AC No.-4.31

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE, VASHI. NAVI MUMBAI
(EMPOWERED AUTONOMOUS COLLEGE)

Sector-15- A, Vashi, Navi Mumbai - 400 703

Program: M.Sc. Information Technology Syllabus for M.Sc.

Information Technology–Part II

NEP 2024-2025

Rayat Shikshan Sanstha‟s

Karmaveer Bhaurao Patil College Vashi, Navi Mumbai

Empowered Autonomous College

[University of Mumbai]

Syllabus

Sr. No.	Heading	Particulars
1	Title of Course	M.Sc. Information Technology
2	Eligibility for Admission	Degree with 12th Math
3	Passing Marks	40%
4	Ordinances/Regulations (if any)	
5	No. of Years/Semesters	04 Semester /One Semester
6	Level	P.G.
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic year	2024-2025

Preamble of the Syllabus:

The subject of Information Technology is one of the important application tools which can be applied to different areas in teaching, training and learning which is considered to be important in terms of human resource development, Information Processing and Decision Making which enhances the development of a Nation.

Information Technology as an application science is studied to be applied for other areas, right from Mathematics to other basic sciences, applied sciences, social sciences and each and every aspect of human life.

The main aim of the course is to focus on the technological tools and concepts available and how they can be applied to the developmental processes

The various concepts include Embedded System, Information Security Management, Virtualization, Ethical Hacking, Artificial Intelligence, IT Infrastructure Management, Computer Forensics, Cloud Management, Project and so on..

Information Technology Experts are very much required right from academic institutions, Research and Development to Industries both Public and Private Sectors. The two year programme of M.Sc. (Information Technology) is prescribed according to the credit system of University of Mumbai from the academic year 2020-21. The course has been divided into four semesters. The programme has a total 16 theory papers, and four in each semester.

The programme is designed to provide students a focused elaborate training in Information Technology concepts and tools as well as exposing them to the advanced fields. In addition to theoretical knowledge, significant emphasis has been given to provide hands-on experience to the students in the frontier areas of Information Technology. A multidisciplinary approach has been employed to provide best leverage to students to enable.

Syllabus for M.Sc. Part-2 Information Technology

Objectives of the Course:

A few years after graduation, students with a M.Sc in Information Technology will be able to::

- Prepare highly qualified specialists for the IT industry in the field of information technology.
- Develop interpersonal skills, teamwork skills, leadership skills, and project management skills.
- Learn how to operate a professional IT practice
- Study a broad context of advanced contemporary IT issues

Course Outcome:

By the end of the course, a student should develop the ability:

Upon graduation, students with a M.Sc in Information Technology will be able to:

- Students will develop the ability to use IT skills in decision making, by analyzing problems, developing solutions and explaining findings.
- Students can recognize ethical and professional responsibilities in IT.
- Students can design an IT solution using best practices and standard methodologies in the field.
- Students can easily implement, and test an IT solution, and evaluate its effectiveness.
- Studentsș can use and apply current technical concepts and practices in the core information technologies of networking, data management, software engineering, computer security.
- Student can demonstrate a deep understanding of the IT methodologies and frameworks used to solve complex computing problems related to at least one IT Body-of-Knowledge
- Students will build the ability to identify and analyze user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems.
- Students can effectively integrate IT-based solutions into the user environment.
- Students will develop and implement optimal solutions to complex computing problems using industry-recognized best practices and standards.
- Students can apply ethical decision making in the development, implementation, and management of IT systems.

Scheme of examination for Each Semester:

Continuous Internal Evaluation: 40 Marks (40 Marks for- Assignment, Projects, Open book test, Presentation, Seminar/Workshop, Research Paper Writing, NPTEL/ Swayam Online Courses, Teaching Assistance, Social Responsibility Activity etc.)

Semester End Examination: 60 Marks will be as follows -

I	**Theory:** The Semester End Examination for theory course work will be conducted as per the following scheme.	
	Each theory paper shall be of two and half hour duration.	
	All questions are compulsory and will have internal options.	
	Q – I	From Unit – I (having internal options.) 15 M
	Q – II	From Unit – II (having internal options.) 15 M
	Q – III	From Unit – III (having internal options.) 15 M
	Q – IV	From Unit – IV (having internal options.) 15 M
II.	**Practical**	The Semester End Examination for practical coursework will be conducted as per the following scheme.

Sr. No.	**Particulars of Semester End Practical Examination**	**Marks%**
1	Laboratory Work	40
2	Journal	05
3	Viva	05
	TOTAL	**50**

Semester – III		
Course Code	**Course Title**	**Credits**
IT501	Machine Learning(4+2)	6
IT502	Industrial I oT (4+2)	6
IT503	React JS (2)	2
Elective		
IT504A IT504B	Virtual Reality and Augmented Reality(2+2) OR Robotic Process Automation(2+2)	4
IT505	Research Projects	4
	Total Credits	**22**

Semester – IV		
Course Code	**Course Title**	**Credits**
IT551	Deep Learning(4+2)	6
IT552	Natural Language Processing(4+2)	6
Elective		
IT553A IT553B	Human Computer Interaction(2+2) OR Blockchain(2+2)	4
IT554	Research Projects	6
	Total Credits	**22**

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE, VASHI.

NAVI MUMBAI (Autonomous)

Department of Information Technology

M. Sc. Information Technology

Program Outcomes (POs)

Learners are able to–

PO-1	**Disciplinary Knowledge and Skills**	Acquire the comprehensive and in-depth knowledge of various subjects in sciences such as Physics, Chemistry, Mathematics, Microbiology, Bio-analytical Science, Computer Science, Data Science, Information Technology and disciplinary skills and ability to apply these skills in the field of science, technology and its allied branches
PO-2	**Communication and Presentation Skills**	Develop various communication skills including presentation to express ideas evident y to achieve common goals of the organization.
PO-3	**Creativity and Critical Judgment**	Facilitate solutions to current issues based on investigations, evaluation and justification using evidence based approach.
PO-4	**Analytical Reasoning and Problem Solving**	Build critical and analytical attitude in handling the problems and situations.
PO-5	**Sense of Inquiry**	Curiously raise relevant questions based on highly developed ideas, scientific theories and its applications including research.
PO-6	**Use of Digital Technologies**	Use various digital technologies to explore information/data for business, scientific research and related purposes.
PO-7	**Research Skills**	Construct, collect, investigate, evaluate and interpret information/data relevant to science and technology to adapt, evolve and shape the future.
PO-8	**Application of Knowledge**	Develop a scientific outlook to create consciousness against the social myths and blind faith. VIR
PO-9	**Moral and Ethical Reasoning**	Imbibe ethical, moral and social values to develop virtues such as justice, generosity and charity as beneficial to individuals and society at large.
PO-10	**Leadership and Teamwork**	Work cooperatively and lead proactively to achieve the goals of the organization by implementing the plans and projects in various field-based situations related to science, technology and society at large.
PO-11	**Environment and Sustainability**	Create social awareness about the environment and develop sustainability for betterment of the future.

PO-12	**Lifelong Learning**	Realize that pursuit of knowledge is a lifelong activity and in combination with determined efforts, positive attitude and other qualities to lead a successful life.

Department of Information Technology
Program Specific Outcomes(PSO)

PSO-1	Prepare highly qualified specialists for the IT industry in the field of information technology.
PSO-2	Develop interpersonal skills, teamwork skills, leadership skills, and project management skills.
PSO-3	Learn how to operate a professional IT practice.
PSO-4	Study a broad context of advanced contemporary IT issues.

SEMESTER III

M.Sc Information Technology Course Code: IT501 Course Name: Machine Learning		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
04	**04**	**TH-60 Marks** **INT-40 Marks**

IT Machine Learning

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Understand the concept of machine learning and its applications in various domains.
CO2: Identify scenarios where geometric models, such as SVM and k-NN, are suitable for solving machinelearning problems.
CO3: Analyze real-world datasets and identify relevant features for solving specific machine learning problems.
CO4: Define binary classification and explain methods for assessing classification performance, such as accuracy, precision, and recall.
CO5: Understand rule-based models and their applications in subgroup discovery and association rule mining.

ICT Tools Used: Videos, PPT, Pen-Tablet, Python, R, Jupyter Notebooks, PyCharm, Visual Studio Code,

TensorFlow, PyTorch, scikit-learn, NumPy, pandas, Matplotlib

Students Centric Methods: Problem Solving and Participative
(Experimental,Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1. https://www.udemy.com/course/data_science_a_to_z/?couponCode=ST15MT31224
2. https://www.udemy.com/course/machinelearning/?couponCode=ST15MT31224
3. https://onlinecourses.swayam2.ac.in/aic20_sp27/preview

The CO-PO Mapping Matrix

CO\PO	P O1	P O2	PO3	P O4	PO5	P O6	P O7	PO8	PO9	PO 10	PO 11	PO12
CO1	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	2	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	1	-	-	-	-	-	3	-
CO5	-	1	-	-	-	-	-	-	-	-	-	-

Unit	Details	Lectures

I	**Introduction:** Machine learning, Examples of Machine Learning Problems, Structure of Learning, learning versus Designing, Trainingversus Testing, Characteristics of Machine learning tasks, Predictiveand descriptive tasks, Machine learning Models: Geometric Models,Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.	**12**
II	**Classification and Regression: Classification:** Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification. **Regression**: Assessing performance of Regression- Error measures,Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.	**12**
III	**Logic Based and Algebraic Model: Distance Based Models:** Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering,**Rule Based Models:** Rule learning for subgroup discovery, Association rule mining. **Tree Based Models:** Decision Trees, Rankingand Probability estimation Trees, Regression trees, Clustering Trees.	**12**
IV	**Linear Models:** Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity. **Trends In Machine Learning :** Model and Symbols- Bagging andBoosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.	**12**

Books and References:

1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data,I1Peter Flach,CambridgeUniversity Press,2nd Edition,2012
2. Introduction to Statistical Machine Learning with Applications in R,I1Hastie, Tibshirani,Friedman,Springer,2nd Edition,2012
3. Introduction to Machine Learning,I1Ethem Alpaydin,PHI,2nd Edition,2013

M.Sc Information Technology Course Code: IT501 Course Name: Machine Learning Practical		
Practical per week(1 periods is 60minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-50 Marks**
List of Practical's		
1. Write a python program for Feature Engineering.		
2. Demonstrate the Linear regression by using python programming.		
3. Program on Comparison between linear, Polynomial, Lasso and Ridge.		
4. Demonstrate the Support vector machine(SVM) by using python program.		
5. Demonstrate on K-mean Algorithm.		
6. Demonstrate H-Clustering.		
7. Write a program on Apriori Algorithm.		
8. Demonstrate the probabilistic Model- Naïve Bayes.		
9. Demonstrate on Random Forest Algorithm- Bagging.		
10. Demonstrate on Reinforcement Learning.		

M.Sc Information Technology
Course Code: IT502
Course Name: Industrial I oT

Periods per week(1 periods is 60 minutes)	No. of Credits	Evaluation System
04	04	TH-60 Marks INT-40 Marks

IT502 Industrial IoT

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Gain a comprehensive understanding of advanced technologies such as Artificial Intelligence 2.0, IoT, and Blockchain, including their principles, applications, and integration possibilities.
CO2: Master the utilization of Microsoft Cognitive APIs for building smarter applications, including imagerecognition, natural language processing.
CO3: demonstrate competence in implementing Blockchain as a service for ensuring data security, integrity, and trustworthiness in IoT applications.
CO4: Develop proficiency in building custom IoT platforms using Azure services, microservices architecture,message brokers.
CO5: Competence in Implementing Blockchain for Data Security.

ICT Tools Used: Videos, PPT, Pen-Tablet, Microsoft Azure IoT Suite,AWS IoT Core,Google Cloud IoT,
Raspberry Pi,Arduino.

Students Centric Methods: Problem Solving and Participative (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:
https://onlinecourses.swayam2.ac.in/aic20_sp01/preview https://nptel.ac.in/courses/108108123
https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/?couponCode=IND21PM

The CO-PO Mapping Matrix

CO\PO	P O1	P O2	PO3	P O4	PO5	P O6	P O7	P O8	PO 9	PO 10	PO 11	PO12
CO1	-	-	1	-	-	2	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-

Unit	Details	Lectures

I	The Artificial Intelligence 2.0, IoT and Azure IoT Suite, Creating Smart IoT Application Cognitive APIs, Consuming Microsoft Cognitive APIs, Building Smarter Application using Cognitive APIs.	**12**
II	Implementing Blockchain as a service, Capturing, Analysing and Visualizing real-time data, Making prediction with machine learning.	**12**
III	IoT and Microservices, Service Fabric, Build your own IoT platform: Introduction, Building blocks for IoT solution, Essentials for building your own platform, Platform requirements, building the platform by initializing cloud instance, installing basic software stacks, securing instance and software, installing node.js and Node-RED, Message broker.	**12**
IV	Building Critical components, configuring message broker, creating REST interface, Rule engine and authentication, documentation and testing, Introspection on what we build and deliverables.	**12**

Books and References:

1. IoT, AI, and Blockchain for .NET- Building a Next-Generation Application from the Ground Up,Nishith Pathak AnuragBhandari,Apress,2018
2. Microservices, IoT and Azure,Bob Familiar,Apress,2015
3. Build your own IoT Platform,Anand Tamboli,Apress,2019
4. Internet of Things Architectures, Protocols andStandards ,Simone Cirani Gianluigi Ferrari Marco Picone LucaVeltri,Wiley,2019

M.Sc Information Technology
CourseCode: IT502
Course Name: Industrial IoT
Practical

Practical per week(1 periods is 60minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-50 Marks**

List of Practical's

1. Loading Raspbian and Windows IoT Core on Raspberry Pi and executing applications on it using Python and node.js.
2. Create a home automation system and control the devices remotely.
3. Create the programs using the Microsoft Cognitive APIs for IoT.
4. Create blockchain on Raspberry Pi and implement and test it. Authenticate IoT with blockchain.
5. Implement Microservices on IoT device.
6. Build your own IoT platform.
7. Use IoT device with AWS.
8. Send telemetry from a device to an IoT hub and read it with a service application.
9. Use the Azure CLI and Azure portal to configure IoT Hub message routing.
10. Face Detection using IoT device. (Pi Camera or anything else).

M.Sc Information Technology CourseCode: IT503 Course Name: React JS Practical		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-50 Marks**

React JS Practical

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Be familiar with client-side Javascript application development and the React library.

CO2: Implement single page applications in React.

CO3: Use various React features including components and forms.

CO4: Implement a functional front-end web application using React.

CO5: Use Reactstrap for designing responsive React applications.

CO6: Use Redux to design the architecture for a React-Redux application..

ICT Tools Used: Visual Studio code

Students Centric Methods: Problem Solving and Participative (Experimental, Participative, Problem Solving)

The CO-PO Mapping Matrix

CO\PO	P O1	P O2	PO3	P O4	PO5	P O6	P O7	P O8	PO 9	PO 10	PO 11	PO12
CO1	-	-	1	-	-	2	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-

Practical List	
1	**Setting Up Your Development Environment:**
a.	Install Node.js and npm/yarn

b.	Create a new React application using Create React App
2	**Basic Concepts:**
a.	Create and render components
b.	Use JSX (JavaScript XML)
c.	Component props and state management
3	**Handling Events and Forms:**
a.	Event handling in React
b.	Controlled vs uncontrolled components
c.	Form validation and submission
4	**Component Lifecycle:**
a.	Lifecycle methods (e.g., componentDidMount, componentDidUpdate)
b.	Using useEffect hook for side effects
5	**State Management:**
a.	useState hook for local component state
b.	Context API for application-level state management
6	**Routing and Navigation:**
a.	React Router for declarative routing
b.	Nested routes and route parameters
7	**API Integration:**
a.	Fetching data from RESTful APIs
b.	Using axios or fetch API
c.	Handling asynchronous operations with async/await
8	**Styling:**
a.	CSS Modules or Styled Components for scoped CSS
b.	Integration with CSS frameworks like Bootstrap or Material UI
9	**Deployment:**
a.	Build for production and optimize assets
b.	Deploy to platforms like GitHub Pages, Netlify, or AWS
10	Real-world Projects:
a.	Build a CRUD application (e.g., todo list, contact manager)
b.	Integration with external APIs (weather forecast, news feed)
c.	Interactive UI components (e.g., sliders, charts)

M.Sc Information Technology **Course Code: IT504A** **Course Name: Virtual Reality and Augmented Reality**		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
02	**02**	**TH-45 Marks** **INT-30 Marks**

Virtual Reality and Augmented Reality

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Apply the concepts of VR and AR in real life.

CO2: Reduce the greatest risk to VR.

CO3: Design the way users interact within the scenes they find themselves in.

CO4: Be exposed to VR, AR and today's resources

ICT Tools Used: Videos, PPT

Students Centric Methods: Problem Solving and Participative (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/
2. https://onlinecourses.swayam2.ac.in/nou23_ge34/preview

The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	-	-	-	-	-	-	2	-	-	-	2
CO-2	-	-	2	-	-	-	-	-	-	-	-	-
CO-3	-	-	-	-	-	-	2	-	-	-	-	-
CO-4	-	-	2	-	-	-	-	-	-	-	-	-

Unit	Details	Lectures
I	Introduction: What Is Virtual Reality, A History of VR, An Overview of Various Realities, Immersion, Presence, and Reality Trade-Offs, The Basics: Design Guidelines, Objective and Subjective Reality, Perceptual Models and Processes, Perceptual Modalities	
II	Perception of Space and Time, Perceptual Stability, Attention, and Action, Perception: Design Guidelines, Adverse Health Effects, Motion Sickness, EyeStrain, Seizures, and Aftereffects, Hardware Challenges, Latency, Measuring Sickness, Reducing Adverse Effects, Adverse Health Effects: Design Guidelines	
III	Content Creation, Concepts of Content Creation, Environmental Design, Affecting Behavior, Transitioning to VR Content Creation, Content Creation: Design Guidelines, Interaction, Human- Centered Interaction, VR Interaction Concepts, Input Devices, Interaction Patterns and Techniques, Interaction: Design Guidelines	

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	The VR Book, Human CenteredDesign for Virtual Reality	Jason Jerald	ACM Books	1st	2016
2.	Creating Augmented and Virtual Realities	Erin Pangilinan, Steve Lukas, Vasanth Mohan	O'Reilly	1st	2019

3.	Virtual reality with VRTK4	Rakesh Baruah	APress	1st	2020

M.Sc Information Technology **Course Code: IT504A** **Course Name: Virtual Reality and Augmented Reality**		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-25 Marks**

List of Practical:	
1.	Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2.	Use the primitive objects and apply various projection types by handling camera.
3.	Download objects from asset store and apply various lighting and shading effects.
4.	Model three dimensional objects using various modelling techniques and apply texturesover them.
5.	Create three dimensional realistic scenes and develop simple virtual reality enabled mobileapplications which have limited interactivity.
6.	Add audio and text special effects to the developed application.
7.	Develop VR enabled applications using motion trackers and sensors incorporating fullhaptic interactivity.
8.	Develop AR enabled applications with interactivity like E learning environment, Virtualwalkthroughs and visualization of historic places.
9.	Develop AR enabled simple applications like human anatomy visualization, DNA/RNAstructure visualization and surgery simulation.
10.	Develop simple MR enabled gaming applications.

M.Sc Information Technology **Course Code: IT504B** **Course Name: Robotic Process Automation**		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
02	**02**	**TH-45 Marks** **INT-30 Marks**

Robotic Process Automation

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Understand the mechanism of business process and can provide the solution in an optimizeway.
CO2: Understand the features use for interacting with database plugins.
CO3: Use the plug-ins and other controls used for process automation.
CO4: Use and handle the different events, debugging and managing the errors.
CO5: Test and deploy the automated process.

ICT Tools Used: Videos, PPT, Pen-Tablet,

Students Centric Methods: Problem Solving and Participative(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

4. https://www.udemy.com/course/data_science_a_to_z/?couponCode=ST15MT31224
5. https://www.udemy.com/course/machinelearning/?couponCode=ST15MT31224
6. https://onlinecourses.swayam2.ac.in/aic20_sp27/preview

The CO-PO Mapping Matrix

CO\PO	P O1	P O2	P O3	P O4	PO5	P O6	P O7	P O8	P O 9	PO 10	PO 11	P O 1 2
CO1	-	-	-	-	-	2	-	-	-	-	-	-
CO2	-	-		-	-	-	-	-	-	-	-	1
CO3	3	-	-	-	-	-	2	-	-	-	-	2
CO4	-	-	-	-	-	-	-	-	-	1	-	-
CO5	-	-	1	-	-	-	-	-	-	-	-	-

Unit	Details	Lectures
I	**Robotic Process Automation:** Scope and techniques of automation, About UiPath **Record and Play:** UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step-by-step examples using the recorder.	12
II	**Sequence, Flowchart, and Control Flow:** Sequencing the workflow, Activities, Control flow, various types of loops, anddecision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Controlflow **Data Manipulation:** Variables and scope, Collections, Arguments – Purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example, CSV/Excel to data table and vice versa (with a step-by-step example)	12

II I	**Handling User Events and Assistant Bots:** What are assistant bots?, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger ,Monitoring image and element triggers, An example of monitoring email, Example of monitoring a copying event and blocking it, Launching an assistant bot on a keyboard event **Exception Handling, Debugging, and Logging:** Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Errorreporting	**12**

Books and References:

1. Learning Robotic Process Automation , Alok Mani Tripathi, Packt, 1st Edition, 2018
2. Robotic ProcessAutomation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation, Srikanth MeriandaCreatespace Independent Publishing, 1st Edition, 2018
3. The Simple Implementation Guide to Robotic Process Automation (Rpa): How to Best Implement Rpa in an Organization, KellyWibbenmeyer, iUniverse, 2nd Edition, 2020

M.Sc Information Technology
CourseCode: IT504B
Course Name: Robotic Process Automation
Practical

Practical per week(1 periods is 60minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-25 Marks**

List of Practical's

1. Show the installation of UiPath Studio.
2. Implement step-by-step example of Recorder.
   a) Emptying the trash folder in Gmail.
   b) Emptying recycle bin
3. Demonstrate the following control flow activities
   a) The delay activity
   b) The do while activity
   c) The for each activity
4. Demonstrate the following file Operations
   a) Read cell
   b) Write cell
   c) Read range
   d) Write range
5. Show the Demonstration of Basic Recording and Desktop recording.
6. Implement Try Catch Block.
7. Implement how to nest a workflow inside a single workflow
8. Implement the steps to publish a workflow in UiPath.
9. Demonstrate writing /editing the published package info into the .json file.
10. Demonstrate deploying of Process.

SEMESTER IV

M.Sc Information Technology
Course Code: IT551
Course Name: Deep Learning

Periods per week(1 periods is 60 minutes)	No. of Credits	Evaluation System
04	04	TH-60 Marks INT-40 Marks

Deep Learning

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Explore advanced deep learning architectures such as convolutional networks and sequence modeling.
CO2: Identify and handle numerical computation challenges such as overflow, underflow, and poor conditioning in machine learning algorithms.
CO3: Understand the role of special matrices and vectors in various machine learning algorithms.
CO4: Define binary classification and explain methods for assessing classification performance, such asaccuracy, precision, and recall.
CO5: Gain a solid understanding of linear algebra concepts including scalars, vectors, matrices, and tensors.

ICT Tools Used: Videos, PPT, Pen-Tablet, TensorFlow Probability or Pyro, MATLAB/Octave.

Students Centric Methods: Problem Solving and Participative(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

7. https://courses.nvidia.com/courses/course-v1:DLI+S-FX-01+V1/
8. https://www.coursera.org/specializations/deep-learning
9. https://www.deeplearning.ai/courses/

The CO-PO Mapping Matrix

CO\PO	P O1	P O2	P O3	P O4	PO5	P O6	P O7	P O8	P O 9	PO 10	PO 11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	1	-	-	-	-	-	-	-
CO5	-	-	1	-	-	3	-	-	-	-	-	2

Unit	Details	Lectures

I	**Applied Math and Machine Learning Basics:** Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors , Identityand Inverse Matrices, Linear Dependence and Span , norms, special matrices and vectors, eigen decompositions. **Numerical Computation:** Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization.	**12**
II	**Deep Networks:** Deep feedforward network , regularization for deep learning , Optimization for Training deep models	**12**
III	Convolutional Networks, Sequence Modelling, Applications	**12**
IV	Deep Learning Research: Linear Factor Models, Autoencoders, representation learning,Approximate Inference, Deep Generative Models	**12**

Books and References:

1. Deep Learning,Ian Goodfellow, Yoshua Bengio, Aaron Courvile,An MIT Press book,1st Edition,2016
2. Fundamentals of Deep Learning,Nikhil Buduma,O'Reilly,1st Edition,2017
3. Deep Learning: Methods and Applications,Deng & Yu,Now Publishers,1st Edition,2013
4. Deep Learning CookBook,Douwe Osinga,O'Reilly,1st Edition,2017

M.Sc Information Technology Course Code: IT551 Course Name: Deep Learning Practical		
Practical per week(1 periods is 60minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-50 Marks**
List of Practical's		
1. Performing matrix multiplication and finding eigen vectors and eigen values using TensorFlow		
2. Solving XOR problem using deep feed forward network.		
3. Implementing deep neural network for performing binary classification task.		
4. Using deep feed forward network with two hidden layers for performing multiclass classification and predicting the class. 5. Using a deep feed forward network with two hidden layers for performing classification and predicting the probability of class. 6. Using a deep feed forward network with two hidden layers for performing linear regression and predicting values.		
7. Evaluating feed forward deep network for regression using KFold cross validation. 8. Evaluating feed forward deep network for multiclass Classification using KFold cross-validation.		
9. Implementing regularization to avoid overfitting in binary classification.		
10. Demonstrate recurrent neural network that learns to perform sequence analysis for stock price.		
11. Performing encoding and decoding of images using deep autoencoder.		
12. Implementation of convolutional neural network to predict numbers from number images		
13. Denoising of images using autoencoder.		

M.Sc Information Technology Course Code: IT552 Course Name: Natural Language Processing		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
04	**04**	**TH-60 Marks** **INT-40 Marks**

Natural Language Processing

Course Outcomes: After successful completion of this course, students will be able to:

CO1: get idea about know-hows, issues and challenge in Natural Language Processing and NLP applications and their relevance in the classical and modern context.

CO2: get understanding of Computational techniques and approaches for solving NLP problems and develop modules for NLP tasks and tools such as Morph Analyzer, POS tagger, Chunker, Parser, WSD tool etc.

CO3: introduced to various grammar formalisms, which they can apply in different fields of study

CO4: take up project work or work in R&D firms working in NLP and its allied areas

ICT Tools Used: Videos, PPT, NLTK

Students Centric Methods: Problem Solving and Participative(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

1. https://www.coursera.org/specializations/natural-language-processing
2. https://onlinecourses.nptel.ac.in/noc23_cs80/preview

The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	-	-	-	-	-	-	-	-	-	-	-
CO-2	2	-	-	2	-	-	-	-	-	-	-	-
CO-3	2	-	-	-	-	-	-	2	-	-	-	-
CO-4	-	-	-	-	-	-	-	-	-	1	-	2

Unit	Details	Lectures
I	Introduction to NLP, brief history, NLP applications: Speech to Text(STT), Text to Speech(TTS), Story Understanding, NL Generation, QA system, Machine Translation, Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers etc., challenges/Open Problems, NLP abstraction levels, Natural Language (NL) Characteristics and NL computing approaches/techniques and steps, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Web 2.0 Applications : Sentiment Analysis; Text Entailment; Cross Lingual Information Retrieval (CLIR).	**12**

II	Character Sets, Language, Corpus and Application Dependence issues, Segmentation: word level(Tokenization), Sentence level. Regular Expression and Automata Morphology, Types, Survey of English and Indian Languages Morphology, Morphological parsing FSA and FST, Porter stemmer, Rule based and Paradigm based Morphology, Human Morphological Processing, Machine Learningapproaches.	**12**
III	Word Classes ad Part-of-Speech tagging(POS), survey of POS tagsets, Rule basedapproaches (ENGTOWL), Stochastic approaches(Probabilistic, N-gram and HMM), TBL morphology, unknown word handling, evaluation metrics: Precision/Recall/F-measure, error analysis.	**12**
IV	NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar Formalisms: constituency and dependency school, Grammar notations CFG, LFG, PCFG, LTAG, Feature- Unification, overview of English CFG, Indian Language Parsing in Paninian Karaka Theory, CFG parsing using Earley's and CYK algorithms,Probabilistic parsing, Dependency Parsing: Covington algorithm, MALT parser, MST parser. Concepts and issues in NL, Theories and approaches for Semantic Analysis, Meaning Representation, word similarity, Lexical Semantics, word senses and relationships, WordNet (English and IndoWordnet), Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, Coreferences Resolution:Anaphora, Cataphora.	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Handbook of Natural Language Processing	Indurkhya, N., & Damerau, F. J.	CRC Press Taylor and Francis Group	2nd	2010
2.	Speech and Language Processing	Martin, J. H., &Jurafsky, D.	Pearson Education India	2nd	2013
3.	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	MIT Press	1st	1997
4.	Natural Language ProcessingWith Python	Steven Bird, Edward Loper	O'Reill yMedia	2nd	2016
5.	Video Links : http://www.nptelvideos.in/2012/11/natural-language-processing.html				

M.Sc Information Technology Course Code: IT552 Course Name: Natural Language Processing		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-50 Marks**

List of Practical:	
1.	a. Install NLTK b. Convert the given text to speech c. Convert audio file Speech to Text.
2.	a. Study of various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fields, raw, words, sents, categories, b. Create and use your own corpora(plaintext, categorical) c. Study Conditional frequency distributions Study of tagged corpora with methods like tagged_sents, tagged_words. d. Write a program to find the most frequent noun tags. e. Map Words to Properties Using Python Dictionaries f. Study DefaultTagger, Regular expression tagger, UnigramTagger g. Find different words from a given plain text without any space by comparing this text with a given corpus of words. Also find the score of words.
3.	a. Study of Wordnet Dictionary with methods as synsets, definitions, examples, antonyms. b. Study lemmas, hyponyms, hypernyms, entailments, c. Write a program using python to find synonym and antonym of word "active" using Wordnet d. Compare two nouns e. Handling stopword. Using nltk Adding or Removing Stop Words in NLTK's Default Stop Word List Using Gensim Addingand Removing Stop Words in Default Gensim Stop Words List Using Spacy Adding and Removing Stop Words in Default Spacy Stop Words List
4.	Text Tokenization a. Tokenization using Python's split() function b. Tokenization using Regular Expressions (RegEx) c. Tokenization using NLTK d. Tokenization using the spaCy library e. Tokenization using Keras f. Tokenization using Gensim
5.	Important NLP Libraries for Indian Languages and perform: a. word tokenization in Hindi b. Generate similar sentences from a given Hindi text input c. Identify the Indian language of a text

6.	Illustrate part of speech tagging. a. Part of speech Tagging and chunking of user defined text. b. Named Entity recognition of user defined text. c. Named Entity recognition with diagram using NLTK corpus – treebank
7.	a. Define grammer using nltk. Analyze a sentence using the same. b. Accept the input string with Regular expression of FA: 101+ c. Accept the input string with Regular expression of FA: (a+b)*bba d. Implementation of Deductive Chart Parsing using context free grammar and a given sentence.
8.	Study PorterStemmer, LancasterStemmer, RegexpStemmer, SnowballStemmer Study WordNetLemmatizer
9.	Implement Naive Bayes classifier
10.	Speech Tagging: a. Speech tagging using spacy b. Speech tagging using nktl Statistical parsing: a. Usage of Give and Gave in the Penn Treebank sample b. probabilistic parser Malt parsing: Parse a sentence and draw a tree using malt parsing.
11.	a. Multiword Expressions in NLP b. Normalized Web Distance and Word Similarity c. Word Sense Disambiguation

M.Sc Information Technology
Course Code: IT553A
Course Name: Human Computer Interaction

Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
02	**02**	**TH-45 Marks** **INT-30 Marks**

Human Computer Interaction

Course Outcomes: After successful completion of this course, students will be able to:

CO1: Analyze and design elements of the WIMP interface, focusing on interactivity and user experience.
CO2: Implement user interface elements within windowing systems, utilizing programming techniques, toolkits, and User Interface Management Systems (UIMS) effectively.
CO3: Collect and analyze data from various sources to conduct task analysis effectively and inform the design of interactive systems.
CO4: Evaluate the effectiveness of communication and collaboration features in interactive systems through expert analysis and user feedback.

ICT Tools Used: Videos, PPT, Pen-Tablet, Adobe XD, Figma, or Sketch for creating interactive prototypes and wireframes.

Students Centric Methods: Problem Solving and Participative(Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:

10. https://www.careers360.com/university/indian-institute-of-technology-guwahati/user-centric-computing- for-human-computer-interaction-certification-course
11. https://nptel.ac.in/courses/106103115
12. https://onlinecourses.nptel.ac.in/noc19_cs86/preview

The CO-PO Mapping Matrix

CO\PO	P O1	P O2	P O3	P O4	PO5	P O6	P O7	P O8	P O 9	PO 10	PO 11	P O 12
CO1	-	2	-	-	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	2
CO3	-	-	1	-	1	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-

Unit	Details	Lectures
I	**The Interaction:** Models of interaction, Design Focus, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity **Interaction design basics:** What is design?, The process of design, User focus, Cultural probes, Navigation design, the big button trap, Modes, Screen design and layout, Alignment and layout matters, Checking screen colors, Iteration and prototyping. **HCI in the software process**: The software life cycle, Usabilityengineering , Iterative design and prototyping, Prototyping in practice, Design rationale	**12**
II	**Implementation support:** Elements of windowing systems, Programming the application, Going with the grain, Using toolkits, User interface management systems **Evaluation techniques:** What is evaluation?, Goals of evaluation,Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. **Dialog notations and design:** What is dialog?, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design	**12**

III	**User support:** Requirements of user support, Approaches to user support, Adaptive help systems, Designing user support systems **Communication and collaboration models:** Face-to- face communication, Conversation, Text-based communication, Group working **Task analysis:** Differences between task analysis and other techniques, Task decomposition, Knowledge- based analysis, Entity–relationship-based techniques, Sources of information and data collection, Uses of task analysis	**12**

Books and Reference:

1. Human Computer Interaction, Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Pearson Education,3rd Edition
2. Designing the User Interface, Shneiderman B., Plaisant C., Cohen, M., Jacobs S.,Pearson,5th Edition

M.Sc Information Technology
Course Code: IT553A
Course Name: Human Computer Interaction Practical

Practical per week(1 periods is 60minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR- 25 Marks**

List of Practical's

11. Design a homepage for music website using figma.
12. Create Wireframe for login using pencil and figma.
13. Demonstrate the prototyping in figma.
14. Design a sitemap page in figma.
15. Write a case study on what's app features.
16. Write a program to generate simple calculator using Gradient button.
17. Write a Program to provide common formatting to Button.
18. Write WAF code to generate Menu.

M.Sc Information Technology
Course Code: IT553B
Course Name: Blockchain

Periods per week(1 periods is 60 minutes)	No. of Credits	Evaluation System
02	02	TH-45 Marks INT-30 Marks

Blockchain

Course Outcomes: After successful completion of this course, students will be able to:
CO1: The students would understand the structure of a blockchain and why/when it is better than a simple distributed database.
CO2: Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities
CO3: Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations

ICT Tools Used: Videos, PPT

Students Centric Methods: Problem Solving and Participative (Experimental, Participative, Problem Solving)

Links: SWAYAM / MOOCS:
https://onlinecourses.swayam2.ac.in/aic21_ge01/preview https://www.coursera.org/specializations/blockchain

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	-	-	-	-	-	-	-
CO2	-	-	1	2	-	-	-	-	-	-	-	2
CO3	-	-	2	-	-	-	-	1	-	-	-	-

Unit	Details	Lectures
I	**Blockchain:** Introduction, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases. **Working of Blockchain:** Blockchain foundation, Cryptography, Game Theory, Computer Science Engineering, Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain **Working of Bitcoin:** Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes and SVPs, Bitcoin wallets.	12

II	browser, Wallets as a Computing Metaphor, The Bank Teller Metaphor, Breaking with Banking History, How Encryption Leads to Trust, System Requirements, Using Parity with Geth, Anonymity in Cryptocurrency, Central Bank Network, Virtual Machines, **Solidity Programming:** Introduction, Global Banking Made Real, Complementary Currency, Programming the EVM, Design Rationale, Importance of Formal Proofs,Automated Proofs, Testing, Formatting Solidity Files, Reading Code, Statements andExpressions in Solidity, Value Types, Global Special Variables, Units, and Functions, **Smart Contracts and Tokens:** EVM as Back End, Assets Backed by Anything, Cryptocurrency Is a Measure of Time, Function of Collectibles in Human Systems, Platforms for High-Value Digital Collectibles, Tokens as Category of Smart Contract, Creating a Token, Deploying the Contract, Playing with Contracts.	**12**
III	**Blockchain Application Development:** Decentralized Applications, Blockchain Application Development, Interacting Programmatically with Ethereum—Sending Transactions, Creating a Smart Contract, **Building an Ethereum DApp:** The DApp, Setting Up a Private Ethereum Network, Creating the Smart Contract, Deploying the Smart Contract, Client Application, **DApp deployment:** Seven Ways to Think About Smart Contracts, Dapp Contract Data Models, EVM back-end and front-end communication, JSON- RPC, Web 3.	**12**

Books and References:

1. Beginner Blockchain A Beginner's Guide to Building Blockchain Solutions, Bikrama ditya Singhal, GautamDhameja, PriyansuSekhar Panda, Apress, 2018
2. Introducing Ethereum and Solidity, Chris Dannen, Apress, 2017
3. The Blockchain Developer, Elad Elrom, Apress, 2019
4. Mastering Ethereum, Andreas M. Antonopoulos Dr. Gavin Wood, O'Reilly, First, 2018
5. Blockchain Enabled Applications, Vikram Dhillon David Metcalf Max Hooper, Apress, 2017

M.Sc Information Technology Course Code: IT553B Course Name: Blockchain Practical		
Practical per week(1 periods is 60minutes)	**No. of Credits**	**Evaluation System**
04	**02**	**PR-25 Marks**
List of Practical's		
1. Write the following programs for Blockchain in Python:		
a. A simple client class that generates the private and public keys by using the built-in Python RSA algorithm and test it.		
b. A transaction class to send and receive money and test it.		
c. Create multiple transactions and display them.		
d. Create a blockchain, a genesis block and execute it.		
e. Create a mining function and test it.		
f. Add blocks to the miner and dump the blockchain.		
2. Install and configure Go Ethereum and the Mist browser. Develop and test a sample application.		
3. Implement and demonstrate the use of the following in Solidity:		
a. Variable, Operators, Loops, Decision Making, Strings, Arrays, Enums, Structs, Mappings, Conversions, Ether Units, Special Variables.		
b. Functions, Function Modifiers, View functions, Pure Functions, Fallback Function, Function Overloading, Mathematical functions, Cryptographic functions.		
4. Implement and demonstrate the use of the following in Solidity:		
a. Withdrawal Pattern, Restricted Access.		
b. Contracts, Inheritance, Constructors, Abstract Contracts, Interfaces.		
c. Libraries, Assembly, Events, Error handling.		
5. Install hyperledger fabric and composer. Deploy and execute the application.		
6. Write a program to demonstrate mining of Ether.		
7. Demonstrate the running of the blockchain node.		
8. Demonstrate the use of Bitcoin Core API.		
9. Create your own blockchain and demonstrate its use.		
10. Build Dapps with angular.		

M.Sc Information Technology Course Code: IT554 Course Name: Research Project		
Periods per week(1 periods is 60 minutes)	**No. of Credits**	**Evaluation System**
06	**06**	**--**