Academic Program - UG

Academic Year 2024-25

Syllabus V & VI Semester B.E.

(Under NEP 2020)

Branch: Artificial Intelligence & Machine Learning

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for V & VI Semesters of UG program in Artificial Intelligence and Machine Learning is recommended by the Board of Studies of Artificial Intelligence and Machine Learning Department and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2024 - 25 till further revision.

Principal Chairman BoS & HoD

College Vision and Mission

Vision

To develop competent professionals with human values

Mission

- To have contextually relevant Curricula.
- To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
- To enhance Research Culture.
- To involve the Industrial Expertise for connecting Classroom contents to real-life situations.
- To inculcate Ethics and soft-skills leading to overall personality development.

QUALITY POLICY:

In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stakeholders.

Core Values:

- Competency
- Commitment
- Equity
- Teamwork and Trust

Vision and Mission of the Department

Vision

To develop expert AIML professionals to serve the society by practicing values

Mission

1. To incorporate relevant Curricula.
2. To practice appropriate Teaching Learning techniques using modern teaching technological tools.
3. To enhance and embrace Research Culture.
4. To involve Industrial Expertise for exposure to the industrial environment.
5. To inculcate Ethical values and provide soft-skill leading to well rounded Personality Development

Program educational Objectives (PEO)

I. Develop into Artificial Intelligence and Machine Learning Professionals with expertise in providing solutions to Artificial Intelligence and Machine Learning problems

II. Pursue higher studies with a sound knowledge of basic concepts and skills in basic science, humanities, Artificial Intelligence and Machine Learning disciplines

III. Exhibit professionalism and teamwork by providing the environment for exploring current technology trends through collaborative and complementary work ethics

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

Program Outcomes (POs):

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes (PSOs):

13. An ability to develop logical reasoning, coding skills, analysis and mathematical modeling.
14. An ability to modify, debug, test and adapt software modules for varied application

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Artificial Intelligence & Machine Learning
V Semester
Scheme of Teaching and Examinations 2024 – 25

Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture	Tutorial	Practical	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMS	22UAIC500	Software Engineering and Project Management	AIML	3	0	0	3	50	100	100	3
2	PCC	22UAIC501	Theory of Computation	AIML	4	0	0	4	50	100	100	4
3	PCC	22UAIC502	Computer Networks	AIML	4	0	0	4	50	100	100	4
4	PEC	22UAIE5XX	Program Elective Course - I	AIML	4	0	0	4	50	100	100	4
5	PCCL	22UAIL503	Artificial Intelligence and Machine Learning Laboratory	AIML	0	0	2	3	50	50	100	1
6	PCCL	22UAIL504	Computer Networks Laboratory	AIML	0	0	2	3	50	50	100	1
7	PROJ	22UAIL505	Minor Project - I	AIML	0	0	4	3	50	50	100	2
8	MC	22URMK506	Research Methodology and IPR	AIML	2	0	0	2	50	50	100	2
9	MC	22UESK507	Environmental Studies	AIML	1	0	0	1	50	50	100	1
10	HSMS	22USSK508	Soft Skills - I	-	0	0	2	-	50	-	50	Audit
11	MC	22UPYK509	Physical Education and Yoga	PE&Y	0	0	2	-	50	-	50	Audit
Total											**1000**	**22**

Program Elective Course – I												
Sl No	**Course**	**Course Code**	**Course Title**	**Teaching Department**	**Teaching Hrs/Week**			**Examination**				**Credits**
					Lecture	**Tutorial**	**Practical**	**Duration in Hrs**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**					
11	PEC - I	22UAIE521	Advanced Data Structures and Algorithms	AIML	4	0	0	4	50	100	100	4
12	PEC - I	22UAIE522	Advanced Database Management Systems	AIML	4	0	0	4	50	100	100	4

HSMS: Humanity and management Science course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **AEC:** Ability Enhancement course, **MC:** Mandatory Course, **L:** Lecture, **T:** Tutorial, **P:** Practical, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. **K:** This letter in the course code indicates common to all the streams of engineering. **PEC:** Program Elective Course, **PROJ:** Project. **TD:** Teaching department, **PSB:** Paper setting Board.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses are added to supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course.

Minor - Project - I: The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HoD.

Soft Skills - I: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resources. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

Physical Education and Yoga: All students have to register for the course namely National Service Scheme (NSS) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out during III Semester to VI Semester. Successful completion of the registered course and requisite CIE score are mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the PE & Y activities. This courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of the degree.

AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case a student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Artificial Intelligence & Machine Learning
VI Semester
Scheme of Teaching and Examinations 2024 – 25

Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture	Tutorial	Practical	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	22UAIC600	Deep Learning and Reinforcement Learning	AIML	4	0	0	4	50	100	100	4
2	PCC	22UAIC601	Data Science and Analytics	AIML	4	0	0	4	50	100	100	4
3	PCC	22UAIC602	Cloud Computing	AIML	3	0	0	3	50	100	100	3
4	PEC	22UAIE6XX	Program Elective Course - II	AIML	3	0	0	3	50	100	100	3
5	PEC	22UAIE6XX	Program Elective Course - III	AIML	3	0	0	3	50	100	100	3
6	OEC	22UAIO6XX	Open Elective Course - I	AIML	3	0	0	3	50	100	100	3
7	PCCL	22UAIL603	Deep Learning and Reinforcement Learning Laboratory	AIML	0	0	2	3	50	50	100	1
8	PCCL	22UAIL604	Data Science and Analytics Laboratory	AIML	0	0	2	3	50	50	100	1
9	PROJ	22UAIL605	Minor Project - II	AIML	0	0	4	3	50	50	100	2
10	HSMS	22USSK606	Soft Skills - II		0	0	2	-	50	-	50	Audit
11	MC	22UPYK607	Physical Education and Yoga	PE&Y	0	0	2	-	50	-	50	Audit
Total											**1000**	**24**

Program Elective Course – II												
Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture L	Tutorial T	Practical P	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
11	PEC - II	22UAIE621	Natural Language Processing	AIML	3	0	0	3	50	100	100	3
12	PEC - II	22UAIE622	Agile Methodology	AIML	3	0	0	3	50	100	100	3

Program Elective Course – III												
Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture L	Tutorial T	Practical P	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
11	PEC - III	22UAIE631	Computer Vision	AIML	3	0	0	3	50	100	100	3
12	PEC - III	22UAIE632	Blockchain Technology	AIML	3	0	0	3	50	100	100	3

Open Elective Course – I												
Sl No	Course	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture L	Tutorial T	Practical P	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
11	OEC - I	22UAIO641	Human Computer Interaction	AIML	3	0	0	3	50	100	100	3
12	OEC - I	22UAIO642	Business Intelligence and Analytics	AIML	3	0	0	3	50	100	100	3

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Minor-project-II: It is either a continuation of Mini-Project-I or a new project. The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HoD.
Soft Skills-II: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resources. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.
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AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case a student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

22UAIC500 Software Engineering and Project Management (3 - 0- 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To outline software engineering principles and activities involved in building large software programs.
- To identify ethical and professional issues.
- To describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
- To discuss various types of software testing practices and software evolution processes.
- To recognize the importance of Project Management with its methods and methodologies.
- To identify the objectives of Small Scale Industries, various types of supporting agencies and financing available for an entrepreneur.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the activities involved in software engineering and **analyze** the role of various process models	1	2	12,13
CO-2	**Explain** the basics of object-oriented concepts and build a suitable class model using modeling techniques.	-	2	3,13
CO-3	**Describe** various software testing methods and to understand the importance of agile methodology and DevOps.	-	4	13,14
CO-4	**Illustrate** the role of manager in project planning in software development.	8	2,9	11,12
CO-5	**Describe** the concept of entrepreneurship, objectives of Small Scale Industries, various types of supporting agencies and financing available for an entrepreneur.	-	10	11

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	2.0	-	2.0	-	-	-	3.0	-	-	1.0	1.0	1.0	1.0

Pre-requisites: NIL

Contents:

Unit I

Software and Software Engineering: The nature of Software, The unique nature of Web Apps, Software Engineering, The software Process, The software Engineering practice, The software myths.

Process Models: A generic process model, Process assessment and improvement, Prescriptive process models, Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Specialized process models.**8 Hrs**

Unit II

Understanding Requirements: Requirements Engineering, Establishing the groundwork, Eliciting Requirements, Developing use cases, Building the requirements model, Negotiating Requirements, Validating Requirements.

Requirements Modeling Scenarios, Information and Analysis classes: Requirement Analysis, Scenario based modeling, UML models that supplement the Use Case, Data modeling Concepts class Based Modeling. **8 Hrs**

Unit III

Agile Development: What is Agility?, Agility and the cost of change. What is an agile Process?, Extreme Programming (XP), Other Agile Process Models, A tool set for Agile process Principles that guide practice: Software Engineering Knowledge, Core principles, Principles that guide each framework activity. **8 Hrs**

Unit IV

Project Management: Introduction, Definition, Importance, Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.

8 Hrs

Unit V

Entrepreneurship: Introduction, Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship.

Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries **7 Hrs**

Reference Books:

1. Roger S. Pressman: “Software Engineering-A Practitioner's approach”, 7/E, Tata McGraw Hill.
2. Bob Hughes, Mike Cotterell, Rajib Mall: “Software Project Management”, 6/E, McGraw Hill Education, 2018.
3. Michael Blaha, James Rumbaugh: “Object Oriented Modelling and Design with ML”, 2/E, Pearson Education, 2005
4. Deepak Gaikwad, Viral Thakkar, “DevOps Tools From Practitioner’s Viewpoint”, 1/E Wiley, 2019.
5. Pankaj Jalote: “An Integrated Approach to Software Engineering”, 3/E, Wiley India, 2010.
6. Ian Sommerville, “Software Engineering”, 9/E, Addison-Wesley,2011.
7. P.C. Tripathi, P.N.Reddy, “Principles of Management”, 6/E, McGraw-Hill Education, 2008.
8. Daniel L. Babcock, Lucy C. Morse, “Managing Engineering and Technology”, 6/E, PHI, India, 2014.
9. Poornima M. Charantimath, “Entrepreneurship Development and Small Business Enterprises”, 2/E, Pearson Education, 2013.

22UAIC501	Theory of Computation	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Finite Automata and Regular Expressions.
- Context Free Grammars and Pushdown Automata.
- Lexical Analysis and Syntax Analysis.
- Turing Machines.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1 to 12) / PSO (13-14)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Construct** a finite automaton for a given pattern and **explain** its working principles.	-	1, 2,3,13	-
CO-2	**Write** regular expressions for given patterns and **explain** different techniques and principles used.	-	1,2,3,13	-
CO-3	**Design** grammars and pushdown automata for a given language specification.	-	1,2,3,13	-
CO-4	**Design** lexical analyzer and syntax analyzer using regular expressions and grammars.	14	1,2,3,13	-
CO-5	**Design** turing machine for recursively enumerable languages.	-	1,2,3,13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	2.0	3.0

Prerequisites: 1. Knowledge of any programming language

Contents:

Unit I

Introduction to Automata Theory: Three Basic Concepts - Alphabet, String, Language, Finite Automata - Deterministic and Non-Deterministic, Equivalence of Deterministic and Non-Deterministic Finite Acceptors.

Introduction to Compilers: Language Processors, The Structure of a Compiler.**10 Hrs**

Unit II

Regular Expressions: Definition, Design, Languages associated with regular expressions.

Lexical Analysis: Definition, The Role of Lexical Analyzer, The Lexical - Analyzer Generator Lex. **11 Hrs**

Unit III

Context - Free Grammar: Definition, Design, Leftmost and Rightmost Derivations, Derivation Trees, Ambiguity

Normal Forms: Simplification of CFG, Chomsky Normal Form, Greibach Normal Form. **11 Hrs**

Unit-IV

Syntax Analysis: Left Recursion, Left Factoring, Top - Down Parsing: Recursive Descent Parsing, FIRST and FOLLOW, LL(1) Grammars. **10 Hrs**

Unit V

Pushdown Automata (PDA): Definition, Design - Non-Deterministic and Deterministic, Language.

Turing Machine: Definition, Design, Language, Types of Turing Machine. **10 Hrs**

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman "Introduction to Automata Theory, Languages and Computation", 3/E, Pearson Education, 2013.
2. Peter Linz "An Introduction to Formal Languages and Automata", 5/E, Narosa Publishing House, 2011.
3. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman,"Compilers-Principles, Techniques and Tools", 2/E, Addison-Wesley, 2007.
4. D.M.Dhamdhere, "System Programming and Operating Systems", 2/E (Revised), Tata McGraw - Hill, 2009 reprint.

22UAIC502 Computer Networks (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Fundamental concepts of computer networking.
- Basic taxonomy and terminology of computer networking.
- Advanced concepts of computer networking.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12) / PSO (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the uses of computer networks, layered architecture, and their significance.	1, 2	-	12
CO-2	**Illustrate** the various applications of data link layer and Medium Access Control Sub Layer.	2	1,13	-

CO-3	**Comprehend** the concepts of network layer and transport layer for both connectionless and connection-oriented circuits.	1	2, 13	-
CO-4	**Implement** the different application layer protocols.	2, 13	4	5
CO-5	**Design** different applications for Internet usage in the application layer.	2, 13	6	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.3	2.8	-	2.0	1.0	2.0	-	-	-	-	-	1.0	2.5	-

Prerequisites: 1. Basics of Digital Circuits Principles.
2. Knowledge of any Programming Language

Contents:

Unit I

Introduction: Uses of Computer Networks, Network Hardware, Network Software, Reference Models, Example Networks.
Data Link Layer: Design Issues, Error Detection and Correction, Elementary Data Link Layer Protocols, Sliding Window Protocols. **10 Hrs**

Unit II

Medium Access Control Sub Layer: The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Wireless LANs, Data Link Layer Switching. **11 Hrs**

Unit III

Network Layer: Design Issues, Routing Algorithms, Quality of Service, Internetworking, The Network Layer in the Internet. **11 Hrs**

Unit-IV

Transport Layer: The Transport Service, Elements of Transport Protocols, Congestion Control Algorithms, Internet Transport Protocols: UDP, TCP. Performance Issues. **10 Hrs**

Unit V

Application Layer: DNS - Domain Name System, Electronic Mail, The World Wide Web, Real time Audio and Video, Content Delivery and Peer - to - Peer. **10 Hrs**

Reference Books:

1. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks", 5/E, Pearson, 2011.
2. Behrouz Forouzan, “Data Communications and Networking”, 4/E, McGraw Hill, 2006.
3. Alberto Leon-Garcia, Indra Widjaja “Communication Networks**”,** 2/E, Tata McGraw-Hill Education India, 2004.
4. Behrouz Forouzan, “TCP/IP Protocol Suite”, 3/E, McGraw Hill, 2005.

22UAIL503 Artificial Intelligence and Machine Learning Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To provide a strong formal foundation in Artificial Intelligence and Machine Learning concepts.
- To implement AI and ML algorithms in Python programming and compare the performance of algorithms.
- To make use of data sets in implementing machine learning algorithms.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Implement** and **demonstrate** the searching and concept learning in Artificial Intelligence.	3, 13, 14	1, 2	12
CO-2	**Evaluate** different AI algorithms	13, 14	1, 2, 3	12
CO-3	**Demonstrate** the implementation of machine learning algorithms	5, 13, 14	4	12
CO-4	**Analyze** the different machine learning algorithms	5, 13, 14	3	12
CO-5	**Develop** solutions for real life problems using AI and ML techniques by working in teams	6, 7, 13, 14	10, 11, 12	8, 9

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.0	2.0	2.3	2.0	3.0	3.0	3.0	1.0	1.0	2.0	2.0	1.2	3.0	3.0

Pre-requisites: 1. Knowledge of Basic Python Programming Skills.
2. Logical Reasoning

Contents:

Programs List:

PART- A: AI & ML Programs are to be implemented in Python programming language.

1. Implement Depth First Search Algorithm and Best First Search Algorithm on any AI problem.
2. Implement TSP using a heuristic approach.
3. Implement A* Search algorithm and Implement AO* Search algorithm.
4. Implement candidate Elimination algorithm.
5. Implement ID3 algorithm, CART algorithm.
6. Implement Backpropagation Algorithm.
7. Implement Naive Bayesian Classifier Algorithm.
8. Implement EM expectation–maximization (EM) Algorithm.
9. Implement KNN Algorithm.
10. Implement Regression Algorithm

PART- B:

Design and implement a real-world ML application in the form of a project.

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, 3/E, Tata McGraw Hill, 2009.
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “ Machine Learning”, 1/E, Pearson, 2020.
3. Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning using Python” , 1/E, Wiley, 2019.
4. Stephan Marsland, “Machine Learning, An algorithmic Perspective”, 2/E, CRC Press 2015.
5. Ethem Alpaydin, Introduction to Machine Learning, 2/E, PHI Learning Pvt. Ltd, 2013.
6. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education, 2013.

7. StaurtRussel, Peter Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 3/E, 2009.

22UAIL504	Computer Networks Laboratory	(0-0-2) 1

Contact Hours: **26**

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To understand the working principles of various communication protocols.
- To analyze the various routing algorithms.
- To understand the concept of data transfer between nodes.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/PSOs (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Demonstrate** the working of different concepts of networking using sockets in C/C++.	13	1, 2	12, 14
CO-2	**Implement** and **analyze** the networking protocols in NS2 / NS3.	5	1, 2	-
CO-3	**Implement** network applications using sockets and protocols	5,13,14	7, 8	6, 12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	2.0	-	-	3.0	1.0	2.0	2.0	-	-	-	1.0	3.0	2.0

Prerequisites: 1.Knowledge of C/C++ programming

Contents:

PART A (using Cisco Packet Tracer/NS2/NS3 Simulator):

1. Simulation of simple networks using two end devices (nodes).
2. Simulation of simple networks using two end devices (nodes) with a network device (switch).

3. Simulation of simple networks using two end devices (nodes) with a network device (router).
4. Simulation of different network topologies and routing algorithms.

PART B (using sockets):

5. C/C++ Program to demonstrate different networking concepts and routing algorithms using sockets.

Reference books:

1) Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks", 5/E, Pearson, 2011.
2) Behrouz Forouzan, “Data Communications and Networking”, 4/E, McGraw Hill,2006.
3) Alberto Leon-Garcia, Indra Widjaja “Communication Networks**”,** 2/E, Tata McGraw-Hill Education India, 2004.
4) Behrouz Forouzan, “TCP/IP Protocol Suite”, 3/E,McGraw Hill, 2005.

22UAIL505	**Minor Project - I**	**(0 - 0 - 4) 2**

Contact Hours: 52

Course Learning Objectives (CLOs): This course enables the student to identify the community expectations in terms of possible engineering solutions and prepare project proposals.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** societal problems.	-	2, 6, 7, 9, 12, 13, 14	-
CO-2	**Analyze** the real environment and **Formulate** the problem statement.	-	2, 9, 12, 13, 14	-
CO-3	**Conduct** exhaustive literature surveys.	-	2, 9, 12, 13, 14	-
CO-4	**Propose** sustainable engineering solutions / prototypes.	-	3, 5, 7,12, 13, 14	-
CO-5	**Prepare** the report and communicate effectively through presentation.	-	8, 9, 10, 12	-

CO-6	**Manage** the project in terms of various resources in a particular discipline or multi-disciplinary domain.	-	11	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	2.0	2.0	-	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Guidelines for Conduction:

1. The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work.
2. The problem could be defined to develop prototypes for industrial needs.
3. A team consisting of 3 to 4 students shall be guided by a faculty member.
4. This project work is to supplement and prepare the students to take up major project work at higher semesters.
5. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics.
6. The weightage of marks shall be 50% for the committee and 50% for the guide.
7. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HoD.

22URMK506 Research Methodology and IPR (2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs): The students are expected to learn about the need and types of research, problem formulation, literature review, measurement, scaling, data collection, testing of hypothesis, result interpretation and report writing. Also, they are expected to learn about the importance of IPR and trade mark.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Formulate** the research problem, carry out literature survey and decide the methodology.	-	2	-
CO-2	**Explain** the importance of Literature survey and the need to identify research gaps.	-	2	5
CO-3	**Describe** measurement and scaling and data collection & report writing.	-	-	3
CO-4	**Explain** the basic concepts concerning IPR and copyrights	-	4	-
CO-5	**Explain** the need for Trademarks and IT acts.	-	5	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	2.0	1.0	2.0	1.5	-	-	-	-	-	-	-	-	-

Pre-requisites: Design and Analysis of Engineering subjects related issues.

Contents:

Unit-I

Research Methodology: Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology.

Defining the Research Problem: Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, an illustration. **5 Hrs**

Unit-II

Reviewing the literature: Importance of the literature review in research, How to review the literature, searching the existing literature, reviewing the selected literature and writing about the literature reviewed.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design. **5 Hrs**

Unit-III

Data Collection: Collection of primary data, observation method, interview metho collection of data through questionnaires.

Testing of Hypotheses: What is a Hypothesis? Basic concepts concerning testing of hypotheses, procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, tests of hypotheses

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing. **5 Hrs**

Unit-IV

IPR: Meaning and concepts, competing, rationale for protection, international conventions, world court.

Copyright: Historical evolution of the law on copyright, meaning, content

Patents: Meaning of Patent, purpose and policy object of patent law, gains to inventor, application of patents, joint application, discovery and invention, patentable and non-patentable inventions. **6 Hrs**

Unit-V

Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known and well-known trademarks, application for registration and procedure for registration, procedure and certification of Trademarks.

The Information Technology Act: Definitions, certifying authority, meaning of compromise of digital signature, offenses, and penalties, applicability of IPRs, cybercrimes, adjudicating officer, violation, damages and penalties, Cyber regulation appellate tribunal, WWW and domain names and cyber flying, Self study. **5 Hrs**

Reference Books:

1. C.R. Kothari, Gaurav Garg, “Research Methodology: Methods and Techniques”, 4/E, New Age International, 2018.
2. Ranjit Kumar, “Research Methodology a step-by-step guide for beginners”, 3/E, SAGE Publications, 2011.
3. Fink A, “Conducting Research Literature Reviews: From the Internet to Paper”, Sage Publications, 2009.
4. N. K. Acharya, “Text book on Intellectual Property Rights”, 4/E, Asia Law House, Hyderabad.

22UESK507	Environmental Studies	(1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs): The students are expected to learn about the need for a balanced ecosystem, effects of human activities on the environment, optimized use of natural resources including energy extraction and current environmental issues.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Discuss** the concept of ecosystem and effects of human activities on the environment.	-	7	-
CO-2	**Describe** the adverse effects on health and society due to erratic exploitation of natural resources.	-	-	6
CO-3	**Explain** the various types of energy and sources of energy.	-	6	-
CO-4	**Explain** the different types of pollution and concept of global warming, ozone layer depletion	-	7	-
CO-5	**Discuss** the current developments towards NGO to protect the environment.	-	6	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	-	-	-	-	1.6	2.0	-	-	-	-	-	-	-

Prerequisites: None

Contents:

Unit-I

Environment and Effects of Human activities on Environment: Introduction, Ecosystem – Types & Structure of Ecosystem, Impacts of Agriculture & Housing, Mining & Transportation. Environmental Impact Assessment, Sustainable Development. **3 Hrs**

Unit-II

Natural Resources: Introduction Water resources – Availability & Quality aspects, Water borne diseases, Fluoride problem in drinking water. Material Cycles - Carbon cycle and Nitrogen cycle. **3 Hrs**

Unit-III

Energy in Ecological System: Different types of energy, Conventional sources & Non Conventional sources of energy. Solar energy, Hydroelectric energy, Wind energy, Nuclear energy, Biomass & Biogas, Fossil Fuels, Hydrogen as an alternative energy. **3 Hrs**

Unit-IV

Environmental Pollution: Water Pollution, Land Pollution, Air Pollution, Global Warming, Ozone layer depletion. **2 Hrs**

Unit-V

Current Environmental Issues & Environmental Protection: Environmental Acts & Regulations, Role of Nongovernmental Organizations (NGOs). Introduction to GIS & Remote Sensing, Applications of GIS & Remote Sensing. **2 Hrs**

Reference Books:

1. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006.
2. Benny Joseph "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, 2010.
3. Raj Gopalan "Environmental Studies" 3/E, Oxford University press, New Delhi, 2016.
4. Kaushik and Kaushik "Perspectives in Environmental Studies", New Age International Private Limited, 2005.
5. D. L. Manjunath "Environmental Studies", Pearson, Noida, 2016.

22USSK508	Soft Skills - I	(0-0-2) Audit

Contact Hours: 26

Course Learning Objectives (CLOs): This course is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of communication in the profession.	-	10	-
CO-2	**Use** the English language with proficiency	-	10	12
CO-3	**Solve** Aptitude related problems	-	9	12

CO-4	**Demonstrate** the competency in the placement activities.	-	9	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-

Prerequisites: None

Contents:

Number System, Linear Equations + Assessment Test ▪ HCF and LCM, Ratios & Proportions + Assessment Test ▪ Percentage, Profit & Loss + Assessment Test ▪ Time, Work & Distance + Assessment Test ▪ Simple and compound Interest, Averages and Mixtures + Assessment Test ▪ Permutations, Probability + Assessment Test ▪ Data analysis **14Hrs**

Cryptarithmetic ▪ Analytical Puzzles ▪ Classification Puzzles ▪ Mathematical Puzzles ▪ Human Relations ▪ Directional tests ▪ Coding and decoding ▪ Series completion – Verbal and Non-verbal ▪ Questions from recent recruitment tests **12 Hrs**

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UAIE521 Advanced Data Structures and Algorithms (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Asymptotic and Amortized Analysis.
- String matching algorithms.
- Linear sorting algorithms.
- Advanced data structures such as Heaps, B-trees, Red-Black trees etc.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Analyze** the performance of the given algorithm using asymptotic notations and amortized techniques.	-	1,2	-
CO-2	**Explain** the working and assumptions of linear sorting methods and **apply** them to solve a given problem.	-	2,13	1
CO-3	**Compare** the working of different string matching algorithms and **use** them appropriately in developing applications.	-	2,13	1
CO-4	**Build** and **perform** the operations on heap structures.	-	2,13	1
CO-5	**Build** and **perform** the operations on search structures.	-	2,13	1
CO-6	**Use** the hash tables for the implementation of dictionary operations in constant time.	-	2,13	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.7	2.0	-	-	-	-	-	-	-	-	-	-	2.0	-

Pre-requisites: Knowledge of Programming, Data Structures, Algorithms.

Contents:

Unit-I

Introduction to Complexity Analysis: Review of Asymptotic notations and their properties, Amortized analysis – Aggregate, Accounting and Potential methods.

10 Hrs

Unit-II

Linear Sorts: Counting Sort, Bucket Sort, and Radix Sorting with Analysis for all algorithms. **9 Hrs**

Unit-III

String Matching: Naive algorithm; Rabin-Karp algorithm; String matching with Finite automata, KMP algorithm, Boyer-Moore algorithm. **10 Hrs**

Unit-IV

Heap Structures: Binomial heaps, Fibonacci heaps.

Search Structures: 2-3 trees, 2-3-4 trees, B-trees, B^+ trees **13 Hrs**

Unit-V

Hashing: Direct Address Tables, Hash Tables, Collision Resolution by Chaining – Analysis, Hash Functions – Properties, Division and Multiplication methods, Universal Hashing, Open Addressing – Linear and Quadratic Probing, Double hashing. **10 Hrs**

Reference Books:

1. Thomas H.Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein "Introduction to Algorithms", 3/E, PHI 2009.
2. E. Horowitz, S.Sahni and Dinesh Mehta- "Fundamentals of Data structures in C++", Galgotia, 2006.
3. Anany Levitin, "Introduction to the Design and analysis of algorithms", 3/E, Pearson Education, 2011

22UAIE522	Advanced Database Management Systems	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Parallel and Distributed databases.
- Object oriented databases.
- Intelligent databases.
- Data warehousing and mining.
- Emerging and Advanced Data Models.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the relational database concepts and the real world data using object oriented database.	1	2	-

CO-2	**Choose** the appropriate high performance database amongst parallel and distributed databases.	1, 2	-	12
CO-3	**Illustrate** the different data mining and data warehouse applications.	1, 2	-	12
CO-4	**Illustrate** enhanced data models for some advanced applications.	1	-	2
CO-5	**Write** PL/SQL codes to solve different database problems.	1, 2, 13, 14	3, 5, 6	7, 8, 12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.4	2.0	-	2.0	2.0	1.0	1.0	-	-	-	1.0	3.0	3.0

Pre-requisites: Knowledge of Database Management Systems

Contents:

Unit-I

Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas, Update operations, anomalies, dealing with constraint violations, Types and violations.

Objects and Object - Relational Databases: Overview of Object-Oriented Concepts – Objects, Basic properties. Advantages, examples, Abstract data types, Encapsulation, class hierarchies, polymorphism, examples, Complex objects; Identity, structure etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL. **8 Hrs**

Unit-II

Parallel Databases: Architectures for parallel databases, Parallel query evaluation, Parallelizing individual operations, Parallel query optimizations.

Distributed Databases: Introduction, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Concurrency Control and Recovery in Distributed Databases, Transaction Management in Distributed Databases, Query Processing and Optimization in Distributed Databases, Types of Distributed Database Systems, Distributed Database Architectures, Distributed Catalog Management. **8 Hrs**

Unit-III

Data Mining Concepts: Overview of Data Mining Technology, Association Rules, Classification, Clustering, Approaches to Other Data Mining Problems, Applications of Data Mining, Commercial Data Mining Tools

Data Warehousing and OLAP: Introduction, Definitions, and Terminology, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Difficulties of Implementing Data Warehouses. **8 Hrs**

Unit-IV

Enhanced Data Models for Some Advanced Applications: Active Database Concepts and Triggers, Temporal Database Concepts, Spatial Database Concepts, Multimedia Database Concepts, Introduction to Deductive Databases.

Introduction to Information Retrieval and Web Search: Information Retrieval (IR) Concepts, Retrieval Models, Types of Queries in IR Systems, Text Preprocessing, Inverted Indexing, Evaluation Measures of Search Relevance, Web Search and Analysis. Trends in Information Retrieval. **8 Hrs**

Unit-V

PL/SQL: Basics, Cursors, Exceptions, Subprograms, Packages. **7 Hrs**

Reference Books:

1. Elmasri and Navathe, “Fundamentals of Database Systems”, 7/E, Pearson Education, 2017.
2. Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems”, 3/E, McGraw-Hill, 2013.
3. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, 6/E, McGraw Hill, 2010.

22UPYK509	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and importance of Physical Education & Yoga in day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	1	2	-	1	1	-	-	3

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and Wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health. Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, Importance prayer Suryanamaskara,

Asana:- Trikonasana, Ardha Chakrasana, Baddha konasana, Utkatasana.

Pranayama:- Bhramari Pranayamai, Kapalbhati Pranayama.

Mudras:- Chinmaya mudra & Nasika mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Netball, Kabaddi, Football Tug of war, Throwball Rules and regulation of all games. **05Hrs**

Unit-V

Modern Technology in Sports and Games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga (English), 2005

VI Semester

22UAIC600	Deep Learning and Reinforcement Learning	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To introduce the idea of artificial neural networks and their architecture
- To introduce techniques used for training artificial neural networks
- To enable design of an artificial neural network for classification
- To enable design and deployment of deep learning models for machine learning problems

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the mathematics behind the functioning of artificial neural networks.	1, 2	3	12
CO-2	**Explain** the types (feedforward and feedback) of neural networks.	1, 2	5	4, 12
CO-3	**Analyze** the given dataset for designing a neural network based solution.	1, 3, 13	5	6
CO-4	**Design** and **implement** deep learning models for various applications.	1	2	6
CO-5	**Design** and **deploy** simple TensorFlow-based deep learning solutions to classification problems	4	1	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.8	2.7	2.5	2.0	2.0	1.0	-	-	-	-	-	1.0	3.0	-

Pre-requisites: Knowledge of Machine Learning and Python Programming.

Contents:

Unit-I

Introduction to Deep Learning: Discover the basic concepts of deep learning such as neural networks and gradient descent. Implement a neural network in NumPy and train it using gradient descent with in-class programming exercises. Build a neural network to predict student admissions.
Introduction to PyTorch and TensorFlow. **12 Hrs**

Unit-II

Deep Learning with PyTorch and TensorFlow: Build your first neural network to classify images of clothing. Work through a set of Jupyter Notebooks to learn the major components of PyTorch. Load a pre-trained neural network to build a state-of-the-art image classifier.
Convolution Neural Networks: Build Convolution Neural Networks for state-of-the-art computer vision applications. Train a convolutional network to classify dog breeds from images of dogs. **12 Hrs**

Unit-III

Time Series Forecasting: Learn how to perform time series forecasting using deep learning and TensorFlow.
Recurrent Neural Networks: Build recurrent neural networks with PyTorch that can learn from sequential data such as natural language. Implement a network that learns from Tolstoy's Anna Karenina to generate new text based on the novel. **10 Hrs**

Unit-IV

Natural Language Classification: Implement a recurrent neural network that can classify text. Use your network to predict the sentiment of movie reviews.
Deploying with PyTorch / TensorFlow: Build a chatbot and compile the network for deployment in a production environment. **10 Hrs**

Unit-V

Introduction to TensorFlow Lite: Learn how to deploy your models on Android, and IoT devices. Capstone Project with Deep Learning using scikit-learn, TensorFlow, pytorch, etc. **10 Hrs**

Reference Books:

1. Ian Goodfelllow, Yoshua Benjio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning Series)", The MIT Press, 2016
2. Andrew. Trask , "Grokking Deep Learning", 1/E, Manning Publications, 2019.
3. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2/E, Wiley & Sons Inc, 2000.

4. Chirstopher M. Bishop, “Pattern Recognition and Machine Learning”, 1/E (Revised), Springer Publications, 2016.
5. CourseEra/EDX/Udacity Courses:
   a. Deep Learning with TensorFlow
   b. Deep Learning with Pytorch

22UAIC601 Data Science and Analytics (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
- To employ cutting edge tools and technologies to analyze Big Data.
- To enable students to understand not only how to apply certain methods, but when and why they are appropriate.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Define** data science and its fundamentals	-	-	4
CO-2	**Demonstrate** the process in Data Science	-	3	-
CO-3	**Explain** the machine learning algorithms for data science.	-	2	-
CO-4	**Illustrate** the process of feature selection and analysis of data analysis algorithms.	-	2	-
CO-5	**Visualize** the data and follow ethics.	1	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	2.0	1.0	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Database Management Systems

Contents:

Unit-I

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modeling, probability distributions, fitting a model, Introduction to R. **10 Hrs**

Unit-II

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: RealDirect (online real estate firm).
Three Basic Machine Learning Algorithms: Linear Regression, kNearest Neighbors (k-NN), k-means. **10 Hrs**

Unit-III

One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scraping the Web. **10 Hrs**

Unit-IV

Feature Generation and Feature Selection (Extracting Meaning From Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system. **12 Hrs**

Unit-V

Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists. **10 Hrs**

Reference Books:

1. Rachel Schutt, “Doing Data Science - Straight Talk from the Frontline”, 1/E, O’Reilly Publications, 2013
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, 2/E, Dreamtech Press, 2016.
3. Kevin. V. Murphy, “Machine Learning: A Probabilistic Perspective”, Illustrated Edition, MIT Press, 2012.

4. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining: Concepts and Techniques” 3/E, Morgan Kaufmann, 2011

22UAIC602	Cloud Computing	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the architecture and infrastructure of cloud computing.	1, 2	-	12
CO-2	**Explain** the core issues of cloud computing.	1	4	12
CO-3	**Choose** the appropriate technologies, algorithms, and approaches for the cloud related issues.	2	4, 5	13, 14
CO-4	**Illustrate** the appropriate cloud computing solutions and recommendations according to the applications used.	1	4	13, 14
CO-5	**Illustrate** recent advances in cloud computing.	1, 2	5, 13	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	3.0	-	2.0	2.0	-	-	-	-	-	-	1.0	1.0	1.0

Pre-requisites: Knowledge of Programming Skills, Computer Networks, and Web 2.0

Contents:

Unit-I

Introduction to Cloud Computing: Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud-based Services & Applications

Cloud Concepts & Technologies: Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing. **8 Hrs**

Unit-II

Cloud Services & Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment & Management Services, Identity & Access Management Services, Open Source Private Cloud Software

Hadoop & Map Reduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, and Hadoop Cluster Setup. **8 Hrs**

Unit-III

Cloud Application Design: Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches. **8 Hrs**

Unit-IV

Python for Cloud: Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for Map Reduce, Python Packages of Interest, Python Web Application Framework - Django, Designing a RESTful Web API.

Cloud Application Development in Python: Design Approaches, Image Processing App, Document Storage App, MapReduce App, Social Media Analytics App. **8 Hrs**

Unit-V

Advanced Topics: Clustering and Classification of Big Data, Multimedia Cloud, Cloud Application Benchmarking & Tuning, Cloud Security, Cloud for Industry, Healthcare & Education, Containers, Dockers, and Kubernetes **7 Hrs**

Beyond the Syllabus Coverage (Suggestive):

1. Students' Survey papers related to Cloud Computing
2. Laboratory Experiments
3. Seminar

Reference Books:

1. Arshdeep Bahga, Vijay Madishetti, “Cloud Computing: A Hands-On Approach”, 1/E, Universities Press India, 2014
2. Dan C. Marinescu, “Cloud Computing: Theory and Practice”, 1/E, Morgan Kaufmann Publishers, 2013.
3. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing: Foundations and Applications Programming”, Illustrated Edition, Morgan Kaufmann Publishers, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing - A Practical Approach” 3/E, McGraw Hill Education (India) Private Limited, 2017
5. Tom White, “Hadoop - The Definitive Guide”, 3/E, O’Reilly Publications, 2012.

22UAIL603 Deep Learning and Reinforcement Learning Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To introduce the idea of artificial neural networks and their architecture.
- To introduce techniques used for training artificial neural networks.
- To enable design of an artificial neural network for classification.
- To enable design and deployment of deep learning models for machine learning problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the mathematics behind the functioning of artificial neural networks.	1, 2	3	12
CO-2	**Explain** the types (feedforward and feedback) of neural networks.	1, 2	5	4, 12
CO-3	**Analyze** the given dataset for designing a neural network based solution.	1, 3, 13	5	6

CO-4	**Design** and **implement** deep learning models for various applications.	1	2	6
CO-5	**Design** and **deploy** simple TensorFlow-based deep learning solutions to classification problems	4	1	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.8	2.7	2.5	2.0	2.0	1.0	-	-	-	-	-	1.0	3.0	-

List of Experiments (Sample):

1. Build Machine Learning model to solve real world regression problems.
2. Build machine learning model to real world binary classification problems
3. Build a simple model to understand overfitting and underfitting conditions.
4. Build simple convolution network to identify hard written character recognition
5. Analyze performance metrics of the machine learning model

Reference Books:

1. Ian Goodfelllow, Yoshua Benjio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning Series)”, The MIT Press, 2016
2. Andrew. Trask , “Grokking Deep Learning”, 1/E, Manning Publications, 2019.
3. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2/E, Wiley & Sons Inc, 2000.
4. Chirstopher M. Bishop, “Pattern Recognition and Machine Learning”, 1/E (Revised), Springer Publications, 2016.
5. CourseEra/EDX/Udacity Courses:
   a. Deep Learning with TensorFlow
   b. Deep Learning with Pytorch

22UAIL604	Data Science and Analytics Laboratory	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To apply quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
- To employ cutting edge tools and technologies to analyze Big Data.
- To enable students to understand not only how to apply certain methods, but when and why they are appropriate.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Define** data science and its fundamentals	-	-	4
CO-2	**Demonstrate** the process in Data Science	-	3	-
CO-3	**Explain** the machine learning algorithms for data science.	-	2	-
CO-4	**Illustrate** the process of feature selection and analysis of data analysis algorithms.	-	2	-
CO-5	**Visualize** the data and follow ethics.	1	-	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.0	2.0	1.0	-	-	-	-	-	-	-	-	-	-

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, etc.

Suggested Exercises:

1. Working with Pandas data frames.
2. Basic plots using Matplotlib.
3. Frequency Distributions, Averages, Variability.
4. Regression.

5. Building and Validating Linear and Logistic Models.
6. Time Series Analysis.

22UAIL605	Minor Project - II	(0 - 0 - 4) 2

Contact Hours: 52

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- Understand the domain.
- Analyze through Modeling.
- Implementation through state of the art technology available.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and formulate the problem.	11, 12	1, 2, 8	6, 7
CO-2	**Analyze** the problem scenario and **design** the solutions to complex engineering problems using software engineering principles or appropriate research methodology.	11, 12	2, 3, 5, 8, 13, 14	6, 7
CO-3	**Identify** and **implement** a feasible solution using appropriate technology, tools, procedures and techniques.	11, 12	3, 4, 5, 8, 13, 14	-
CO-4	**Verify** and **validate** the proposed system for correctness and to demonstrate compliance with the design and hence the stated requirements/ research gap.	11, 12	5, 8, 13, 14	-
CO-5	**Prepare** the report and communicate effectively through presentation.	10, 11	8, 9	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	2.0	2.0	2.0	2.0	1.0	1.0	2.0	2.0	3.0	3.0	3.0	2.0	2.0

Guidelines for Conduction:

1. It is either a continuation of Mini-Project-I or a new project.
2. The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work.
3. The problem could be defined to develop prototypes for industrial needs.
4. A team consisting of not more than 2-4 students shall be guided by a faculty member.
5. This project work is to supplement and prepare the students to take up major project work at higher semesters.
6. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics.
7. The weightage of marks shall be 50% for the committee and 50% for the guide.
8. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HoD.

22USSK606	Soft Skills - II	(0 - 0 - 2) Audit

Contact Hours: 26

Course Learning Objectives (CLOs): This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Demonstrate** the skill in sentence completion and faster reading of passages.	-	10	-
CO-2	**Use** the English language with proficiency.	-	10	12
CO-3	**Demonstrate** the capability of interview facing ability.	-	9	12
CO-4	**Demonstrate** the competency in the placement activities.	-	9	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-

Contents:

Vocabulary ▪ Formatting and feeding correct structures ▪ Synonyms and Antonyms ▪ Analogies ▪ Sentence Completion ▪ Error Detection and Correction ▪ Faster reading of Passages ▪ Essays ▪ Carryover plan - Dictionary Usage **11 Hrs**

Understanding Discussions ▪ Parameters measured in GDs ▪ Video Analysis of GDs ▪ Knowledge base and Ideas ▪ Taking the initiative ▪ Introduction and Conclusion **4 Hrs**

Most common personal interview questions ▪ What companies expect ▪ Showing Commitment and Learning Ability ▪ Handling difficult questions ▪ Understanding interviewer psychology ▪ Situation Reaction and Presence of Mind ▪ Dressing right ▪ Interview etiquette **11 Hrs**

Evaluation:
Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UAIE621 Natural Language Processing (3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To gain fundamental understanding about the methods and evaluation metrics for various natural language processing tasks.
- To understand concepts of morphology, syntax, semantics and pragmatics of the language.
- To harness, employ, and analyze linguistics and textual data effectively.
- To apply information retrieval techniques for natural language processing.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** the natural language text.	3	2, 4, 5,12	13, 14
CO-2	**Generate** the natural language using regular expressions**.**	3	2, 4, 5,12	13, 14
CO-3	**Explain** the concepts of Text Mining.	3	1, 2, 4, 5,12	13, 14
CO-4	**Analyze** textual signatures and Automatic Document Separation.	-	3, 4, 5, 12	13, 14
CO-5	**Illustrate** information retrieval techniques.	1	5, 3, 12	13, 14

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.5	2.0	2.6	2.0	2.0	-	-	-	-	-	-	2.0	2.0	2.0

Pre-requisites: Knowledge of Programming Skills

Contents:

Unit-I

Introduction to Natural Language Processing: Origins and challenges of NLP Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval.

Language Modeling: Grammar based Language Models, Statistical Language Model. **8 Hrs**

Unit-II

Word Level Analysis: Finite - State Automata, Regular Expressions, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of-Speech Tagging.

Syntactic Analysis: Context - Free Grammar, Constituency Parsing, Probabilistic Parsing. **8 Hrs**

Unit-III

Extracting relations from Text: Introduction, Subsequence Kernels for Relation Extraction, A Dependency Path Kernel for Relation Extraction, Experimental Evaluation.

Mining Diagnostic Text Reports: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to annotate cases with knowledge roles and evaluations. **8 Hrs**

Unit-IV

Textual Signatures: Introduction, Cohesion, CohMetrix, Approaches to analyzing texts, Latent Semantic Analysis, Predictions.

Automatic Document Separation: Introduction, Related Work, Data Preparation, Document Separation as a sequence mapping problem. **8 Hrs**

Unit-V

Information Retrieval: Introduction, Design Features of Information Retrieval Systems - Classical and Non - Classical Models, Alternative Models,

Lexical Resources: Introduction, Stemmers. **7 Hrs**

Reference Books:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2006.
3. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2/E, Prentice Hall, 2008.
4. James Allen, “Natural Language Understanding”, 2/E, Benjamin/Cummings publishing company, 1995.
5. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, 2/E, Kluwer academic Publishers, 2000

22UAIE622	Agile Methodology	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To understand how an iterative, incremental development process leads to faster delivery of more useful software.
- To understand the essence of agile development methods.
- To understand the principles and practices of extreme programming.
- To understand the roles of prototyping in the software process.
- To understand the concept of Mastering Agility.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** The XP Lifecycle, XP Concepts, Adopting XP.	1	-	12
CO-2	**Implement** Work on Pair Programming, Root - Cause Analysis.	1	4	13
CO-3	**Design** Retrospectives, Planning, Incremental Requirements and Customer Tests.	1	4	12
CO-4	**Implement** concepts to eliminate waste.	2	-	1
CO-5	**Determine** value of productive systems through agile methods.	4	-	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.5	3.0	-	2.7	-	-	-	-	-	-	-	1.0	1.0	-

Pre-requisites: Knowledge of Software Engineering

Contents:

Unit-I

Introduction to Agile: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor.

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility. **7 Hrs**

Unit-II

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives.

Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting.

Releasing: "Done Done", No Bugs, Version Control, TenMinute Build, Continuous Integration, Collective Code Ownership, Documentation. **8 Hrs**

Unit-III

XP-Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating,

Developing: Incremental Requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing. **8 Hrs**

Unit-IV

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading.

Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules.

Rely on People: Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People.

Eliminate Waste: Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput. **8 Hrs**

Unit-V

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently.

Seek Technical Excellence: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery. **7 Hrs**

Reference Books:

1. James shore, Chromatic, "The Art of Agile Development (Pragmatic guide to agile software development)", O'Reilly Media, Shroff Publishers & Distributors, 2013.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall; 1/E, 2002.
3. Craig Larman, "Agile and Iterative Development A Manger's Guide",1/E, Pearson Education India, 2004.

22UAIE631	Computer Vision	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To understand basic principles of image formation
- To learn image processing algorithms and different algorithms for recognition from single or multiple images

- To understand the core vision tasks of scene understanding.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the fundamentals of Computer Vision concepts.	1	-	12, 13, 14
CO-2	**Analyze** and **interpret** the inherent difficulties encountered in Computer Vision.	2	3, 5	12, 13, 14
CO-3	**Apply** Computer Vision techniques to solve problems in the visible world around us**.**	1	2, 5	12, 13, 14
CO-4	**Apply** Computer Vision techniques to Classify Images.	1	2	12
CO-5	**Explain** video processing and motion computation.	1	3, 5	12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3.0	2.3	2.0	-	2.0	-	-	-	-	-	-	1.0	1.0	1.0

Pre-requisites: Knowledge of Programming

Contents:

Unit-I

Introduction: What is computer vision? A brief history, Geometric primitives and transformations.

Image Formation: Photometric image formation, Pinhole Perspective, Weak perspective, Cameras with lenses, Geometric Camera.

Calibration: Linear approach to camera calibration, Non - Linear approach to camera calibration.

Light and Shading: Modeling Pixel brightness, Reflection at surfaces, Sources and their effects, Lambertine and Spectacular model. Inferences from shading. **8 Hrs**

Unit-II

Early vision: Linear Filters and Convolution, Shift Invariant Linear Systems, Discrete Convolution, Continuous Convolution, Edge Effects in Discrete Convolution, Spatial Frequency and Fourier Transforms - Fourier Transforms, Sampling and Aliasing, Filters as Templates.

Stereopsis: Binocular Camera Geometry and the Epipolar constraint - Epipolar geometry, The essential matrix, The fundamental matrix. **8 Hrs**

Unit-III

Mid level Vision: Segmentation by clustering, Human Vision - Grouping and Gestalt, Important applications, Image Segmentations by Clustering pixels, Segmentation, Clustering, and Graphs. **8 Hrs**

Unit-IV

High level Vision: Registration, Model based Vision - Registering Rigid Objects, Registering deformable objects, Classifying images - Building good Image features, Classifying Images of Single Objects, Image Classification in practice. **8 Hrs**

Unit-V

Detecting Objects in Images: Sliding Window method, Detecting Deformable Objects, The State of the Art of Detection Object recognition: Basics of Object Recognition, Object Recognition System, Current Strategies, Categorization, Selection, Feature questions, Geometrical questions, Semantic questions. **7 Hrs**

Reference Books:

1. David Forsyth and Jean Ponce, “Computer Vision: A Modern Approach”, 2/E, Pearson Education India, 2015.
2. Richard Szeliski, “Computer Vision: Algorithms and Applications”, 2/E, Springer Publications, 2022.
3. Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, 4/E, Pearson Education, 2018.
4. Adrian Low, “Introductory Computer Vision, Imaging Techniques and Solutions” 2/E, BS Publications, 2010.
5. Dana H. Ballard, Christopher M. Brown, “Computer Vision”, Prentice-Hall, 1/E, 1982.
6. Shamshad Ansari “Building Computer Vision Applications Using Artificial Neural Networks with Step-by-step Examples in Open cv And Tensor flow with Python”, 1/E, Apress, 2020.

22UAIE632	Blockchain Technology	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To understand basic principles of blockchain technology.
- To understand the different types (Public, Private and Consortium) of blockchain and consensus algorithms in a decentralized network architecture.
- To understand the meaning, characteristics and types of cryptocurrency.
- To learn about Bitcoin and Ethereum.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Describe** the fundamentals of blockchain.	-	1	12, 13, 14
CO-2	**Explain** the procedure of execution of transactions in blockchain.	-	1	12, 13, 14
CO-3	**Predict** the future prospects of cryptocurrency investment market.	-	2, 3, 5	12, 13, 14
CO-4	**Distinguish** between public, private, and consortium blockchain systems.	-	1, 2	12, 13, 14
CO-5	**Explain** the features and need of smart contracts in blockchain.	-	1, 3	12, 13, 14

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.0	2.0	2.0	-	2.0	-	-	-	-	-	-	1.0	1.0	1.0

Pre-requisites: Knowledge of Computer Networks.

Contents:

Unit-I

Fundamentals of Blcokchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain, The Technology and the Future.

Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. **8 Hrs**

Unit-II

Cryptocurrency: Introduction, Bitcoin, Cryptocurrency Basics, Types, Usage. **8 Hrs**

Unit-III

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain. **8 Hrs**

Unit-IV

Smart Contracts: Introduction, Smart Contract, Characteristics, Types, Smart Contracts in Ethereum, Smart Contracts in Industry. **7 Hrs**

Unit-V

Private Blockchain System: Introduction, Characteristics, Need, Examples.

Consortium Blockchain: Introduction, Characteristics, Need, Hyperledger Platform.

8 Hrs

Reference Books:

1. S. Chandramouli et al, “Blockchain Techology”, 1/E, Universities Press, 2020.
2. Kumar Saurabh and Ashutosh Saxena, “Blockchain Technology”, 1/E, Wiley Publications, 2020.
3. Asharaf S et al, “Blockchain Technology: Algorithms and Applications”, 2/E, Wiley Publications, 2023.

22UAIO641	Human Computer Interaction	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To understand the foundations of human computer interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To learn the guidelines for user interface.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12) / PSOs (13-16)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Describe** the different interaction styles and **design** an effective dialog for Human Computer Interface.	1	-	12,13,14
CO-2	**Design** effective HCI for individuals and persons with disabilities.	2,5	3	12,13,14
CO-3	**Apply** theories and concepts associated with effective work design for real world applications.	1	2	12,13,14
CO-4	**Explain** the HCI implications for designing multimedia, e-commerce and e-learning Web sites.	1	2	12
CO-5	**Develop** meaningful user interface.	1,3	5	12,14

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3.0	2.3	2.5	-	2.5	-	-	-	-	-	-	1.0	1.0	1.0

Contents:

Unit-I

Foundation of HCI : Objective & Overview , Definition of HCI , Nature of the field, HCI Discipline, History evolution of the field, Evolution of HCI- Major milestones. **The Human:** I/O channels, Memory, Reasoning and problem solving, The Computer: Devices, Memory, processing and networks, Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity- Paradigms. . **8 Hrs**

Unit-II

Design & Software Process: Interactive Design- Basics process, scenarios, navigation, screen design, Iteration and prototyping.
HCI in software process: Software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques, Universal Design. **8 Hrs**

Unit-III

Models and Theories: HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements, Communication and collaboration models, Hypertext, Multimedia and WWW. **8 Hrs**

Unit-IV

Mobile Ecosystem: Platforms, Application frameworks, Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture.
Mobile Design: Elements of Mobile Design, Tools. **8 Hrs**

Unit-V

Design Web Interfaces: Designing Web Interfaces, Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. **7 Hrs**

Reference Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3/E, Pearson Education, 2004.
2. Brian Fling, "Mobile Design and Development", 1/E, O'Reilly Media Inc. 2009.
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", 1/E, O'Reilly, 2009.
4. Helen Sharp, Jennifer Preece, Yvonne Rogers, "Interaction Design Beyond Human Computer Interaction", 5/E, Wiley, 2019.

22UAIO642 Business Intelligence and Analytics (3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course focuses on the following learning perspectives:

- To explain the business intelligence, analytics and decision support systems.
- To list the technologies for decision making, automated decision systems.
- To explain sentiment analysis techniques.
- To illustrate multi-criteria decision making systems, predictive modelling techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** business intelligence and decision support systems**.**	-	13,14	1,12

CO-2	**Explain** the technologies for decision making.	-	2	3,13
CO-3	**Describe** the concept of neural networks and **apply** sentiment analysis techniques.	-	2	3,13
CO-4	**Illustrate** multi criteria decision making systems and predictive modeling techniques.	-	2	3,13
CO-5	**Describe** the structure of expert systems, knowledge engineering and development of expert systems.	-	13,14	1,13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.0	2.0	-	-	-	-	-	-	-	-		1.0	1.3	2.0

Contents:

Unit-I

An Overview of Business Intelligence, Analytics, and Decision Support: Information Systems Support for Decision Making, An Early Framework for Computerized Decision Support, The Concept of Decision Support Systems, A Framework for Business Intelligence, Business Analytics Overview, Brief Introduction to Big Data Analytics. **8 Hrs**

Unit-II

Decision Making: Introduction and Definitions, Phases of the Decision, Making Process, The Intelligence Phase, Design Phase, Choice Phase, Implementation Phase, Decision Support Systems Capabilities, Decision Support Systems Classification, Decision Support Systems Components**.** **8 Hrs**

Unit-III

Neural Networks and Sentiment Analysis: Basic Concepts of Neural Networks, Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity, Support Vector Machines, A Process Based Approach to the Use of SVM, Nearest Neighbor Method for Prediction, Sentiment Analysis Overview, Sentiment Analysis Applications, Sentiment Analysis Process,, Sentiment Analysis, Speech Analytics. **8 Hrs**

Unit-IV

Model-Based Decision Making : Decision Support Systems modeling, Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk, Decision modeling with spread sheets, Mathematical programming optimization, Decision Analysis with Decision Tables and Decision Trees, Multi-Criteria Decision Making With Pair wise Comparisons. **8 Hrs**

Unit-V

Automated Decision Systems and Expert Systems: Automated Decision Systems, The Artificial Intelligence field, Basic concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems. **7 Hrs**

Reference Books:

1. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,Ting-Peng Liang, David King, “Business Intelligence and Analytics: System for Decision Support”, 10/e, Pearson Global Edition, 2013.
2. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017by Edward Mize.
3. Ramesh Sharda, Dursun Delen, EfraimTurban, “Business Intelligence and Analytics: System for Decision Support”, 10/e, Pearson Global Edition, 2018.

22UPYK607	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and importance of Physical Education & Yoga in day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human	12		8, 9

	Body conditioning & Sports training			
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	-	-	-	-	1	2	-	1	1	-	-	3

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health, Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, importance prayer Suryanamaskara,

Asana:- Padahastasana, Ardha matsyendrasana, Halasana, Navasana.

Pranayama:- Sitali Pranayama & Nadishodhana Pranayama

Mudras:- Prana mudra & Adhi mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Football, Badmintion, Chess, Teakwondo, Rules and regulation of all games. **05 Hrs**

Unit-V

Modern technology in sports and games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997

2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

CIE and SEE Evaluation (from 2024 - 25 batch)

Courses with LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

Continuous Internal Evaluation (CIE):

- Two Internal Assessments and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course each of 5marks. Total CTA marks-10
- CIE=40 (from tests)+10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for 100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

ASC(IC)/PCC with LTP 2-0-2, 3-0-2 and 2-2-2

Continuous Internal Evaluation (CIE):

Theory CIE component:

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.

- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.

Course Teacher Assessment (CTA): Totally based on conduction of experiments as set by the course teacher.

Laboratory component assessment:

- 5 marks: for conduction, regularity, involvement, journal writing, etc. Minimum 75% of attendance is compulsory. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- 5 marks: Lab Test. A Lab test as per the class time table has to be conducted at the end for50 marks and scale down to 5 marks.
- CIE for integrated course =40 (from IA tests)+10 (from CTA i.e. lab component) =50 marks.
- There will not be any remuneration for Final Lab Test since it is CTA of integrated course.
- Copy of the Marks list to be sent to the concerned course instructor immediately after the completion of test for that batch. Original Marks list to be maintained in the department.
- CIE=40(from tests)+10(from CTA i.e. lab component) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.