

AC-4/4/2022

Item No-7.7



**Rayat Shikshan Sanstha's
KARMAVEER BHAAURAO PATIL COLLEGE, VASHI. NAVI
MUMBAI
(AUTONOMOUS COLLEGE)**

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

**Program: M.Sc. Information Technology
Syllabus for M.Sc. Information
Technology–Part II
(Choice Based Credit System with effect from the
academic year 2022-2023)**

Rayat Shikshan Sanstha's

**KARMAVEER BHURAO PATIL COLLEGE, VASHI,
NAVI MUMBAI
(AUTONOMOUS COLLEGE)**

Syllabus

Sr.No.	Heading	Particulars
1	Title of the Course	M.Sc Information Technology
2	Eligibility for Admission	Degree with 12 th Mathemtaics
3	Passing marks	40%
4	Ordinances/ Regulations(if any)	
5	No.of Years/Semester	04 Semester/02 Years
6	Level	P.G
7	Pattern	Semester
8	Status	New
9	To be implemented from Academic Year	2022-2023

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 evidently 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.

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.) 12 M
	Q - II	From Unit - II (having internal options.) 12 M
	Q - III	From Unit - III (having internal options.) 12 M
	Q - IV	From Unit - IV (having internal options.) 12 M
	Q - V	From Unit - V (having internal options.) 12 M
II.	Practical	The Semester End Examination for practical course work 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

Credit and Workload Calculation M.Sc Information Technology Program as per CBCS pattern

Sem	Course Type	Course Code	Course Name	Credit	Semester Wise Credit	Workload (TH + PR)	Semester wise Workload (TH + PR)
I	CORE COURSE	PGIT101	Big Data Analytics	6	28	4+4	19+18=37
	CORE COURSE	PGIT102	Data Science	6		4+4	
	CORE COURSE	PGIT103	Cloud Computing	6		4+4	
	Skill Enhancement Course (SEC)	PGIT104	Soft Computing Techniques OR Advanced Python Programming (other department)	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT105A PGIT105B	Ethical Hacking OR Image Processing	6		4+4	
II	CORE COURSE	PGIT201	Research in Computing	6	28	4+4	19+18=37
	CORE COURSE	PGIT202	Microservices Architecture	6		4+4	
	CORE COURSE	PGIT203	Modern Networking	6		4+4	
	Skill Enhancement Course (SEC)	PGIT204	Applied Artificial Intelligence	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT205A PGIT205B	Computer Forensic OR Computer Vision	6		4+4	
III	CORE COURSE	PGIT301	Technical Writing and Entrepreneurship Development	6	28	4+4	15+14=29
	CORE COURSE	PGIT302	Machine Learning	6		4+4	
	Skill Enhancement Course (SEC)	PGIT303	Advanced IoT	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT304 A PGIT304B	Malware Analysis OR Robotic Process Automation	6		4+4	
	Other	PGIT305	Internship	6		---	
IV	CORE COURSE	PGIT401	Blockchain	6	28	4+4	19+18=37
	CORE COURSE	PGIT402	Deep Learning	6		4+4	
	Skill Enhancement Course (SEC)	PGIT403	Natural Language Processing	4		3+2	
	Elective: Discipline Specific (DSE)	PGIT404 A PGIT404B	Human Computer Interaction OR Virtual Reality and Augmented Reality	6		4+4	

	Other	PGIT405	Project	6		4+4	
				112	112	72+68	140

Semester - III		
Course Code	Course Title	Credits
PGIT301	Technical Writing and Entrepreneurship Development	4
PGIT302	Machine Learning	4
PGIT303	Advanced IoT	3
PGIT304A or PGIT304B	Malware Analysis Robotic Process Automation	4
PGIT305	Internship	6
PGIT3P1	Technical Writing and Entrepreneurship Development Practical	2
PGIT3P2	Machine Learning Practical	2
PGIT3P3	Advanced IoT Practical	1
PGIT3P4A or PGIT3P4B	Malware Analysis Practical Robotic Process Automation Practical	2
Total Credits		28

Semester - IV		
Course Code	Course Title	Credits
PGIT401	Blockchain	4
PGIT402	Deep Learning	4
PGIT403	Natural Language Processing	3
PGIT404A or PGIT404B	Human Computer Interaction Or Virtual Reality and Augmented Reality	4
PGIT405	Project	6
PGIT4P1	Blockchain Practical	2
PGIT4P2	Deep Learning Practical	2
PGIT4P3	Natural Language Processing Practical	1
PGIT4P4A Or PGIT4P4B	Human Computer Interaction Practical Virtual Reality and Augmented Reality Practical	2
Total Credits		28

SEMESTER III

M. Sc (Information Technology)		Semester – III	
Course Name : Technical Writing and Entrepreneurship Development		Course Code: PGIT301	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

PGIT301 Technical Writing and Entrepreneurship Development

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

CO1: Develop technical documents that meet the requirements with standard guidelines.

Understanding the essentials and hands-on learning about effective Website Development.

CO2: Write Better Quality Content Which Ranks faster at Search Engines. Build effective Social Media Pages.

CO3: Evaluate the essentials parameters of effective Social Media Pages.

CO4: Understand importance of innovation and entrepreneurship.

CO5: Analyze research and development projects

ICT Tools Used: Videos, PPT

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

Links: SWAYAM / MOOCS:

1. <https://www.udemy.com/course/start-your-career-as-user-assistance-developer/>

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
C01	2	-	-	-	-	-	2	-	-	-	-	-
C02	-	2	2	-	-	-	-	-	-	-	-	1
C03	-	-	-	-	-	-	3	-	-	-	-	-
C04	2	-	-	-	-	-	-	-	-	1	-	-
C05	-	-	-	1	-	-	2	-	-	-	-	-

Unit	Details	Lectures
I	<p>Introduction to Technical Communication: What Is Technical Communication? The Challenges of Producing Technical Communication, Characteristics of a Technical Document, Measures of Excellence in Technical Documents, Skills and Qualities Shared by Successful Workplace Communicators, How Communication Skills and Qualities Affect Your Career? Understanding Ethical and Legal Considerations: A Brief Introduction to Ethics, Your Ethical Obligations, Your Legal Obligations, The Role of Corporate Culture in Ethical and Legal Conduct, Understanding Ethical and Legal Issues Related to Social Media, Communicating Ethically Across Cultures, Principles for Ethical Communication Writing Technical Documents: Planning, Drafting, Revising Editing, Proofreading Writing Collaboratively: Advantages and Disadvantages of Collaboration, Managing Projects, Conducting Meetings, Using Social Media and Other Electronic Tools in Collaboration, Importance of Word Press Website, Gender and Collaboration, Culture and Collaboration.</p>	12
II	<p>Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models. Introduction to Content Writing: Types of Content (Article, Blog, E-Books, Press Release, Newsletters Etc), Exploring Content Publication Channels. Distribution of your content across various channels. Blog Creation: Understand the psychology behind your web traffic, Creating killing landing pages which attract users, Using Landing Page Creators, Setting up Accelerated Mobile Pages, Identifying UI UX Experience of your website or blog. Organizing Your Information: Understanding Three Principles for Organizing Technical Information, Understanding Conventional Organizational Patterns, Emphasizing Important Information: Writing Clear, Informative Titles, Writing Clear, Informative Headings, Writing Clear Informative Lists, Writing Clear Informative Paragraphs.</p>	12

<p style="text-align: center;">III</p>	<p>Creating Graphics: The Functions of Graphics, The Characteristics of an Effective Graphic, Understanding the Process of Creating Graphics, Using Color Effectively, Choosing the Appropriate Kind of Graphic, Creating Effective Graphics for Multicultural Readers.</p> <p>Researching Your Subject: Understanding the Differences Between Academic and Workplace Research, Understanding the Research Process, Conducting Secondary Research, Conducting Primary Research, Research and Documentation: Literature Reviews, Interviewing for Information, Documenting Sources, Copyright, Paraphrasing, Questionnaires. Report Components: Abstracts, Introductions, Tables of Contents, Executive Summaries, Feasibility Reports, Investigative Reports, Laboratory Reports, Test Reports, Trip Reports, Trouble Reports</p>	<p style="text-align: center;">12</p>
<p style="text-align: center;">IV</p>	<p>Writing Proposals: Understanding the Process of Writing Proposals, The Logistics of Proposals, The –Deliverables of Proposals, Persuasion and Proposals, Writing a Proposal, The Structure of the Proposal. Writing Informational Reports: Understanding the Process of Writing Informational Reports, Writing Directives, Writing Field Reports, Writing Progress and Status Reports, Writing Incident Reports, Writing Meeting Minutes. Writing Recommendation Reports: Understanding the Role of Recommendation Reports, Using a Problem-Solving Model for Preparing Recommendation Reports, Writing Recommendation Reports. Reviewing, Evaluating, and Testing Documents and Websites: Understanding Reviewing, Evaluating, and Testing, Reviewing Documents and Websites, Conducting Usability Evaluations, Conducting Usability Tests, Using Internet tools to check writing Quality, Duplicate Content Detector, What is Plagiarism?, How to avoid writing plagiarism content?</p>	<p style="text-align: center;">12</p>
	<p>Innovation management: an introduction: The importance of innovation, Models of innovation, Innovation as a management process.</p> <p>Market adoption and technology diffusion: Time lag between innovation and useable product, Innovation and the market Innovation and market vision ,Analysing internet search data to help adoption and forecasting sales ,Innovative new products and consumption patterns, Crowd sourcing for new product ideas, Frugal innovation and ideas from everywhere, Innovation diffusion theories.</p>	

V	<p>Managing innovation within firms: Organisations and innovation, The dilemma of innovation management, Innovation dilemma in low technology sectors, Dynamic capabilities, Managing uncertainty, Managing innovation projects Operations and process innovation: Operations management, The nature of design and innovation in the context of operations, Process design, Process design and innovation Managing intellectual property: Intellectual property, Trade secrets, An introduction to patents, Trademarks, Brand names, Copyright Management of research and development: What is research and development?, R&D management and the industrial context, R&D investment and company success, Classifying R&D, R&D management and its link with business strategy, Strategic pressures on R&D, Which business to support and how?, Allocation of funds to R&D, Level of R&D expenditure Managing R&D projects: Successful technology management, The changing nature of R&D management, The acquisition of external technology, Effective R&D management, The link with the product innovation process, Evaluating R&D projects</p>	12
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Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Technical Communication	Mike Markel	Bedford/St . Martin's	11	2014
2.	Innovation Management and New Product Development	Paul Trott	Pearson	06	2017
3.	Handbook of Technical Writing	Gerald J. Alred , Charles T. Brusaw , Walter E. Oliu	Bedford/St . Martin's	09	2008
4.	Technical Writing 101: A Real-World Guide to Planning and Writing Technical Content	Alan S. Pringle and Sarah S. O'Keefe	scriptoriu m	03	2009
5.	Innovation and Entrepreneurship	Peter Drucker	Harper Business	03	2009

M. Sc (Information Technology)		Semester - III	
Course Name : Technical Writing and Entrepreneurship Development Practical		Course Code: PGIT3P1	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGITP1 Technical Writing and Entrepreneurship Development

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

CO1: Craft Technical Documents Adhering to Standard Guidelines, Demonstrating Proficiency in Website Development

CO2: Generate SEO-Optimized Content for Improved Search Engine Ranking and Construct Engaging Social Media Pages

CO3: Evaluate Crucial Parameters for the Effectiveness of Social Media Pages

CO4: Appreciate and Apply Principles of Innovation and Entrepreneurship in Practical Scenarios

ICT Tools Used: Videos, PPT

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

Links: SWAYAM / MOOCS:

1. <https://www.udemy.com/course/start-your-career-as-user-assistance-developer/>

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
CO1	2	1	-	1	-	3	-	1	-	-	-	-
CO2	3	2	-	1	-	1	-	2	-	-	-	-
CO3	1	2	-	3	-	2	-	1	-	-	-	-
CO4	2	-	3	2	-	2	-	2	-	1	-	-

The learners are expected to develop a project beyond the undergraduate level. Normal web sites, web applications, mobile apps are not expected. Preferably, the project should be from the elective chosen by the learner at the post graduate level in semester III. The learner is supposed to prepare the synopsis and documentation. The same project has to be implemented in Semester IV.

M. Sc (Information Technology)		Semester - III	
Course Name : Machine Learning		Course Code: PGIT3P2	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

PGIT302 Machine Learning

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

CO1: Identify and Address Key Challenges in Machine Learning for Intelligent Business and Scientific Computing

CO2: Apply Classification and Regression Techniques Proficiently to Generate Database Knowledge

CO3: Implement Advanced Techniques for Knowledge Extraction Using Diverse Machine Learning Methods

CO4: Explore Big Data Analytics Applications in Various Domains, including Recommender Systems and Social Media Applications

ICT Tools Used: Videos, PPT, Jupiter, IDLE

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

Links: SWAYAM / MOOCS:

1. <https://www.coursera.org/specializations/machine-learning-introduction>
2. https://onlinecourses.nptel.ac.in/noc23_cs87/preview

The CO-PO Mapping Matrix

CO\ P O	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12
CO1	1	-	3	2	-	2	-	1	-	-	-	-
CO2	1	-	-	1	-	-	2	1	-	-	-	-
CO3	2	-	-	2	-	1	-	-	-	-	-	-
CO4	1	-	2	-	-	3	2	-	-	-	-	-

Unit	Details	Lectures
I	Introduction: Machine learning, Examples of Machine Learning Problems, Structure of Learning, learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and 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. Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.	12
0000	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.	12
IV	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, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.	12
V	Probabilistic Model: Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models. Trends In Machine Learning : Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction Data Streams and Active Learning, Deep Learning, Reinforcemen Learning.	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press		2012
2.	Introduction to Statistical Machine Learning with Applications in R	Hastie, Tibshirani, Friedman	Springer	2nd	2012
3.	Introduction to Machine Learning	Ethem Alpaydin	PHI	2nd	2013

M. Sc (Information Technology)		Semester - III	
Course Name: Machine Learning Practical		Course Code: PGIT3P2	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT3P2 Machine Learning

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

CO1: Understand the key issues in Machine Learning and its associated applications in intelligent business and scientific computing.

CO2: Acquire the knowledge about classification and regression techniques where a learner will be able to explore his skill to generate data base knowledge using the prescribed techniques.

CO3: Understand and implement the techniques for extracting the knowledge using machine learning methods.

CO4: Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

CO5: Understand the statistical approach related to machine learning. He will also Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

ICT Tools Used: Videos, PPT, Jupiter, IDLE

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

Links: SWAYAM / MOOCS:

- <https://www.coursera.org/specializations/machine-learning-introduction>
- https://onlinecourses.nptel.ac.in/noc23_cs87/preview

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	2	-	-	-	-
CO3	3	-	-	-	-	-	-	1	-	-	-	-
CO4	2	-	-	-	-	-	-	2	-	-	-	-
CO5	1	-	-	-	1	-	-	1	-	-	-	-

Practical No	Details
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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)		Semester - III	
Course Name: Advanced IoT		Course Code: PGIT303	
Periods per week 1 Period is 60 minutes	Lectures	3	
	Credits	3	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

PGIT303 Advanced IoT

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

CO1: Build smart IoT applications on Azure

CO2: Use Microsoft cognitive APIs to build IoT applications

CO3: Implement Blockchain in IoT

CO4: Install and use microservices in IoT.

CO5: Build own IoT platform and use it in a customized way.

ICT Tools Used: Videos, PPT, IoT Kit

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

Links: SWAYAM / MOOCS:

- <https://www.udemy.com/course/internet-of-things-iot-fundamentals/>
- <https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/>

The CO-PO Mapping Matrix

CO\ P O	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12
CO1	-	-	3	-	-	-	-	3	-	-	-	1
CO2	-	-	-	-	-	2	-	3	-	-	-	-
CO3	-	-	3	-	-	-	2	-	-	-	-	-
CO4	-	-	3	-	-	2	-	2	-	-	-	-
CO5	-	-	3	-	-	-	1	-	-	-	-	1

Unit	Details	Lectures
I	The Artificial Intelligence 2.0, IoT and Azure IoT Suite, Creating Smart IoT Application	12
II	Cognitive APIs, Consuming Microsoft Cognitive APIs, Building Smarter Application using Cognitive APIs.	12
III	Implementing Blockchain as a service, Capturing, Analysing and Visualizing real-time data, Making prediction with machine learning.	12

IV	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
V	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:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	IoT, AI, and Blockchain for .NET- Building a Next-Generation Application from the Ground Up	Nishith Pathak Anurag Bhandari	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 and Standards	Simone Cirani Gianluigi Ferrari Marco Picone Luca Veltri	Wiley	1	2019

M. Sc (Information Technology)		Semester – III	
Course Name: Advanced IoT Practical		Course Code: PGIT3P3	
Periods per week 1 Period is 60 minutes	Lectures	2	
	Credits	1	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT3P3 Advanced IoT

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

CO1: Engineer Intelligent IoT Applications using Azure Platform

CO2: Apply Microsoft Cognitive APIs to Enhance Functionality in IoT Applications

CO3: Incorporate Blockchain Technology into IoT Systems.

ICT Tools Used: Videos, PPT, IoT Kit

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

Links: SWAYAM / MOOCS:

- <https://www.udemy.com/course/internet-of-things-iot-fundamentals/>
- <https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/>

The CO-PO Mapping Matrix

CO\ P O	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12
CO1	1	-	-	2	-	2	-	2	-	-	-	-
CO2	2	-	-	3	-	3	-	3	-	-	-	-
CO3	3	-	-	1	-	1	-	3	-	-	-	-

Practical No	Details
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).

Unit	Details	Lectures
I	<p>Malware Analysis: Introduction, Techniques, Types of malware, General rules for Malware Analysis. Basic Static Techniques: Antivirus Scanning, Hashing, Finding Strings, Packed and Obfuscated Malware, Portable Executable Malware, Portable executable File Format, Linked Libraries and Functions, Static Analysis, The PE file headers and sections. Malware Analysis in Virtual Machines: Structure of VM, Creating and using Malware Analysis machine, Risks of using VMware for malware analysis, Record/Replay. Basic Dynamic Analysis: Sandboxes, Running Malware, Monitoring with process monitor, Viewing processes with process explorer, Comparing registry snapshots with regshot, Faking a network, Packet sniffing with Wireshark, Using INetSim, Basic Dynamic Tools. x86 Disassembly.</p>	12
II	<p>IDA PRO: Loading an executable, IDA Pro Interface, Using cross references, Analysing functions, Using graphing options, Enhancing disassembly, Extending IDA with plug-ins.</p> <p>Recognising C Code constructs in assembly: Global v/s local variables, Disassembling arithmetic operations, recognizing if statements, recognizing loops, function call conventions, Analysing switch statements, Disassembling arrays, Identifying structs, Analysing linked list traversal. Analysing Malicious Windows Programs: The windows API, The Windows Registry, Networking APIs, Understanding running malware. Kernel v/s user mode, Native API. Advanced Dynamic Analysis – Debugging: Source- level v/s Assembly-level debugging, kernel v/s user mode debugging, Using a debugger, Exceptions, Modifying execution with a debugger, modifying program execution.</p>	12
III	<p>Advanced Dynamic Analysis – OLLYDBG: Loading Malware, The Ollydbg Interface, Memory Map, Viewing threads and Stacks, Executing code, Breakpoints, Loading DLLs, Tracing, Exception handling, Patching, Analysing shell code, Assistance features, Plugins, Scriptable debugging. Kernel Debugging with WINDBG: Drivers and kernel code, Using WinDbg, Microsoft Symbols, kernel debugging and using it, Rootkits, Loading drivers, kernel issues with windows. Malware Functionality – Malware Behavior: Downloaders and launchers, Backdoors, Credential stealers, Persistence mechanisms, Privilege escalation, covering the tracks. Covert Malware Launching: Launchers, Process injection, Process replacement, Hook injection, detours, APC injection.</p>	12

IV	<p>Data Encoding: Goal of Analysing algorithms, Simple ciphers, Common cryptographic algorithms, Custom encoding, decoding.</p> <p>Malware - focused network signatures: Network countermeasures, Safely investigating attacker online, Content-Based Network Countermeasures, Combining Dynamic and Static Analysis Techniques, Understanding the Attacker's Perspective.</p> <p>Anti-disassembly: Concepts, Defeating disassembly algorithms, anti-disassembly techniques, Obscuring flow control, Thwarting stack-frame analysis.</p> <p>Anti-debugging: Windows debugger detection, debugger behavior Interfering with debugger functionality, Debugger vulnerabilities..</p>	12
V	<p>Anti-virtual machine techniques: VMWare artifacts, Vulnerable functions, Tweaking settings, Escaping the virtual machine.</p> <p>Packers and unpacking: Packer anatomy, Identifying Packed Programs, Unpacking options, Automated Unpacking, Manual Unpacking, Common packers, Analysing without unpacking, Packed DLLs, Shellcode Analysis: Loading shellcode for analysis, Position- independent Code, Identifying Execution Location, Manual Symbol Resolution, Shellcode encoding, NOP Sleds, Finding Shellcode.</p> <p>C++ Analysis: OOP, Virtual and Non-virtual functions, Creating and destroying objects. 64-bit Malware: Why 64-bit malware? Differences in x64 architecture, Windows 32-bit on Windows 64-bit, 64-bit hints at malware functionality.</p>	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Practical Malware Analysis - The Hands-On Guide to Dissecting Malicious Software	Michael Sikorski, Andrew Honig	No Starch Press	-	2013
2.	Mastering Malware Analysis	Alexey Klymenov, Amr Thabet	Packt Publishing	-	2019
3.	Windows Malware Analysis Essentials	Victor Marak	Packt Publishing		2015

M. Sc (Information Technology)		Semester – III	
Course Name: Malware Analysis Practicals		Course Code: PGIT3P4A	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT3P4A Malware Analysis

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

CO1: Master Introductory Techniques for Malware Analysis and Establish Testing Environments

CO2: Execute Advanced Dynamic Analysis, Identifying Constructs in Assembly Code

CO3: Conduct Reverse Engineering Using OLLYDBG and WINDBG, Analyzing Malware Behaviors and Functions

CO4: Gain Proficiency in Data Encoding, Implement Various Anti-disassembly, and Anti-debugging Techniques

ICT Tools Used: Videos, PPT

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

Links: SWAYAM / MOOCS:

1. <https://www.coursera.org/learn/malware-analysis-and-assembly>

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
CO1	1	-	-	1	-	3	-	3	-	-	-	-
CO2	-	-	-	3	-	-	2	1	-	-	-	-

C03	3	-	-	-	-	2	3	-	-	-	-	-
C04	3	-	-	3	-	3	-	1	-	-	-	-

List of Practical:

10 Practicals covering the entire syllabus must be performed.

M. Sc (Information Technology)		Semester – III	
Course Name: Robotic Process Automation		Course Code: PGIT304B	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

PGIT304B 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 optimized way.

CO2: Understand the features used 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, UiPath Studio

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

Links: SWAYAM / MOOCS:

- <https://www.coursera.org/specializations/roboticprocessautomation>
- <https://www.careers360.com/courses-certifications/swayam-automation-and-robotics-courses-brp-org>

The CO-PO Mapping Matrix

CO\ PO	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
CO1	2	-	-	2	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	2	-	-	-	-
CO4	-	-	1	2	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	2	-	-	-	-

Unit	Details	Lectures
Unit-I	<p>Robotic Process Automation: Scope and techniques of automation, About UiPath</p> <p>Record and Play: UiPath stack, Downloading and installing UiPath Studio, Learning UiPath Studio, Task recorder, Step- by-step examples using the recorder.</p>	12
Unit-II	<p>Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, Step-by-step example using Sequence and Flowchart, Step-by-step example using Sequence and Control flow</p> <p>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)</p>	12
Unit-III	<p>Taking Control of the Controls : Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Working with UiExplorer, Handling events, Revisit recorder, Screen Scraping, When to use OCR, Types of OCR available How to use OCR, Avoiding typical failure points</p> <p>Tame that Application with Plugins and Extensions: Terminal plugin, SAP automation, Java plugin, Citrix automation, Mail plugin, PDF plugin, Web integration, Excel and Word plugins, Credential management, Extensions – Java, Chrome, Firefox, and Silverlight,</p>	12
Unit-IV	<p>Handling User Events and Assistant Bots: What are assistant bots?, Monitoring system event triggers, Hotkey trigger, Mouse trigger, System trigger</p> <p>,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</p> <p>Exception Handling, Debugging, and Logging: Exception handling, Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting</p>	12
Unit-V	<p>Managing and Maintaining the Code: Project organization, Nesting workflows, Reusability of workflows, Commenting techniques, State Machine, When to use Flowcharts, State Machines, or Sequences, Using config files and examples of a config file, Integrating a TFS server</p> <p>Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots, License management, Publishing and managing updates</p>	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Learning Robotic Process Automation	Alok Mani Tripathi	Packt	1st	2018
2.	Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation	Srikanth Merianda	Createspace Independent Publishing	1st	2018
3.	The Simple Implementation Guide to Robotic Process Automation (Rpa): How to Best Implement Rpa in an Organization	Kelly Wibbenmeyer	iUniverse	1st	2018

M. Sc (Information Technology)		Semester – III	
Course Name: Robotic Process Automation Practical		Course Code: PGIT3P4B	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT3P4B Robotic Process Automation

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

- CO1:** Evaluate Business Processes and Develop Optimal Solutions
- CO2:** Effectively Utilize Features for Database Plugin Interactions
- CO3:** Implement Plug-ins and Controls for Streamlined Process Automation
- CO4:** Proficiently Manage Various Events, Debugging, and Error Handling in Automation

ICT Tools Used: Videos, PPT, UiPath Studio

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

Links: SWAYAM / MOOCS:

1. <https://www.coursera.org/specializations/roboticprocessautomation>
2. <https://www.careers360.com/courses-certifications/swayam-automation-and-robotics-courses-brp-org>

The CO-PO Mapping Matrix

CO\ PO	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
CO1	1	-	-	3	-	2	-	-	-	2	-	-

C02	2	-	-	-	-	3	1	1	-	-	-	-
C03	3	-	-	-	-	1	-	3	-	-	-	-
C04	2	-	-	2	-	-	-	1	-	-	-	-

Practical No	Details
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.

M. Sc (Information Technology)		Semester - III	
Course Name : Internship		Course Code: PGIT305	
Periods per week 1 Period is 60 minutes	Lectures	-	
	Credits	6	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGCS305 Internship

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

C01: An opportunity to get hired by the Industry/ organization.

C02: Practical experience in an organizational setting.

C03: Excellent opportunity to see how the theoretical aspects learned in classes are integrated into the practical world. On-floor experience provides much more professional experience which is often worth more than classroom teaching

C04: Opportunity to learn new skills and supplement knowledge.

C05: Opportunity to practice communication and teamwork skills.

ICT Tools Used: Videos, PPT

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

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
C01	2	-	-	-	-	-	-	-	-	-	-	3
C02	-	-	-	-	-	2	-	-	-	-	-	2
C03	-	-	-	-	-	-	1	-	-	2	-	3
C04	-	-	-	2	-	-	-	-	-	-	-	2
C05	-	2	-	-	-	-	-	-	-	3	-	3

Every student is required to prepare a file containing documentary proofs of the activities done by him. The evaluation of these activities will be done by Programmed Head/Cell In-charge/ Project Head/ TPO/ faculty mentor or Industry Supervisor

SEMESTER IV

M. Sc (Information Technology)		Semester - IV	
Course Name: Blockchain		Course Code: PGIT401	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

PGIT401 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

CO4: Understand what constitutes a –smartll contract, what its legal implications are and what it can and cannot do, now and in the near future.

CO5: Develop blockchain DApps.

ICT Tools Used: Videos, PPT

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

Links: SWAYAM / MOOCS:

1. https://onlinecourses.swayam2.ac.in/aic21_ge01/preview
2. <https://www.coursera.org/specializations/blockchain>

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
CO1	2	-	-	-	2	-	-	-	-	-	-	-
CO2	-	-	1	2	-	-	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	1	-	-	-	-
CO4	3	-	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	-	-	-	-	-

Unit	Details	Lectures
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I	<p>Blockchain: Introduction, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases.</p> <p>Working of Blockchain: Blockchain foundation, Cryptography, Game Theory, Computer Science Engineering, Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain</p> <p>Working of Bitcoin: Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes and SVPs, Bitcoin wallets.</p>	12
II	<p>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, EVM Applications, State Machines, Guts of the EVM, Blocks, Mining's Place in the State Transition Function, Renting Time on the EVM, Gas, Working with Gas, Accounts, Transactions, and Messages, Transactions and Messages, Estimating Gas Fees for Operations, Opcodes in the EVM.</p> <p>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 and Expressions in Solidity, Value Types, Global Special Variables, Units, and Functions,</p>	12
III	<p>Hyperledger: Overview, Fabric, composer, installing hyperledger fabric and composer, deploying, running the network, error troubleshooting.</p> <p>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.</p>	12
IV	<p>Mining Ether: Why? Ether's Source, Defining Mining, Difficulty, Self-Regulation, and the Race for Profit, How Proof of Work Helps Regulate Block Time, DAG and Nonce, Faster Blocks, Stale Blocks, Difficulties, Ancestry of Blocks and Transactions, Ethereum and Bitcoin, Forking, Mining, Geth on Windows, Executing Commands in the EVM via the Geth Console, Launching Geth with Flags, Mining on the Testnet, GPU Mining Rigs, Mining on a Pool with Multiple GPUs.</p> <p>Cryptoeconomics: Introduction, Usefulness of cryptoeconomics, Speed of blocks, Ether Issuance scheme, Common Attack Scenarios.</p>	12
	<p>Blockchain Application Development: Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum—Sending Transactions, Creating a Smart Contract, Executing Smart Contract Functions, Public vs. Private Blockchains, Decentralized Application Architecture, Building an Ethereum DApp: The DApp, Setting Up a Private Ethereum Network, Creating</p>	

V	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, JavaScript API, Using Meteor with the EVM, Executing Contracts in the Console, Recommendations for Prototyping, Third-Party Deployment Libraries, Creating Private Chains.	12
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Books and References:

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions	Bikrama ditya Singhal, Gautam Dhameja , Priyansu Sekhar 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. Antonopo ulos Dr. Gavin Wood	O'Reilly	First	2018
5.	Blockchain Enabled Applications	Vikram Dhillon David Metcalf Max Hooper	Apress		2017

M. Sc (Information Technology)		Semester – IV	
Course Name: Blockchain Practical		Course Code: PGIT401	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT401 Blockchain

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

CO1: Gain Insight into the Structure of Blockchain and Recognize its Superiority over Simple Distributed Databases

CO2: Analyze the Incentive Structure in Blockchain Systems, Critically Evaluating Functions, Benefits, and Vulnerabilities

CO3: Assess Suitable Scenarios for Blockchain Implementation, Considering its Potential and Recognizing Limitations

CO4: Grasp the Concept of "Smart" Contracts, Evaluate Legal Implications, and Understand their Present and Future Capabilities

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\ P O	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12
CO1	1	-	2	2	-	-	-	2	-	-	-	-
CO2	3	-	-	1	-	-	2	1	-	-	-	-
CO3	1	-	2	1	-	-	-	2	-	-	-	-
CO4	3	-	-	2	-	-	-	3	2	-	-	-

List of Practical:	
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)		Semester – IV	
Course Name: Deep Learning		Course Code: PGIT402	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Theory Internal	--	40

PGIT402 Deep Learning

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

C01: Develop web applications using Model View Control

C02: Create MVC Models and write code that implements business logic within Model methods, properties, and events.

C03: Create Views in an MVC application that display and edit data and interact with Models and Controllers

C04: Boost your hire ability through innovative and independent learning.

C05: Gaining a thorough understanding of the philosophy and architecture of .NET Core.

ICT Tools Used: Videos, PPT, Postgress, SQL.

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

Links: SWAYAM / MOOCS:

- https://onlinecourses.nptel.ac.in/noc23_cs110/preview
- <https://www.coursera.org/specializations/deep-learning>

The CO-PO Mapping Matrix

CO\ P O	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
C01	-	-	-	-	2	-	-	-	-	-	-	-
C02	-	-	-	-	3	-	-	-	-	-	-	2
C03	-	-	2	-	2	-	-	-	-	-	-	-
C04	-	-	-	-	-	-	2	-	-	2	-	-
C05	2	-	2	-	-	-	-	-	-	-	-	-

Unit	Details	Lectures
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I	Applied Math and Machine Learning Basics: Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors , Identity and 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	12
V	Approximate Inference, Deep Generative Models	12

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	An MIT Press book	1st	2016
2.	Fundamentals of Deep Learning	Nikhil Buduma	O'Reilly	1st	2017
3.	Deep Learning: Methods and Applications	Deng & Yu	Now Publishers	1st	2013
4.	Deep Learning CookBook	Douwe Osinga	O'Reilly	1st	2017

M. Sc (Information Technology)		Semester - IV	
Course Name: Deep Learning Practical		Course Code: PGIT4P2	
Periods per week 1 Period is 60 minutes	Lectures	4	
	Credits	2	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT4P2 Deep Learning

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

CO1: Build Web Applications Using the Model-View-Controller (MVC) Paradigm

CO2: Implement MVC Models with Business Logic in Model Methods, Properties, and Events

CO3: Design Views in MVC Applications for Efficient Data Display, Editing, and Interaction with Models and Controllers

CO4: Enhance Employability Through Innovative and Self-directed Learning Initiatives

ICT Tools Used: Videos, PPT, Postgress, SQL.

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

Links: SWAYAM / MOOCS:

1. https://onlinecourses.nptel.ac.in/noc23_cs110/preview
2. <https://www.coursera.org/specializations/deep-learning>

The CO-PO Mapping Matrix

CO\ P O	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12
CO1	-	-	-	2	-	1	-	1	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	1	-	-	-	-
CO4	2	2	2	-	-	-	-	2	-	-	-	1

Practical No	Details
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.

<p>4</p>	<p>a) Using deep feed forward network with two hidden layers for performing multiclass classification and predicting the class. b) Using a deep feed forward network with two hidden layers for performing classification and predicting the probability of class. c) Using a deep feed forward network with two hidden layers for performing linear regression and predicting values.</p>
<p>5</p>	<p>a)Evaluating feed forward deep network for regression using KFold cross validation. b)Evaluating feed forward deep network for multiclass Classification using KFold cross-validation.</p>
<p>6</p>	<p>Implementing regularization to avoid overfitting in binary classification.</p>
<p>7</p>	<p>Demonstrate recurrent neural network that learns to perform sequence analysis for stock price.</p>
<p>8</p>	<p>Performing encoding and decoding of images using deep autoencoder.</p>
<p>9</p>	<p>Implementation of convolutional neural network to predict numbers from number images</p>
<p>10</p>	<p>Denoising of images using autoencoder.</p>

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 Learning approaches.	12
III	Word Classes ad Part-of-Speech tagging(POS), survey of POS tagsets, Rule based approaches (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.	12
V	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	Indurkha, N., & Damerau, F. J.	CRC Press Taylor and Francis Group	2 nd	2010

2.	Speech and Language Processing	Martin, J. H., & Jurafsky, D.	Pearson Education India	2 nd	2013
3.	Foundations of Statistical Natural Language Processing	Manning, Christopher and Heinrich, Schutze	MIT Press	1 st	1997
4.	Natural Language Processing With Python	Steven Bird, Edward Loper	O'Reilly Media	2 nd	2016
5.	Video Links : http://www.nptelvideos.in/2012/11/natural-language-processing.html				

M. Sc (Information Technology)		Semester - IV	
Course Name: Natural Language Processing Practical		Course Code: PGIT4P3	
Periods per week 1 Period is 60 minutes	Lectures	2	
	Credits	1	
		Hours	Marks
Evaluation System	Practical Examination	2	40

PGIT4P3 Natural Language Processing

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

CO1: Develop an Understanding of Know-hows, Issues, and Challenges in Natural Language Processing (NLP) and its Relevance in Classical and Modern Contexts

CO2: Master Computational Techniques for NLP Problem Solving, Create Modules for NLP Tasks, and Utilize Tools such as Morph Analyzers, POS Taggers, Chunkers, Parsers, WSD Tools, etc.

CO3: Explore Various Grammar Formalisms and Apply Them Across Different Fields of Study

CO4: Undertake Project Work or Contribute to Research and Development in NLP and Related Areas within Industry Firms

ICT Tools Used: Videos, PPT, NLTK

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

Links: SWAYAM / MOOCS:

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

The CO-PO Mapping Matrix

CO \ PO	P 01	P 02	P 03	P 04	P 05	P 06	P 07	P 08	P 09	PO 10	PO 11	PO 12
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C01	1	-	2	1	-	-	2	-	-	-	-	-
C02	-	-	-	-	-	1	-	3	-	-	-	-
C03	3	-	-	1	-	2	-	-	-	-	-	-
C04	1	2	-	1	-	-	-	3	-	2	-	-

List of Practical:	
1.	<ul style="list-style-type: none"> a. Install NLTK b. Convert the given text to speech c. Convert audio file Speech to Text.
2.	<ul style="list-style-type: none"> 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 <p>Study of tagged corpora with methods like tagged_sents, tagged_words.</p> <ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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 stopwords.Using nltk Adding or Removing Stop Words in NLTK's Default Stop Word List Using Gensim Adding and Removing Stop Words in Default Gensim Stop Words List Using Spacy Adding and Removing Stop Words in Default Spacy Stop Words List
4.	<p>Text Tokenization</p> <ul style="list-style-type: none"> 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.	<p>Important NLP Libraries for Indian Languages and perform:</p> <ul style="list-style-type: none"> a. word tokenization in Hindi b. Generate similar sentences from a given Hindi text input c. Identify the Indian language of a text
6.	<p>Illustrate part of speech tagging.</p> <ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> a. Define grammar 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.	<p>Study PorterStemmer, LancasterStemmer, RegexpStemmer, SnowballStemmer</p> <p>Study WordNetLemmatizer</p>
9.	<p>Implement Naive Bayes classifier</p>
10.	<p>Speech Tagging:</p> <ul style="list-style-type: none"> a. Speech tagging using spacy b. Speech tagging using nltk <p>Statistical parsing:</p> <ul style="list-style-type: none"> a. Usage of Give and Gave in the Penn Treebank sample b. probabilistic parser Malt <p>parsing: Parse a sentence and draw a tree using malt parsing.</p>
11.	<ul style="list-style-type: none"> a. Multiword Expressions in NLP b. Normalized Web Distance and Word Similarity c. Word Sense Disambiguation

M. Sc (Information Technology)		Semester - IV	
Course Name: Human Computer Interaction		Course Code: PGIT404A	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Internal	--	40

PGIT404A Human Computer Interaction

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

CO1: Have a clear understanding of HCI principles that influence a system's interface design, before writing any code.

CO2: Understand the evaluation techniques used for any of the proposed system.

CO3: Understand the cognitive models and its design.

CO4: Able to understand how to manage the system resources and do the task analysis.

CO5: Able to design and implement a complete system.

ICT Tools Used: Videos, PPT, Figma, Visual Studio

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

Links: SWAYAM / MOOCS:

1. <https://archive.nptel.ac.in/courses/106/103/106103115/#>
2. <https://archive.nptel.ac.in/courses/106/106/106106177/>
3. https://onlinecourses.nptel.ac.in/noc19_cs86/preview

The CO-PO Mapping Matrix

CO\PO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3	-	2	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-
CO3	2	-	2	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-
CO5	-	-	-	-	3	-	-	2	-	-	-	-

Unit	Details	Lectures
I	<p>The Interaction: Models of interaction, Design Focus, Frameworks and HCI, Ergonomics, Interaction styles, Elements of the WIMP interface, Interactivity</p> <p>Paradigms: Introduction, Paradigms for interaction</p> <p>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</p> <p>HCI in the software process: The software life cycle, Usability engineering, Iterative design and prototyping, Prototyping in practice, Design rationale</p>	12
II	<p>Implementation support: Elements of windowing systems, Programming the application, Going with the grain, Using toolkits, User interface management systems</p> <p>Evaluation techniques: What is evaluation?, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method</p>	12
III	<p>Universal design: Universal design principles, Multi-modal interaction, Designing websites for screen readers, Choosing the right kind of speech, Designing for diversity</p> <p>User support: Requirements of user support, Approaches to user support, Adaptive help systems, Designing user support systems</p> <p>Cognitive models: Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, Cognitive architectures</p>	12
IV	<p>Socio-organizational issues and stakeholder requirements: Organizational issues, Capturing requirements</p> <p>Communication and collaboration models: Face-to-face communication, Conversation, Text-based communication, Group working</p> <p>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</p>	12
V	<p>Dialog notations and design: What is dialog?, Dialog design notations, Diagrammatic notations, Textual dialog notations, Dialog semantics, Dialog analysis and design</p> <p>Models of the system: Standard formalisms, Interaction models, Continuous behavior</p> <p>Modeling rich interaction: Status-event analysis, Rich contexts, Low intention and sensor-based interaction</p>	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Human Computer Interaction	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale	Pearson Education	3 rd	

2.	Designing the User Interface	Shneiderman B., Plaisant C., Cohen M., Jacobs S.	Pearson	5th	2013
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M. Sc (Information Technology)		Semester - IV	
Course Name: Human Computer Interaction Practical		Course Code: PGIT4P4A	
Periods per week (1 Period is 60 minutes)		4	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2	50
	Internal	--	--

PGIT4P4A Human Computer Interaction

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

CO1: Apply Fundamental HCI Principles in Crafting Effective System Interfaces before Code Implementation

CO2: Utilize Varied Evaluation Techniques for Rigorous Assessment of Proposed Systems

CO3: Implement Cognitive Models for Intuitive and User-Centric System Design

ICT Tools Used: Videos, PPT, Figma, Visual Studio

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

Links: SWAYAM / MOOCS:

1. <https://archive.nptel.ac.in/courses/106/103/106103115/#>
2. <https://archive.nptel.ac.in/courses/106/106/106106177/>
3. https://onlinecourses.nptel.ac.in/noc19_cs86/preview

The CO-PO Mapping Matrix

CO\PO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	1	-	-	2	-	3	-	2	-	-	-	-
CO2	-	1	-	3	-	-	2	-	-	-	-	-
CO3	2	1	-	-	-	1	-	3	-	-	-	-

List of Practical:

10 Practicals covering the entire syllabus must be performed.

M. Sc (Information Technology)		Semester - IV	
Course Name: Virtual Reality and Augmented Reality		Course Code: PGIT404B	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Internal	--	40

PGIT404B 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

CO5: Effectively use open source VR software.

ICT Tools Used: Videos, PPT

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

Links: SWAYAM / MOOCS:

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

The CO-PO Mapping Matrix

CO\PO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	3	-	-	-	-	-	-	2	-	-	-	2
CO2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	-	3	-	-	-	-

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	12
II	Perception of Space and Time, Perceptual Stability, Attention, and Action, Perception: Design Guidelines, Adverse Health Effects, Motion Sickness, Eye Strain, Seizures, and Aftereffects, Hardware Challenges, Latency, Measuring Sickness, Reducing Adverse Effects, Adverse Health Effects: Design Guidelines	12
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	12
IV	Design and Art Across Digital Realities, Designing for Our Senses, Virtual Reality for Art, 3D Art Optimization, Computer Vision That Makes Augmented Reality Possible Works, Virtual Reality and Augmented Reality: Cross-Platform Theory	12
V	Virtual Reality Toolkit: Open Source Framework for the Community, Data and Machine Learning Visualization Design and Development in Spatial Computing, Character AI and Behaviors, The Virtual and Augmented Reality Health Technology Ecosystem	12

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	The VR Book, Human Centered Design 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)		Semester - IV	
Course Name: Virtual Reality and Augmented Reality Practical		Course Code: PGIT4P4B	
Periods per week (1 Period is 60 minutes)		4	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2	50
	Internal	--	--

PGIT4P4B Virtual Reality and Augmented Reality

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

CO1: Implement VR and AR Concepts in Real-life Situations

CO2: Identify and Minimize Key Risks Associated with VR Implementations

CO3: Develop User Interaction Designs for Immersive Virtual and Augmented Reality Environments

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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	1	-	-	-	-	2	-	3	-	-	-	-
CO2	3	-	-	2	-	2	-	1	-	-	-	-
CO3	-	1	-	2	-	-	-	3	-	-	-	-

List of Practical:

10 Practicals covering the entire syllabus must be performed.

M. Sc (Information Technology)		Semester – IV	
Course Name: Project		Course Code: PGIT405	
Periods per week (1 Period is 60 minutes)		8	
Credits		6	
		Hours	Mark s
Evaluation System	Practical Examination	2	50
	Internal	--	-

Project

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

CO1: Craft Project Proposals with Well-defined Objectives, Scope, Deliverables, Timeline, and Resource Requirements

CO2: Apply Project Management Tools and Techniques for Ongoing Progress Monitoring, Risk Identification, and Adaptive Planning

CO3: Develop Comprehensive Project Plans that Detail Tasks, Dependencies, Milestones, and Deadlines

CO4: Evaluate Existing Solutions, Methodologies, and Best Practices Applicable to the Project

ICT Tools Used: Videos, PPT

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

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	-	-	-	-	1	1	-
CO2	1	2	-	-	-	3	-	-	-	2	-	-
CO3	-	1	-	-	-	2	-	-	-	2	-	-
CO4	3	-	-	3	-	-	2	3	-	-	-	-

Goals of the course Project Documentation and Viva-Voce

The student should:

be able to apply relevant knowledge and abilities, within the main field of study, to a given problem within given constraints, even with limited information, independently analyse and discuss complex inquiries/problems and handle larger problems on the advanced level within the main field of study reflect on, evaluate and critically review one's own and others' scientific results be able to document and present one's own work with strict requirements on structure, format, and

language usage be able to identify one's need for further knowledge and continuously develop one's own knowledge

To start the project:

Start thinking early in the programme about suitable projects. Read the instructions for the project.

Attend and listen to other student's final oral presentations. Look at the finished reports.

Talk to senior master students. Attend possible information events (workshops / seminars / conferences etc.) about the related topics.

Application and approval:

Read all the detailed information about project. Finalise finding a place and supervisor.

Check with the coordinator about subject/project, place and supervisor. Write the project proposal and plan along with the supervisor. Fill out the application together with the supervisor. Hand over the complete application, proposal and plan to the coordinator. Get an acknowledgement and approval from the coordinator to start the project.

During the project:

Search, gather and read information and literature about the theory. Document well the practical work and your results.

Take part in seminars and the running follow-ups/supervision. Think early on about disposition and writing of the final report. Discuss your thoughts with the supervisor and others. Read the SOP and the rest you need again.

Plan for and do the mid-term reporting to the coordinator/examiner.

Do a mid-term report also at the work-place (can be a requirement in some work-places).

Write the first draft of the final report and rewrite it based on feedback from the supervisor and possibly others.

Plan for the final presentation of the report.

Finishing the project:

Finish the report and obtain an OK from the supervisor. Ask the supervisor to send the certificate and feedback form to the coordinator. Attend the pre-final oral presentation arranged by the Coordinator.

Rewrite the final report again based on feedback from the opponents and possibly others.

Prepare a title page and a popular science summary for your report.

Send the completed final report to the coordinator (via plagiarism software) Rewrite the report based on possible feedback from the coordinator. Appear for the final exam.

Project Proposal/research plan

The student should spend the first 1-2 weeks writing a 1-2 pages project plan containing:

Short background of the project

Aims of the project

Short description of methods that will be used

Estimated time schedule for the project

The research plan should be handed in to the supervisor and the coordinator.

Writing the project plan will help you plan your project work and get you started in finding information and understanding of methods needed to perform the project.

Project Documentation

The documentation should contain:

Introduction - that should contain a technical and social (when possible) motivation of the project topic.

Description of the problems/topics.

Status of the research/knowledge in the field and literature review.

Description of the methodology/approach. (The actual structure of the chapters here depends on the topic of the documentation.)

Results - must always contain analyses of results and associated uncertainties. Conclusions and proposals for the future work.

Appendices (when needed). Bibliography - references and links.

For the master's documentation, the chapters cannot be dictated, they may vary according to the type of project. However, in Semester III Project Documentation and Viva Voce must contain at least 4 chapters (Introduction, Review of Literature, Methodology / Approach, Proposed Design / UI design, etc. depending on the type of project.) The Semester III report should be spiral bound