>iii)Implementation of Discrete Fourier Transform<br>iv)Implementation of Discrete Cosine Transform (Forward and Inverse Transform) | 2,2, 2,2 |
| III | Image Segmentation and Image Morphology | i)Implementation of Horizontal and Vertical Line Detection<br>ii)Implementation of Edge Detection using Sobel, Prewitt, Robert and Canny operators<br>iii)Implementation of Opening followed by closing<br>iv)Implementation of Hit or Miss Transform | 2,2 |
| IV | Image Compression | i)Implementation of Huffman Coding | 2,2, 2,2 |
| V | Video Processing Fundamentals | i) Extraction of frames from video<br>ii) Enhance video quality | 2,2 |
| VI | 2D Motion Estimation and Coding | i) Implement motion estimation techniques.<br>ii) Apply Block Matching Algorithm | 2,2 |

**6. Theory Assessment:**

**A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

**B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**7. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**8. Books and References:**

**A.Text Books:**


1. Rafel C. Gonzalez and Richard E. Woods, 'Digital Image Processing', 3ed, Pearson Education Asia.
2. S. Jayaraman, E.Esakkirajan and T. Veerakumar, "Digital Image Processing" TMH Education Private Ltd.
3. S. Sridhar, "Digital Image Processing", 2ed, Oxford University Press.
4. Yao Wang, Joem Ostarmann and Ya – Quin Zhang, "Video processing and communication," 1e, PHI.
5. A. Bovik, Handbook of Image & Video Processing, Academic Press


**B.References:**


1. Anil K. Jain, "Fundamentals and Digital Image Processing", PHI Private Ltd, Third Edition.
2. B. Chandra and D.Dutta Majumder, "Digital Image Processing and Analysis", PHI Private Ltd.
3. A. M. Tekalp, "Digital Video Processing," Prentice-Hall.


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT 5X1 | Evolutionary Computing and Fuzzy Systems | Contact Hours | 3 | 2 | - | 5 |
| | | Credits | 3 | 1 | - | 4 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IT 5X1 | Evolutionary Computing and Fuzzy Systems | 40 | 40 | 40 | 60 | 25 | – | 25 | 150 |

1. **Prerequisite:** Algorithm Concept And Fundamental of Computing

**2. Course Objectives:**

1. To Understand of core Evolutionary Computing (EC) concepts and Evolutionary Algorithm(EA) mechanisms
2. To identify (real-world) and formulate problems for which EC is appropriate
3. To Understand and Configure Genetic Algorithms.
4. To Understand and configure selection schemes and search strategies and to perform statistical analysis on stochastic algorithms such as EAs
5. To Understand the basic concept of Fuzzy Logic
6. To Understand advanced Fuzzy Logic Operation and its application

**3. Course Outcomes:**

1. Understanding of core Evolutionary Computing (EC) concepts and Evolutionary Algorithm(EA) mechanisms
2. Identifying (real-world) problems for which EC is appropriate
3. Understanding and configure Genetic Algorithm,
4. Understanding and configuring selection schemes and search strategies.
5. Understanding the basic concept of Fuzzy Logic
6. Understanding advanced Fuzzy Logic Operation and its application

**4. DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Basic Algorithm Concept and Fundamental of Computing | | |
| I | Introduction to Evolutionary Computation | Introduction, Possible Applications, Pros and Cons<br>Biological and artificial evolution Principles of Evolutionary Processes and GeneticsEvolutionary computation and AI Different historial branches of EC, e.g., GAs, EP, ES, GP, etc<br>A simple evolutionary algorithm | 5 | CO1,CO2 |
| II | Genetic Algorithms and Evolutionary Strategies | Genetic Algorithms, Evolutionary Strategies, Evolutionary Programming. Derivative Methods in Genetic Programming, Learning Classifier Systems, Hybrid Methods. Introduction to Representations, Binary Strings, RealValued Vectors. Permutations, Finite-State Representations, Parse Trees | 8 | CO3 |

| | | | | |
|---|---|---|---|---|
| III | Selection Schemes | Introduction to Selection, Proportional Selection and Sampling Algorithms, Tournament Selection, Rank-based Selection, Boltzmann Selection, Generation Gap Methods, A comparison of Selection Mechanisms | 6 | CO3, CO4 |
| IV | Search Operators and Representations | Introduction to Search Operators, Mutation Operators, Recombination, Mixing different search operators<br>An anomaly of self-adaptive mutations, The importance of representation, e.g., binary vs. Gray coding<br>Adaptive representations | 8 | CO4 |
| V | Fundamental of Fuzzy Logic | Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types. | 6 | CO5 |
| VI | Advanced Fuzzy Logic Operation | Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization. | 6 | CO6 |

**5. DETAILED PRACTICAL SYLLABUS:**

**Evolutionary Computing and Fuzzy Systems Lab (Credit - 01) :**

**Lab Prerequisite:** Basic computer algorithms and data structures and at least one high level programming language
**Software Requirements:** One high level programming language.
**Hardware Requirements:** Basic computing facility.

**Suggested List of Experiments :**

| Sr. No. | Module Name | Detailed Lab Description | Hrs | LO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Students must have a good understanding of basic computer algorithms and data structures and at least one high level programming language | 02 | -- |
| I | I | Lab1: The graph k-coloring problem<br>Lab2: The minimum vertex cover problem | 04 | LO1 |
| II | II | Lab3: The N-queens problem generalizes<br>Lab4: The Traveling-salesperson problem | 04 | LO2 |
| III | III | Lab5 Implementation of Simple Genetic Application<br>Lab6: Consider a genetic algorithm to solve vector of integer representation | 04 | LO3 |
| IV | IV | Lab 7: Consider a genetic algorithm using permutation representation | 02 | LO4 |
| V | V | Lab8: Implementation of Fuzzy Relations (Max-min Composition) | 02 | LO5 |
| VI | VI | Lab 9:Implementation of Fuzzy Controller (Washing Machine) | 04 | LO6 |

**6.Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
    - Question paper will consist of 5 questions, each carrying 20 marks.
    - Total 3 questions need to be solved.
    - Q.1 will be compulsory, based on the entire syllabus.
    - Remaining questions will be randomly selected from all the modules.
    - Weightage of marks should be proportional to the number of hours assigned to each module.

**7. Practical Assessments:**

3. **Termwork Assessment:** Term Work shall consist of at least 10 to 12 practical's based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).
4. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

**8. Books and references:**

**A. Text Books:**


1. Jacob, C., 2001. Illustrating Evolutionary Computation with Mathematica. Morgan Kaufmann
2. Rajasekaran. S.. Vijayalakshmi Pai. G.A. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India Private Limited, 2003
3. "Introduction to Evolutionary Computing", Eiben and Smith. Springer-Verlag


**B. References:**


1. Bäck, T, 2000. Evolutionary Computation 1: Basic Algorithms and Operators. Institute of Physics Publishing, Bristol.
2. Klir.G, Yuan B.B. "Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
3. An Introduction to Genetic Algorithms", Melanie Mitchell. MIT Press, 1996


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Natural Language Processing | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Natural Language Processing | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives**: The course is aimed to:

1. To understand natural language processing and to learn how to apply basic algorithms in this field.
2. To understand the basic text processing techniques and significance of morphology.
3. To get acquainted with the basic concepts and algorithmic description of the main language levels: syntax, semantics.
4. To understand language models generation and applications.
5. To recognize the significance of pragmatics and discourse for natural language understanding.
6. To design and implement applications based on natural language processing

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. Have a broad understanding of the field of natural language processing.
2. Be able to apply text processing techniques and analysis of morphology of text.
3. Be able to model linguistic phenomena with formal grammars and design semantic structure.
4. Be able to create a language model and apply it for NLP applications.
5. Understand the mathematical and linguistic foundations underlying approaches to analyse pragmatic and resolve corereference.
6. Be able to apply NLP techniques to design real world NLP applications such as machine translation, text categorization, text summarization, information extraction...etc.

**3. Detailed Theory Syllabus:**

**Prerequisite**: Data structure & Algorithms, Theory of computer science, Probability Theory.

| Module No | Module | Detailed Contents of Module | Hrs | CO Mapping |
|---|---|---|---|---|
| 1 | Introduction | Introduction to Natural Language Processing, History of NLP, Natural Language Generation, Natural Language Understanding, Generic NLP system, Ambiguity in Natural language, Stages in NLP, Challenges of NLP | 3 | CO1 |
| 2 | Morphology analysis and Language modeling | Text Processing Challenges, Pre Processing of text (tokenization,text filtration,script validation, stop words), Survey of English and Indian Language Morphology, Inflectional morphology & Derivational morphology, Stemming(Porter stemmer), Lemmatization, Regular expression, Morphological parsing with FST, The role of language models, Simple N-gram models, Estimating parameters and smoothing, Evaluating language models.<br>**Self Learning Topics**: N-gram for spelling correction. | 8 | CO2,CO4 |

| | | | | |
|---|---|---|---|---|
| 3 | Syntax analysis | Part-Of-Speech tagging( POS)- Tag set for English ( Penn Treebank), Rule based POS tagging, Stochastic POS tagging, Introduction to CFG, Parsing with CFG, Statistical parsing and probabilistic CFGs (PCFGs), Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).<br>**Self Learning Topics**: Introduction to Indian Language Parsing in Paninian Karaka Theory | 8 | CO3 |
| 4 | Semantic Analysis | Lexical Semantics, Attachment for fragment of English- sentences,noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses (Homonymy, Polysemy, Synonymy, Hyponymy) WordNet, Vector Space Models of Semantics,Word Sense Disambiguation (WSD), Semantic Role Labeling, Semantic Parsing<br>**Self Learning Topics:** | 6 | CO3 |
| 5 | Discourse Context and World Knowledge | Pragmatic analysis and understanding, Discourse : reference resolution, Reference Phenomena,, Preferences in Pronoun Interpretation and resolution, Syntactic and Semantic Constraints on Coreference, Coreference Resolution: Coreference, Distinctions in Coreference, Coreference vs. Anaphora, Application<br>**Self Learning Topics**: Challenges of Coreference Resolution | 6 | CO5 |
| 6 | Applications of NLP | Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition, Topic Modeling, Plagiarism Detection | 8 | CO6 |

**4. Suggested Experiments: Software Requirements:** Python

1. Write a program to perform tokenization, filtration and script validation of English and Hindi Text
2. Write a program to identify stop words, stem and lemma of English and Hindi Text
3. Write a program to generate n-gram (bigram,trigram,etc) of English and Hindi Text
4. Write a program to generate new words by using inflection and derivational morpheme
5. Write a program to identify word frequency and generate word cloud of English and Hindi Text
6. Write a program to identify Part of Speech of English and Hindi Text
7. Write a program to generate parse tree from text and extract noun and verb phrase of English Text
8. Write a program Get word definition, examples, synonyms, antonyms using English WordNet
9. Write a program to demonstrate use of various text similarity prediction algorithms
10. Write a program to demonstrate coreference resolution
11. Write a program to generate name entity (NER) from English and Hindi Text
12. Write a program to generate feature vector of text using Bag of Words and TF-IDF
13. Write a program to generate word embedding of the text using Word2Vec
14. Mini Project

**Reference for Experiments**: http://cse24-iiith.virtual-labs.ac.in/#

**Mini Project:**

1. The mini project work is to be conducted by a group of three/four students
2. Each group should meet with the concerned faculty during Laboratory hours and the progress of work discussed must be documented.
3. Mini Project topics can be Natural Language Processing Applications with limited scope and it can be done using English or any other Indian language

**5. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

**B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

**A. Text Books:**

1. Sharvari Govilkar, Sgaar Kulkarni, Dhiraj Amin — Natural Language Processing, 2018, StartEDU solutions
2. Daniel Jurafsky, James H. Martin —Speech and Language Processing‖ Second Edition, Prentice Hall, 2008.
3. Christopher D.Manning and Hinrich Schutze, — Foundations of Statistical Natural Language Processing —, MIT Press, 1999.

**B. Reference Books:**

1. Siddiqui and Tiwary U.S., Natural Language Processing and Information Retrieval, Oxford University Press (2008).
2. Daniel M Bikel and Imed Zitouni — Multilingual natural language processing applications‖ Pearson, 2013
3. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor) — The Handbook of Computational Linguistics and Natural Language Processing — ISBN: 978-1-118-
4. Steven Bird, Ewan Klein, Natural Language Processing with Python, O'Reilly
5. Brian Neil Levine, An Introduction to R Programming
6. Niel J le Roux, Sugnet Lubbe, A step by step tutorial : An introduction into R application and programming

Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Wireless Technology | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Wireless Technology | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1.Prerequisite:** Computer Networks.

**2.Course Objectives:**

1. Understand the fundamentals of wireless networks,analyze and learn different wireless networks.
2. To design the problem solution as per the requirement analysis done using Motes sensors.
3. To study the basic concepts of programming/sensors/ emulators like COOJA etc.
4. Understand and evaluate emerging wireless technologies and standards.
5. To learn object exchange protocol and node discovery using J2ME..
6. Learn and analyze and evaluate the security threats and related security standards.

**3.Course Outcomes:**

1. Explain the basic concepts of wireless network and wireless generations.
2. Demonstrate the different wireless technologies such as CDMA, GSM, GPRS etc
3. Appraise the importance of Ad-hoc networks such as MANET and VANET and Wireless Sensor networks.
4. Describe and judge the emerging wireless technologies standards such as WLL, WLAN, WPAN, WMAN.
5. Explain the design considerations for deploying the wireless network infrastructure.
6. Differentiate and support the security measures, standards. Services and layer wise securities considerations.

**4. DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Modulation and Demodulation Techniques, PSTN | 00 | |
| 1 | Fundamentals Wireless Communication | Fundamentals of Wireless Communication, Advantages, limitations and application, wireless media, principle of Cellular Communication – Frequency Reuse concept, cluster size and system capacity, cochannel interference and signal quality; GSM – System Architecture, Wireless generations: 1G: Cellular, 2G: Mobile Radio,3G: UMTS, Evolution of wireless generations – 1G to 5G (Based on technological differences and advancements) | 08 | CO1 |
| 2 | Evolution of Wireless Technologies | Wireless Technologies: GSM, GPRS, EDGE, CDMA, UMTS | 08 | CO1,CO2 |

| | | | | |
|---|---|---|---|---|
| 3 | Types of Wireless Networks | Ad-hoc: MANET & VANET, Application, Advantage and limitations; Wireless Sensor Network: Application, advantages and limitations | 04 | CO1<br>CO3 |
| 4 | Emerging Wireless Technologies and standards | WLL , WLAN- 802.11 (Wi-Fi), WPAN- 802.15.1/3/4 (Bluetooth, Zigbee), WMAN-802.16a (Wi-max) , Wi-max and LTE /3GPP | 08 | CO1<br>CO2<br>CO4 |
| 5 | Wireless Network Design Considerations | Designing Wireless Networks with Lightweight Access Points and Wireless LAN Controllers | 04 | CO1, CO2<br>CO3, CO4<br>CO5 |
| 6 | Wireless Network Security | The need, attacks, security serviced, security in GSM; UMTS Security; Bluetooth Security, Network Layer Security | 04 | CO1, CO2<br>CO3, CO6 |

**5. Suggested Experiments:**

**Lab Prerequisite:** Computer Networks, Linux OS
**Software Requirements:** Linux OS, Java/Python, J2ME, android, PHP, Tinkercad, cupcarbon simulation tools.
**Hardware Requirements:** PC i3 or above configuration, high internet connectivity.

| Sr. No. | Detailed Lab Description | Hrs |
|---|---|---|
| I | i) Studies of various wireless communication technologies like IEEE 802.15.1, IEEE 802.15.4, and IEEE 802.11.<br>ii) Study of various types of sensors (DHT-11/22, HC-SR04, PIR Sensor)<br>iii) Study of different WSN open-source simulators like Tinkercad, and Cupcarbon. | 2,2,2 |
| II | i) Installation/study of Tinkercad and Cupcarbon simulators and perform a literature survey for mini project.<br>ii) Study of designing and automation using Tinkercad. | 2,2 |
| III | i) Measurement of distance using ultrasonic sensor in Tinkercad.<br>Mini Project: Topic selection | 2 |
| IV | i) Installation and testing the simulation tools (eg. TinkerCad/Cupcarbon).<br>Mini Project: Topic validation and finalizing software and Hardware requirement. | 2 |
| V | i) Study of interface using Mobile/Web to publish or remotely access the data on the Internet.<br>Mini Project: Study of remote access technologies with respect to the selected project | 2 |
| VI | i) Implementation of the Mini Project:<br>a. Design, configure, testing the Mini Project.<br>b. Report submission as per the guidelines. | 2,2,2 |

**Documentation of the Mini Project**

1. The Mini Project Report can be made on following lines:
2. Abstract
3. Contents
4. List of figures and tables
5. Chapter-1 (Introduction, Literature survey, Problem definition, Objectives, Proposed Solution, Wireless Technology used)
6. Chapter-2 (System design/Block diagram, Flow chart, Circuit/Interfacing diagram, Hardware and Software requirements, cost estimation)
7. Chapter-3 (Implementation snapshots/figures with explanation, code, future directions)
8. Chapter-4 (Conclusion)
9. References

**6.Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**7. Practical Assessment:** An Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment/ Mini project) + 5 Marks (Assignments) + 5 Marks (Attendance)

**8. Books and References:**

**A.Text Books:**


1. Cellular Communications: A Comprehensive and Practical Guide, Nishith Tripathi, Jeffery H Reed, Wiley.
2. Wireless Mobile Internet Security, 2nd Edition, Man, Young Rhee, Wiley- IEEE press.
3. Designing for Cisco Internetwork Solutions (DESIGN), 2nd Edition, CCDA, Diane Teare, Cisco Press.
4. Fundamentals of Sensor Network Programming: Applications and Technology, By S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, Wiley publication.
5. Contiki Cooja User Guide


**B.References:**


1. Introduction to Digital mobile communication, 2nd Edition, Yoshihiko Akaiwa.
2. “Wireless Communications and networks", William Stallings, Pearson / Prentice Hall.
3. Wireless communication and networking, Vijay Garg.
4. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
5. A comparative review of wireless sensor network mote technologies, IEEE paper 2009


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Data Science | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Data Science | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives**:The course is aimed to:

1. To understand the foundations of the Data Science process, methods and techniques.
2. To understand management of data and make predictions over the data.
3. To understand the principles of text analytics.
4. To understand why visualization is an important part of data analysis.
5. To understand the ethical responsibilities of data scientists and organizations.
6. To work on various applications of data science.

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. Learn the fundamentals of data science to enable, reproduce and scalable data from a variety of sources.
2. Generate and process dataset and develop models for prediction
3. Analyze text for common theme and trends
4. Design visualizations and narrate stores based on data
5. Develop data science project ethically
6. Analyze importance and impact of data science in varied applications

**3. Detailed Theory Syllabus:**

**Prerequisite:** BDA, ML, DBMS, Python, NLP

| Module No | Module | Detailed Contents of Module | Hrs. |
|---|---|---|---|
| 1 | Introduction to data science | Definition, working, defining goal, benefits and uses of Data Science, Data science vs BI, The data science process, Role of a Data Scientist. | 5 |
| 2 | Data management and Predictive modeling | Data management - Understanding how to create the data set, Data collection methods, Data preparation - importance of data 'cleaning', validity and quality. Data analysis - how format and volume of data limits methods of analysis available<br>Predictive Modeling - Probability and Statistics Basics, Common machine learning models, Feature engineering, Model selection, Performance metrics and hyperparameter optimization, Model Deployment | 8 |

| | | | |
|---|---|---|---|
| 3 | Text Analytics | Introduction to text Analytics, Need of Text Analytics, Understanding Text, Cleaning Text Data Sets, Text Classification, Text Clustering, Text mining techniques | 5 |
| 4 | Data visualization and communication | Identifying audience requirements, Data scientist as 'storyteller', Building a narrative, Explaining the technical - how to communicate the role played by ML and/or AI techniques resulting in an informed audience, Introduction to Data Visualization, Visualization Tools(Area Plots, Histograms ,Bar Charts, Pie Charts, Box Plots, Scatter Plots, Waffle Charts, Word Clouds), Visualizing Geospatial Data, visualizing time series data, Importance of data visualization Dashboards | 8 |
| 5 | Ethics of data science | Responsibilities of actuaries around data science and AI, Data Science Ethics, Doing good data science, Owners of the data, Valuing different aspects of privacy, Getting informed consent, The Five Cs, Developing ethical and professional safeguards | 5 |
| 6 | Applications | Healthcare, Banking, Finance, Sports, Advertisement, Transport, Tourism | 5 |

**4. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and half hour.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**5. Books and References:**


1. Davy Cielen, Meysman, Mohamed Ali, "Introducing Data Science", Dreamtech Press
2. Kevin P. Murphy, "Machine Learning a Probabilistic Perspective", The MIT Press
3. Ethics and Data Science, D J Patil, Hilary Mason, Mike Loukides, O' Reilly, 1st edition, 2018
4. Noel Cressie, Christopher K. Wikle , "Statistics for Spatio-Temporal Data, Wiley
5. Rachel Schutt and Cathy O'Neil, "Doing Data Science", O'Reilly Media
6. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media
7. EMC Education Services,"Data Science and Big Data Analytics",Wiley


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Prediction and Estimation Modeling | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Prediction and Estimation Modeling | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives**: The course is aimed to:

1. To learn, how to develop models to predict categorical and continuous outcomes, using different techniques
2. To know the use of the binary classifier and numeric predictor nodes to automate model selection.
3. To advise on when and how to use each model and combine two or more models to improve prediction.
4. To understand the Probability Distributions ,random variables and estimators.
5. To design a Predictions model with regression analysis.
6. To measure and evaluate the performance of different predictions with classification models.

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. Gain knowledge regarding development of models to predict categorical and continuous outcomes, using different techniques.
2. Have a broad understanding of the binary classifier and numeric predictor nodes .
3. Ability to select models to improve the prediction.
4. Able to understand the probability distribution and random variables and estimators
5. Able to apply different techniques to design prediction models.
6. Able to measure and evaluate the Performance in Classification Models.

**3. Detailed Theory Syllabus: Prerequisite:** Linear Algebra and Mathematical statistics

| Module No | Module | Detailed Contents of Module | Hrs. | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | KDD, Supervised and unsupervised learning | 02 | |
| 1 | Introduction to analytics | Introduction to Analytics, Analytics in Decision Making Game changers & Innovators Predictive Analytics Experts view on Analytics | 03 | CO1 |
| 2 | Preparing Data for Predictive Modelling | Introduction, Study Designs for Prediction Model Development, Sample Size Considerations, Pre-processing Your Data, Missing Data. | 03 | CO2 |

| | | | | |
|---|---|---|---|---|
| 3 | Probability Distributions | Discrete Random Variables: Binomial distribution, Geometric distribution, Poisson distribution, Continuous Random Variables: Uniform distribution, Exponential distribution, Normal distribution, Chi-squared distribution, Function of a continuous distribution, Numerical simulation. | 08 | CO3 and CO4 |
| 4 | Predictions with Regression Analysis | Regression Approach, Examples, Finding Good Regression Models, Other Considerations for Valid Predictions: Precision of the prediction, Goodness of Fit measure, Linear Regression Models and Nonlinear Regression Models, Regression Trees and Rule-Based Models: Basic Regression Trees, Regression Model Trees, Rule-Based Models, Bagged Trees, Random Forests, Boosting. | 10 | CO5 |
| 5 | Prediction with Classification Models | Measuring Performance in Classification Models: Class Predictions, Evaluating Predicted Classes, Evaluating Class Probabilities, Discriminant Analysis for Linear Classification Models and Nonlinear Classification Models, Neural Networks, Support Vector Machines, K-Nearest Neighbors, Naıve Bayes. | 08 | CO6 |
| 6 | Estimators | Properties of an Estimator, Bias, Mean Square Error, Construction of estimators, Method of Moments, Method of Maximum Likelihood, Interval estimate. | 04 | CO4 |

**4. Suggested Experiments:**

1. Case study on Predictive Analytics with example datasets using excel
2. Data Summarization
3. Probability Distributions
4. Supervised Learning using python (Regression and Classification algorithms)
5. study experiment on prediction modelling tools
6. Data visualization using any python library

**5. Theory Assessment:**

**A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

**B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

**A. Books:**

1. Frank E. Harrell, Regression Modeling Strategies With Applications to Linear Models, Logistic Regression, and Survival Analysis. Springer Series in Statistics.
2. M. Kuhn and K. Johnson, Applied Predictive Modeling, DOI 10.1007/978-1-4614-6849-3 1, © Springer Science+Business Media New York 2013.
3. Mathieu ROUAUD, Probability, Statistics and Estimation, Propagation of Uncertainties in Experimental Measurement, Short Edition, Date of publication: July 2013 Revision and translation: April 2017

**B. References:**

1. An Introduction to Statistical Learning: with Applications in R by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.
2. Data Analysis using Regression and Multilevel/Hierarchical Models by Andrew Gelman and Jennifer Hill.
3. Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce, Released May 2017, Publisher(s): O'Reilly Media, Inc., ISBN: 9781491952962.

Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X3T | Information Retrieval | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X3T | Information Retrieval | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives**: The course is aimed to:

1. To learn the important concepts and algorithms in IRS
2. To understand the data/file structures that are necessary to design, and implement information retrieval (IR) systems.
3. To understand different models for information retrieval systems.
4. To understand and analyse different types of search algorithms for retrieval.
5. To understand indexing and clustering algorithms.
6. To understand information retrieval from multimedia.

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. Ability to apply IR principles to locate relevant information large collections of data
2. Ability to design different document clustering algorithms
3. Ability to Implement retrieval systems for web search tasks.
4. Ability to Design an Information Retrieval System for web search tasks.
5. Ability to apply appropriate algorithms to retrieve relevant information from documents, images and videos.
6. Ability to implement indexing and searching algorithms.

**3. Detailed Theory Syllabus:** Prerequisite: Data Structures

| Module No | Module | Detailed Contents of Module | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Data Structures | | |
| 1 | Introduction | **Introduction to IR:** Definition, Objectives and Taxonomy of IR, Relationship to DBMS, Digital Libraries and Data Warehouses, Information versus Data Retrieval. Retrieval Process. **Classic IR Models:** Boolean Model, Vector Model, Probabilistic Model, Brief Comparison of Classic Models. **Set Theoretic Models:** Fuzzy Set Model, Extended Boolean Mode. **Alternative Algebraic Models:** Generalized Vector Space Model, Latent Semantic Indexing Model. | 08 | CO1 |
| 2 | IR Functions and Indexing | Search Capabilities - Browse Capabilities - Miscellaneous Capabilities - Indexing Process –Automatic Indexing-Statistical Indexing – Natural Language – Concept Indexing - Hypertext Linkages-Information Extraction | 08 | CO2 |
| 3 | Data Structure in IR | Stemming Algorithms - Inverted File Structure - N-Gram Data Structures - PAT Data Structure - Signature File Structure - Hypertext and XML Data Structures - Hidden Markov Models | 06 | CO2 |

| | | | | |
|---|---|---|---|---|
| 4 | Document and Term Clustering | Introduction to Clustering - Thesaurus Generation - Item Clustering - Hierarchy of Clusters | 04 | CO2 |
| 5 | Search Techniques | Search Statements and Binding - Similarity Measures and Ranking - Relevance Feedback - Selective Dissemination of Information Search - Weighted Searches of Boolean Systems - Searching the INTERNET and Hypertext – Introduction to Text Search Techniques - Software Text Search Algorithms | 08 | CO3, CO4, CO6 |
| 6 | Visualization and Multimedia IR | Introduction to Information Visualization - Cognition and Perception - Information Visualization Technologies. Spoken Language Audio Retrieval –Non-Speech Audio Retrieval - Graph Retrieval - Imagery Retrieval - Video Retrieval | 06 | CO5 |

**4. Suggested Experiments:** Software Requirements if any: Python / Java / Hadoop.

1. Study of different Retrieval Models
2. Implement Page Rank Algorithm.
3. Implement Dynamic programming algorithm for computing the edit distance between strings s1 and s2. (Hint. Levenshtein Distance)
4. Write a program to Compute Similarity between two text documents.
5. Write a map-reduce program to count the number of occurrences of each alphabetic character in the given dataset. The count for each letter should be case-insensitive (i.e., include both upper-case and lower-case versions of the letter; Ignore non-alphabetic characters).
6. Implement a basic IR system using Lucene.
7. Write a program for Pre-processing of a Text Document: stop word removal.
8. Write a program to implement a simple web crawler.
9. Write a program to parse XML text, generate Web graphs and compute topic specific page rank.
10. CaseStudy on a text processing tool AntConc:Concordance Tool,Concordance Plot Tool,File View Tool,Clusters/N-Grams Tool,Collocates Tool,Word List Tool,Keyword List

**5. Theory Assessment:**

**A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

**B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

1. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
2. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

**A. Books:**

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer

2. Introduction to Information Retrieval By Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze
3. Information Retrieval : Implementing and Evaluating Search Engines By Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack

**B. References:**


1. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992
2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons
3. Modern Information Retrieval By Yates and Neto Pearson Education


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X3T | Cyber Crime and IT Acts | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X3T | Cyber Crime and IT Acts | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives**: The course is aimed to:

1. To evaluate the security and to identify vulnerabilities in systems, networks or system infrastructure.
2. To understand various cyber crimes and IT Act addressing cyber crimes.
3. Learn different tools and techniques for cyber crimes and safety measures.
4. To Understand the concept of cybercrime and its effect on the outside world using real life case studies.

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system by hiding details.
2. Understand the different law provisions against cyber crimes using real life case studies.
3. Distinguish different aspects of cyber law.

**3. Detailed Theory Syllabus: Prerequisite:** Concept of Network security and system security.

| Module No | Module | Detailed Contents of Module | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Concept of Network security and system security | | |
| 1 | Introduction | Introduction to application security, common sources of threat to web application, common design level security mistakes in Web application. Types of cyber crime and classification, Hacking, cracking, phreaking. Social media frauds. Introduction to IT Act 2000. | 6 | CO1 |
| 2 | Cyber Attack planning | How do criminals plan the cyber attack?. Data and Data sources, Information gathering: from social media accounts, extraction of photographs exif data, phone number, vehicle registration number, dumpster dumping, google street view and google history. Social Engineering techniques, Google Dork query, Browser extension to collect information. Principles of Ethical hacking (Legality & Ethics) Steps in cyber attack:Reconnaissance (Survey), Probing, Actual attack,Maintaining presence, Covering attack track. | 9 | CO1 |
| 3 | Tools and techniques for Cyber Crime | Social Engineering, open source tools for scanning, Password cracking tools, Keyloggers and Spywares, Botnets, Virus and Worms, SQL Injection, Buffer Overflow | 7 | CO3 |
| 4 | Hiding attacker details | Proxy chain for using proxy servers, hiding your IP and obtaining access. What is VPN and how to stay anonymous with VPN. Mac-changer, use of mac-changer to change your MAC address. Incident Response and Forensic Analysis. | 6 | CO3 |

| | | | | |
|---|---|---|---|---|
| 5 | IT ACT 2000 | Indian IT ACT 2000, various sections, IT Act Amendments. Challenges faced by law and enforcement agencies while applying IT Act. | 6 | CO2 |
| 6 | Case studies on cyber crime cases | Net banking frauds, Social Media frauds, Online defamation, Email spoofing, Phishing, Vishing, Smishing | 5 | CO4 |

**4. Suggested Experiments: Software Requirements:** Python

1. OpenV Installation,Read & Save Images
2. Basic Operation On images,Color Spaces in OpenCV
3. Arithmetic Operations on Images, Bitwise Operations on Binary Images
4. Image Processing:OpenCV Resize Image ,OpenCV Image Rotation
5. OpenCV Drawing Functions,Eroding an Image,Blurring an Image,Create Border around Images, Grayscaling of Images,Scaling, Rotating, Erosion and Dilation of images
6. Convert an image from one color space to another ,Filter Color with OpenCV Denoising of colored images,Visualizing image in different color spaces
7. OpenCV Blob Detection,Canny Edge Detection
8. OpenCV Image Smoothing Shifting and Edge Detection
9. Line detection using Hough Line method, Circle Detection, Detect corner of an image
10. Analyze an image using Histogram, Histograms Equalization, Simple Thresholding Adaptive Thresholding,
11. OpenCV Image Threshold , OpenCV Contours,OpenCV Mouse Event
12. OpenCV Video Capture
13. Face Detection with OpenCV, Car detection with OpenCV, Face Recognition with OpenCV

**5. Theory Assessment:**

**A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

**B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance) = 25 Marks

**7. Books and References:**

**A. Books:**


1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi.
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi.


**B. References:**


1. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai.
2. Nina Godbole, Information Systems Security, Wiley India, New Delhi**.**
3. Howse, Joseph. OpenCV computer vision with python. Packt Publishing Ltd, 2013.
4. Bradski, Gary, and Adrian Kaehler. Learning OpenCV: Computer vision with the OpenCV library. " O'Reilly Media, Inc.", 2008

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X3T | Cloud Computing | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X3T | Cloud Computing | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1.Prerequisite:** Computer Network, OSI references Model,Operating System

**2.Course Objectives:** The course is aimed to:

1.Basics of cloud computing.
2. Key concepts of virtualization.
3. To study different Cloud Computing services and Models
4. Key components of Amazon Web Services and Google cloud Platform
5. To study cloud management
6. To study the Cloud security

**3.Course Outcomes:** On successful completion of course learner/student will be able to:

1.Define Cloud Computing and memorize the different Cloud service and deployment models
2. Describe the importance of virtualization along with their technologies.
3. Use and Examine different cloud computing services and cloud Models.
4. Analyze the components Google Cloud platform and AWS
5. Describe the key components cloud Management
6. Design & develop Cloud Security

4.**DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Computer Network, OSI references Model,Operating System | 0 | |
| 1 | Introduction | Defining Cloud Computing, Cloud and other similar configurations, Components of Cloud Computing , SLA,Cloud computing architecture,NIST Model, Cube Model | 6 | CO1 |
| 2 | Virtualization | Hypervisors, Types of Hypervisors,Taxonomy of virtualization, Implementation Levels of Virtualization, Virtualization of CPU, Memory and I/O Devices, Virtualization Platforms | 8 | CO2 |
| 3 | Cloud Computing Services | Exploring Cloud Computing Services: SPI Model: Software as a service, Platform as a service, and Infrastructure as a service.Anything as a service or Everything as a service (XaaS):Devops and containers in clouds | 8 | CO3 |

| | | | | |
|---|---|---|---|---|
| 4 | AWS and Google Cloud | AWS cloud computing Platform, Elastic Compute Cloud(EC2): Compute Basics, Instance types, Life cycle of instances. Simple Storage Service (S3): Basics and Operations, Features, Amazon Glacier, Glacier vs S3.Amazon Virtual Private Cloud (Amazon VPC): Subnets, Route tables, Elastic IP Addresses (EIP), Elastic Network Interfaces (ENIs) & Security groups & ACL.<br>Google Cloud Platform | 5 | CO4 |
| 5 | Containers and Kubernete Engine | Pod and cluster autoscaling, Kubernetes applications,Architecting with Kubernetes Engine ,Kubernetes Scheduling II,Reliability & fault tolerance,Diagnosis via monitoring & tracing | 6 | CO5 |
| 6 | Cloud Security | Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service, SAML, OAuth | 6 | CO6 |

**5. Suggested Experiments:**

- **Lab Prerequisite:** Computer Network, Operating System
- **Software Requirements:** Windows, Linux, AWS, Docker, kubernetes

| Sr. No. | Module Name | Detailed Lab Description | Hrs |
|---|---|---|---|
| I | NIST Model | **Lab1:**Study of NIST model of cloud computing.<br>**Lab2**:Understand different types of virtualizations, Host and bare metal hypervisors and implement horizontal scalability. | 06 |
| II | IAAS | **Lab3**:To create and access VM instances and demonstrate EC2 of AWS<br>**Lab4**: To create and access S3 instances and demonstrate S3 of AWS<br>**Lab5:** To design VPC using AWS/Azure | 6 |
| III | PAAS | **Lab6**: Objective: Deploy web applications on commercial cloud. | 2 |
| IV | Database as a services | **Lab7** :To create and access DynamoDB instances and demonstrate DynamoDB of AWS.<br>**Lab 8**: To create and access RDS instances<br>**Lab 9** : To create a NOSQL database using MonogoDB | 4 |
| V | Docker Containerization | **Lab10:** To study and Implement Containerization using Docker<br>**Lab11:** To study and implement container orchestration using Kubernetes | 4 |
| VI | Cloud Security | **Lab 12:** To study and implement Identity and Access Management (IAM) practices on AWS/Azure cloud. | 2 |

**6. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)

4. Total three questions need to be solved.

**7. Practical Assessment:** An Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of 10 experiments based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.
B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**8.. Books and References:**

**A.Text Books:**


1. Barrie Sosinsky ,"Cloud Computing Bible",Wiley Publication.
2. Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr. Deven Shah, "Cloud Computing Black Book", Dreamtech Press.
3. Joe Baron et.al ,"AWS certified solution Architect", Sybex publication.
4. Mastering Cloud Computing, Rajkumar Buyya, MGH publication.
5. Enterprise Cloud Computing by Gautam Shroff, Cambridge,2010
6. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley - India, 2010 ,
7. Getting Started with OwnCloud by Aditya Patawar , Packt Publishing Ltd, 2013


**B.References:**


1.Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", Pearson Publication.
2. Judith Hurwitz ,"Cloud Computing for Dummies" , Wiley Publication.
3. www.openstack.org
4. www.ulteo.org


Back to Scheme

| Course Code | Course Name | Teaching Scheme | Contact Hours | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | TH | Pract | Tut | Total | TH | Pract | Tut | Total |
| IT515L | DLOC Lab - I | | - | 2 | - | 1 | - | 2 | - | 1 |
| | | Examination Scheme | Internal Assessment | | | End Sem Exam | | Term Work | Pract | Oral | Total Marks |
| | | | IA1 | IA2 | Avg | TH | Hrs | | | | |
| | | | - | - | - | - | - | 25 | - | 25 | 50 |

| Module | Detailed Content | Hrs/Week |
|---|---|---|
| I | Two Laboratory Practicals to be conducted for each of the DLOC subjects. | 2 |

**1. Modality and Assessment:**

- Each Laboratory assignment will be done in a group of two students. The Faculty teaching each DLOC subject will be required to propose and evaluate the respective DLOC laboratory assignments. These will be essentially hands-on practical and not theory / research review types of assignments.
- Practical/Oral examination is to be conducted by a pair of internal and external examiners for all the DLOC subjects together.

**2. Term Work:** Term Work shall consist of practicals based on the list given in each DLOC course.

**3. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

**4. Practical / Oral Exam**: 25 Marks. It will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

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**Program Structure for**
**Master of Technology in Information Technology**
**Semester II**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Pract | Total |
| IT517T | Deep Learning | 3 | -- | 3 | -- | 3 |
| IT518T | User Experience Design | 3 | -- | 3 | -- | 3 |
| IT5xxT | Department Level Optional Course-IV | 3 | -- | 3 | -- | 3 |
| IT5xxT | Department Level Optional Course-V | 3 | -- | 3 | -- | 3 |
| IT5xxT | Department Level Optional Course-VI | 3 | -- | 3 | -- | 3 |
| IT532L | Course Lab-II | -- | 2 | -- | 1 | 1 |
| IT533L | Dissertation-II | -- | 2 | -- | 1 | 1 |
| **TOTAL** | | **15** | **4** | **15** | 2 | 17 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Oral/ Pract | Total |
| | | IA 1 | IA 2 | Avg | | | | | |
| IT517T | Deep Learning | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT518T | User Experience Design | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT5xxT | Department Level Optional Course-IV | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT5xxT | Department Level Optional Course-V | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT5xxT | Department Level Optional Course-VI | 40 | 40 | 40 | 60 | 2 | -- | -- | 100 |
| IT532L | DLOC Lab-II | -- | -- | -- | -- | -- | 25 | 25 | 50 |
| IT533L | Dissertation-II | -- | -- | -- | -- | -- | 25 | 25 | 50 |
| **TOTAL** | | **200** | **200** | **200** | **300** | **15** | **50** | **50** | **600** |

## Department Level Optional Course (DLOC)

| SN | DLOC - IV | DLOC - V | DLOC -VI |
|---|---|---|---|
| 1 | Computer Vision | Internet of Everything | Cyber Security |
| 2 | Big Data Analytics | Blockchain Technology | Ethical Hacking |
| 3 | ACN and SDN | Robotic Process Automation | Secured Application Design |

| Course Code | Course Name | Teaching Scheme | Contact Hours | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | TH | Pract | Tut | Total | TH | Pract | Tut | Total |
| IT 517 | Deep Learning | | 3 | - | - | 3 | 3 | - | - | 3 |
| | | Examination Scheme | Internal Assessment | | | End Sem Exam | | Term Work | Pract | Oral | Total Marks |
| | | | IA1 | IA2 | Avg | TH | Hrs | | | | |
| | | | 40 | 40 | 40 | 60 | 2 | - | - | - | 100 |

1. **Prerequisite:** Fundamentals of Neural Networks, Basics of Statistics.

**2. Course Objectives:** The course / instructor aims to

1. Define fundamentals of NN concepts, DL and compare ML with DL algorithms.
2. Describe how the deep learning models are evaluated, improved and optimized.
3. Explain how supervised deep learning CNN is used in image classification and compare with other models.
4. Give insight into the supervised deep learning RNN model and compare CNN with RNN.
5. Show how unsupervised deep learning GAN and autoencoder is applied and compare the performance of GAN and autoencoders.
6. Describe how DL algorithms are used in image classification, image captioning, image generation, text summarization and video to Text operation.

**3. Course Outcomes:** On successful completion of this course, learner/ student will be able to:

1. Understand fundamentals concepts of NN, DL and compare ML with DL algorithms.
2. Know how the deep learning models are evaluated, improved and optimized.
3. Apply supervised deep learning CNN for image classification and compare with other models.
4. Apply supervised deep learning RNN and compare performance of RNN model.
5. Apply unsupervised deep learning GAN and autoencoder and compare the performance of GAN and autoencoders.
6. Demonstrate how deep learning algorithms are used for image classification, image captioning, image generation, text summarization and video to Text operations.

**4. Detailed Theory Syllabus**

| SN | Module | Detailed Content | Hrs | COs |
|---|---|---|---|---|
| I | Introduction | **Introduction to NN:** Biological Neuron. McCulloch Pitts NN, Linear Separability, Learning Rule: Perceptron, Delta. **Introduction to Deep Learning:** ML vs DL approach, Types of DL Algorithms, Hyperparameters, Loss functions, Data augmentation, Activation functions: Sigmoid, Tanh, ReLU, Softmax. | 05 | CO1 |
| II | Performance Evaluation | **Model Evaluation:** Underfitting, Overfitting, Lasso regularization, Ridge regularization, Elastic Net regularization. **Model Improvement:** Ensemble methods, Sparse and convex functions, Bagging to avoid overfitting, Boosting to avoid underfitting, Stacking to avoid underfitting. **Optimizers:** Gradient Descent (GD), Types of GD, Vanishing Gradient Problem, Exploding Gradient Problem, Frobenius norm regularization, Early stopping, Adam optimizer. | 08 | CO1, CO2 |
| III | Supervised Deep Learning: CNN | **Introduction:** Edge Detection Filters, Filter Size, Convolutions, Padding, Stride, Compare CNN and ANN, Limitations of CNN. **Architecture:** CNN architecture, Layers: Pooling, Convolutions. Transfer learning, Compare DL architecture: LeNET vs AlexNET. | 07 | CO3 |
| IV | Supervised Deep Learning: RNN | **Introduction:** Recurrent neuron, RNN model, RNN types, Gradients in RNN, Back propagation, Compare CNN and RNN. **Architecture:** Gated recurrent units (GRUs), Long short term memory (LSTM). | 07 | CO4, CO5 |
| V | Unsupervised Deep Learning | **Generative Adversarial Network:** Discriminative vs. Generative Modeling, Architecture of GAN, Types of GANs. **Autoencoders:** Types, Linear autoencoder, Undercomplete vs Overcomplete autoencoders, Regularized autoencoders: Denoising and Sparse autoencoder. Contractive autoencoder, Convolutional autoencoder. Compare GANs and autoencoders. | 07 | CO4, CO5 |
| VI | Applications | Case Study: Image Captioning, Image Generation, Text summarization, Video to Text using LSTM. | 05 | CO6 |

**5. Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   - Question paper will consist of 5 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - Weightage of marks should be proportional to the number of hours assigned to each **module.**

**6. Text Books:**


1. Satish Kumar, "Neural Networks: A Classroom Approach", McGraw Hill Education; 2ed, 2017.
2. Jacek M. Zurada, "Introduction to Artificial Neural Systems", West Publishing Company, 1092.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press Ltd, 2016

4. Li Deng and Dong Yu, "Deep Learning Methods and Applications", Now Publishers Inc., 2014.
5. Mykel J. Kochenderfer and Tim A. Wheeler, "Algorithms for Optimization", The MIT Press, Cambridge, Massachusetts London.

**7. References:**

- Simon Haykin, "Neural Network - A Comprehensive Foundation", 2ed, Pearson Education, 2005.
- S.N. Sivanandam and S.N. Deepa, "Principles of soft computing", Wiley India
- François Chollet, "Deep learning with Python," New York: Manning, Vol. 361. 2018.
- Douwe Osinga, "Deep Learning Cookbook", O′Reilly; 1st edition, 2018, SPD Publishers.

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| Course Code | Course Name | Teaching Scheme | Contact Hours | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | TH | Pract | Tut | Total | TH | Pract | Tut | Total |
| IT 518 | User Experience Design | | 3 | - | - | 3 | 3 | - | - | 3 |
| | | Examination Scheme | Internal Assessment | | | End Sem Exam | | Term Work | Pract | Oral | Total Marks |
| | | | IA1 | IA2 | Avg | TH | Hrs | | | | |
| | | | 40 | 40 | 40 | 60 | 2 | - | - | - | 100 |

**1. Course Objectives**:
The course is aimed to:

1. To study and understand importance of user experience design principles
2. To understand elements of user experience design
3. To encourage students to participate in designing futuristic applications
4. To understand data visualization interaction design.
5. To understand prototype design.
6. To understand usability testing.

**2. Course Outcomes**:
On successful completion of course learner/student will be able to:

1. To Apply principles of user experience
2. To apply emerging and established technologies to enhance User Experience design
3. To create an interface for international standards with ethics.
4. To design prototypes.
5. To apply usability tests.
6. To evaluate user experience

**3. Detailed Theory Syllabus:**

**Prerequisite:** Web Technologies, Software Engineering, Human Computer Interaction

| Module No | Module | Detailed Contents of Module | Hrs. |
|---|---|---|---|
| 1 | Introduction | Introduction to interface design, Understanding and conceptualizing Interface, Understanding User's conceptual cognition. | 4 |
| 2 | Elements of UX Design | Core Elements of User Experience, Working of UX elements | 4 |
| 3 | The UX Design Process – Understanding Users | Defining the UX, Design Process and Methodology, Understanding user requirements and goals, Understanding the Business Requirements/Goals, User research, mental models, wireframes, prototyping, usability testing. | 8 |
| 4 | The UX Design Process- The Structure: Information Architecture and Interaction Design | Visual Design Principles, Information Design and Data Visualization Interaction Design, Information Architecture, Wire framing & Storyboarding, UI Elements and Widgets, Screen Design and Layouts | 8 |
| 5 | UX Design Process: Prototype and Test | Testing your Design, Usability Testing, Types of Usability Testing, Usability Testing Process, Preparing and planning for the Usability Tests, Prototype your Design to Test, Introduction of prototyping tools, conducting Usability Test, communicating Usability Test Results | 8 |

| | | | |
|---|---|---|---|
| 6 | UX Design Process: Case study and application Design Activity | Select any problem statement Apply UX design steps and concepts to provide low fidelity and high fidelity design , Prototype. | 4 |

**4. Theory Assessment:**

**A. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and half hour.

**B. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**5. Books and References:**

**A. Books:**


1. Interaction Design, Beyond Human Computer Interaction, Rogers, Sharp, Preece Wiley India Pvt Ltd.
2. The essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin.
3. Designing The user Interface by Shneiderman, Plaisant,Cohen,Jacobs Pearson.


**B. References:**


1. The Elements of User Experience by Jesse James Garrett.
2. Don’t make me think, by Steve Krug.
3. Observing the User Experience: A Practitioner's Guide to User Research by Mike Kuniavsky.


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## Department Level Optional Course (DLOC)

| SN | DLOC - IV | DLOC - V | DLOC -VI |
|---|---|---|---|
| 1 | Computer Vision | Internet of Everything | Cyber Security |
| 2 | Big Data Analytics | Blockchain Technology | Ethical Hacking |
| 3 | ACN and SDN | Robotic Process Automation | Secured Application Design |

| Course Code | Course Name | Teaching Scheme | Contact Hours | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | TH | Pract | Tut | Total | TH | Pract | Tut | Total |
| IT5X1T | Computer Vision | | 3 | - | - | 3 | 3 | - | - | 3 |
| | | Examination Scheme | Internal Assessment | | | End Sem Exam | | Term Work | Pract | Oral | Total Marks |
| | | | IA1 | IA2 | Avg | TH | Hrs | | | | |
| | | | 40 | 40 | 40 | 60 | 2 | - | - | - | 100 |

**1. Prerequisite:** Basic coordinate geometry, matrix algebra, linear algebra

**2. Course Objectives**: The course aims to:

1. To introduce fundamentals of computer vision and its relationship with Artificial Intelligence.
2. To learn the process of image formation, transformation and geometric primitives using a digital camera.
3. To learn various algorithms in computer vision.
4. To study various algorithms for Image Descriptors and Features.
5. To explore pattern recognition and classification techniques using ANN and CNN.
6. To know computer vision applications such as motion estimation, segmentation and object recognition.

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. To describe fundamentals of Computer Vision and distinguish between Image Processing and Computer Vision and also explain its relationship with other domains like AI,ML etc.
2. To describe the process of image formation and storage using digital devices.
3. To remember and apply image pre-processing techniques required for computer vision.
4. To extract color, texture and shape features from images to describe and perform analysis.
5. To implement classification techniques to identify and recognize objects.
6. To identify and apply computer vision techniques in real life situations.

**3. Detailed Theory Syllabus:**

| Module No | Module | Detailed Contents of Module | Hrs. | COs |
|---|---|---|---|---|
| I | Introduction | What is Computer Vision (CV), Challenge of CV, Tasks in CV, Difference between Image Processing and CV, Relationship of Artificial Intelligence and CV. | 3 | CO1 |
| II | Image Formation | **Transformations:** Camera, Sampling and aliasing, Geometric primitives. 2D and 3D transformation, 3D rotations, 3D to 2D projections, Lens distortions.<br>**Photometric image formation:** Lighting, Reflectance and shading, Optics. | 6 | CO2 |
| III | Image Preprocessing | **Image Enhancement:** Point Processing, Mask Processing, Spatial and Frequency Domain Filtering.<br>**Image Transforms:** Haar, Curvelet, Ridgelet, Shearlet, Contourlet Transform | 8 | CO3 |

| | | | | |
|---|---|---|---|---|
| | | **Image Morphology**: Binary Morphological operations, Dilation, Erosion, Opening and Closing. Grayscale Morphological operations. | | |
| IV | Image Feature Representation | **Image Features:** Color, Texture, Shape. Histogram of Oriented Gradients, Scale Invariant Feature Transform.<br>**Image Representation and Description**: Chain Code, Shape Number, Fourier Descriptors, Image Moments.<br>**Texture Descriptors:** Texture representation methods,Gabor filter, MPEG-7 homogeneous texture descriptor<br>**Edge Detection:** Gradient-based methods, Laplacian of Gaussian operator, Difference of Gaussian Operator, Canny Edge Detector, Hough Transform. | 8 | CO4 |
| V | Pattern Recognition and Classification | **Introduction to Pattern Recognition:** Linear Regression, Decision Functions, Statistical Decision Theory, Gaussian Classifier, Parameter Estimation, Dimension Reduction, Template Matching.<br>**Image Classification:** Artificial Neural Network (ANN), Convolutional Neural Networks (CNNs), Autoencoder. | 8 | CO5 |
| VI | Applications of Computer Vision | Motion Estimation and Object Tracking, Gesture Recognition, Face and Facial Expression Recognition, Image Fusion, Medical Image Segmentation. | 4 | CO6 |

**5. Suggested Experiments for DLOC Lab:**

Software Requirements if any: Python.

1. Install OpenCV for Python on Windows & Manipulate with the images Images.
2. Image Processing:
    a. Image Processing:OpenCV Resize Image ,OpenCV Image Rotation
    b. OpenCV Drawing Functions,Eroding an Image,Blurring an Image,Create Border around Images, Grayscaling of Images,Scaling, Rotating, Erosion and Dilation of images
    c. Convert an image from one color space to another ,Filter Color with OpenCV Denoising of colored images,Visualizing image in different color spaces

3.Feature Detection:

    a. OpenCV Blob Detection,Canny Edge Detection
    b. OpenCV Image Smoothing
    c. Shifting and Edge Detection
    d. Line detection using Hough Line method
    e. Circle Detection
    f. Detect corner of an image

4.Histogram:

    a. Analyze an image using Histogram,Histograms Equalization, Simple Thresholding Adaptive Thresholding
    b. OpenCV Image Threshold OpenCV Contours,OpenCV Mouse Event

5.Pattern Recognition and Classification

    a. OpenCV Video Capture
    b. Face Detection with OpenCV
    c. Car detection with OpenCV

**6. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**7. Practical Assessment under DLOC Lab:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**8. Books and References:**

**A. Text Books:**


1. Bhuyan, Manas Kamal. Computer vision and image processing: Fundamentals and applications. CRC Press, 2019.
2. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
3. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010


**B. References:**


1. Milan Sonka,Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision" Thomson Learning
2. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
3. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
4. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X1T | Blockchain | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X1T | Blockchain | 40 | 40 | 40 | 60 | - | - | - | 100 |

**Course Objectives:** The course is aimed to:

1. Understand how blockchain systems work
2. Understand the use of cryptography required for blockchain
3. Integrate ideas from blockchain technology into their own projects.
4. Understandthe concept of public blockchain
5. Understandthe concept of private blockchain
6. Design, build, and deploy smart contracts and distributed applications using cryptocurrency

**Course Outcomes:** On successful completion of course learner/student will be able to:

1. Explain blockchain concepts.
2. Apply cryptographic hash required for blockchain.
3. Apply the concepts of smart contracts for an application.
4. Design a public blockchain using Ethereum.
5. Design a private blockchain using Hyperledger.
6. Design a blockchain application

**3. Detailed Theory Syllabus: Prerequisite:** Programming and Mathematic course

| Module No | Module | Detailed Contents of Module | Hrs | CO Mapping |
|---|---|---|---|---|
| 1 | Introduction to Blockchain Technology | What is a blockchain, Origin of blockchain (cryptographically secure hash functions), Foundation of blockchain: Merkle trees, Components of blockchain, Block in blockchain, Types: Public, Private, and Consortium, Consensus Protocol, Limitations and Challenges of blockchain | 5 | CO1 |
| 2 | Cryptocurrency | Cryptocurrency: Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets, Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem,<br>Bitcoin blockchain: Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS), and Proof-of-Elapsed Time (PoET), Life of a miner, Mining difficulty, Mining pool and its methods | 6 | CO2 |
| 3 | Programming for Blockchain | Introduction to Smart Contracts,Types of Smart Contracts, Structure of a Smart Contract, Smart Contract Approaches, Limitations of Smart Contracts<br>Introduction to Programming: Solidity Programming –Basics, functions, Visibility and Activity Qualifiers, Address | 6 | CO3 |

| | | | | |
|---|---|---|---|---|
| | | and Address Payable, Bytes and Enums, Arrays-Fixed and Dynamic Arrays, Special Arrays-Bytes and strings, Struct, Mapping, Inheritance, Error handling<br>Case Study –Voting Contract App, Preparing for smart contract development | | |
| 4 | Public Blockchain | Introduction to Public Blockchain, Ethereum and its Components, Mining in Ethereum, Ethereum Virtual Machine (EVM), Transaction, Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum Types of test-networks used in Ethereum, Transferring Ethers using Metamask, Mist Wallet, Ethereum frameworks, Case study of Ganache for Ethereum blockchain. Exploring etherscan.io and ether block structure. | 7 | CO4 |
| 5 | Private Blockchain | Introduction, Key characteristics, Need of Private Blockchain, Smart Contract in a Private Environment, State Machine Replication, Consensus Algorithms for Private Blockchain -PAXOS and RAFT, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT<br>Introduction to Hyperledger, Tools and Frameworks, Hyperledger Fabric, Comparison between Hyperledger Fabric & Other Technologies<br>Hyperledger Fabric Architecture, Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow, Working of Hyperledger Fabric, Creating Hyperledger Network, Case Study of Supply Chain Management using Hyperledger | 8 | CO5 |
| 6 | Blockchain in Action: Use Cases | Use case in Financial Services, Insurance, Government, Supply Chain Management, Healthcare, Healthcare payments pre-authorization, The Internet of Things (IoT), Agriculture | 6 | CO6 |

**4. Suggested Experiments:**

Software Requirements if any: Python, Java Scripts, Geth

1. Implementation of any symmetric and asymmetric cryptosystem.
2. Simple blockchain implementation in any suitable programming language
3. Block chain implementation with database
4. Smart contract with token/coin.
5. Smart Contract to solve/optimize a problem using Ethereum
6. Use Geth to Implement Private Ethereum BlockChain
7. Create a DApp, with Ethereum
8. Create wallet in Metamask and connect it to Ganache Test Network
9. Create a Case study of BlockChain being used in the real world.

**5. Theory Assessment:**

**C. Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

**D. End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

C. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

D. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

A. **Books:**


1. Blockchain Technology, Chandramouli Subramanian, Asha A. George, Abhillash K. A and Meena Karthikeyen, Universities Press.
2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
3. Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum,and more, 3rd Edition, Packt Publishing


B. **References:**


1. Blockchain Basics A Non-Technical Introduction In 25 Steps
2. Introduction to Blockchain Technology Author: Tiana Laurence
3. Mastering Ethereum, Andreas M. Antonopoulos, O'relly
4. Blockchain for Beginners, Yathish R and Tejaswini N, SPD
5. Blockchain Basics, A non Technical Introduction in 25 Steps, Daniel Drescher, Apress.
6. Blockchain with Hyperledger Fabric,Luc Desrosiers, Nitin Gaur, SalmanA. Baset, Venkatraman Ramakrishna, Packt Publishing
7. https://solidity.readthedocs.io/en/v0.6.2/


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X1T | Knowledge Representation and Reasoning | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X1T | Knowledge Representation and Reasoning | 40 | 40 | 40 | 60 | - | - | - | 100 |

1. **Course Objectives:**
   1. To provide a strong foundation of fundamental concepts in Artificial Intelligence and Knowledge Representation.
   2. To provide a strong foundation to the notation of reasoning.
   3. To provide a basic exposition to the methods of Knowledge Representation.
   4. To provide knowledge based representation language.
   5. To provide a basic exposition to the goals of Knowledge Representation.
   6. To enable the student to apply these techniques in applications which involve Knowledge Representation.

2. **Course Outcomes:**
   1. Able to understand the fundamental principle of logic based knowledge representation.
   2. Able to understand the notation of reasoning.
   3. Able to understand fundamental of reasoning algorithm.
   4. Able to understand knowledge based representation language.
   5. Able to perform application using knowledge representation techniques.
   6. Able to Enhance and formulate real world problems using knowledge representation.

3. **Detailed Theory Syllabus: Prerequisite:** Basic concept of Artificial Intelligence.

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Basic concept of Artificial Intelligence Some exposure to formal languages, logic and programming | | |
| 1 | Introduction | The Key Concepts: Knowledge, Representation, and Reasoning, Why Knowledge Representation and Reasoning? : Knowledge-Based Systems Why Knowledge Representation? Why Reasoning? The Role of Logic | 4 | CO1, CO2 |
| 2 | The Language of First-Order Logic | Introduction, Propositional Logic, Syntax and Semantics Proof Systems, Natural Deduction, Tableau Method, Resolution Method. First Order Logic (FOL), Syntax and Semantics, Unification, Forward Chaining | 8 | CO2, CO3 |
| 3 | Resolution | Resolution ,Knowledge Engineering, Vocabulary Entailments The Propositional Case , Handling Variables and Quantifiers, Dealing with Computational Intractability | 6 | CO2, CO4 |

| | | | | |
|---|---|---|---|---|
| 4 | Reasoning with Horn Clauses | Reasoning with Horn Clauses, Horn Clauses, SLD Resolution, Computing SLD Derivations | 6 | CO4, CO5 |
| 5 | Description Logic (DL) | Description Logic (DL), Structure Matching, Classification, Extensions of DL, The ALC Language, Inheritance in Taxonomies | 6 | CO4 |
| 6 | Default Reasoning and Logic | Default Reasoning, Circumscription, the Event Calculus Revisited, Default Logic, Autoepistemic Logic, Epistemic Logic, Multi Agent Scenarios, Conceptual Dependency (CD) Theory, Understanding Natural Language | 8 | CO5 ,CO6 |

**4. Suggested Experiments:**

1. Study of need of knowledge management
2. Identify any small problem statements
3. Design rules
4. Identify and specify reasoning
5. Apply Description logic
6. Prepare a mini project report on identified problem statements.
7. Two case studies related to problem statement will be provided.

Note : Areas to be considered but not limited to , Education, Agriculture, Banking, Healthcare, Business

**5. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

**A. Books:**

1.Ronald J. Brachman Hector J. Levesque ,Knowledge Representation And Reasoning

2.Elias M. Awad, Hassan M. Ghaziri, Knowledge Management, Pearson Education Inc., Prentice Hall (2004).

3.Irma Becerra-Fernandez, Avelino Gonzalez, Rajiv Sabherwal (2004). Knowledge Management Challenges, Solutions, and Technologies . Prentice Hall. ISBN: 0-13-109931-0

**B. References:**

1. Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.
2. 2Stuart Barnes (Ed.) (2002). Knowledge Management Systems Theory and Practice. Thomson Learning.
3. Kimiz Dalkir, Knowledge Management in Theory and Practice, Elsevier, Butterworth Hinemann.
4. Applying Knowledge Management: Techniques for Building Corporate Memories. Morgan Kaufmann. ISBN: 1558607609.essional" Information Today, Inc., 2000.

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Internet of Everything | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Internet of Everything | 40 | 40 | 40 | 60 | - | - | - | 100 |

1. **Prerequisite:** Computer Network, Microcontroller, Wireless Technology

2. **Course Objectives:** The course is aimed to:
   1. To learn the concepts of IoT.
   2. To identify the different technologies.
   3. To learn different applications in IoT.
   4. To learn different protocols used in IoT.
   5. To learn and design hardware for smart city applications in IoT.
   6. To learn how to analyze and evaluate data collected in IoT.

3. **Course Outcomes:** On successful completion of course learner/student will be able to
   1. Describe the basic concepts of IoT
   2. Design architecture for an IoT application
   3. Apply IOT to different applications.
   4. Analysis and evaluate protocols used in IoT.
   5. Design and develop smart cities in IoT.
   6. Analysis and evaluate the data received through sensors in IoT.

**4. DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| I | Introduction to IoT | Basics of Internet of Things,Smart Objects, Smart Environments, Machine to Machine Communications, Industrial Internet of Things,Who Works on the Internet of Things?, Internet of Things Framework | 04 | CO 1 |
| II | Architecture of IoT | Characteristics of IoT,Physical & Logical Design of IoT. Architecture and Reference Models of IoT, Introduction to Industrial IoT (IIoT). | 07 | CO 2 |
| III | RFID Technology | Introduction, Principle, Components and Architecture of RFID, RFID middleware, Issues in RFID, IPv6 Addressing Schemes and Electronic Product Code, RFID Applications and case studies, Hardware issues. | 08 | CO 2 |
| IV | Communication Protocols | Introduction to Wireless Sensor Network, Protocols: MQTT, CoAP, REST Transferring data, Basic Difference between Protocols, Security IoT Protocols and Technology: CoAP and DTLS. | 05 | CO 2<br>CO 3<br>CO 4 |

| | | | | |
|---|---|---|---|---|
| V | Network Localization and Mobility | Localization, mobility management, localization and handover management, technology considerations,simulation setup, performance evaluation and results. Identification of IoT. | 10 | CO 4<br>CO 5 |
| VI | Data Analytics for IoE | Big Data Analytics, Cloud and Fog Computing in the Internet of Things: IoT System Requirements, Cloud Computing in IoT ,Advantages of Using the Cloud for IoT, Examples of Cloud - Based IoT | 05 | CO 5<br>CO 6 |

**5. Detailed Practical syllabus:**

**Lab Prerequisite:** Wireless Technology Lab , Python, Java.
**Software Requirements:** Arduino IDE, Tinkercad,
**Hardware requirement:** Arduino/Raspberry Pi, Sensors

| SN | Module | Title | Hrs |
|---|---|---|---|
| I | Mini Project | Create a Problem statement based on Survey identifying the Hardware and software requirement for their mini project problem statement. | 4 |
| II | Mini Project | Study of IoT architecture with respect to your mini project.<br>Identify and design the required hardware and sensors for your circuit board configuration.<br>Use suitable software and an emulator for coding the input devices and sensors. | 4 |
| III | Mini Project | Create a Web/ Mobile Application with features required for the mini project | 4 |
| IV | Mini Project | Interface hardware with Web to publish or remotely access the data on the Internet. | 4 |
| V | Mini Project | Analyze the readings obtained in the project and identify its future scope | 2 |
| VI | Presentation | Documentation (PPT + Report) of mini-project and technical paper writing. | 2 |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   a. Question paper will consist of 5 questions, each carrying 20 marks.
   b. Total 3 questions need to be solved.
   c. Q.1 will be compulsory, based on the entire syllabus.
   d. Remaining questions will be randomly selected from all the modules.
   e. Weightage of marks should be proportional to the number of hours assigned to each module.

**7. Practical Assessments:**

**1. Termwork Assessment:** Term Work shall consist of Mini Projects based on the above syllabus. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Mini Project) + 5 Marks (Assignments) + 5 Marks (Attendance).
**2. Oral/Viva Assessment:** An oral exam will be held based on the Mini Project.

8.**Textbooks and reference:**

**A. Text Books:**

1. Hassan, Q. F, "Internet of things A to Z: technologies and applications",Wiley; IEEE Press, 2018
2. Internet of Things connecting objects to the web, by Hakima Chaouchi, Wiley.
3. Internet of Things ( A Hands-on-Approach) by Arshdeep Bhaga and Vijay Madisetti.

**B. References:**

1. The Internet of Things (MIT Press) by Samuel Greengard.
2. The Internet of Things (Connecting objects to the web) by Hakima Chaouchi (Wiley Publications).
3. RFID and the Internet of Things, by Herve chabanne, Wiley

Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Big Data Analytics | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Big Data Analytics | 40 | 40 | 40 | 60 | - | - | - | 100 |

1. **Prerequisite: : Database Management System.**

2. **Course Objectives:** The course is aimed to:

1. To provide an overview of an exciting growing field of Big Data analytics.
2. To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
3. To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce to the students several types of big data like social media, web graphs and data streams.
6. To enable students to have skills that will help them to solve complex real-world problems in decision support.

**3. Course Outcomes:** On successful completion of course learner/student will be able to

1. Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
2. Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.
3. Implement several Data Intensive tasks using the Map Reduce Paradigm
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data
5. Design algorithms to analyze Big data like streams, Web Graphs and Social Media data.
6. Design and implement successful Recommendation engines for enterprises.

**4 .DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Data Mining, database Systems, Algorithms | 0 | |
| I | Introduction to Big Data | Data Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Big Data Challenges, Examples of Big Data in Real Life, Big Data Applications | 03 | CO1 |
| II | Introduction to Big Data Frameworks: Hadoop, NOSQL | What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop What is NoSQL? NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, MongoDB | 08 | CO2 |
| III | MapReduce Paradigm | MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector | 07 | CO3 |

| | | | | |
|---|---|---|---|---|
| | | Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step . Illustrating use of MapReduce with use of real life databases and applications. | | |
| IV | Mining Big Data Streams | The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter<br>Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-IndykMotwani Algorithm, Query | 06 | CO5 |
| V | Big Data Mining Algorithms | Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbour. | 07 | CO4 |
| VI | Big Data Analytics Applications | Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm. Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. | 08 | CO4<br>CO6 |

**5. DETAILED PRACTICAL SYLLABUS:**

**Lab Prerequisite:** Java, Python
**Software Requirements:** Virtual Machine, Hadoop Framework, NOSQL and MongoDb Compilers
**Hardware Requirements:** PC i3 or above, 8 GB RAM
**Suggested List of Experiments :**

1. Assignment on Study of Hadoop ecosystem
2. Programming exercises on Hadoop Using Hive, Pig, Hbase Sqoop NOSQL, MongoDB
3. Implementing simple algorithms in MapReduce Matrix multiplication, Aggregates, joins, sorting, searching etc.
4. Implementing Algorithms using MapReduce (Any 2)
5. Implementing Frequent Itemset Mining
6. Implementing Clustering algorithms Implementing Classification Algorithms
7. Big Data Applications (Any 2)
    a. Implementing Analytics on data streams
    b. Implementing Social Network Analysis Algorithms
    c. Implementing Web Graph Algorithms Implementing recommendation Engines
8. Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web) a) Twitter data analysis b) Fraud Detection c) Text Mining d) Recommendation Engines (list of datasets also given in the textbook)

**6. Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
    - Question paper will consist of 5 questions, each carrying 20 marks.
    - Total 3 questions need to be solved.
    - Q.1 will be compulsory, based on the entire syllabus.
    - Remaining questions will be randomly selected from all the modules.
    - Weightage of marks should be proportional to the number of hours assigned to each module.

**7. Practical Assessments:**

1. **Termwork Assessment:** Term Work shall consist of at least 10 to 12 practical's based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

**8. Books and References:**

**A. Text Books:**


**1.** Radha Shankarmani, M Vijayalakshmi, "Big Data Analytics", Wiley Publications,
2. Anand Rajaraman and Jeff Ullman "Mining of Massive Datasets", Cambridge University Press.
3. Alex Holmes "Hadoop in Practice", Manning Press, Dreamtech Press.
4. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
5. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf, O'Reilly Publications


**B. References:**


1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Publications


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X2T | Robotics Process Automation | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X2T | Robotics Process Automation | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives**: The course is aimed to:

1. Learn the basics of Robots.
2. Learn the concepts of Direct and Inverse Kinematics of Robotics.
3. Learn the concepts of Motions, velocities and dynamic analysis of force.
4. Learn the concepts of Trajectory planning.
5. Learn the concepts of Motion Planning
6. To learn robot programming languages and acquire skills to program robots.

**2. Course Outcomes**: On successful completion of course learner/student will be able to:

1. Apply the basic concepts of Robots.
2. Apply and evaluate the concepts of Direct and Inverse Kinematics of Robotics.
3. Apply and evaluate the Motions, velocities and dynamic analysis of force.
4. Apply and evaluate Trajectory Planning for rigid robots and mobile robots.
5. Design task plan and motion for a robot.
6. Apply Robotics to solve day to day problems using vision algorithms.

**3. Detailed Theory Syllabus:**

| Module No | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | Introduction | Robot Classification, Robot Components, Degrees of freedom, Joints, Coordinates, Coordinate frames, workspace, applications, Soft and Hard automation | 3 |
| 2 | Direct and Inverse Kinematics: | Co-ordinate frames, Rotations, Link Coordination Arm Equation, (Two axis , Three axis, Four-axis robot SCARA, Five-axis only Rhino XR-3 Robot).General properties of solutions Tool configuration Two axis, Three axis planar articulated, Four axis SCARA, Five axis robots only Rhino | 8 |

| | | | |
|---|---|---|---|
| | | XR-3 Robot. | |
| 3 | Workspace analysis and trajectory planning | Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories.s,Workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion,Straight-line motion. | 6 |
| 4 | Robot Vision | Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration). | 7 |
| 5 | Machine Intelligence | Machine Intelligence: Object Detection using Adaboost, Object Recognition using Moments, Template Matching using correlation principle & Principal Component Analysis ( PCA), Object Tracking using Discrete Wavelet Transform, Segmentation, Region Labeling, Shrink and Swell operators, Perspective Transformation, Stereo Vision, Depth Measurement with Vision Systems, Real Time Video Processing | 7 |
| 6 | Robotics Convergence Technology | Telematric camera Robotic System, NonImaging Sensors, Artificial intelligence for robotics, Knowledge representation, planning, and task scheduling. Sound and touch sensing, People sensing, Autonomous mobile robot,humanoid robots and simulated humans,human-robot interaction. | 6 |

**4. Suggested Experiments:**

1. Forward Kinematics of Cylindrical Robot Coordinates
2. Forward Kinematics of 3 DOF Robot using D-H algorithm
3. Inverse Kinematics of 2 DOF Robots.
4. Inverse Kinematics of 3 DOF Robot
5. Inverse Kinematics of 3 DOF Robot Arm
6. Trajectory using Third Order Polynomial.
7. Edge detection algorithm
8. Shrink and swell Operator

**5. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and a half hours.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Term Work Assessment:** The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practical's based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

A. **Books:**


1. Saeed Benjamin Niku, "Introduction to Robotics – Analysis, Control, Applications", Wiley India Pvt. Ltd., Second Edition, 2011
2. Robert Shilling, "Fundamentals of Robotics-Analysis and control", PHI.
3. J.J, Craig, Introduction to Robotics, Pearson Education
4. Curtis D. Johnson, Process Control Instrumentation Technology, PHI Publication, Eighth Edition
5. An Embedded Software Primer – David E. Simon – Pearson Education
6. Embedded Microcomputer Systems -Jonathan W. Valvano - Thomson


B. **References:**


1. Mark W. Spong & M. Vidyasagar, "Robot Dynamics & Control", Wiley India Pvt. Ltd., Second Edition, 2004
2. Staughard, "Robotics and AI", PHI.
3. Grover, Wiess, Nagel, Oderey, "Industrial Robotics", McGraw Hill
4. Walfram Stdder, "Robotics and Mechatronics", TMH.
5. Niku, "Introduction to Robotics", Pearson Education
6. Klafter, Chmielewski, Negin, "Robot Engineering", PHI
7. Mittal, Nagrath, "Robotics and Control", TMH


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X3T | Cyber Security | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X3T | Cyber Security | 40 | 40 | 40 | 60 | - | - | - | 100 |

**1. Course Objectives:** The course is aimed to:

1. Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization.
2. Practice with an expertise in academics to design and implement security solutions.
3. Understand key terms and concepts in Cryptography, Governance and Compliance
4. Develop cyber security strategies and policies
5. Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

**2. Course Outcomes:** On successful completion of course learner/student will be able to:

1. Analyze and evaluate the cyber security needs of an organization.
2. Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
5. Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators
6. Design and develop a security architecture for an organization.
7. Design operational and strategic cyber security strategies and policies.

**3. DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| I | Introduction | Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace. | 5 | CO1 |
| II | Cyber Security Vulnerabilities | Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, | 7 | CO2 |

| | | | | |
|---|---|---|---|---|
| | | Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management. | | |
| III | Securing Web, Services | Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges. | 5 | CO2 and CO3 |
| IV | Intrusion Detection and Prevention | Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation. | 6 | CO4 |
| V | Cryptography and Network Security | Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, Security Protocols: - security at the Application Layer- PGP, Security at Transport Layer- SSL, Security at Network Layer-IPSec. | 7 | CO5 |
| VI | Cyberspace and Laws | Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time | 9 | CO6, CO1 |

**4. List of Suggested Experiments: Lab Prerequisite:** Rootkits

| Sr. No. | Module Name | Detailed Lab Description | Hours |
|---|---|---|---|
| I | Introduction | Study of steps to protect your personal computer system by creating User Accounts with Passwords and types of User Accounts for safety and security. | 02 |
| II | Cyber Security Vulnerabilities | Study the steps to protect a Microsoft Word Document of different versions with different operating systems. | 4 |
| III | Securing Web Services | Case study Securing Web: firewall, penetration testing, Antivirus, staff training etc | 04 |
| IV | Intrusion Detection and Prevention | Case study: study tools apply the steps to remove Passwords from Microsoft Word .<br>Study “How to make strong passwords” and “passwords cracking techniques”<br>Study the steps to hack a strong password. | 06 |
| V | Cryptography and Network Security | Study various methods of protecting and securing databases.<br>Manipulate the database using SQLMap. | 02 |
| VI | Cyberspace and the Law | Group discussion : | 04 |

**5. Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   a. Question paper will consist of 5 questions, each carrying 20 marks.

b. Total 3 questions need to be solved.
c. Q.1 will be compulsory, based on the entire syllabus.
d. Remaining questions will be randomly selected from all the modules.
e. Weightage of marks should be proportional to the number of hours assigned to each module.

**6. Practical Assessments:**

**1. Termwork Assessment:** Term Work shall consist of Mini Projects based on the above syllabus. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Mini Project) + 5 Marks (Assignments) + 5 Marks (Attendance).

**2. Oral/Viva Assessment:** An oral exam will be held based on the Mini Project.

**7. Textbooks and references**

**A. Text Books:**


1. Wu, Chwan-Hwa John, and J. David Irwin. *Introduction to computer networks and cybersecurity*. CRC Press, 2016.
2. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.
3. Erickson, Jon. *Hacking: the art of exploitation*. No starch press, 2008.
4. Brooks, Charles J., et al. *Cybersecurity essentials*. John Wiley & Sons, 2018.


**B. References:**


1. Andreasson, Kim J. *Cybersecurity: public sector threats and responses*. Taylor & Francis, 2011
2. Sumeet Dua and Xian Du , Data Mining and Machine Learning in Cybersecurity, Auerbach Publications, 2011


Back to Scheme

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X3T | Ethical Hacking | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X3T | Ethical Hacking | 40 | 40 | 40 | 60 | - | - | - | 100 |

1. **Prerequisite:** Fundamentals for communication, Static and Dynamic website development, Basics of various operating systems.

2. **Course Objectives:** The course is aimed to:
   1. Understand how an attacker plans for an attack through data collection.
   2. To evaluate the security and to identify vulnerabilities in systems, networks or system infrastructure.
   3. Perform security scan to test the application and network for vulnerability.
   4. Understand the threats to web application and mitigation techniques.
   5. Simulate the actual hacking attack on the test bed.
   6. Understand the concepts of VPN and IP/MAC address

3. **Course Outcomes:** On successful completion of course learner/student will be able to:
   1. Critically evaluate security techniques used to protect system and user data.
   2. Describe the legal and ethical requirements related to ethical hacking.
   3. Assess an environment using foot-printing.
   4. Plan a vulnerability assessment and penetration test for a network.
   5. Install, configure, use and manage hacking software on a closed network environment.
   6. Examine the tools for conducting ethical hacking and Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system by hiding details.

**4. DETAILED THEORY SYLLABUS:**

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| I | Security essentials | Introduction to Digital cybercrime, Introduction to Ethical hacking, Prevention from Cybercrime, Hackers, Crackers, Phreakers, Introduction to Cyber laws. | 2 | CO1 |
| II | Introduction to Ethical Hacking and Information gathering | Ethical Hacking definition, difference between hacking and ethical hacking. Vulnerability, Attack Vector. Five stages of hacking: Reconnaissance (Survey), Probing, Actual attack, maintaining presence, Covering attack tracks, Introduction to OWASP top 10 attacks. Data and Data sources, Information gathering: from social media accounts, extraction of photographs exif data, phone number, vehicle registration number, dumpster dumping, google street view and google history. Social Engineering techniques, Google Dork query, Browser extension to collect information. Principles of Ethical hacking (Legality & Ethics) | 8 | CO2 |

| | | | | |
|---|---|---|---|---|
| III | Enumeration and System Hacking | Scanning & Enumeration: Port Scanning, Network Scanning, Vulnerability Scanning, NMAP Scanning tool, OS Fingerprinting, Enumeration.<br>System Hacking: Password cracking techniques, Keyloggers, Escalating privileges, URL Hiding Files, Sniffers & SQL Injection: Active and passive sniffing, ARP Poisoning, Session Hijacking, DNS Spoofing, Conduct SQL Injection attack, Countermeasures. Study of open source scanning tools. | 8 | CO3, CO4 |
| IV | Web application security using OWASP | 1. Injection 2. Broken Authentication 3. Sensitive Data Exposure 4. XML External Entities (XXE) 5. Broken Access Control 6. Security misconfiguration 7. Cross-Site Scripting XSS 8. Insecure Deserialization 9. Using Components with Known Vulnerabilities 10 Insufficient Logging & Monitoring.<br>Benefits to developers and organizations. | 7 | CO5 |
| V | Hacking Environment DVWA | Installation and configuration of DVWA environment. Virtual box installation, Installation of Kali Linux within virtual box. Kali Linux penetration testing and ethical hacking tools. What is TOR? How can you use it to protect your anonymity online? Social Engineering: Phases of an attack, Common targets, Common sources of information. Web Servers and applications: Common attacks and flaws, Current tools. | 8 | CO5, CO6 |
| VI | Hiding hacker details | Proxy chain using proxy servers, hiding your IP and obtaining access. What is VPN? How you can stay anonymous with VPN. Mac-changer, use of mac-changer to change your MAC address. Incident Response and Forensic Analysis. | 6 | CO6 |

**5. DETAILED PRACTICAL SYLLABUS:**

- **Ethical Hacking and Cyber Security Lab (Credit-01) :**
- **Software Requirements:** Kali Linux, Oracle VMware, DVWA, NMAP, NESUS,
- **Hardware Requirements:** i5, 16GB RAM, 1 TB HDD

**Suggested List of Experiments :**

1. Use of Google dork query to identify vulnerable websites for SQL injection and other attacks.
2. Social Engineering attacks: Hacking whatsapp, creating fake facebook profile.
3. Extract the exif data from Photograph and other files. Remove the exif data from files.
4. Information gathering from phone number and vehicle registration number.
5. Google Dork Querying to get required information.
6. NMAP Installation and configuration
7. Port scanning and network scanning using NMAP for vulnerability
8. Installation, configuration and study of various browser level keyloggers.
9. OWASP 10 attack and mitigation
10. Develop authorization (Login) application which will whitelist and blacklist the characters to avoid SQLI attack.
11. Installation and configuration of DVWA environment
12. Simulate the SQL, XSS attack in DVWA environment.
13. Virtual box installation with Kali linux OS
14. Creating Proxy chain using proxy servers to hide your identity.
15. Change your MAC address using mac-changer in Kali linux.
16. Setting up VPN

**6. Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

2. **End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**7. Practical Assessments:**

1. **Termwork Assessment:** Term Work shall consist of at least 2 to 3 practical's based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

**8. Books and References:**

**A. Text Books:**


1. Mark Rhodes-Ousley, "Information Security: The Complete Reference", Second Edition, McGraw-Hill, 2013
2. Dafydd Stutarf, Marcus Pinto, "Web Application Hacker's Handbook", Wiley
3. Skoudis E. Perlman R. "Counter hack: A step by step Guide to Computer Attacks and Effective Defense", Prentice Hall Professional technical Reference, 2001.


**B. References:**


1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press
2. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning
3. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning
4. The Hacker Playbook: Practical Guide To Penetration Testing", by Peter Kim, January 1, 2014


**C. MOOC Courses:**

1. "Ethical Hacking" By Indranil Sengupta, IIT Kharagpur, (https://nptel.ac.in/courses/106/105/106105217)
2. https://www.udemy.com/share/101Ws2AEEdeVlaRXUJ/

**D. E- books:**

1. http://www.modir-shabake.com/wp-content/uploads/2016/07/CEH-v9-Certified-Ethical-Hacker-Version-9-Study-Guide-3rd-Edition-Technet24.pdf (Certified Ethical Hacker Study Guide v9, Sean-Philip Oriyano, Sybex; Study Guide Edition,2016)
2. https://ptgmedia.pearsoncmg.com/images/9780789751270/samplepages/0789751275.pdf (Certified Ethical Hacker: Michael Gregg, Pearson Education,1st Edition, 2013)

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| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IT5X3T | Secured Application Design | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Internal Assessment | | | End Sem Exam | Term Work | Practical | Oral | Total |
| | | IA 1 | IA 2 | Average | | | | | |
| IT5X3T | Secured Application Design | 40 | 40 | 40 | 60 | - | - | - | 100 |

1. **Course Objectives:** The course is aimed to:
   1. To explore the vulnerabilities and secure Application concepts.
   2. To study web application security concepts.
   3. To explore the concepts of J2EE security
   4. To study about the concepts of Windows .NET Security.
   5. To explore how to Control the Application Behavior
   6. To study Security management operations.

2. **Course Outcomes:** On successful completion of course learner/student will be able to:
   1. To understand the vulnerabilities and secure Application concepts.
   2. To understand web application security concepts.
   3. To understand the concepts of J2EE security
   4. To understand the concepts of Windows .NET Security and be able to implement the application.
   5. To understand to Control the Application Behavior
   6. To understand about the Security management operations.

3. **Detailed Syllabus:**

**Prerequisite:** Web application Security, Information Security, Cryptography and network security

| Module No | Module | Detailed Content | Hrs | CO Mapping |
|---|---|---|---|---|
| 1 | Introduction | Vulnerabilities, assets, threat, harm, CIA Authentication Methods- Password, Token and Biometric, Access Control Policies and Models. Application Security Architecture, Secure Development Lifecycle, Application Security Practices | 5 | CO1 |
| 2 | Web Application Security | SQL injection, Forms and scripts, Cookies and session management, General attacks, Client Application Security, Remote Administration Security, Security, Vulnerabilities: Causes and Prevention, Whitelisting vs. Blacklisting | 6 | CO2 |
| 3 | J2EE Security | J2EE Architecture, Attacks on the JVM, Authentication and Authorization, Protocols - HTTP, HTTPs, Web Services Protocols, IIOP, JRMP, Proprietary Communication Protocols | 8 | CO3 |

| | | | | |
|---|---|---|---|---|
| 4 | Windows .NET Security | Core Security Features of .NET - Managed Code, Role-Based Security, Code Access Security, AppDomains and Isolated Storage, Application-Level Security in .NET - Using Cryptography, .NET Remoting Security, Securing Web Services and Web Applications | 7 | CO4 |
| 5 | Controlling Application Behavior | Controlling Applications on the Network - Access Control Challenges, Application Visibility, Controlling Application Communications, Restricting Applications Running on Computers - Application Whitelisting Software, Application Security Settings | 7 | CO5 |
| 6 | Security Operations Management | Communication and Reporting, Acceptable Use Enforcement, Administrative Security, Accountability Controls - Security Monitoring and Auditing, Keeping Up with Current Events, Incident Response and Forensic Analysis | 6 | CO6 |

**4. Suggested Experiments:**

1. Implementation of Cross-site scripting
2. Cross-site request forgery
3. Denial of Service Attacks
4. SQL injection using SQLMap
5. Exploring Kali Linux and the inbuilt tools for reconnaissance
6. Exploring Authentication and access control using RADIUS, TACACS and TACACS+
7. Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA
8. Study of different types of vulnerabilities for hacking websites / Web Applications.
9. Analysis of the Security Vulnerabilities of E-commerce services.
10. Analysis the security vulnerabilities of E-Mail Application
11. Study of the features of firewall in providing network security
12. Setting up Firewall Security in windows.
13. Design and develop strong, robust authentication and authorization implementations within the context of .NET
14. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)

**5. Theory Assessment:**

A. **Internal Assessment (IA):** Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

B. **End Semester Theory Examination:** In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

**6. Practical Assessment:** An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. **Term Work:** Term Work shall consist of practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

**7. Books and References:**

**A. Books:**


1. Information Security The Complete Reference 2nd Edition, Mark Rhodes-Ousley, Copyright © 2013 by The McGraw-Hill Companies.
2. Information Security Principles and Practice 2nd edition by Mark Stamp, Wiley Publications
3. Security in Computing FIFTH EDITION Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Prentice Hall Publications


B. **References:**


1. Application Security Architecture Hari Simhadri.
2. Computer Security Principles and Practice Third Edition William Stallings, Lawrie Brown Pearson Publications.
3. Computer Security, Dieter Gollman, Third Edition, Wiley


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| Course Code | Course Name | Teaching Scheme | Contact Hours | | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | TH | Pract | Tut | Total | TH | Pract | Tut | Total |
| IT532L | DLOC Lab - II | | - | 2 | - | 1 | - | 2 | - | 1 |
| | | Examination Scheme | Internal Assessment | | | End Sem Exam | | Term Work | Pract | Oral | Total Marks |
| | | | IA1 | IA2 | Avg | TH | Hrs | | | | |
| | | | - | - | - | - | - | 25 | - | 25 | 50 |

| Module | Detailed Content | Hrs/Week |
|---|---|---|
| I | Two Laboratory Practicals to be conducted for each of the DLOC subjects. | 2 |

**1. Modality and Assessment:**

- Each Laboratory assignment will be done in a group of two students. The Faculty teaching each DLOC subject will be required to propose and evaluate the respective DLOC laboratory assignments. These will be essentially hands-on practical and not theory / research review types of assignments.
- Practical/Oral examination is to be conducted by a pair of internal and external examiners for all the DLOC subjects together.

**2. Term Work:** Term Work shall consist of practicals based on the list given in each DLOC course.

**3. Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance).

**4. Practical / Oral Exam**: 25 Marks. It will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

**Program Structure for**
**Master of Technology in Information Technology**
**Semester III**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Pract | Total |
| CE600LC | Internship / Relevant Certification | - | - | - | 03 | 03 |
| CE601LC | Dissertation-III | - | - | - | 12 | 12 |
| **TOTAL** | | - | - | - | 15 | **15** |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | | | |
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract /Oral | Total |
| | | Test1 | Test 2 | Avg | | | | | |
| CE600LC | Internship / Relevant Certification | - | - | - | - | - | 50 | 50 | 100 |
| CE601LC | Dissertation-III | - | - | - | - | - | 100 | - | 100 |
| **TOTAL** | | - | - | - | - | - | 150 | 50 | 200 |

**Program Structure for**
**Master of Technology in Information Technology**
**Semester IV**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|
| | | Theory | Pract | Theory | Pract | Total |
| CE603LC | Dissertation-IV | - | 30 | - | 15 | 15 |
| | | - | 30 | - | 15 | **15** |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | | | |
| | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract/Oral | Total |
| | | Test 1 | Test 2 | Avg | | | | | |
| CE603LC | Dissertation-IV | - | - | - | - | - | 100 | 100 | 200 |
| **TOTAL** | | - | - | - | - | - | 100 | 100 | 200 |

## GUIDELINES

**Course Name: Department Level Optional Courses for SEM I and II**

- Facilitate students with the same department level electives in UG level with some advances. Ideally 80-85% of UG DLOC and 15-20% of advances in respective subjects .

**Course Name: Internship / Relevant Certification**

- Students must complete internship or relevant certification (list of organization/certification provided by the department) in Semester III.
- It is expected that students will complete internship or relevant certifications inline with the dissertation topic

**Course Name: Course Lab**

- Student has to perform course lab I based on DLOC I ,II and III and course lab II based on DLOC IV, V and VI
- Student has to complete lab experiments/lab work/case studies specified respect to the course

**Course Name: Dissertation-I**

- Students have to select project topics from the repository created by the faculty of the department. The same faculty will be continued as mentors/guide for dissertation I, II, III and IV
- Students should do a literature survey in the identified topic and finalize it with consultation of the Guide/Supervisor.
- Students should use multiple literatures (at least 20 papers from Refereed Journals/conferences) and understand the topic and research gap.
- Compile the report in standard format and present Seminar in front of the Panel of Examiners.
- Note: At least 4-5 hours of course on Research Methodology should be conducted which includes literature survey, identification of problems, analysis and interpretation of results and technical paper writing in the beginning of I semester.

**Course Name: Dissertation-II**

- Students have to perform complete system analysis, Design and develop a theoretical/mathematical background for the system proposed.
- Students should attempt to solve the problem by analytical/simulation/experimental methods. The solution to be validated with proper justification and compile the report in standard format.and Present Seminar in front of Panel of Examiners

**Course Name: Dissertation-III**

- Students have to create/implement and deploy the project. Critical analysis has to be carried out with conclusion
- The solution to be validated with proper justification and compile the report in standard format and present Seminar in front of Panel of Examiners

**Course Name: Dissertation-IV**

- Publish the developed work in terms of Research Paper / Patent / Copyright

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