

RAMAIAH Institute of Technology

CURRICULUM

Outcome Based Education

Academic year 2023 – 2024

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

V & VI SEMESTER B.E.

RAMAIAH INSTITUTE OF TECHNOLOGY

(Autonomous Institute, Affiliated to VTU) Bangalore – 560054.

About the Institute

Dr. M. S. Ramaiah a philanthropist, founded "Gokula Education Foundation" in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 11 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with "A⁺" grade by NAAC in March 2021 for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Ouality Improvement Program (TEOIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 67% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection ofbook volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, Ramaiah Institute of Technology has achieved 78th rank among 1314 top Engineering Institutions & 23rd Rank for School of Architecture in India for the year 2023.

About the Department

Year of Establishment	2021
Names of the Programme offered	UG: B.E. in Artificial Intelligence and Data Science

The Department of Artificial Intelligence and Data Science was established in 2021 The department focuses on the application of Artificial Intelligence, Data Analysis, Machine Learning, and various Statistical techniques to extract insights and make data-driven decisions.

The department has highly qualified faculty members with doctorate degree. The faculty members has published their research in refereed International journals and conferences. The department is equipped with state-of-the-art laboratories and classrooms. Department has incorporated the ICT techniques for effective Teaching. Further department frequently Conducts technical events like: seminars, workshops, hackathons etc., to allow students to gain critical skill sets in Data Science. The department encourages the students for overall development by encouraging students to participate in extracurricular/cocurricular activities. Department works towards strengthening the bridge between academic and the industry Through the Academia-Industry Collaborations.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socioeconomic needs

MISSION OF THE INSTITUTE

MSRIT shall meet the global socio-economic needs through

- 1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- 2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- 3. Establishing innovative skills development, techno-entrepreneurial activities, and consultancy for socio-economic needs

QUALITY POLICY

We at M. S. Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To build strong technical environment and enhance problem solving abilities in the domain of Artificial Intelligence and Data Science to generate professionals who are capable of handling social and technical problems

MISSION OF THE DEPARTMENT

- 1. To facilitate students with latest tools and techniques by providing professionally committed faculty and staff
- 2. To develop ethical values, leadership and research capabilities in students to face the global challenges
- To establish state of the art laboratories, MOU with leading industries in order to promote research and innovation activities in Artificial Intelligence and Data Science domain among students

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

A B.E (Artificial Intelligence and Data Science) graduate of Ramaiah Institute of Technology should, within three to five years of graduation

PEO1: Excel with professional skills to become data science leaders, AI research scientists, or entrepreneur

PEO2: Be aware of the development in the field of Artificial intelligence and data science, enhance knowledge through research or pursue graduate studies

PEO3: Will engage in life-long earning, work effectively in multidisciplinary teams with social awareness and responsibilities

PROGRAM OUTCOMES (POs):

The Outcomes of the Bachelor of engineering in Artificial Intelligence and Data Science Programme are as follows:

Engineering Graduates must be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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.

PO4: 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.

PO5: 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.

PO6: 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.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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):

- **PSO1:** Understand the principles, and architecture of computers, concepts of intelligent systems, and data analytic technologies
- **PSO2:** Apply the concepts of AI and data science in modelling and design of intelligent systems
- **PSO3:** Apply appropriate tools and techniques to develop software and hardware solutions for healthcare, education, agriculture, automation, robotics, cloud technology, and mobile applications.

Semester wise Credit Breakdown for B.E Degree Curriculum Batch 2021-25

Semester Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	08	08	03	03					22
Engineering Sciences (ESC)	09	11							20
Humanities, Social Sciences and Management (HSMC)	02		01	01	03	03			10
Ability Enhancement Course (AEC)	01	01	01	01	01		03		08
Universal Human Values (UHV)			02						02
Professional Core Courses (PCC)			11	12	11	05	04		43
Integrated Professional Core Course (IPCC)			03	03	03		04		13
Professional Elective Courses (PEC)					03	06	03		12
Institutional Open Elective Courses (IOE)						03	03		06
Internship (INT)				02		02		05	09
Mini Project / Project Work (PW)						03	03	09	15
Non Credit Mandatory Courses (NCMC)			Yes		Yes				
Total Credits	20	20	21	22	21	22	20	14	160

SCHEME OF TEACHING V SEMESTER

SI.	Course	Course Name	Teaching	Category		С	redits		Total contact hours /week
No.	Code		Department	0.	L	Т	Р	Total	
1	AD51	Big Data Analytics	AIDS	PCC	3	0	0	3	3
2	AD52	Operating Systems	AIDS	IPCC	2	0	1	3	4
3	AD53	Machine Learning	AIDS	PCC	3	0	0	3	3
4	AD54	Soft Computing	AIDS	PCC	3	0	0	3	3
5	ADE55x	Program Elective Course – 1	AIDS	PEC	3	0	0	3	3
6	ADL56	Machine Learning Laboratory	AIDS	PCC	0	0	1	1	2
7	ADL57	Android Application Development Laboratory	AIDS	PCC	0	0	1	1	2
8	AL58	Research Methodology & Intellectual property rights	Humanities	HSMC	3	0	0	3	3
9	AEC510	AEC – V: AI for Business Managers	CSE	AEC	1	0	0	1	1
	Total 21							25	
10	HS59	Environmental Studies *		NCMC	0	0	0	0	1

* Environmental Studies is under the category of NCMC, 1 hour teaching per week has to be allocated in the time table.

	ADE55x: Program Elective Course – 1															
SI.	Course	Irse Course Name	Teaching	Category		C	Total contact hours /week									
No.	Code	Course Manie	Department	Department	Department	Department	Department	Department	Department	Department	Category	L	Т	Р	Total	
1	ADE551	Graph Theory	AIDS	PEC	3	0	0	3	3							
2	ADE552	Computer Vision	AIDS	PEC	3	0	0	3	3							
3	ADE553	Computer Organization and Architecture	AIDS	PEC	3	0	0	3	3							
4	ADE554	Advanced Algorithms	AIDS	PEC	3	0	0	3	3							
5	ADE555	Sensors and Actuators	AIDS	PEC	3	0	0	3	3							

Nomenclature: IPCC: Integrated Professional Core Course, **PCC:** Professional Core Course, **HSMC:** Humanity and Social Science & Management Courses, **PEC:** Professional Elective Courses , **AEC**–Ability Enhancement Courses, **NCMC:** Non-credit Mandatory Course

L –Lecture, T – Tutorial, P- Practical/ Drawing

Note: XXE55x, where x=1,2,3,4,5

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (2 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10. However, this

conditional shall not be applicable to cases where the admission to the program is less than 10.

Innovation/ Societal/ Entrepreneurship based Internship: At the End of fourth Semester four - weeks Summer Internship Shall Be Carried Out – Based On industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. Credited in fifth Semester. All the students admitted shall have to undergo mandatory internship of 04 weeks during the vacation of IV semester. A Viva-Voce examination shall be conducted during VI semester and the prescribed credit shall be included in VI semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

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. Students entering 4 years^{ee} degree program through lateral entry are required to earn 75 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 8th semester grade card. The activities to earn the points can be spread over the duration of the course. 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. Incase student fail to earn the prescribed activity points; 8th 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 8th semester grade card.

The Non-Credit Mandatory Course The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured "F" grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

Credits Total SI. Subject Teaching contact Subject Category No. Code Department Т Р hours L Total /week AL61 Management & Entrepreneurship AIDS HMSC 3 0 3 3 1 0 PCC 2 AD62 Deep Learning AIDS 3 0 3 3 0 Program Elective Course – 2 3 ADE63x AIDS PEC 3 3 3 0 0 Program Elective Course – 3 3 4 ADE64x AIDS PEC 3 0 3 0 5 ADL65 Data Analytics Laboratory AIDS PCC 0 0 2 1 1 ADL66 Deep Learning Laboratory AIDS PCC 2 6 0 0 1 1 Institutional Open Elective - 1 7 ADOE0x* AIDS IOE 3 3 3 0 0 PW 8 ADP67 Mini Project AIDS 3 3 0 0 -Innovation/Societal/ 2 INT68 AIDS INT 0 0 2 -9 Entrepreneurship based Internship Total 22 19

ADE63x: Program Elective Course – 2										
Course	Teaching		a .		Cre	Total contact				
Code	Course Name	Department	Department Category		Т	Р	Total	hours /week		
ADE631	Statistical Machine Learning Algorithms	AIDS	PEC	3	0	0	3	3		
ADE632	Robotics Process Automation - Design and Development	AIDS	PEC	3	0	0	3	3		
ADE633	3D Printing	AIDS	PEC	3	0	0	3	3		
ADE634	Digital Signal Processing	AIDS	PEC	3	0	0	3	3		
ADE635	Software Engineering	AIDS	PEC	3	0	0	3	3		

	ADE64x: Program Elective Course – 3																	
SI	Course		Toophing			Cre	dits		Total									
No.	Code	Course Name	Department Category	L	Т	Р	Total	contact hours /week										
1	ADE641	Cryptography and Network Security	AIDS	PEC	3	0	0	3	3									
2	ADE642	Edge Computing	AIDS	PEC	3	0	0	3	3									
3	ADE643	Optimization Methods in Machine Learning	AIDS	PEC	3	0	0	3	3									
4	ADE644	Block Chain Technologies	AIDS	PEC	3	0	0	3	3									
5	ADE645	Information Retrieval	AIDS	PEC	3	0	0	3	3									

	ADOE0x*: Institutional Open Elective - 1													
SI	Course		Teeching			Cre	edits		Total					
No.	Code	Course Name	Department	Department	Department	Department	Department	Department	Category	L	Т	Р	Total	contact hours /week
1	ADOE01	Introduction to Artificial Intelligence and Data Science	AIDS	PEC	3	0	0	3	3					
2	ADOE02	Embedded Intelligence	AIDS	PEC	3	0	0	3	3					
3	ADOE03	Block Chain Technologies	AIDS	PEC	3	0	0	3	3					
4	ADOE04	Introduction to IOT and Cloud Computing	AIDS	PEC	3	0	0	3	3					

Nomenclature, PCC: Professional Core Course, PEC: Professional Elective Courses, IOE: Institutional Open Elective, PW: Mini Project, INT –Internship

L-Lecture, T-Tutorial, P-Practical/Drawing

Note: XXE63x , where x=1,2,3,4,5

XXE64x, where x=1,2,3,4,5

XXOE0x*, where x=1,2,..,.. continued from previous

L –Lecture, T – Tutorial, P- Practical/ Drawing/ Project work

Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10. However, this conditional

shall not be applicable to cases where the admission to the program is less than 10.

Institutional Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by theirparent department. However, they can take an elective offered by other departments, provided they satisfy the prerequisite condition, if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall not be allowed if,

- 1. The candidate has studied the same course during the previous semesters of the program.
- 2. The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- 3. A similar course, under any category, is prescribed in the higher semesters of the program.
- 4. The minimum students" strength for offering open electives is 10. However, this condition shall not be applicable to caseswhere the admission to the program is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinaryMiniproject can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session as per the rubrics defined by the department.(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, andquestion and answer session as per the rubrics defined by the parent department.

SEE component for Mini-Project: SEE will be conducted by the two examiners appointed by the Institute. SEE marks awarded for the mini project shall be based on the evaluation of project work report, project presentation skill and question and answer session.

Research/Industrial Internship - At the end of sixth / seventh semester (in two cycles to accommodate all the students of the) Research/Industrial Internship shall be carried out – Based on Industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo mandatory internship of 24 weeks during the vacation of VI/VII semesters. A Viva-Voce examination shall be conducted during VII semester and the prescribed credit shall be included in VII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

Research internship Students have to take up research internship at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organization / Institutes. Research internship is basically intended to give you the flavor of current research going on in a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: Is an extended period of work experience undertaken by /Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome unexpected obstacles and successfully navigate

organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

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. Students entering 4 years" degree program through lateral entry are required to earn 75 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 8th semester grade card. The activities to earn the points can be spread over the duration of the course. 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. Incase student fail to earn the prescribed activity points; 8th 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 8th semester grade card.

V SEMESTER

BIG DATA ANALYTICS

Course Code: AD51 Pre – requisites: Nil Credits: 3:0:0 Contact Hours: 42L

Course Coordinator: Dr. Vinay T R

Course Content

Unit I

Introduction to Big Data Analytics:

Types of Digital Data: Classification of Digital Data. Introduction to Big Data: Introduction to Big Data, Characteristics of Data, Definition of Big Data, Challenges with Big Data, Big Data Analytics: What is Big Data Analytics?, Top Challenges Facing Big Data, CAP Theorem, Basically Available Soft State Eventual Consistency (BASE).

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_cs112/preview</u>

Unit II

Introduction to Hadoop: Introducing Hadoop, Why Hadoop?, Why not RDBMS?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet Another Resource Negotiator), Interacting with Hadoop Ecosystem

MapReduce Programming: MapReduce, MapReduce and Hadoop Workflow, MapReduce Examples.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_cs112/preview</u>

Unit III

Introduction to Hive: What is Hive?, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, User-Defined Function (UDF).

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_cs112/preview</u>

Unit IV

Introduction to Pig: What is Pig?, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig, When to use Pig?, When not to use Pig?, Pig at Yahoo!, Pig versus Hive.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_cs112/preview</u>

Unit V

Introduction to Cassandra: Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD (Create, Read, Update, and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_cs112/preview</u>

Suggested Learning Resources

Text Book:

1. Big Data Analytics, Seema Acharya and Subhashini Chellappan. Wiley India Pvt. Ltd. 20152.

Reference:

1. Network Data Analytics, Siddesh G M et.al., Springer, 2018.

Course Outcomes (COs):

At the end of the course, students will be able to:

• Understand fundamentals of Big Data analytics. (PO-1,2,4,5. PSO-1)

- Investigate the Hadoop framework and Hadoop Distributed File system. (PO-1,2,3,4,5. PSO-1,2)
- Demonstrate the MapReduce programming model to process the big data along with Hadoop tools. (PO-1,2,3,4,5.8,12. PSO-1,2,3)
- Usage of Hive platforms to manage Big data. (PO-1,2,3,4,5.8,12. PSO-1,2,3)
- Apply Pig Latin for solving big data challenges and Apply Cassandra query language in handling Big data storage. (PO-1,2,3,4,5,8,12.PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks							
Assessment Tools	Marks	Course Outcomes (COs) addressed					
Internal Test-I (CIE-I)	30	CO1, CO2, CO3					
Internal Test-II CIE-II)	30	CO3, CO4, CO5					
Average of the two CIE shall be taken for 30 marks							
Other Components							
Quiz	10	CO1, CO2, CO3					
Assignment	10	CO3, CO4, CO5					
The Final CIE out of 50 Marks =	Average of two	OCIE tests for 30 Marks+					
Marks scored in Quiz-I +Marks s	cored in Assig	nment					
Semester End Examination (SEE))						
Course End Examination		CO1 CO2 CO3 CO4 CO5					
(Answer One full question from	100	001, 002, 005, 004, 005					
each Unit- Internal Choice)							

OPERATING SYSTEMS Course Code: AD52 Credits: 2:0:1 Pre – requisites: Nil Contact Hours: 28L+14P Course Coordinator: Dr. Vaneeta M Contact Hours: 28L+14P

Course Content

Unit I

Introduction to Operating Systems- What operating systems do, Operating System operations, Process management, Memory management, Storage management, Protection and security. System Structures- Operating System Services, System calls, Operating System design and implementation, Operating System structure, Virtual machines. Process Management - Process concept, Process scheduling, Operations on processes, Inter-process communication

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106106144</u>, <u>https://nptel.ac.in/courses/106102132</u> <u>https://www.youtube.com/watch?v=vBURTt97EkA</u>

Unit II

Multi-threaded Programming: Overview; Multithreading models, Threading issues. **Process Scheduling-** Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling. **Process Synchronization**-Background, The Critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://nptel.ac.in/courses/106106144 https://nptel.ac.in/courses/106102132

https://www.youtube.com/watch?v=OrM7nZcxXZU

Unit III

Deadlocks- System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock. **Memory Management Strategies**- Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation. **Virtual Memory Management**- Background, Demand paging, Page replacement,

Thrashing.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106106144</u> <u>https://nptel.ac.in/courses/106102132</u> https://www.youtube.com/watch?v=rWFH6PLOIEI

Unit IV

File System- File concept, Access methods, Directory structure, Protection. Implementing File System- File system structure, File system implementation, Directory implementation, Allocation methods, Free space management. Secondary Storage Structures-Mass storage structures, Disk structure, Disk scheduling.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106106144</u> <u>https://nptel.ac.in/courses/106102132</u> <u>https://www.youtube.com/watch?v=Uro0GDMR2A8</u>

Unit V

Dockers-Docker Basics and Architecture, what is containerization, how are containers different from physical machines and VMs, Docker evolution and architecture, Developments in Docker world, Docker tooling, Basic Docker commands. **Docker Networking**- Introduction, Types of Docker networks, Using

Networks, Identifying container networks.

Docker Volumes-Managing data in Docker containers with volumes, Volume file systems and basic Docker image file systems, Creating and managing volumes.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=pTFZFxd4hOI</u> <u>https://docs.docker.com/</u>

Lab Component:

- 1. Working with s Linux commands
- 2. Implement of simple System programs.
- 3. Implement CPU Scheduling algorithms
- 4. Illustrate producer consumer problem using semaphore
- 5. Illustrate Inter process communication using suitable method
- 6. Illustrate Bankers algorithm for deadlock avoidance
- 7. Develop Paging technique for memory management
- 8. Illustrate page replacement algorithms
- 9. Implement any two file allocation strategies
- 10. Working with Docker commands

Text Book:

 Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 9th edition, Wiley-India, 2012.

Reference Books:

- 1. William Stallings: Operating systems Internals and Design Principles, Ninth Edition, Pearson Education, 2018.
- 2. Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Operating, systems: Three easy pieces, URL: <u>http://pages.cs.wisc.edu/~remzi/OSTEP/</u>.
- **3.** James Turnbull: The Docker Book: Containerization is the new virtualization Kindle Edition, Kindle Edition, 2014.

Course Outcomes (COs):

At the end of the course students should be able to:

- 1. Describe operating system operations and operating system structures.(PO-1,2,3, PSO-1)
- 2. Assess different scheduling algorithms and concurrency control techniques to provide co-ordination among threads and processes. (PO-1,2,3,4,5. PSO-1,2)
- 3. Illustrate various methods for handling deadlocks and memory management Techniques. (PO-1,2,3,4,5. PSO-1,2)
- 4. Demonstrate different directory structure, file allocation methods and disk scheduling algorithms used for managing the disk. (PO-1,2,3,4,5. PSO-1,2)
- 5. Illustrate Dockers techniques for various networking and file system applications. (PO-1,2,3,4,5. PSO-1,2,3)

Continuous Internal Evaluation (CIE): 50 Marks								
Assessment Tools	Marks	Course Outcomes (COs)						
		addressed						
Internal Test-I (CIE-I)	30	CO1, CO2, CO3						
Internal Test-II CIE-II)	30	CO3, CO4, CO5						
Average of the two CIE shall be taken for 30 marks								
Other Components								
Lab Test	10	CO1, CO2, CO3, CO4, CO5						
Lab Record	10	CO1, CO2, CO3, CO4, CO5						
The Final CIE out of 50 Marks = A	The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+							
Marks scored in Lab Test + Marks scored in Lab Record								
Semester End Examination (SEE)100CO1, CO2, CO3, CO4, CO5								

Course Assessment and Evaluation:

MACHINE LEARNINGCourse Code: AD53Credits: 3:0:0Pre – requisites: Python ProgrammingContact Hours: 42 LCourse Coordinator: Dr. Sowmya B J

Course Content

Unit I

Introduction to Machine Learning: What is Machine Learning, Key Terminology, Key tasks of machine learning, well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

Data Preprocessing. Association Rule Mining Frequent Patterns – Apriori Algorithm Description. Association Rule Mining - Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Unit II

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Model Evaluation and Selection, Techniques to Improve Classification Accuracy.

Classification and Prediction: Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Unit III

Cluster Analysis - Types of Data – Partitioning Methods: K-means, K-mediods, PAM, CLARA, CLARANS – Hierarchical Methods: AGNES, DIANA, Density-Based Methods: DBSCAN –Grid Based Methods – STING, CLIQUE, Cluster Analysis, Evaluation of clustering.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Unit IV

The Curse of Dimensionality; Testing Machine Learning Algorithms – Overfitting, Training, Testing and Validation Sets, The Confusion Matrix, Accuracy Metrics, ROC Curve, Unbalanced Dataset, Measuring Precision Turning Data into Probabilities: Minimizing Risk, maximum a posteriori hypothesis; Basic Statistics: Averages, Variance and Covariance, The Gaussian; Bias-Variance Trade-off

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Unit IV

Dimensionality Reduction - Unsupervised: Introduction, Subset Selection, PCA (Principal Component Analysis) – Technique, Examples as Numerical. Mining different types of data: Mining the World Wide Web - Page Rank Algorithm, Text mining, Mining Time Series Data, Ensemble methods-Increasing the Accuracy.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/preview

Text Books:

- 1. Tom M Mitchell, "Machine Learning", McGraw-Hill Education (Indian Edition), 2013.
- 2. Jiawei Han and Micheline Kamber: Data Mining Concepts and Techniques, Elsevier, 2nd Edition, 2009.
- Stephen Marsland, "Machine Learning An AlgorithmicPerspective", Second Edition, CRC Press - Taylor and Francis Group, 2015
- 4. Ethem Alpaydin, "Introduction to Machine Learning", Second Edition, MITPress, Prentice Hall of India (PHI) Learning Pvt. Ltd. 2010
- 5. Peter Harrington. "Machine learning in action", Shelter Island, NY: Manning Publications Co, 2012.
- Géron, Aurélien. "Hands-on machine learning with Scikit-Learn and TensorFlow: concepts, tools, and techniques to build intelligent systems", O'Reilly Media, Inc., 2017.

Reference Books:

- 1. Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, PHI Learning, 2016.
- 2. Andreas Muller and Sarah Guido," Introduction to Machine Learning with Python: A Guidefor Data Scientists", Shroff/O"Reilly, 2016
- Alejandro Barredo Arrieta, Natalia D'1az-Rodr'1guez, Javier Del Ser, et.al.," Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI, Information Fusion", Volume 58,2020, Pages 82-115, ISSN 1566-2535, https://doi.org/10.1016/j.inffus.2019.12.012. https://machinelearningmastery.com/bayes-theorem-for-machine-learning/

Course Outcomes (COs):

At the end of the course, the student should be able to:

- Recognize the preliminary concepts associated with data mining and machine learning such as its need, types, statistical terms and algorithms (PO-1, 2, 3, 4,5, 10,11,12, PSO-1,2,3)
- 2. Differentiate between different classification and prediction techniques. (PO-1, 2, 3, 4,5, 10,11,12, PSO-1,2,3)
- Identify the clustering methods that can be used for a given data set and the need of unsupervised learning using Partitional, Hierarchical Clustering. (PO-1, 2, 3, 4,5, 10,11,12, PSO-1,2,3)
- 4. Get an introduction to machine learning and its types and appreciate the need for dimensionality reduction and use the same. (PO-1,2,3,4, PSO-1,2,3)
- 5. Illustrate the use of techniques in various fields like world wide web, time series data and genomic data. (PO-1,2,3,4, PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks								
Assessment Tools	Marks	Course Outcomes (COs) addressed						
Internal Test-I (CIE-I)	30	CO1, CO2, CO3						
Internal Test-II CIE-II)	30	CO3, CO4, CO5						
Average of the two CIE shall be taken for 30 marks								
Other Components								
Quiz –I	10	CO1, CO2, CO3						
Assignment	10	CO3, CO4, CO5						
The Final CIE out of 50 Marks	= Average of t	wo CIE tests for 30 Marks+						
Marks scored in Quiz	z-I +Marks sco	red in Assignment						
Semester End Examination (SEE)								
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5						

SOFT COMPUTINGCourse Code: AD54Credits: 3:0:0Pre – requisites: NilContact Hours: 42 LCourse Coordinator: Dr. Jagadish S Kallimani

Course Content

Unit I

Introduction: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems, **Artificial Neural Networks**: Fundamental concept, Evolution, Basic model of ANN, Important terminologies of ANN, MP neuron, Hebb Network.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106105173</u> <u>https://www.youtube.com/watch?v=K9gjuXjJeEM</u>

Unit II

Supervised Learning Network: Perceptron Networks, Adaptive linear neuron, multiple adaptive linear neurons, Back propagation Network

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106105173</u>

Unit III

Introduction to Fuzzy logic, classical sets and fuzzy sets: Classical sets, Fuzzy sets. Classical relations and fuzzy relations: Cartesian product of relation, Classical relation, Fuzzy relations, Tolerance and equivalence relations. Membership functions: Features, Fuzzification, methods of membership value assignments.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106105173</u>

Unit IV

Defuzzification: Lambda-cuts for fuzzy sets, Lambda-cuts for fuzzy relations, Defuzzification methods. Fuzzy decision making: Individual, multi person, multi objective, multi attribute, and fuzzy Bayesian decision making.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106105173</u>

Unit V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA, General genetic algorithms, the schema theorem, Genetic programming, applications.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106105173</u>

Text Book:

1. Principles of Soft computing, S N Sivanandam, Deepa S. N, Wiley, India, (Chapters 1, 2, 3(Up to 3.5), 7, 8, 9, 10, 13, 15 (up to 15.6 & 15.9, 15, 10).

Reference Book:

1. Neuro-fuzzy and soft computing, J.S.R. Jang, C T Sun, E Mizutani, PHI (EEE edition) ISBN: 978-81-203-2243-1.

Course Outcomes (COs):

At the end of the course, the student should be able to:

- 1. Describe various problems on artificial neural networks and familiarize all concepts on various networks and applications in them. (PO-1,2,4. PSO-1,2)
- 2. Identify the compositions of neural networks, perceptrons and other networks. (PO-1,2,3,4. PSO-1,2)
- 3. Examine various fuzzification techniques and practice them. (PO-1,2,3,4. PSO-1,2)
- 4. Design problems and obtain crisp values from fuzzy data using defuzzification. (PO-1,2,3,4. PSO-1,2)
- 5. Summarize various compositions and complexities of genetic algorithms. (PO-1,2,3,4.PSO-1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks								
Assessment Tools	Marks	Course Outcomes (COs) addressed						
Internal Test-I (CIE-I)	30	CO1, CO2						
Internal Test-II CIE-II)	30	CO3, CO4, CO5						
Average of the two CIE shall be taken for 30 marks								
Other Components								
Quiz	10	CO1, CO2, CO3, CO4, CO5						
Assignment	10	CO1, CO2, CO3, CO4, CO5						
The Final CIE out of 50 Marks =	Average of two	OCIE tests for 30 Marks+						
Marks scored in Quiz + Marks so	ored in Assign	ment						
Semester End Examination (SEE)							
Course End Examination								
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5						
each Unit- Internal Choice)								

GRAPH THEORY

Course Code: ADE551 Pre – requisites: Nil

Contact Hours: 42 L

Credits: 3:0:0

Course Coordinator: Dr. Vinay T R

Course Content

Unit I

Introduction to Graph Theory: Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://digimat.in/nptel/courses/video/106108054/L17.html</u> http://www.digimat.in/nptel/courses/video/111106102/L26.html

Unit II

Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://digimat.in/nptel/courses/video/106108054/L21.html</u> https://www.youtube.com/watch?v=C0A-O1UVEdk

Unit III

Trees: Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees, and Prefix Codes

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=fZqfkJ-cb28</u> <u>https://www.youtube.com/watch?v=0ZhwzXX_bp8</u>

Unit IV

Optimization and Matching: Dijkstra"s Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Mincut Theorem, Matching Theory

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc22_cs17/preview</u> http://www.digimat.in/nptel/courses/video/111106102/L11.html

Unit V

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalon Numbers

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_ma58/preview</u>

Suggested Learning Resources

Text Book:

1. S.Arumugam and S.Ramachandran, "Invitation to Graph Theory", SCITECH Publications India Pvt. Ltd., 7/3C, Madley Road, T.Nagar, Chennai – 17

Reference Books:

- 1. S.Kumaravelu, Susheela Kumaravelu, Graph Theory.
- 2. S.A.Choudham, A First Course in Graph Theory, Macmillan India Ltd.
- 3. Robin J.Wilson, Introduction to Graph Theory, Longman Group Ltd.
- 4. J.A.Bondy and U.S.R. Murthy, Graph Theory with Applications, Macmillon, London.

Course Outcomes (COs):

At the end of the course, the student should be able to:

- 1. Understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices. (PO-1,2,3. PSO-1)
- 2. Identify the properties of trees. (PO-1,2,3. PSO-1)
- 3. Apply Eulerian and Hamiltonian graphs for suitable applications (PO-1,2,3. PSO-1,2)
- 4. Summarize principles of counting in permutation and combination (PO-1,2,3. PSO-1,2)
- 5. Apply the knowledge of graphs to solve the real-life problem. (PO-1,2,3,4,5. PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment Tools	Marks	Course Outcomes (COs)		
		addressed		
Internal Test-I (CIE-I)	30	CO1, CO2		
Internal Test-II CIE-II)	30	CO3, CO4		
Average of the two CIE shall be taken for 30 marks				
Other Components				
Quiz	10	CO1, CO2, CO3, CO4		
Assignment	10	CO1, CO2, CO3, CO4		
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+				
Marks scored in Quiz + Marks scored in Assignment				
Semester End Examination (SEE)				
Course End Examination				
(Answer One full question from	100	CO1, CO2, CO3, CO4		
each Unit- Internal Choice)				

COMPUTER VISION			
Course Code: ADE552	Credits: 3:0:0		
Pre – requisites: Nil	Contact Hours: 42 L		
Course Coordinator: Dr. Anita Kanavalli			

Course Content

Unit I

Introduction to Computer Vision: Image representation and analysis, Image Formation – geometric primitives and transformations, photometric image formation, digital camera, Image Processing – point operators, linear filtering, segmentation, Features and object recognition, Image segmentation.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_ee78/preview</u> https://nptel.ac.in/courses/108103174

Unit II

Binary Machine Vision: Thresholding, hierarchical segmentation, spatial clustering, split & merge, rule-based segmentation, motion-based segmentation. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Link: <u>https://nptel.ac.in/courses/117105101</u> <u>https://www.youtube.com/watch?v=vaS6rS8ZpkU</u>

Unit III

Object motion and tracking, Optical flow and feature matching, Robot localization, Graph slam, Object detection, face recognition, instance recognition, category recognition, Stereo Correspondence – Epipolar geometry, correspondence, 3D reconstruction.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=W5mLa8p9xaw</u> <u>https://www.youtube.com/watch?v=6hr6xpOU-uw</u>

Unit IV

Image formation, projective geometry, lighting, Practical linear algebra, Image processing, descriptors, Image warping, Linear models with optimization.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=IzXBT9GkzJ4</u> https://archive.nptel.ac.in/courses/106/106/106106198/

Unit V

CNN architecture, Recurrent neural networks, Attention mechanisms, Image captioning, Neural networks, Applications of neural networks, Motion and flow, Single-view geometry, multi-view geometry, Applications, Course Project.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/108103174</u> <u>https://nptel.ac.in/courses/117105101</u>

Suggested Learning Resources

Text Books:

- 1. Computer Vision: Algorithms and Applications by Richard Szeliski.
- 2. Szeliski R., "Computer Vision: Algorithms and Applications", Springer, 2010
- 3. Computer Vision: A Modern Approach (Second Edition) by David Forsyth and Jean Ponce.
- 4. Multiple View Geometry in Computer Vision (Second Edition) by Richard Hartley and Andrew Zisserman.

References:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.

Course Outcomes (COs):

At the end of the course, the student should be able to:

- 1. Understand the fundamental image processing techniques required for computer vision. (PO-1,2,3. PSO-1,2)
- 2. Understand the shape analysis (PO-1,2,3. PSO-1,2)
- 3. Understand motion related techniques and 3D vision techniques. (PO-1,2,3. PSO-1,2)
- 4. Apply CNN concepts in computer vision (PO-1,2,3,4,5 PSO-1,2,3)

5. Apply the knowledge of computer vision techniques to solve the real-life problem. (PO-1,2,3.4.5. PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment Tools	Marks	Course Outcomes (COs)		
	20			
Internal Test-I (CIE-I)	30	CO1, CO2		
Internal Test-II CIE-II)	30	CO3, CO4		
Average of the two CIE shall be taken for 30 marks				
Other Components				
Quiz	10	CO1, CO2		
Assignment	10	CO3, CO4		
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+				
Marks scored in Quiz +Marks scored in Assignment				
Semester End Examination (SEE)				
Course End Examination				
(Answer One full question from	100	CO1, CO2, CO3, CO4		
each Unit- Internal Choice)				

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code: AD553 Pre – requisites: Nil Credits: 3:0:0

Course Coordinator: Mrs.MEGHA J

Contact Hours: 42 L

Course Content

Unit I

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: numbers, arithmetic operations and characters, Memory Location and Addresses, Memory Operations

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/4TzMyXmzL8M</u>

Unit II

Instructions and Instruction Sequencing: register transfer notation, assembly language notation, basic instruction types, branching, condition codes, generating memory address, **Addressing Modes:** variables and constants, indirection and pointers, indexing and arrays, relative addressing, Basic Input and Output Operations

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/4TzMyXmzL8M</u>

Unit III

Arithmetic unit: Multiplication of two numbers, A signed operand multiplication, Booth algorithm, Bit pair recoding and CSA – integer division, IEEE standard for floating point numbers, Operations, Guard bits and truncation.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/4TzMyXmzL8M</u>

Unit IV

The Processor: Introduction, a basic MIPS Implementation, Logic Design

Conventions: Clocking methodology, building a data path, an overview of pipelining: Designing instruction sets for pipelining, Pipeline hazards, Pipelined data path and control: Graphically representing pipelines, Data hazards: Forwarding versus stalling.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/4TzMyXmzL8M</u> https://youtu.be/MIWTxHbPBA0

Unit V

Memory system: cache memory, mapping functions, replacement algorithms, Performance Considerations: interleaving, hit rate and miss penalty, virtual memories, address translation.

Input Output Unit: Accessing I/O devices, Interrupts: Interrupt hardware, Enabling and disabling of interrupts

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos.
- Links: <u>https://youtu.be/4TzMyXmzL8M</u> https://youtu.be/MIWTxHbPBA0

Text Book:

- 1. Carl Hamacher, ZvonkoVranesic, SafwatZaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
- 2. David A. Petterson, John L. Hennessy: Computer Organization and Design, M.K Publishers, 4th edition, 2010
- 3. John L Hennessy, David A Patterson: Computer Architecture A Quantitative Approach, Elsevier, 5 th Edition 2012.

Reference Books:

- 1. W. Stallings: Computer Organization and Architecture: Designing For Performance, 8th edition, Prentice hall, 2012.
- 2. L L Wear: Computer An introduction to hardware and software design, McGraw Hill international edition, 1991.
Course Outcomes (COs):

- 1. Describe an overview of computer hardware and software which includes the basic functional units, interconnection (PO-1,2,3. PSO-1)
- 2. Illustrate Instruction sequencing and Addressing modes (PO-1,2,3. PSO-1).
- 3. Appraise different algorithms used to perform fast multiplication, division and to represent floating point numbers in binary. (PO-1,2,3,4. PSO-1)
- 4. Illustrate building a datapath for MIPS architecture and the advantages of pipelining to achieve instruction level parallelism. (PO-1,2,3.4, PSO-1,2)
- 5. Illustrate cache memory mapping techniques, various memory architectures and assessing the cache performance and Summarize the basics concepts of I/O, interrupts (PO-1,2,3.4, PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tools	Marks	Course Outcomes (COs) addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO3, CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+			
Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)			
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, C05	
each Unit- Internal Choice)			

ADVANCED ALGORITHMSCourse Code: ADE554Credits: 3:0:0Pre – requisites: AlgorithmsContact Hours: 42 LCourse Coordinator: Dr. Sowmya B J

Course Content

Unit I

Analysis Techniques: Growth of Functions, Asymptotic notations, Standard notations and common functions, Recurrences and Solution of Recurrence equations – The Substitution method, The recurrence – tree method, The master method, Amortized Analysis: Aggregate, Accounting and Potential Methods.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://pages.cs.wisc.edu/~shuchi/cou res/787-F07/about.html</u> <u>https://www.youtube.com/watch?v=0JUN9aDxVmI&list=PL2SOU6wwxB0uP</u> <u>4rJgf5ayhHWgw7akUWSf</u>

Unit II

Graph Algorithms: Bellman-Ford Algorithm, Single source shortest paths in a DAG, Johnson's Algorithm for sparse graphs, Maximum bipartite matching.

Trees: B-trees, Red- Black trees.

Hashing: General Idea, Hash Function, Separate Chaining, Open addressing, Rehashing, Extendible hashing.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://pages.cs.wisc.edu/~shuchi/cou res/787-F07/about.html</u> <u>https://www.youtube.com/watch?v=tWVWeAqZ0WU</u>

Unit III

Number – Theoretic Algorithms: Elementary notations, GCD, Modular Arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, RSA cryptosystem. Heaps: Heaps, Priority Queues, Binomial Heaps, Fibonacci Heaps.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://pages.cs.wisc.edu/~shuchi/cou res/787-F07/about.html</u> <u>https://www.youtube.com/watch?v=0JUN9aDxVmI&list=PL2SOU6wwxB0</u> <u>uP4rJgf5ayhHWgw7akUWSf</u>

Unit IV

String Matching Algorithms: Naïve string matching, Rabin – Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm, Boyer- Moore Algorithms.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://pages.cs.wisc.edu/~shuchi/cou res/787-F07/about.html</u> https://www.youtube.com/watch?v=NkivfrexTw8

Unit V

Algorithmic Puzzles: Magic Square, n-queens problem, Glove Selection, Ferrying Soldiers, Jigsaw Puzzle Assembly, A Stack of Fake Coins, Maximum Sum Descent, Hats of Two Colors, Pluses and Minuses, Searching for a Pattern, Locker Doors, Palindrome Counting, Inverting a Coin Triangle, Sorting 5 in 7.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://pages.cs.wisc.edu/~shuchi/cou res/787-F07/about.html</u>

Suggested Learning Resources

Text Books:

- 1. T H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms 3/e, PHI, 2011.
- 2. Mark Allen Weiss: Data Structures and Algorithm Analysis in C++, 3rd Edition, Pearson Education, 2011.
- 3. Anany Levitin and Maria Levitin: Algorithmic Puzzle, Oxford University Press, 2011.

Reference Books:

- 1. Ellis Horowitz, Sartaj Sahni, S Rajasekharan: Fundamentals of Computer Algorithms, University Press, 2007.
- 2. Alfred V Aho, John E Hopcroft, J D Ullman: The Design and Analysis of Computer Algorithms, Pearson Education, 2011.

Course Outcomes (COs):

At the end of the course the student will be able to:

- 1. Devise recurrence relations and amortized cost of various operations. (PO-1,2,3.4, PSO-1,2,3)
- 2. Illustrate graph algorithms such as Bellman-Ford, Shortest path, and bipartite matching, B-trees, Red-Black trees and hashing techniques. (PO-1,2,3.4, PSO-1,2,3)
- 3. Identify the methods for solving modular linear equations, Chinese remainder theorem and RSA cryptosystem, Describe types of heaps such as Binomial and Fibonacci heaps. (PO-1,2,3.4,5, PSO-1,2,3)
- 4. Assess the string-matching algorithms such as Boyer-Moore and Knuth-Morris- Pratt algorithm. (PO-1,2,3.4,5, PSO-1,2,3)
- 5. Create mathematical models, objective functions and constraints to solve algorithmic puzzles. (PO-1,2,3.4,5, PSO-1,2,3)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tools	Marks	Course Outcomes (COs) addressed	
Internal Test I (CIE I)	20		
Internal Test-I (CIE-I)	50	01,002	
Internal Test-II CIE-II)	30	CO3, CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Programming Competition/	20	CO1, CO2, CO3, CO4,	
Hackathon/Codethon	20	CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+			
Marks scored in other component			
Semester End Examination (SEE)			
Course End Examination		CO1 CO2 CO3 CO4	
(Answer One full question from	100	CO1, CO2, CO3, CO4,	
each Unit- Internal Choice)		005	

SENSORS AND ACTUATORS		
Course Code: ADE555	Credits: 3:0:0	
Pre – requisites: Basic electronics,	Contact Hours: 42 L	
Measurements and Instruments		
Course Coordinator: Dr. Vaneeta M		

Course Content

Unit I

Difference between sensor, transmitter and transducer - Primary measuring elements selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.slideshare.net/saaz1425/dc-motor-23906628</u> <u>https://www.electricaleasy.com/2014/01/basic-working-of-dc-motor.html</u> <u>https://www.youtube.com/watch?v=hmP5CSIendo</u>

Unit II

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn. Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.slideshare.net/saaz1425/dc-motor-23906628</u> <u>https://www.electricaleasy.com/2014/01/basic-working-of-dc-motor.html</u> <u>https://www.youtube.com/watch?v=hmP5CSIendo</u>

Unit III

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators,

Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=LHn7O6PUaoY</u> <u>https://realpars.com/control-valve/</u>

Unit IV

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=T09ONHU6OnY</u> <u>https://www.youtube.com/watch?v=2XnnwoIDq6I</u>

Unit V

Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electroplating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.youtube.com/watch?v=VF5mI0CZC4Y</u> <u>https://www.youtube.com/watch?v=oBKhN4n-EGI</u>

Text Books:

- 1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
- 2. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
- 3. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.

Reference Books:

- 1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
- 2. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.,
- Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.
- 4. Manfred Kohl, "Shape Memory Actuators", first edition, Springer

Course Outcomes (COs):

At the end of the course the student will be able to:

- 1. Identify different sensors, transmitters and actuators (PO-1,2,3. PSO-1)
- 2. Illustrate Inductive and Capacitive Transducer. (PO-1,2,3. PSO-1)
- 3. Identify the different characteristics of actuators (PO-1,2,3. PSO-1)
- 4. Assess the properties of micro sensors and micro actuators (PO-1,2,3. PSO-1)
- 5. Identify different sensor materials and processing techniques. (PO-1,2,3,4,5. PSO-1)

Continuous Internal Evaluation (CIE): 50 Marks				
Assossment Teels	Marks	Course Outcomes (COs)		
Assessment 1001s		addressed		
Internal Test-I (CIE-I)	30	CO1, CO2,CO3		
Internal Test-II CIE-II)	30	CO3, CO4,CO5		
Average of the two CIE shall be taken for 30 marks				
Other Components				
Quiz	10	CO1, CO2, CO3		
Assignment	10	CO4,CO5		
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+				
Marks scored in Quiz +Marks scored in Assignment				
Semester End Examination (SEE)				
Course End Examination				
(Answer One full question from	100	CO1, CO2, CO3, CO4,C05		
each Unit- Internal Choice)				

MACHINE LEARNING LABORATORY					
Course Code: ADL56 Credits: 0:0:1					
Pre – requisites: Basic Programming	Contact Hours: 14P				
Course Coordinator: Mrs. Megha J					

Course Content

- 1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
- 2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
- 3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
- 4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
- 5. Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
- 6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.
- 7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML library classes/API in the program.
- 8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
- 9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
- 10. Implement and demonstrate the working of SVM algorithm for classification.

Suggested Learning Resources

Text Books:

- 1. Tom M Mitchell, "Machine Lerning",1st Edition, McGraw Hill Education, 2017.
- Nello Cristianini, John Shawe-Taylor, An Introduction to Support Vector Machines and Other Kernel-based Learning Methods, Cambridge University Press, 2013.
- 3. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf)

Course Outcomes (COs):

At the end of the course the student will be able to:

- 1. Understand the Importance of different classification and clustering algorithms. (PO-1,2,3,4,5,9,12. PSO-1,2,3)
- 2. Demonstrate the working of various algorithms with respect to training and test data sets. PO-1,2,3,4,5,9,12. PSO-1,2,3)
- 3. Illustrate and analyze the principles of Instance based and Reinforcement learning techniques, Elicit the importance and Applications of Supervised and unsupervised machine learning, and Compare and contrast the Bayes theorem principles and Q learning approaches. PO-1,2,3,4,5,9,12. PSO-1,2,3)

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment Tools	Marks	Course Outcomes (COs) addressed		
Lab Test-I	10	CO1, CO2		
Lab Test-II	10	CO3		
Weekly Evaluation-Lab Record	30	-		
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in				
Lab Test-I + Marks scored in Lab Test-II				
Semester End Examination (SEE)				
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3		

ANDROID APPLICATION DEVELOPMENT LABORATORY

Course Code: ADL57	Credits: 0:0:1
Pre – requisites: Java Programming	Contact Hours: 14P
Course Coordinator: Mr. Amrutesh S M	

Course Content

Experiments that are to be conducted as a part of the course:

- 1. Introducing different Android development tools and developing Hello World application.
- 2. Develop an android application to investigate the activity life cycle.
- 3. Develop an android application to investigate the fragments.
- 4. Develop an android application to create user interfaces with different layouts and views.
- 5. Develop an android application to create a Registration form using appropriate widgets.
- 6. Develop an android application to embed Picker Views in an activity.
- 7. Develop an android application on using implicit & explicit Intents.
- 8. Develop an android application to utilize Action bar.
- 9. Develop an android application to utilize Toasts and Notifications.
- 10. Develop an android application to work SQLite data storage and create a table.
- 11. Develop an android application to work SQLite data storage and perform various operations on the table.
- 12. Develop an android application to introduce content providers.
- 13. Developing applications to work with messaging and telephony services.
- 14. Develop an android application for creating location based service.

Text Books:

- 1. Professional Android 4 Application Development, by Reto Meier, WROX Press, Wiley Publishing.
- Hello Android, Introducing Google"s Mobile Development Platform, 3rd Edition, by Ed Burnette, Pragmatic Programmers, LLC.ISBN-10: 1-934356-56-5, ISBN-13: 978-1-934356-56-2
- 3. https://developer.android.com/training/index.html
- 4. http://www.codelearn.org/android-tutorial

Reference Books:

- Android Application Development, Programming with the Google SDK, by, Rick Rogers, John Lombardo, Zigurd Mednieks, Blake Meike, SPD, Oreilly, ISBN10: 81-8404-733-9, ISBN13:978-81-8404-733-2
- R2. Hello Android, Introducing Google"s Mobile Development Platform, 3rd Edition, by Ed Burnette, Pragmatic Programmers, LLC.ISBN-10: 1-934356-56-

5, ISBN-13: 978-1-934356-56-2

Course Outcomes (COs):

At the end of the course, the student will be able to:

- 1. Identify the various aspects of android platform, different android developer tools and activity life cycle, views and view groups. (PO1, 3, 5, 9,12. PSO-1,2,3)
- 2. Demonstrate the usage of intents, menu creation and SQLite database to perform different (PO1, 3, 5, 9,12. PSO-1,2,3)
- 3. Develop the Android applications using SMS services, Telephony services, notifications and media files. (PO1, 3, 5, 9,12. PSO-1,2,3)

Continuous Internal Evaluation (CIE): 50 Marks				
Assessment Tools	Marks	Course Outcomes (COs) addressed		
Lab Test-I	10	CO1, CO2		
Lab Test-II	10	CO3		
Weekly Evaluation-Lab Record	30	-		
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in				
Lab Test-I + Marks scored in Lab Test-II				
Semester End Examination (SEE)				
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3		

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS

Course Code: AL58

Credits: 3:0:0

Contact Hours: 42L

Pre – requisites: Nil Course Coordinator: Dr. Jagadish S Kallimani

Course Content

Unit I

Introduction: Meaning of Research, Objectives of Research, Types of Research, Ethics in Research, Types of Research Misconduct.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Conceptualizing Research, Critical and Creative Reading.

Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge flow through Citations, Acknowledgments, and Attributions.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: <u>https://onlinecourses.nptel.ac.in/noc22_ge08/preview</u>

Unit II

Research Design: Need for Research Design, Important Concepts Related to Research Design: Dependent and Independent Variables, Extraneous Variable, Variable, Common Control, Confounded Relationship, Research Hypothesis, Experimental and Control Groups, Treatments.

Experimental Designs: Introduction to Randomised Block Design, Complete Randomised Design, Latin Square Design, and Factorial Design.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: <u>https://onlinecourses.nptel.ac.in/noc22_ge08/preview</u>

Unit III

Method of Data Collection: Primary and Secondary Data Collection.

Sampling Design: Sampling fundamentals, Measurement, and Scaling Techniques, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, and Types of Sample Design.

Data Analysis: Testing of Hypotheses: Null Hypothesis, Alternative Hypothesis, Type I and Type II Errors, Level of Significance. Procedure for Hypothesis Testing: Mean, Variance, Proportions. Chi-square Test, Analysis of Variance (One Way

ANOVA), and Covariance (ANOCOVA)

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_ge36/preview</u>

Unit IV

Introduction to IPR: Different forms of IPR, Role of IPR in Research and Development. TRIPS Agreement, Patent Cooperation Treaty (PCT).

Patents: Brief history of Patents-Indian and Global Scenario, Principles Underlying Patent Law, Types of Patent Applications in India, Procedure for Obtaining a Patent. Non Patentable Inventions. Rights Conferred to a Patentee, Basmati Rice Patent Case.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://archive.nptel.ac.in/courses/110/105/110105139/

Unit V

Design: What is a Design? Essential Requirements for a Registrable Design, Procedure of Registration of a Design,

Trademarks: Essentials of a Trademark, Registration, and Protection of Trademarks, Rights Conferred by Registration of Trademarks, Infringements, Types of Reliefs, Case Studies.

Copyrights: Characteristics of Copyrights, Rights Conferred by Registration of Copyrights, Registration of Copyrights, Infringements, Remedies against Infringement of Copyrights, Case studies

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://archive.nptel.ac.in/courses/110/105/110105139/

Suggested Learning Resources

Text Books:

- 1. C. R Kothari, Gourav Garg, Research Methodology Methods and Techniques. New Age International Publishers.
- Dr. B L Wadehra Law relating to Intellectual property. Universal Law Publishing Co.
- Dipankar Deb, Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), <u>https://doi.org/10.1007/978-981-13-2947-0</u>.

Reference Book:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4

Course Outcomes (COs):

At the end of the course, the student will be able to:

- 1. Understand the knowledge of research and conduct a literature review.(PO-8,10,12. PSO-2)
- 2. Apply the knowledge of research design and design of experiments. (PO-3, 4,8, 10, 12, PSO-2,3)
- 3. Analyse data collection methods, analysis, and sampling design. (PO-4, 8, 10, 12, PSO-2)
- 4. Understand the global and Indian scenarios of patents and patent applications. (PO-8, 10, 12, PSO-3)
- 5. Acquire the requirements of registration and infringements related to trademarks, copyrights, and designs. (PO-8, 10, 12, PSO-3)

Continuous Internal Evaluation (CIE): 50 Marks				
Assossment Tools	Marks	Course Outcomes (COs)		
Assessment 1001s		Addressed		
Internal Test-I (CIE-I)	30	CO1, CO2, CO3		
Internal Test-II CIE-II)	30	CO3, CO4, CO5		
Average of the two CIE shall be take	Average of the two CIE shall be taken for 30 marks			
Other Components				
Quiz	10	CO1, CO2, CO3		
Assignment	10	CO3, CO4, CO5		
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+				
Marks scored in Quiz-I +Marks scored in Assignment				
Semester End Examination (SEE)				
Course End Examination (Answer				
One full question from each Unit-	100	CO1, CO2, CO3, CO4, CO5		
Internal Choice)				

ABILITY ENHANCEMENT COURSE - V			
Subject Code: AEC510	Credits: 1:0:0		
Pre requisites: Nil	Contact Hours: 14L		
Course Coordinator: Any Dept			

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

ENVIRONMENTAL STUDIES Course Code: HS59 Credits: 0:0:0 Pre – requisites: Nil Contact Hours: 14L Course Coordinator: Contact Hours: 14L

ourse Coordinator: -

Course Content

Unit I

Environment, Ecology and Biodiversity: Definition, scope and importance. Multidisciplinary nature of Environmental studies. Food chain and food web. Energy flow and material cycling in ecosystem. Biodiversity and threats to biodiversity. Concept of sustainable development: Definition, objectives and applications.

- Pedagogy / Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: https://youtu.be/I_bnGkviWOU https://youtu.be/Ar04qG1P8Es

Unit II

Natural resources: Forest resources: Ecological importance of forests. Water resources: Global water resources distribution. Mineral resources: Environmental effects of extracting and processing Mineral resources. Food resources: Effects of modern agriculture. Land resources: Soil erosion and Desertification.

- Pedagogy / Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: <u>https://youtu.be/vsXv3anIBSU</u> https://youtu.be/1rOVPqaUyv8

Unit III

Energy sources: Growing energy needs. Conventional and non-conventional / Renewable and Non-renewable energy sources. Bio Energy-Ethanol and Bio mass energy. Energy of the future – Hydrogen fuel cells and Nuclear energy. Environmental Impact Assessment (EIA): Definition, Objectives and benefits. Step by step procedure of conducting EIA.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Animations, Models
- Link: https://youtu.be/mh51mAUexK4 https://youtu.be/XS-eXqppf_w

Unit IV

Environmental pollution: Definition, Causes, Effects and control measures of Water pollution, Air pollution and Soil/ land pollution. Management of Municipal Solid Waste and treatment methods of municipal solid waste.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos
- Link: https://youtu.be/NRoFvz8Ugeo https://youtu.be/DAQapF-F4Vw

Unit V

Environmental protection: Global warming and Climate change, Acid rain, Ozone layer depletion. Salient features of Environmental Protection Act, Air & Water Acts. Functions of Central and State Pollution Control Boards.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Opens source softwares
- Link: https://youtu.be/iV-BvYwl4Y8
- Link: https://youtu.be/BYqLRGawoH0

Text Books:

1. Dr. S M Prakash-Environmental Studies, Elite Publishers, 2007.

Reference Books:

1. **P. Venugopala Rao**–Principles of Environmental Science & Engineering Prentice Hall of India, 1st edition, 2006.

Web links and video Lectures (e- Resources):

- 1. https://youtu.be/I_bnGkviWOU
- 2. https://youtu.be/vsXv3anIBSU
- 3. https://youtu.be/mh51mAUexK4
- 4. https://youtu.be/NRoFvz8Ugeo
- 5. https://youtu.be/iV-BvYwl4Y8

Course Outcomes (COs):

At the end of the course, the student will be able to:

- 1. Describe the importance of environmental studies, sustainable development and biodiversity (PO-1, 7)
- Explain the importance and conservation of impacts of natural resources (PO-1, 7)

- 3. Distinguish the energy sources and identify the alternative energy sources for sustainable development (PO-1, 7)
- 4. Identify the causes, effects and control measures of pollution in developmental activities (PO-1, 7)
- 5. Outline the current environmental issues and the role of the agencies for environmental protection (PO-1, 7)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment tool	Marks	Course outcomes attained	
Internal Test-I	30	CO1, CO2, CO3	
Internal Test-II	30	CO4, CO5	
Average of the two internal test shall be taken for 30 marks			
Other components			
Assignment – MCQ, Objectives	10	CO1, CO2	
Assignment – Quiz, Group presentation	10	CO3, CO4	
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5	

VI SEMESTER

MANAGEMENT & ENTREPRENEURSHIP	
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Course Code: AL61

Pre – requisites: Nil

Credits: 3:0:0 Contact Hours: 42L

Course Coordinator: Dr. M Rajesh/Dr. Siddhartha kar

Course Content

Unit I

Introduction to Management: Definition of Management, Its nature and purpose, Contributions of F.W. Taylor and Henry Fayol to management theory, Functions of managers.

Planning: Types of plans, Steps in planning, the planning process, Management by Objectives (MBO).

Organizing: The nature and purpose of organizing, Formal and informal organization. Organization levels and Span of management, Principle of span of management, the structure and process of organizing.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_mg33/preview</u>
 <u>https://www.digimat.in/nptel/courses/video/110107150/L01.html</u>

Unit II

Staffing: Situational factors affecting staffing. **Leading:** Human factors in managing, definition of leadership, Ingredients of leadership. **Controlling**: Basic control process, Critical control points and standards, Control as a feedback system, Feed forward control, Requirements for effective controls.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/110107150</u> <u>https://digimat.in/nptel/courses/video/110104068/L01.html</u>

Unit III

Introduction to Entrepreneurship: The Foundations of Entrepreneurship: What is an Entrepreneurship? The benefits of Entrepreneurship, The potential drawbacks of Entrepreneurship; Inside the Entrepreneurial Mind: From Ideas to Reality: Creativity, Innovation and Entrepreneurship, Creative Thinking, Barriers to Creativity.

- **Pedagogy/Course delivery tools:** Chalk and talk, Power Point Presentation, Videos
- Links:<u>https://youtu.be/Hgj_kRrvbhQ?list=PL7oBzLzHZ1wXW3mtolxV5nIG</u> <u>n48N_LKwrb</u> <u>https://youtu.be/Hgj_kRrvbhQ?list=PL7oBzLzHZ1wXW3mtolxV5nIGn48NL</u> <u>Kwrb</u>

Unit IV

The Entrepreneurial Journey: Crafting a Business Plan: The benefits of creating a business plan, the elements of a business plan; Forms of Business Ownership and Buying an Existing Business: Sole proprietorships and partnership.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Links:<u>https://www.youtube.com/watch?v=Tzzfd6168jk&list=PLyqSpQzTE6M8</u> EGZbmNUuUM7Vh2GkdbB1R https://youtu.be/9kbZnFYDYIs?list=PL7oBzLzHZ1wXW3mtolxV5nIGn48NLK wrb

Unit V

Launching the Business: Franchising and the Entrepreneur: Types of Franchising, The benefits of buying a Franchise; E-Commerce and the Entrepreneur: Factors to consider before launching into E-commerce, Ten Myths of E-Commerce.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Links:<u>https://www.youtube.com/watch?v=5RMqxtMwejM&list=PLyqSpQzT</u> E6M9 zMKj_PSm81k9U8NjaVJkR <u>https://www.youtube.com/watch?v=0apynSCov-</u> 4&list=PL7oBzLzHZ1wXW3mtolxV5nIGn48NLKwrb&index=32

Suggested Learning Resources

Text Books:

- 1. Harold Koontz, H. Weihrich, and A.R. Aryasri, Principles of Management, Tata McGraw-Hill, New Delhi, 2004.
- Essentials of Entrepreneurship and Small Business Management Norman Scarborough & Jeffrey Cornwall (Pearson, 2016)

References:

- 1. Innovation & Entrepreneurship Peter Drucker (Harper, 2006)
- Entrepreneurship: The Art, Science, and Process for Success Charles Bamford & Garry Bruton (McGraw-Hill, 2015)
- 3. Managent and Enterpreneuship-NVR Naidu, T Krishna Rao, I.K. International Publishing House Pvt. Ltd.@ 2008
- 4. Poornima M Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education, 2006.

Course Outcomes (COs):

At the end of the course, student will be able to

- 1. Plan and organize for the manpower in the given type of organization (PO: 6,9,11, PSO-3)
- 2. Use staffing Leading and controlling function for the given organization. (PO: 6,8,9,10, PSO-3)
- 3. Understand the fundamentals of entrepreneurship with the goal of fulfilling the requirements of the industries and holding the responsibilities towards the society. (PO-6,7,8, PSO-3)
- 4. Design a basic business plan by considering case studies and show the involvement of ownership in Business. (PO-3,7,8,11, PSO-3)
- 5. Start a new small business with the help of E-Commerce and the current available technologies. (PO-5,11, PSO-3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs)
		Addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be take	en for 30 marl	<\$
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Av	erage of two (CIE tests for 30 Marks+
Marks scored in Quiz-I +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer		
One full question from each Unit-	100	CO1, CO2, CO3, CO4, CO5
Internal Choice)		

DEEP LEARNING		
Course Code: AD62	Credits: 3:0:0	
Pre – requisites: Machine Learning	Contact Hours: 42L	
Concepts		
Course Coordinator: Dr. Jagadish S Kallimani		

Course Content

Unit I

Introduction: What is a Neural Network?, The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures, Rosenblatt's Perceptron: Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc20_cs62/preview</u>

Unit II

Multilayer Perceptrons: Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR Problem, Heuristics for Making the Back-Propagation Algorithm Perform Better, Back Propagation and Differentiation.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc20_cs62/preview</u>

Unit III

Regularization for Deep Learning: Parameter Norm Penalties - L2 Parameter Regularization, Dataset Augmentation, Semi-Supervised Learning. Optimization for Training Deep Models: Challenges in Neural Network Optimization – Ill Conditioning, Local Minima, Plateaus, Saddle Points and Other Flat Regions.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc20_cs62/preview</u>

Unit IV

Convolution neural networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Convolutional Networks and the History of Deep Learning.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc20_cs62/preview</u>

Unit V

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc20_cs62/preview</u>

Suggested Learning Resources

Text Books:

- 1. Simon Haykin, Neural networks and Learning Machines, Third Edition, Pearson, 2016
- 2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Book:

1. Neural Networks and Deep Learning by Michael Nielsen http://neuralnetworksanddeeplearning.com/

Course Outcomes (COs):

At the end of the course, the student will be able to:

- 1. Illustrate the concepts and applications of neural networks and deep learning. (PO-1,2,3,4,PSO-1)
- 2. Illustrate various types of learning work and its applications. (PO-2,3,4,PSO-2)
- 3. Illustrate the Regularization and Optimization for Deep learning. (PO-2,3,4, PSO-2)
- 4. Apply deep feed forward networks and convolutional to solve practical problems. (PO-1,2,3,4,5,PSO-3)
- 5. Demonstrate recurrent, recursive nets function and practical problems can be mapped to these function. ..(PO-2,3,4,5,PSO-3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Monks	Course Outcomes (COs)
Assessment 1001s	IVIAI KS	addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Programming Competition/	20	CO1, CO2, CO3, CO4,
Hackathon/Codethon	20	CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+		
Marks scored in other component		
Semester End Examination (SEE))	
Course End Examination		CO1 CO2 CO3 CO4
(Answer One full question from	100	CO5
each Unit- Internal Choice)		205

STATISTICAL MACHINE LEARNING ALGORITHMS

Course Code: ADE631	Credits: 3:0:0
Pre – requisites: Basics of linear algebra, probability, statistics algorithm design and analysis	Contact Hours: 42L
Course Coordinator: Dr. Ajina A	

Course Content

Unit I

Classifications -KNN, Bayes Classifier, Naïve Bayes Classifier, Logistic Régression and SVM.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/uFydF-g-AJs</u>

Unit II

Clustering-K-means, GMM, Spectral clustering

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/uFydF-g-AJs</u>

Unit III

Feature Selection and Dimension Reduction -PCA and SVD

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/uFydF-g-AJs</u>

Unit IV

Model Selection: Variance and Bias, Cross-validation; HMM .

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/uFydF-g-AJs</u>

Unit V

Advanced topics-graph learning, sparse learning

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/uFydF-g-AJs</u>

Suggested Learning Resources

Text Book:

1. Pattern Recognition and Machine Learning, Christopher M. Bishop, 2006

Reference Book:

 The Elements of Statistical Learning: Data Mining, Inference, and Prediction(2ndEdition). Trevor Hastie, Robert Tibshirani and Jerome Friedman. Springer-Verlag,2009 (http://web.stanford.edu/~hastie/local.ftp/Springer/OLD/ESLII_print4.pdf)

Course Outcomes (COs):

- 1. Understand the concept of Machine Learning with respect to Statistics. (PO-1,2,PSO-1)
- 2. Understand the feature and model selection in relation to Statistics. (PO-1,2,PSO-1)
- 3. Apply the concept of ML and various classification methods in a project. (PO-3,4, PSO-2)
- 4. Apply the ML concepts to implement Regression, Clustering and Classification. (PO-3,4, PSO-2)
- 5. Apply the analytics in application and practical system. (PO-3,4,5, PSO-3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II CIE-II)	30	CO3,CO4
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2
Assignment	10	CO3, CO4
The Final CIE out of 50 Marks = Average of two CIE tests for 30		
Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)	
Course End Examination		
(Answer One full question from	100	CO1, CO2, CO3, CO4
each Unit- Internal Choice)		

ROBOTIC PROCESS AUTOMATION DESIGN AND DEVELOPMENT

Course Code: ADE632 Pre – requisites: Nil Credits: 3:0:0 Contact Hours: 42L

Course Coordinator: Dr. Meeradevi A K

Course Content

Unit I

Programming Basics: Introduction to Programming, Data and Data Structure, Algorithms, Variables and Arguments, Software Application and Software Development Life Cycle (SDLC), Frameworks and Languages .**Automation and RPA**: History of Automation, Automation and its benefits, Introduction to RPA, Automation vs RPA, Process and Flowchart, RPA Programming Constructs, Robots in RPA, Introduction to Robots, Types of Robots, Benefits and Implementation of RPA.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.uipath.com/rpa/robotic-process-automation.</u>

Unit II

RPA Tool Introduction and Basics: RPA Development Life Cycle, How does RPA Work, Challenges in RPA, Variables and Types of Variables, Variables vs. Arguments, Namespaces, and Importing New Namespace.

Control Flow Activity: Sequences, Control Flow and its types, Decision control-IF, Switch, IF vs Switch, Loops-Do While, While, For each, Other control flow activities - Delay, Break, Assign, Continue and Parallel.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.uipath.com/rpa/robotic-process-automation.</u>

Unit III

Data Manipulation: Data Manipulation and Its Importance, String Manipulations, Data Table Manipulations, Collection, Its Types and Manipulations.

UI Automation & Selectors: UI interactions, Input actions and Input methods, Containers, Recording & its types, Selectors, Types of Selectors- Full and Partial, Containers and Partial Selectors, Dynamic Selectors.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.uipath.com/rpa/robotic-process-automation.</u>

Unit IV

Automation Concepts and Techniques: Desktop and Web Recording, extraction and its techniques- Screen scraping, Data scraping and PDF Extraction. Automation Techniques- Workbook and Excel automation (read/write). Email Automation: Incoming Email automation - Sending Email automation.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://www.uipath.com/rpa/robotic-process-automation.

Unit V

Error and Exception Handling: Errors, Error handling approach, Try Catch, Retry Scope, Exception Handling, Types of Exceptions, Global Exception Handler, Best Practice for Error Handling.

Orchestrator: Overview, Orchestrator Functionalities, Orchestrator User Interface-Automations, Management and Monitoring.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://www.uipath.com/rpa/robotic-process-automation.</u>

Suggested Learning Resources

Text Book:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing .March 2018.

Reference Books:

- Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
- 2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant.
- 3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and

their benefits: Understanding RPA and Intelligent Automation.

Course Outcomes (COs):

At the end of the course, students should be able to:

- 1. Describe the History of Automation , Advent of Automation and Benefits of RPA (PO-2,3,4, 5, PSO-2)
- 2. Demonstrate the use of Sequence, Flowchart, and Control Flow Activities to build Workflow in Automation. (PO-2,3,4, 5, PSO-2)
- 3. Examine the RPA Techniques for Data Manipulation and UI automation.(PO-2,3,4, 5, PSO-2)
- 4. Experiment the Automation Concepts and Techniques to interact with Desktop, Web and Email Applications. (PO-2,3,4, 5,9 PSO-2)
- 5. Test the Bot using Orchestration server and Use Exception Handling Techniques for Error free Applications. (PO-2,3,4, 5,9 PSO-2)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II CIE-II)	30	CO3, CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Programming Competition/ Hackathon/Codethon	20	CO1, CO2, CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30 Marks+		
Marks scored in other component		
Semester End Examination (SEE))	
Course End Examination (Answer One full question from each Unit- Internal Choice)	100	CO1, CO2, CO3, CO4, CO5

3D PRINTINGCourse Code: ADE633Credits: 3:0:0Pre – requisites: NilContact Hours: 42LCourse Coordinator: Mr. Amrutesh S M

Course Content

Unit I

Additive Manufacturing, The Generic AM Process, AM Information work flow, AM – An Integral part of Time compression Engineering, Classification of AM processes, The Benefits of AM, Distinction Between AM and CNC Machining.

Vat Photopolymerization Processes: Introduction, Photo polymerization Process (SLS), **Extrusion-Based Systems**: Introduction, Basic Principles, Fused Deposition Modeling process, Materials, Limitations of FDM.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <u>https://www.youtube.com/watch?v=ICjQ0UzE2Ao</u> <u>https://www.youtube.com/watch?v=7jNodHYUQc8</u>

Unit II

Solid Ground curing: Introduction, Basic Principles, SGC Process, Materials. LOM, Binder Jetting process, Benefits and Drawbacks, Applications

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <u>https://www.youtube.com/watch?v=ThwFB12cbnM</u>

Unit III

Design for Additive Manufacturing: Design for Manufacturing and Assembly, Introduction to Design for Additive Manufacturing, General Guidelines for Designing AM Parts, Design to Minimize Print Time, Design to Minimize Post-processing. **Post-processing:** Support Material Removal, **Polymer Surface Treatments**: Vapour

Smoothing, Sand Blasting, Tumbling, Metal **Surface Treatments**: Shot-Peening, Machining and Grinding, Anodizing, Plasma Spraying, Plating and PVD.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <u>https://www.youtube.com/watch?v=U0xxd70g0y0</u> https://www.youtube.com/watch?v=uuCt_8nGDrM

Unit IV

Powder Bed Fusion: Selective Laser Sintering: Introduction, Process parameter, SLS sintering process, Electron Beam melting (EBM) process.

Directed Energy Deposition Processes: Introduction, General DED Process Description, Material Delivery, DED Systems, Process Parameters, DED Benefits and Drawbacks.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <u>https://youtu.be/LjWL-lQe6ok</u>

Unit V

Indirect Methods for Rapid Tool Production, Role of Indirect Methods in Tool Production, Metal Deposition Tools, RTV Tools, Epoxy Tools, **Direct Methods for Rapid Tool Production:** Classification of Direct Rapid Tool Methods, RapidTool process, Sand Form, Pattern for Investment and Vacuum Casting, Functional Models.

- · Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: <u>https://youtu.be/RQVjwSG1-XY</u>

Suggested Learning Resource

Text Books:

- 1. Additive Manufacturing Technologies, I. Gibson 1 D. W. Rosen 1 B. Stucker, Springer New York Heidelberg Dordrecht London, 2010.
- Applications of 3D Printing Technology, K.G.Jaya Christiyan, DVSSV Prasad, K.R.Senthil Kumar, Kavita Karambelkar, Scientific International Publishing House

Reference Books:

- 1. Stereo lithography and other RP & M Technologies, Paul F.Jacobs: "SME, NY 1996.
- 2. Rapid manufacturing, Fiham D.T & Dinjoy S.S Verlog London 2001.
- 3. Rapid Prototyping: Principles and Application, by Rafiq I. Noorani

Course Outcomes (COs):

At the end of the course, the student will be able to:

- 1. Illustrate the concepts, working principle and construction of Additive Manufacturing technologies. (PO-2,PSO-1)
- 2. Design and manufacturing, modern development in additive manufacturing process. .(PO-2,3,PSO-1,2)
- 3. Enhance the production sequence by choosing the correct optimization and proper Design.(PO-2,,3,4,PSO-2)
- 4. Implement AM techniques for specific application leading to better ROI for the company that uses Laser AM machines. .(PO-2,3,4,PSO-3)

5. Analyze the productivity sequence by choosing the right AM technology.(PO-3,4,PSO-3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assossment Teels	Manlia	Course Outcomes (COs)
Assessment 1001s	IVIALKS	addressed
Internal Test-I (CIE-I)	30	CO1, CO2
Internal Test-II CIE-II)	30	CO3, CO4
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2
Assignment	10	CO3, CO4
The Final CIE out of 50 Marks =	Average of two	OCIE tests for 30
Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)	
Course End Examination		
(Answer One full question from	100	CO1, CO2, CO3, CO4
each Unit- Internal Choice)		

DIGITAL SIGNAL PROCESSING		
Course Code: ADE634	Credits: 3:0:0	
Pre – requisites: Nil	Contact Hours: 42L	
Course Coordinator: Dr. Anita Kanavalli		

Course Content

Unit I

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://https://nptel.ac.in/courses/106/105/106105032/

Unit II

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://https://nptel.ac.in/courses/106/105/106105032/

Unit III

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and 03092022 Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://https://nptel.ac.in/courses/106/105/106105032/

Unit IV

Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hitor Miss Transforms, Some Basic Morphological Algorithms.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://https://nptel.ac.in/courses/106/105/106105032/

Unit V

Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection, Principles of Thresholding. Representation and Description: Representation, Boundary descriptors.

- Pedagogy/Course delivery tools: Chalk and talk, Power point presentation
- Links: https://https://nptel.ac.in/courses/106/105/106105032/

Suggested Learning Resources

Text Books:

- 1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.
- S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Edition, 2016

Reference Books:

- 1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014.
- 2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

Course Outcomes (COs):

At the end of the course, the student will be able to:

- 1. Understand the fundamentals of Digital Image Processing. (PO-1,PSO-1)
- 2. Apply different Image transformation techniques. (PO-2,3,PSO-2)
- 3. Analyze various image restoration techniques. (PO-2,3,4,PSO-2)
- 4. Understand color image and morphological processing. (PO-1,2,PSO-1)
- 5. Design image analysis and segmentation techniques. (PO-2,3,PSO-2)

Continuous Internal Evaluation (CIE): 50 Marks		
Assassment Teels	Monks	Course Outcomes (COs)
Assessment 1 0015	IVIALKS	addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II CIE-II)	30	CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks =	Average of two	OCIE tests for 30
Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)	
Course End Examination		
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5
each Unit- Internal Choice)		

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT		
Course Code: AD635	Credits: 3:0:0	
Pre – requisites: Nil Contact Hours: 42L		
Course Coordinator: Mrs. Swetha B N		

Course Content

Unit I

Introduction: Some Basic Definitions and terminology, the processes and activities of software configuration management, configuration status accounting, configuration audit, software configuration management in geographically distributed teams, Metrics in software configuration management, software configuration management tools and automation. Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies. Software Processes: Models: Waterfall Model, Incremental Model and Spiral Model, Process activities. Requirements Engineering: Requirements Engineering Processes, Functional and non-functional requirements, Requirements validation, Requirements Management.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Link: <u>https://youtu.be/AN5I6fFxyfs</u> <u>https://rb.gy/84I71</u> https://rb.gy/pzzb0

Unit II

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling; abstraction; The Three models. Class Modelling: Object and Class Concept; Link and associations concepts; Generalization and Inheritance; A sample class model; Navigation of class models;

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Link: https://youtu.be/0lhVNEf1QeQ?list=PLrgz73xxhUkPBK2de3CuRb7F3zKh_sq Up
Unit III

System Models: Context models, Interaction models. Structural models. Behavioral models, Model-driven engineering. Design and Implementation: Introduction to RUP, Design Principles. Object-oriented design using the UML. Design patterns. Implementation issues. Open-source development.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Link: <u>https://rb.gy/33hxs</u>

Unit IV

MONITORING AND CONTROL: Creating the Framework, Collecting the Data, Review, Project Termination Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting Project Back to Target, Change Control, Software Configuration Management.

- **Pedagogy/Course delivery tools**: Chalk and talk, Power Point Presentation, Videos
- Link: <u>https://rb.gy/s3a33</u> <u>https://rb.gy/0hxjj</u> <u>https://rb.gy/oi85v</u>

Unit V

MANAGING PEOPLE AND WORKING IN TEAMS: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham– Hackman Job Characteristics Model, Stress– Health and Safety Working In Teams, Becoming a Team, Decision Making, Leadership.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Link: <u>https://youtu.be/ZKOL-rZ79gs</u> <u>https://www.youtube.com/watch?v=XNDePDD_CV4</u> <u>https://youtu.be/5d16JwWwjKo</u>

Text Books:

- 1. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
- 2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.
- 3. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", Fifth Edition, TataMcGrawHill,2011.

Reference Books:

- 1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
- 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India
- 3. "Accounting for Management" Jawaharlal, 5th Edition, Wheeler Publications, Delhi.
- 4. Jack Marchewka," Information Technology- Project Management", Wiley Student Version,4th Edition,2013.
- James P Lewis," Project Planning, Scheduling & Control", McGraw Hill, 5th Edition, 2011.

Course Outcomes (COs):

At the end of the course, the student should be able to:

- 1. Design a software system, component, or process to meet desired needs within realistic constraints. (PO-1,2, 3, 4, 5, 6.PSO-1,2)
- 2. Understand professional and ethical responsibility. (PO-1,2, 3, 4, 5.PSO-1,2,3)
- 3. Apply function on multi-disciplinary teams. (PO-1,2, 3, 4, 5.PSO-1,2,3)
- 4. Apply the practices and methods for successful software project management. (PO-1,2, 3, 4, 5.PSO-1,2,3)
- 5. Identify techniques for requirements, policies and decision making for effective resource management. (PO-1,2, 3, 6.PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tools	Marks	Course Outcomes (COs) addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO3,CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)			
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code: ADE641	Credits: 3:0:0
Pre – requisites: Basics of Computer	Contact Hours: 42L
Networks	
Course Coordinator: Dr. Vaneeta M	

Course Content

Unit I

Introduction: Security Goals, Attacks, Services and Mechanism, Techniques.

Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc22_cs90/preview</u>

Unit II

Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers.

Data Encryption Standard (DES): Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES.

Advanced Encryption Standard (AES): Introduction, Transformations, Key Expansion, Ciphers, Examples, Analysis of AES

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc22_cs90/preview</u>

Unit III

Encipherment using Modern Symmetric-Key Ciphers: Use of Modern Block Ciphers, Use of Stream Ciphers, Other Issues.

Asymmetric Key Cryptography: Introduction, RSA Cryptosystem, Rabin Cryptosystem, Elgamal Cryptosystem.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc22_cs90/preview</u>

Unit IV

Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirement for Message Authentication Codes.

Digital Signatures: Digital Signatures, Digital Signature Standard.

Key Management and Distribution: Distribution of Public keys, X.509 certificates. **User Authentication**: Kerberos.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc22_cs90/preview</u>

Unit V

System Security - Intruders: Intruders, Intrusion detection.

Malicious Software: Types of Malicious Software, Viruses.

Firewalls: The need for Firewalls, Firewall Characteristics, Types of Firewalls.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc22_cs90/preview</u>
- •

Suggested Learning Resources

Text Books:

- 1. Behrouz A. Forouzan, Debdeep Mukhopadhyay: Cryptography and Network
- 2. Security, 3rd Edition, Special Indian Edition, Tata McGraw-Hill, 2015.
- 3. William Stallings, Cryptography and Network Security, Sixth Edition, Prentice Hall of India, 2016.

Reference Book:

1. Josef Pieprzyk, Thomas Hardjono, Jennifer Serberry Fundamentals of Computer Security, Springer.

Course Outcomes (COs):

At the end of the course the students should be able to:

- 1. Illustrate security goals and the various threats to security. (PO-1,2,PSO-1)
- 2. Identify the different data Symmetric encryption techniques and standards.(PO-1,2,PSO-1)
- 3. Implement the Asymmetric Key Cryptosystem. (PO-1,2,3,PSO-1,2)
- 4. Apply the concepts of authentication functions and key distribution techniques. (PO-1,2,3,PSO-1,2)

5. Demonstrate how intruders escalate privileges and analyze the Firewall design to achieve highest system security. (PO-1,2,3,PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tools	Manka	Course Outcomes (COs)	
Assessment 1001s	IVIAI KS	addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)	1		
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

EDGE COMPUTING		
Course Code: ADE642	Credits: 3:0:0	
Pre – requisites: Nil Contact Hours: 42L		
Course Coordinator: Dr. Sowmya B J		

Course Content

Unit I

Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://nptel.ac.in/courses/106104242</u>

Unit II

IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machineto-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://nptel.ac.in/courses/106104242</u>

Unit III

RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout and Pinouts, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://nptel.ac.in/courses/106104242</u>

Unit IV

Implementation of Microcomputer RaspberryPi and device Interfacing, Edge to Cloud Protocols- Protocols,MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://nptel.ac.in/courses/106104242</u>

Unit V

Edge computing with RaspberryPi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://nptel.ac.in/courses/106104242</u>

Suggested Learning Resources

Text Books:

- 1. Iot and Edge Computing for Architects Second Edition, by Perry Lea, Publisher: Packt Publishing, 2020, ISBN: 9781839214806
- Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

References:

- 1. Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama, wiley publication, 2019, ISBN: 9781119524984.
- 2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, MICROSOFT AZURE

Course Outcomes (COs):

At the end of the course the students should be able to:

- 1. Identify the need, communication models and comparison between of Edge and Fog computing. (PO-1,2,PSO-1)
- 2. Explain the architecture and core components of IoT. (PO-1,2,PSO-1)
- 3. Illustrate the architecture and programming essentials of RaspberryPi.(PO-3,PSO-1)
- 4. Demonstrate the implementation of MQTT protocol. (PO-3,4, PSO-2)
- 5. Apply Edge computing in Industrial and commercial IoT. (PO-2,3,PSO-2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assossment Teels	Marks	Course Outcomes (COs)	
Assessment 1001s	IVIALKS	addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)		
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

OPTIMIZATION TECHNIQUES FOR MACHINE LEARNING

Course Code: ADE643	Credits: 3:0:0
Pre – requisites: Linear Algebra, Calculus,	Contact Hours: 42L
Basic Programming	
Course Coordinator: Dr. Ajina A	

Course Content

Unit I

Basics of Linear Algebra and Calculus: Subspaces, EigenValue Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc23_cs64/preview</u>

Unit II

Convex Functions, First and Second Order Conditions for Optimizations, Convex and Non Convex Optimization problems in Machine Learning

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc23_cs64/preview</u>

Unit III

Gradient Descent: math, programming basic optimization problems and their solutions.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc23_cs64/preview</u>

Unit IV

Variants of Gradient Descent: Projected, Stochastic, Proximal, Accelerated, Coordinate

Descent, Training a Neural Network: Theory.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc23_cs64/preview

Unit V

Newton"s Method, Optimization for ML in practice: Pytorch/Tensor Flow. Training a Neural Network, Implementation.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc23_cs64/preview</u>

Suggested Learning Resources

Text Books:

- 1. Linear Algebra and Learning from Data, Gilbert Strang
- 2. Convex Optimisation by Stephen Boyd
- 3. Optimisation for Machine Learning by Suvrit Sra, MIT Press.

Reference Book:

1. Foundations of Data Science, Avrim Blum and Ravi Kannan, Hindustan Book Agency/Cambridge University Press

Course Outcomes (COs):

At the end of the course the students should be able to:

- 1. Illustrate the foundations of Subspaces, EigenValue Decomposition, Singular Value Decomposition Algorithms and Methods, required for solving optimization problems in the context of machine learning. (PO-1,2, PSO-1)
- 2. Illustrate the foundations of PSD Matrices and Kernel Functions, Vector Calculus. (PO-2,3, PSO-1)
- 3. Demonstrate optimization algorithms like stochastic gradient descent and its various variants to solve machine learning problems. (PO-3,4, PSO-2)
- 4. Illustrate use of standard problem formulations as convex (SVM etc). (PO-1,2, PSO-1)
- 5. Illustrate use of standard problem formulations as non-convex (Neural Networks and Deep Neural Networks)(PO-1,2,PSO-1)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tools	Monka	Course Outcomes (COs)	
Assessment 1 001s	IVIAI KS	addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)			
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

BLOCKCHAIN TECHNOLOGY		
Course Code: ADE644	Credits: 3:0:0	
Pre – requisites: NIL Contact Hours: 42L		
Course Coordinator: Dr. Vaneeta M		

Course Content

Unit I

Introduction: Basic Cryptographic primitives used in Blockchain – Secure, Collisonresistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems. Need for Distributed Record Keeping, Modelling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Why Nakamoto Came up with Blockchain based cryptocurrency.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview_</u>

Unit II

Technologies Borrowed in Blockchain – hash pointers, Consensus, Byzantine Models of fault tolerance, digital cash etc.Bitcoin blockchain - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Bitcoin, the challenges, and solutions.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Unit III

Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).Bitcoin scripting language and their use.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Unit IV

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity – Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. Some attacks on smart contracts.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Unit V

Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain. Beyond Cryptocurrency – applications of blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms. Limitations of block chain as a technology, and myths vs. reality of block chain technology.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Suggested Learning Resources

Text Books:

- 1. S. Shukla, M.Dhawan, S. Sharma, S. Venkatesan "Block chain Technology: Cryptocurrency and Applications" Oxford University Press, 2019
- 2. Josh Thompson "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain

Reference Books:

- 1. Arvind Narayanan et. Al, "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press,2016
- 2. Joseph Bonneau et al, SoK, "Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy,2015
- 3. J.A.Garay et al, "The bitcoin backbone protocol analysis and applications", EUROCRYPT LNCS VOI 9057, (2015VOLII), pp 281-310,2015
- 4. Programming" Create Space Independent Publishing Platform 2017

Course Outcomes (COs):

At the end of the course, students will be able to-

- 1. Illustrate the Blockchain terminologies with its applications. (PO-1,PSO-1)
- 2. Analyse the working principles of Blockchain. (PO-1,2,PSO-1)
- 3. Comprehend the principles & methodologies used in Bitcoin and able to deploy smart Contract . (PO-1,2,PSO-1,2)
- 4. Create Ethereum Network, Wallets, Nodes, Smart contract & Dapps(PO-1,2,3,PSO-1)
- 5. Develop Blockchain Based Application Architecture using Hyperledger. (PO-1,2,3,5, PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks			
Aggaggmant Taola	Maala	Course Outcomes (COs)	
Assessment 1001s	WIALKS	addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)		
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

INFORMATION RETRIEVAL			
Course Code: ADE645	Credits: 3:0:0		
Pre – requisites: NIL Contact Hours: 42L			
Course Coordinator: Dr. Meeradevi A K	-		

Course Content

Unit I

Introduction: Overview, History of IR, Text Operations: Document preprocessing, Document Clustering, Text Compression, Indexing: Inverted files, Mathematics for IR: Set Theory, Mathematical Logic, Probability and Linear algebra, Classic IR Models: Boolean Model, Vector space model: tf-idf weighing, Probabilistic Model. Language models for IR: The language model and the query likelihood model.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/44XmuZgGgzI</u>

Unit II

Evaluation Measures: Precision, Recall, Alternative Measures, **Reference Collections:** TREC, **Relevance Feedback and Query Expansion**, **Text Classification:** The text classification problem, **Flat clustering:** Clustering in information retrieval, Problem Statement, **Hierarchical clustering:** Hierarchical agglomerative clustering, Single-link and Complete-link clustering.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/44XmuZgGgzI</u>

Unit III

String Matching algorithms: Knuth Morris Pratt and Rabin Karp, Stemming algorithm: Porter, Map reduce algorithms: tf- idf calculation and indexing, Classification: Naive Bayes algorithm, Clustering: k-means algorithm. Machine learning Algorithms: Machine-learned scoring, Result ranking by machine learning.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/44XmuZgGgzI</u>

Unit IV

Web search basics: web characteristics, Architecture of web search engine, Web Crawling and Indexing: Overview, Crawling, Distributing Indexes, and Connectivity Servers. Link analysis: Web as a graph, Page Rank, Hubs and Authorities.

Unit V

XML Retrieval: Basic XML Concepts, Challenges in XML retrieval, a vector space model for XML retrieval, **Introduction to Semantic Web:** Purpose, Semantic Web Stack, RDF, RDFS, Ontology, Web ontology language (OWL) and ontology tools.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://youtu.be/44XmuZgGgzI</u>

Suggested Learning Resources

Text Books:

- 1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, Pearson Education, 1999.
- 2. Introduction to Information Retrieval. C.D. Manning, P. Raghavan, H. Schütze. Cambridge UP, 2008.

Reference Books:

- 1. William B Frakes, Ricardo Baeza Yates: Information Retrieval Data Structures and Algorithms, PH PTR, 1992.
- 2. David A Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2e, Springer, 2004
- 3. Mathematics for Classical Information Retrieval: Roots and Applications: Dariush Alimohammadi,
- 4. <u>http://www.dcc.fc.up.pt/~zp/aulas/1213/pde/geral/bibliografia/MIT.Press.A</u> Semantic. Web.Primer.eBook-TLFeBOOK.pdf

Course Outcomes (COs):

At the end of the course, student should be able to

- 1. Describe text operations and various information retrieval models. (PO-3, PSO-1)
- 2. Evaluate an IR system using various evaluation measures. (PO-2,3,4, PSO-1)
- 3. Apply various algorithms such as string matching, map reduce, classification and clustering. (PO-2,3, PSO-3)

- 4. Design web search engine, web crawling and link analysis techniques.(PO-3,4 PSO-2)
- 5. Explain XML Retrieval and various semantic web technologies. (PO-2,3,4, PSO-2)

Continuous Internal Evaluation (CIE): 50 Marks			
Assessment Tools	Manka	Course Outcomes (COs)	
Assessment 1001s	IVIAI KS	addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)		
Course End Examination			
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

DATA ANALYTICS LABORATORY

Course Code: ADL65 Pre – requisites: NIL Credits: 0:0:1 Contact Hours: 14P

Course Coordinator: Dr. Sowmya B J

Course Content

List of problems for which student should develop program and execute in the Laboratory

- 1. Installation of R and Study of R as a data analytics tool
- 2. Illustrate R as calculator application
- 3. Demonstrate on Descriptive statistics in R
- 4. Implement Reading and writing different types of datasets
- 5. Illustrate Visualizations
- 6. Demonstrate Correlation and covariance
- 7. Implement Regression model
- 8. Illustrate Multiple regression model
- 9. Demonstrate Regression model for prediction
- 10. Implement Classification model
- 11. Implement Clustering model

Suggested Learning Resources

Reference Book:

1. Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012

Web References:

- 1. http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in
- 2. http://www.ats.ucla.edu/stat/r/dae/rreg.html
- 3. http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html
- 4. http://www.ats.ucla.edu/stat/r/data/binary.csv

Course Outcomes (COs):

At the end of the course, students will be able to-

- 1. Demonstrate working with R tool. (PO-3,5,9,12, PSO-2,3)
- 2. Demonstrate the visualization, correlation and covariance. (PO-3,5,9,12, PSO-2,3)
- 3. Demonstrate machine learning models (PO-3,5,9,12, PSO-2,3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	CO1, CO2
Lab Test-II	10	CO3
Weekly Evaluation-Lab Record	30	-
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in		
Lab Test-I + Marks scored in Lab Test-II		
Semester End Examination (SEE)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and	50	CO1, CO2, CO3
executed)		

DEEP LEARNING LABORATORY

Course Code: ADL66 Pre – requisites: NIL Credits: 0:0:1 Contact Hours: 14P

Course Coordinator: Dr. Jagadish S Kallimani

Course Content

List of Exercises / Experiments

- 1. Basic image processing operations: Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
- 2. Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN
- 3. Study the effect of batch normalization and dropout in neural network classifier
- 4. Familiarization of image labelling tools for object detection, segmentation
- 5. Image segmentation using Mask RCNN, UNet, SegNet
- 6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN,

etc.)

- 7. Image Captioning with Vanilla RNNs
- 8. Image Captioning with LSTMs
- 9. Network Visualization: Saliency maps, Class Visualization
- 10. Generative Adversarial Networks
- 11. Chatbot using bi-directional LSTMs
- 12. Familiarization of cloud based computing like Google COLAB.

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Suggested Learning Resources

Text Books:

- 1. Simon Haykin, Neural networks and Learning Machines, Third Edition, Pearson, 2016
- Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

Reference Book:

1. Neural Networks and Deep Learning by Michael Nielsen http://neuralnetworksanddeeplearning.com/

Course Outcomes (COs):

At the end of the course, students will be able to-

- 1. Implement the various deep learning algorithms in Python. (PO-3,5,9,12, PSO-2,3)
- 2. Demonstrate with different deep learning frameworks like Keras, Tensor flow, PyTorch, Caffe etc. (PO-3,5,9,12, PSO-2,3)
- 3. Demonstrate recurrent, recursive nets function and practical problems can be mapped to these functions. (PO-3,5,9,12, PSO-2,3)

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (COs) addressed
Lab Test-I	10	CO1, CO2
Lab Test-II	10	CO3
Weekly Evaluation-Lab Record	30	-
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in		
Lab Test-I + Marks scored in Lab Test-II		
Semester End Examination (SEE)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Course Code: ADOE01Credits: 3:0:0Pre – requisites: NILContact Hours: 42LCourse Coordinator: Dr. Meeradevi A K

Course Content

Unit I

Introduction: What is AI? Foundation and History of Artificial Intelligence. Intelligent Agents: Agents and Environments, Rationality, the Nature of Environments, the Structure of Agents. Problem-solving by search: Problem Solving Agents, Example Problems, Searching for Solution, Uniformed Search Strategies, Informed Search Strategies, Heuristic Functions.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106105077</u>
- https://nptel.ac.in/courses/106102220

Unit II

Informed (Heuristic) Search Strategies- Greedy best-first search, A* search. Logical Agents: Knowledge-Based Agents, The Wumpus World, First- Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic- Models for first-order logic, Symbols and Interpretations, Atomic Sentences, Complex Sentences, The knowledge Engineering Process.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
 - Links:https://nptel.ac.in/courses/106105077
 - https://nptel.ac.in/courses/106102220

Unit III

What is Data Science? Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, Linear Algebra, Vectors, Matrices, Statistics, Describing a Single Set of Data, Correlation, Simpson''s Paradox, Some Other Correlational Caveats, Correlation and Causation, Probability, Dependence and Independence, Conditional Probability, Bayes''s Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

 Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos • Links: https://nptel.ac.in/courses/106106179

Unit IV

Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, Gradient Descent, The Idea Behind Gradient Descent Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit Models, Minibatch and Stochastic Gradient Descent, Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, Working with Data, Exploring Your Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
 - Links: <u>https://nptel.ac.in/courses/106106179</u> https://nptel.ac.in/courses/106106212

Unit V

Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, The Model, Example: The Iris Dataset, The Curse of Dimensionality, Naive Bayes, A Really Dumb Spam Filter, A More Sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, Simple Linear Regression, The Model, Using Gradient Descent, Maximum Likelihood Estimation, Multiple Regression. Further Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, Logistic Regression, The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://nptel.ac.in/courses/106106179</u> https://nptel.ac.in/courses/106106212

Suggested Learning Resources

Text Books:

- Stuart J Russel and Peter Norvig: "Artificial Intelligence A Modern Approach", 4th Edition, Pearson Education, 2021.
- Joel Grus, "Data Science from Scratch", 2nd Edition, O"Reilly Publications/ Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978- 9352138326

Reference Books:

- Emily Robinson and Jacqueline Nolis, "Build a Career in Data Science", 1st Edition, Manning Publications, 2020. ISBN: 978-1617296246.
- AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-1492032649.

Course Outcomes (COs):

At the end of the course the students should be able to:

- 1. Identify the modern view of artificial intelligence and its applications based on agent Philosophy. (PO-1,2,3, PSO-1,2)
- Apply intelligent agents for Artificial Intelligence programming techniques. (PO-1,2,3, PSO-1,2)
- 3. Identify and demonstrate data using visualization tools. (PO-1,2,3, PSO-1,2)
- 4. Make use of Statistical hypothesis tests to choose the properties of data, curate and manipulate data. (PO-1,2,3,PSO-1,2)
- 5. Utilize the skills of machine learning algorithms and techniques and develop models. (PO-1,2,3, PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks		
Assossment Teels	Marks	Course Outcomes (COs)
Assessment 1 001s		addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II CIE-II)	30	CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30		
Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)		
Course End Examination (Answer		
One full question from	100	CO1, CO2, CO3, CO4, CO5
each Unit- Internal Choice)		

EMBEDDED INTELLIGENCE

Course Code: ADOE02 Pre – requisites: NIL Credits: 3:0:0 Contact Hours: 42L

Course Coordinator: Dr. Anita Kanavalli

Course Content

Unit I

INTRODUCTION: Fundamental Components of Embedded Systems - Architecture of Embedded Systems - Embedded Design Life Cycle - Development Environment -Validation - Host and Target Testing - Debugging tool

• Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Unit II

MEMORY AND INTERRUPTS: Types of Memory - Memory Access Procedure -Memory Management techniques - Memory Testing - Common Memory problems -Interrupts - Interrupt Service Routines

• Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Unit III

COMMUNICATION INTERFACES AND PROTOCOLS: Interfacing Buses - Serial Interfaces - RS232/UART - UART Programming - RS422/RS485 - I2C Interface - SPI Interface - I2C/SPI Programming - USB

• Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation

Unit IV

REAL TIME OPERATING SYSTEMS: Real-Time Concepts - Task Management -Task Scheduling - Classification of Scheduling Algorithms - Clock Driven Scheduling - Event Driven Scheduling - Resource Sharing - Priority Inheritance Protocol - Priority Ceiling Protocol - Commercial RTOS

 Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Unit V

Introduction to Embedded AI Systems Design: sensors technology, fundamentals of AI & Machine Learning, IoT applications, industry case studies

 Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

Suggested Learning Resources

Text Books:

- 1. Arnold S Berger, "Embedded Systems Design An Introduction to Processes, Tools and Techniques", Elsevier, New Delhi, 2011
- 2. Prasad K V K K, "Embedded/Real-Time Systems: Concepts, Design and Programming The Ultimate Reference", Himal Impressions, New Delhi, 2003

Reference Books:

- 1. Raj Kamal, "Embedded Systems Architecture, Programming and Design", 3rd Edition, Tata McGraw Hill, 2017
- Rajib Mall, "Real-Time Systems: Theory and Practice", First Edition, Pearson, 2009
- 3. Sriram V Iyer and Pankaj Gupta, "Embedded Real-time Systems Programming", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

Course Outcomes (COs):

At the end of the course, students will be able to:

- 1. Understand the embedded system with its applications. (PO-1,PSO-1)
- 2. Analyse the memory systems of embedded systems (PO-1,2,PSO-1)
- 3. Comprehend the principles & methodologies used in communication systems used in embedded systems (PO-1,2,PSO-1,2)
- 4. Create real time OS task management system for embedded applications (PO- 1,2,3,PSO-1)
- 5. Develop a system AI and ML enabled embedder system(PO-1,2,3,5, PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks		
A googgmont Tools	Maula	Course Outcomes (COs)
Assessment 1001s	IVIALKS	addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II CIE-II)	30	CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30		
Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination	100	CO1, CO2, CO3, CO4, CO5
(SEE)		

BLOCK CHAIN TECHNOLOGIES		
Credits: 3:0:0		
Pre – requisites: NIL Contact Hours: 42L		
r. Vaneeta M		
Credits: 3:0:0 Contact Hours: 42L r. Vaneeta M		

Course Content

Unit I

Introduction: Basic Cryptographic primitives used in Blockchain – Secure, Collisonresistant hash functions, digital signature, public key cryptosystems, zero-knowledge proof systems. Need for Distributed Record Keeping, Modelling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Why Nakamoto Came up with Blockchain based cryptocurrency.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview_</u>

Unit II

Technologies Borrowed in Blockchain – hash pointers, Consensus, Byzantine Models of fault tolerance, digital cash etc.Bitcoin blockchain - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Bitcoin, the challenges, and solutions.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Unit III

Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).Bitcoin scripting language and their use.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Unit IV

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity – Smart Contracts - The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. Some attacks on smart contracts.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Unit V

Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain. Beyond Cryptocurrency – applications of blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms. Limitations of block chain as a technology, and myths vs. reality of block chain technology.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links : <u>https://onlinecourses.nptel.ac.in/noc20_cs01/preview</u>

Suggested Learning Resources

Text Books:

- 1. S. Shukla, M.Dhawan, S. Sharma, S. Venkatesan "Block chain Technology: Cryptocurrency and Applications" Oxford University Press, 2019
- 2. Josh Thompson "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain

Reference Books:

- 1. Arvind Narayanan et. Al, "Bitcoin and cryptocurrency technologies: a comprehensive introduction", Princeton University Press, 2016
- 2. Joseph Bonneau et al, SoK, "Research perspectives and challenges for Bitcoin and cryptocurrency", IEEE Symposium on security and Privacy,2015
- 3. J.A.Garay et al, "The bitcoin backbone protocol analysis and applications", EUROCRYPT LNCS VOI 9057, (2015VOLII), pp 281-310,2015
- 4. Programming" Create Space Independent Publishing Platform 2017

Course Outcomes (COs):

At the end of the course, students will be able to:

- 1. Illustrate the Blockchain terminologies with its applications. (PO-1,PSO-1)
- 2. Analyse the working principles of Blockchain. (PO-1,2,PSO-1)
- 3. Comprehend the principles & methodologies used in Bitcoin and able to deploy smart Contract . (PO-1,2,PSO-1,2)
- 4. Create Ethereum Network, Wallets, Nodes, Smart contract & Dapps.(PO-1,2,3,PSO-1)
- 5. Develop Blockchain Based Application Architecture using Hyperledger. (PO-1,2,3,5, PSO-1,2)

Continuous Internal Evaluation (CIE): 50 Marks		
A succession of Tools	Marks	Course Outcomes (COs)
Assessment 1001s		addressed
Internal Test-I (CIE-I)	30	CO1, CO2, CO3
Internal Test-II CIE-II)	30	CO4, CO5
Average of the two CIE shall be taken for 30 marks		
Other Components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
The Final CIE out of 50 Marks = Average of two CIE tests for 30		
Marks+ Marks scored in Quiz +Marks scored in Assignment		
Semester End Examination (SEE)	
Course End Examination		
(Answer One full question from	100	CO1, CO2, CO3, CO4, CO5
each Unit- Internal Choice)		

INTRODUCTION TO IOT AND CLOUD COMPUTINGCourse Code: ADOE04Credits: 3:0:0Pre – requisites: Fundamentals of computer
network, WSN, communication & internet
technologyContact Hours: 42LCourse Coordinator: Mrs. Swetha B NContact Hours: 42L

Course Content

Unit I

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:<u>https://onlinecourses.nptel.ac.in/noc22_cs53/preview</u>
 https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit II

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies. IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: https://onlinecourses.nptel.ac.in/noc22_cs53/preview https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit III

The Transport Layer, IoT Application Transport Methods. Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT,

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links: <u>https://onlinecourses.nptel.ac.in/noc22_cs53/preview</u> <u>https://onlinecourses.nptel.ac.in/noc21_cs14/preview</u>

Unit IV

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, Exercises and problems.

• Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos

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Links

https://onlinecourses.nptel.ac.in/noc22_cs53/preview https://onlinecourses.nptel.ac.in/noc21_cs14/preview

Unit V

Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GreThe Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation, Videos
- Links:<u>https://onlinecourses.nptel.ac.in/noc22_cs53/preview</u>
 <u>https://onlinecourses.nptel.ac.in/noc21_cs14/preview</u>

Suggested Learning Resources

Text Books:

- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
- 2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017
- 3. Cloud Computing Theory and Practice, Dan C. Marinescu, Morgan Kaufmann, Elsevier 2013.

Reference Books:

- 1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Handson-Approach)", 1st Edition, VPT, 2014.
- 2. Cloud Computing : A Practical Approach by Anthony T. Velte Toby J. Velte,Robert Elsenpeter, 2010 by TheMcGraw-Hill.
- 3. Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more. by Dr. KrisJamsa.

Course Outcomes (COs):

- 1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.(PO-1,2,3,PSO-1)
- 2. Compare and contrast the deployment of smart objects and the technologies to connect them to network. .(PO-1,2,PSO-1)
- 3. Appraise the role of IoT protocols for efficient network communication. Elaborate the need for Data Analytics and Security in IoT. .(PO-1,2,3,4, PSO-1,2)
- 4. Understand the concepts of cloud computing, virtualization and classifyservices of cloud computing.(PO-1,2,PSO-1)
- 5. Illustrate architecture and programming in cloud.(PO-1,2,PSO-1)

Continuous Internal Evaluation (CIE): 50 Marks			
A second to als	Marks	Course Outcomes (COs)	
Assessment 1001s		addressed	
Internal Test-I (CIE-I)	30	CO1, CO2, CO3	
Internal Test-II CIE-II)	30	CO4, CO5	
Average of the two CIE shall be taken for 30 marks			
Other Components			
Quiz	10	CO1, CO2, CO3	
Assignment	10	CO3, CO4, CO5	
The Final CIE out of 50 Marks = Average of two CIE tests for 30			
Marks+ Marks scored in Quiz +Marks scored in Assignment			
Semester End Examination (SEE)			
Course End Examination (Answer			
One full question from	100	CO1, CO2, CO3, CO4, CO5	
each Unit- Internal Choice)			

MINI PROJECT

Course Code: ADP67

Credits: 0:0:3

Course Content

Based on the curriculum learnt by the students, they are advised to choose suitable project topics and propose the methodologies involved in it. Students are required to carry out this mini project work for a duration of approximately 42 hours during their sixth semester particularly in the domain of artificial intelligence and Data Science. Based on their experiences in intra internship, as well as inter internships, which they carried out previously, they can propose its extension, as mini-project work.

Guidelines:

As a part of Mini Project, students must carry out the following activities:

- 1. Students should form a group to carry out their project. The minimum group size is 3 and maximum group size is 4.
- 2. The groups will be attached to one Internal Guide by the Department.
- 3. Students can carry out their project in-house once guide approves the topic.
- 4. Identify the problem statement based on the current state of Art and trends in the area of Artificial Intelligence and Data Science.
- 5. Based on the survey, identify the project requirements and do feasibilitystudy.
- 6. Identify and draw a system level architecture by showing subsystems andtheir input/output need.
- 7. Implement the programs using step by step for each module.
- 8. Integrate and examine the implementation and test the project scope and therequirements.
- 9. Prepare the demonstration of the Project documents and the presentation.
- 10. The evaluation is based on presentation and report.

Assessment:

- CIE Minimum 2 reviews of the project + any other relevant components (for50 Marks)
- SEE Project Demonstration + any other component as decided by InternalExamination (for 50 Marks)
- The evaluation will be done by the internal guide and a co-examiner twiceduring the semester.
 - Mid-semester evaluation: Students must do a group presentation and produce documents of system requirements, and system design (during 6thweek).
 - Final Evaluation: At the End of the semester students must do a group presentation, demonstrate the project work and submit the complete report.(During 13th week).

Course Outcomes (COs):

At the end of the course, student should be able to

- 1. Formulate a real-world problem and its requirements in the field of Artificial Intelligence and Data Science. (PO-1,2,3,4,6,11,12,PSO-1,2,3)
- 2. Develop a design document for a set of requirements. (PO-1,2,3,4,5,11,12,PSO-1,2,3)
- 3. Test and validate the conformance of the developed prototype against theoriginal requirements of the problem. (PO-1,2,3,4,5,11,12, PSO-1,2,3)
- 4. Appraise the Contribution of an individual or in a team in development of the project. (PO-8,9,11,12, PSO-1,2,3)
- 5. Develop effective communication skills for presentation of project relatedactivities (PO-8,9, 10, 11,12, PSO-1,2,3)

INNOVATION/SOCIETAL/ENTREPRENEURSHIP BASED INTERNSHIP		
Course Code: INT68	Credits: 0:0:2	
Pre – requisites: Nil Contact Hours: -		
Course Coordinator: Artificial Intelligence and Data Science Faculty		

Course Content

Students are required to carry out training in an Artificial Intelligence and Data Science industry or research organization or with a start-up or firm super specialty hospital for not less than four weeks after 4th or during 5th semester. The internship addresses innovation/societal contributions or should evolve a student's entrepreneurial skill sets. Students are required to submit a report on the same in the format provided by the internship committee at the department. The students will be evaluated by the training committee based on the rubrics informed to students by the committee.

Course Outcomes (COs):

On successful completion of this course, students will be able to

- 1. Analyze the functional aspects of Artificial Intelligence and Data Science (PO-2,4,7,11,12, PSO-1,2,3)
- 2. Enhance the communication skills to work in interdisciplinary teams in industry/organization. (PO-9, 10, PSO-2,3)
- 3. Realize the professional and ethical responsibility. (PO-6, 7, 8, PSO-2, 3)