NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING
(Artificial Intelligence &Machine Learning)

Scheme and Syllabus

V Sem to VIII Sem

With effect from Academic Year 2022-23

VISION

To be a center of excellence with quality education and research in Artificial Intelligence through nurturing collaborative culture, disseminating customer oriented innovations and positive contribution to the welfare of the society.

MISSION

- To impart quality technical education to the students to enhance their professional skills and make them globally competitive.
- To carry out research in cutting out technologies in Artificial Intelligence and its allied fields to meet the requirements of industry and society.
- To create an innovation environment with the collaboration of industry in which students can provide solutions to global problems.
- To inculcate strong ethical and leadership qualities to the minds of students and make them as successful entrepreneurs.
- To produce the Computer Science and Engineering professionals with a specialization in AIML with personal and professional responsibilities and commitment to lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The graduates of Computer Science and Engineering are expected to fulfill the following PEOs after a few years of their graduation

PEO1: Graduates in Computer Science and Engineering will apply the technical knowledge of analysis and design of software used for sustainable societal growth.

PEO2: Graduates of Computer Science and Engineering will demonstrate logical thinking and programming skills**.**

PEO3: Graduates in Computer Science and Engineering will demonstrate good communication skills, dynamic leadership qualities with concern for environmental protection.

PEO4: Computer Science and Engineering graduates will be capable of pursuing higher studies, take up research and development work blended with ethics and human values.

PEO5: Computer Science and Engineering graduates will have the ability to be come entrepreneurs there by switching over from responsive engineer to creative engineer.

PROGRAM OUTCOMES (POs):

Graduates of the Computer Science and Engineering Programme will be able to achieve the following POs:

PO1: Engineering Knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and **Computer Science and Engineering** principles to the solution of complex problems in **Computer Science and Engineering.**

PO2: Problem Analysis:

Identify, formulate, research literature, and analyze complex **Computer Science and Engineering** problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO3: Design/Development of Solutions:

Design solutions for complex **Computer Science and 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 related to **Computer Science and Engineering** problems.

PO5: Modern Tool Usage:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex **Computer Science and 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 **Computer Science and Engineering** practice.

PO7: Environment and Sustainability:

Understand the impact of the professional **Computer Science and 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 **Computer Science and 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 **Computer Science and 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 **Computer Science and Engineering** 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):

Program Specific Outcomes (PSOs) are what the graduates of a specific undergraduate engineering program should be able to do at the time of graduation.

PSO1: Professional Skills:

The ability to understand, analyze and develop computer programs in the areas related to system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2: Problem-Solving Skills:

The ability to apply standard practices and strategies in software project development using open - ended programming environments to deliver a quality product for business success.

PSO3: Foundation of mathematical concepts:

Ability to apply mathematical concepts to solve real world problems using appropriate data structure and suitable algorithms.

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Scheme of Teaching and Examinations 2022

Outcome Based Education(OBE)and Choice Based Credit System(CBCS)

(Effective from the academic year 2022-23)

V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				
				Theory Lecture	Tutorial	Practical/Drawing	Self-Study	Duration	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					

								nhours				
1	PCC 21CIT51	Advanced AI&ML Techniques	CSEB	3	0	0		03	50	50	100	3
2	IPCC 21CII52	Applications of Neural Network		3	0	2		03	50	50	100	4
3	PCC 21CIT53	Operating System & Virtualization		3	0	0		03	50	50	100	3
4	PCC 21CIT54	Database Management Systems		3	0	0		03	50	50	100	3
5	PCC 21CIL55	Database Management Systems Lab		0	0	2		03	50	50	100	1
6	RMI 21RMI56	Research Methodology & Intellectual Property Rights	Any Department	2	0	0		02	50	50	100	2
7	ENV 21ENV57	Environmental Studies	HSMC	1	0	0		01	50	50	100	1
8	AEC 21CIL58X	Ability Enhancement Course-V	CSEB	Theory				02	50	50	100	1
				1	0	0						
				Lab								
				0	0	2						
								Total	**400**	**400**	**800**	**18**

Ability Enhancement Course - V

21CIL581	Fuzzy Logic	21CIL583	Android Programing
21CIL582	Internet of Things	21CIL584	Neurocomputing and Applications

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				
				Theory Lecture	Tutorial	Practical /Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC 21CIT61	Information & Network Security	CSEB	3	0	0		03	50	50	100	3
2	IPCC 21CII62	Deep Learning (IC)		3	0	2		03	50	50	100	4
3	PCC 21CIT63	Advanced Statistics		3	0	0		03	50	50	100	3
4	PEC 21XX64x	Professional Elective Course-I		3	0	0		03	50	50	100	3
5	OEC 21XX65x	Open Elective Course-I		0	0	2		03	50	50	100	1
6	PCC 21CIL66	Data Mining Lab (Lab Course)		0	0	2		01	50	50	100	1
7	PROJECT 21CIP67	Mini Project on Deep learning	Two contact hours /week for interaction between the faculty and students.					--	100	--	100	2
8	INT 21INT68	Internship	Completed during the intervening period of IV and V semesters.					--	100	--	100	3
								Total	**500**	**300**	**800**	**22**

Professional Elective - I

21CIT641	Business Intelligence	21CIT643	Evolutionary Algorithms
21CIT642	Data science Using R	21CIT644	Cloud Computing

Open Electives – I offered by the Department to other Department students

21CIT651	Introduction to JAVA Programming	21CIT653	Artificial Intelligence & Machine Learning
21CIT652	Introduction to Cyber Security	21CIT654	Introduction to Database Management System

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC**: Integrated Professional Core Course, **PCC**: Professional Core Course, **PEC**: Professional Elective Courses, **OEC**–Open Elective Course, **MP** –Mini Project, INT –Internship.
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) 2021-22 may be referred.

Professional Elective Courses (PEC):
A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses 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 students' strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt 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,
(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course, under any category, is prescribed in the higher semesters of the program.
In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.
The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to theprogramme 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 multidisciplinary Mini- project 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 in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(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, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)]

Swapping Facility
Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.
Elucidation:
At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.
Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.
The mandatory Research internship /Industry internship is for 24 weeks. The 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 the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.
Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.
Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
The student can take up Interdisciplinary Research Internship or Industry Internship.
The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.
The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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VII SEMESTER

Sl No	Course and Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week								
				Theory Lecture			Self-Study					
				L		P	S					
1	PCC 21CIT71	Natural language Processing	Any CS Board Department	3		0		03	50			3
2	PCC 21CIT72	Reinforcement Learning		2		0		03	50			2
3	PEC 21XX73X	Professional Elective Course - II		3		0		03	50			3
4	PEC 21XX74X	Professional Elective Course - III		3		0		03	50			3
5	OEC 21XX75X	Open Elective Course-II	Concerned Department	3		0		03	50			3
6	Project 21CIP76	Project work		Two contact hours /week for interaction between the faculty and students				03	100	100	200	10
								Total	350		700	24

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VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination			
					Theory Lecture	Tutorial	Practical /Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
					L	T	P	S				
1	Seminar 21CI81		Technical Seminar	Any CS Board Department	One contact hour /week for interaction between the faculty and students.				--	100	--	100
2	INT 21INT82		Research Internship / Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Bath wise)	100	100	200
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100
		21PE83	Physical Education (PE) (Sports and Athletics)	PE								
		21YO83	Yoga	Yoga								
									Total	**250**	**150**	**400**

Professional Elective - II			
21CIT731	Chatbot	21CIT733	Big Data Analytics
21CIT732	Blockchain Technology	21CIT734	Full Stack Development
21CIT735	Cognitive System		
Professional Elective - III			
21CIT741	Quantum Computing	21CIT743	Social Media analytics
21CIT742	Precision Agriculture	21CIT744	Robotic Process Automation
21CIT745	Data visualization		
Open Electives - II offered by the Department to other Department students			
21CIT751	R Programming	21CIT753	Deep learning
21CIT752	Social Media Analytics	21CIT754	Data Science & Visualization

Note: **PCC**: Professional Core Course, **PEC**: Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: **VII and VIII semesters of IV year of the programme**
(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.
(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP76): The objective of the Project work is
(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To instil responsibilities to oneself and others.

(viii)To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii)Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic orally and/or through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(vi) Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ▌No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3)In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

V th Semester Syllabus

ADVANCED AI & ML TECHNIQUES			
Course Code	21CIT51	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40T	Total Marks	100
Credits	03	Exam Hours	03

Pre-Requisites:

1. Mathematics, Probability and statistics.
2. Fundamentals of AI algorithms

Course objectives:

The Student will:

1. Know the AI based problems.
2. Understand feature processing methods to improve the performance of algorithm.
3. Implement markov models to solve the problem.
4. Implement reinforcement learning models to solve the problems.
5. Understand the working of simple deep learning algorithms.

Syllabus

Module I

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes.

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks.

Module II

Feature Engineering:

Factor Analysis, Feature Encoding, Feature Scaling: Normalization and Standardization, Feature selection – Filter, wrapper and hybrid based models, Outlier Detection

Module III

Markov Concepts: Markov Models: Markov chains, Conditional independence, Stationary distributions, Hidden Markov models, particle filters, Robot localization with particle filters, Dynamic bayes nets

Module IV

Policy based Reinforcement Learning: Policy, The objective function, The policy Gradient, Monte carlo sampling, Reinforcement algorithm, Implementing Reinforce, Training a Reinforce agent, Experimental Results : The effect of discount factor and Baseline

Module V

Simple Deep Learning: Introduction to Deep Learning, Brief History of Deep Learning, Challenges motivating Deep Learning, Deep feed forward networks: Gradient based Learning, Hidden units, Architectural Design, Back Propagation and other differentiation algorithms

Text Books

1. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.
2. Alice Zheng and Amanda Casari, Feature Engineering for Machine Learning, O-Reilly Media Inc. 2018
3. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice-Hall, 2010
4. **Laura Graesser and Wah Loon Keng, Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Addison-Wesley Professional, 2019, ISBN: 9780135172490**

References Books:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition,2009.
2. Ian Goodfelllow, YoshuaBenjio and Aaron Courville, Deep Learning-, The MITPress

E - Resources:

1. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_pdf_version.htm
2. https://drive.google.com/file/d/1mPiI4jy6YkJRDiCT21xgzN0VDNkrW23X/view
3. https://towardsdatascience.com/outlier-detection-methods-in-machine-learning-1c8b7cca6cb8
4. http://robots.stanford.edu/papers/thrun.pf-in-robotics-uai02.pdf
5. https://nptel.ac.in/courses/ 106/105/106105077/

Course outcomes:

The Student will be able to:

1. Solve the uncertainty problems using Bayesian algorithm.
2. Optimize the solution by applying suitable feature selection methods.
3. Analyze and solve the problems using Markov models.
4. Design the reinforcement learning based algorithms to solve the problems.
5. Apply simple deep learning algorithms for various applications.

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												**PROGRAM SPECIFIC OUTCOMES (PSO'S)**		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3		3	3	3								3	3	3
CO2	3		3	3	3								3	3	3
CO3	3	2	3	2	3								3	3	3
CO4	3		3	3	3								3	3	3
CO5	3		3	3	3								3	3	3
Avg	3	2	3	3	3								3	3	3

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APPLICATIONS OF NEURAL NETWORK				
Course Code	21CII52		CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:2:0		SEE Marks	50
Total Hours of Pedagogy	40T+20 P		Total Marks	100
Credits	03		Exam Hours	03

Description of the course:

This subject provides students with a basic understanding of the fundamentals and applications of neural networks algorithms. It also introduces students to the state of the art in neural network algorithm and cover the principles involved.

Prerequisite:

Basic Probability concepts, Linear Algebra

Course Learning Objectives:

This course will enable students to:

- Explain the core concepts in the designing of Artificial neurons.
- Understand the difference between supervised and unsupervised algorithm and able to design for complex algorithms.
- Understand the working nature of Radial basis network.
- Understand and explain the restricted boltzmann algissues

Syllabus

Module– I

The Artificial Neuron: Paradigms, Calculate the net input signal, Activation functions, Artificial neuron geometry, Artificial neuron learning – augmented vectors, gradient descendent learning rule, widrow-hoff learning rule, generalized delta learning rule, error-correction learning rule.

08 hours

Teaching Learning Methodology: Chalk & Talk**,** Python IDE

Module–II

Supervised Learning Neural Networks: Neural network types – feed forward, functional link, product unit, simple recurrent neural network, time delay neural network, Supervised Learning rules – The learning problem, gradient descent optimization, scaled conjugate gradient, LeapFrog optimization, Particle swarm optimization, Functioning of Hidden Units, Ensemble neural networks, Performance issues

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– III

Unsupervised Learning Neural Networks: Background, Hebbian learning rule, Principal component learning rule, Learning vector quantizer-I, Self-organizing maps – stochastic training rule, batch map, growing SOM, improving convergence speed, clustering and visualization, using SOM

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– IV

Radial Basis Function network: Introduction, Training an RBF network – training the hidden layer, training the output layer, orthogonal least square algorithm, fully supervised learning, Variations of RBF networks – classification with perceptron criterion, classification with hinge loss, Relationship with kernel methods.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– V

Restricted Boltzmann Machines: Introduction, Hopfield networks, The Boltzmann machines, Restricted Boltzmann machines, Applications of restricted Boltzmann machines, Using RBM beyond binary datatypes, Stacking RBM.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Practical Component

1. Write a program to analyze the effects of weight & bias value in the output of neurons.
2. Implement the following activation functions in the ANN and its associated libraries and plot them.
   a) Linear b) ReLU c) Leaky ReLU d) Sigmoid (or) Logistic
3. Generate XOR function using McCulloch-Pitts neuron.
4. Write a program to create and manipulate the artificial neural network for Iris classification problem.
5. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
6. Write a program for the unsupervised neural network (Autoencoders) to identify the anomaly in the collected data.
7. Write a radial basis network based program to recognize the number images from MNIST dataset.
8. Design the automation program with RBM Model using PyTorch , then train and test the model for the drug class identification from the collected dataset. (https://www.kaggle.com/prathamtripathi/drug-classification).

Course Outcomes:

On completion of this course, the students will be able to:

- Design neural network using basic concepts for simple applications.

- Solve the problems using neural network in supervised and unsupervised fashion.
- Design radial basis network for providing solution to the problem.
- Solve the problem by constructing the restricted Boltzmann machine

Text Books:

1. Andries P Engelbrecht, "Computational Intelligence: An Introduction", Wiley Publications, 2002.
2. Charu C. Agarwal, "Neural Networks and Deep Learning", Springer, 2018.

Reference Books:

1. Tom M Mitchell, "Machine Learning", McGraw-Hill, 1997
2. Rudolph Russell, Machine Learning Step by step guide to implement machine learning algorithms with python
3. Aaron Courville, Ian Goodfellow, and Yoshua Bengio, Deep Learning, MIT Press,2015, ISBN:9780262035613
4. Ethem Alpaydın, Introduction to Machine Learning, MIT press 4th edition ISBN: 9780262043793.
5. C Agarwal, Machine Learning for Text, Pearson Education - 2006 (2 & 4). ISBN – 15:34519801.

E-RESOURCES:

- https://cs.stanford.edu/people/eroberts/courses/soco/projects/neural-networks/Sources/index.html
- https://onlinecourses.nptel.ac.in/noc19_ee53/preview
- https://onlinecourses.nptel.ac.in/noc22_ge04/preview
- http://www.digimat.in/nptel/courses/video/117105084/L35.

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												**PROGRAM SPECIFIC OUTCOMES (PSO'S)**		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1					3								3		3
CO2	3	2	3	3	3								3	3	3
CO3	2	2	3	3	3								3	3	3
CO4	2	2	3	3	3								3	3	3
Avg	2.3	2	3	3	3								3	3	3

OPERATING SYSTEMS AND VIRTUALISATION			
Course Code	**21CIT53**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisites: *Concurrency ,File Systems , I/O Systems , Networking , OS Structure , Scheduling , Security, Virtual Machines , Virtual Memory*

Course Objectives:

This course will enable students to,

1. To introduce Virtualization, operating systems fundamental concepts and its technologies.
2. To provides skills to write programs that interact with operating system components such as processes, thread, memory during concurrent execution.
3. To provide the skills and knowledge necessary to implement, provisioning and administer server and desktop virtualization.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

History of OS - Computer system architecture a layered view with interfaces, Glenford Myer, Monolithic Linux Hybrid Windows 10 kernels Layered architecture of operating system and core functionalists.

08 Hours

Module - II

Introduction, Process Operations, States, Context switching, Data Structures (Process Control Block (PCB), Process Scheduling: Multi-Level Feedback Queue, Multi-processor Scheduling, Deadlocks and its detection.

08 Hours

Module - III

Introduction, Address Spaces, Memory API, Address Translation, Paging - Faster Translations (TLB), Smaller Tables. Virtual Memory System in x86. 08 Hours

Module - IV

Introduction, Thread Models, Thread API, Building Evaluating a Lock, Test And Set, Classical problems handling using semaphore, Monitors, Persistence - File Organization: The i-node, Crash Consistency file security

08 Hours

Module - V

Process and System VMs Taxonomy of VMs , Hardware Emulation, Full Virtualization with binary translation, Hardware assisted, Operating System Virtualization, OS assisted /Para virtualization

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

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

CO1: Study operating system layers and kernel architectures and Design various techniques for process management
CO2: Construct various address translation mechanism
CO3: Perform process threading and synchronization.
CO4: Study various methods of virtualization and perform desktop and server virtualization.
C05: Classify the light-weight virtual machines with dockers and containers

Assessment Details (both CIE and SEE)

Text Books:

1. Silberschatz, Abraham, Greg Gagne, and Peter B. Galvin, "*Operating system concepts"*, 10th Edition, Wiley Publishers, 2018.
2. Matthew Portnoy, "*Virtualization Essentials*", John Wiley Sons Inc; 2nd Edition Edition, 2016.

References :

Thomas Anderson, Michael Dahlin, "*Operating Systems: Principles and Practice*", 2nd Edition, Recursive Books, 2014.

William Stallings, *"Operating Systems: Internals and Design Principles",* 8th Edition, 2014.

Smith, Nair,*"Virtual Machines: Versatile Platforms for Systems and Processes"*, 1st Edition, Morgan Kaufmann Publishers, 2005.

E-Resources:

1. https://www.tutorialspoint.com/operating_system/index.htm.
2. https://www.studytonight.com/operating-system/.

DATABASE MANAGEMENT SYSTEMS			
Course Code	21CIT54	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Provide a strong foundation in database concepts, technology, and practice. CLO 2. Practice SQL programming through a variety of database problems.
CLO 3. Demonstrate the use of concurrency and transactions in database
CLO 4. Design and build database applications for real world problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1:, Ch 5.1 to 5.3, 8.1 to 8.5, 9.1;

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.
Database

Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop.

Textbook 1: Ch 6.1 to 6.5, 7.1 to 7.4; Textbook 2: 6.1 to 6.6;

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

Textbook 1: Ch 14.1 to -14.7, 15.1 to 15.6

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

Textbook 1: Ch 20.1 to 20.6, 21.1 to 21.7;

Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

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

CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
CO 2. Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation.
CO 3. Design and build simple database systems and *relate* the concept of transaction, concurrency control and recovery in database
CO 4. Develop application to interact with databases, relational algebra expression.
CO 5. Develop applications using tuple and domain relation expression from queries.

Assessment Details (both CIE and SEE)

ponent	**Weightage(%)**		
CIE15thweek	20	60	Averageof3tes
CIE210thweek	20		
CIE315thweek	20		
AAT-110th week			1
LabTest	30		Reduc
LabRecord	20		1

InternalEvaluationTotalMarks:100.Reducedto50Marks

Examination(SEE)TotalMarks:100.Reducedto50Marks

Suggested Learning Resources:

Textbooks

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6th EditionTata Mcgraw Hill Education Private Limited

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=3EJlovevfcA
2. https://www.youtube.com/watch?v=9TwMRs3qTcU
3. https://www.youtube.com/watch?v=ZWl0Xow304I
4. https://www.youtube.com/watch?v=4YilEjkNPrQ
5. https://www.youtube.com/watch?v=CZTkgMoqVss
6. https://www.youtube.com/watch?v=Hl4NZB1XR9c
7. https://www.youtube.com/watch?v=EGEwkad_llA
8. https://www.youtube.com/watch?v=t5hsV9lC1rU

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning Demonstration of real time Database projects - E-commerce Platform, Inventory Management, Railway System, College Data Management, Library Data Management, Solution for Saving Student Records, Hospital Data Management, Blood Donation Management.

CO-PO Mapping

CO Identification No.	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3										1	3		
CO 2	2	2	3	1	2							1	3		2
CO 3	2	2	3	2	1							1	2		2
CO4	2	2	3	2	1							1	2		2
CO5	2	2	3	1	2							1	3		2
Average	2.2	2.2	3	1.5	1.5							1	2.6		2

DATABASE MANAGEMENT SYSTEMS LAB			
Course Code	21CIL55	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Provide a strong foundation in database concepts, technology, and practice. CLO 2. Practice SQL programming through a variety of database problems.
CLO 3. Demonstrate the use of concurrency and transactions in database
CLO 4. Design and build database applications for real world problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

PRACTICALCOMPONENTS

Sl NO.	Experiments
1.	Design, develop, and implement the specified queries for the following problems usingOracle,MySQL,MSSQLServer,oranyotherDBMSunderLINUX/Windowsenvironment. Create Schema and insert at least 5 records for each table. Add appropriatedatabase constraints.Demonstrating creation of tables, applying the view concepts on thetables. Program:ConsiderthefollowingschemaforaLibraryDatabase: **BOOK (Book_id, Title, Publisher_Name, Pub_Year)BOOK_AUTHORS(Book_id, Author_Name)PUBLISHER(Name,Address,Phone)BOOK_COPIES(Book_id,Programme_id,No-of_Copies) BOOK_LENDING(Book_id,Programme_id,Card_No,Date_Out,Due_Date)LIBRARY_PROGRAMME(Programme_id,Programme_Name,Address)** 1. WriteERDiagramforfollowingtables. 2. WriteSQLqueriestoRetrievedetailsofallbooksinthelibrary–id,title,nameofpublisher,authors,numberofcopiesineachProgramme,etc. 3. WriteSQLqueriestoGettheparticularsofborrowerswhohaveborrowedmorethan3books,butfromJan2017toJun2017. 4. WriteSQLqueriestoDeleteabookinBOOKtable.Updatethecontentsofothertablestoreflectthisdatamanipulationoperation. 5. WriteSQLqueriestoPartitiontheBOOKtablebasedonyearofpublication.Demonstrateitsworkingwithasimplequery. 6. WriteSQLqueriestoCreateaviewofallbooksanditsnumberofcopiesthatarecurrentlyavailableintheLibrary. Reference:https://www.youtube.com/watch?v=AaSU-AOgulshttps://www.youtube.com/watch?v=-EwEvJxS-Fw
2.	Design, develop, and implement the specified queries for the following problems usingOracle,MySQL,MSSQLServer,oranyotherDBMSunderLINUX/Windowsenvironment. Create Schema and insert at least 5 records for each table. Add appropriatedatabaseconstraints.Discussthevarious conceptson constraints andupdateoperations. Program: Consider the following schema for Order Database:**SALESMAN(Salesman_id, Name, City, Commission)CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)ORDERS(Ord_No,Purchase_Amt,Ord_Date,Customer_id,Salesman_id)**

WriteSQLqueriesto
Countthecustomerswithgradesabove Bangalore'saverage.

1. Findthenameandnumbersofallsalesanwhohadmorethanonecustomer.
2. Listallthesalesmanandindicatethosewhohaveanddon'thavecustomersintheircities(UseUNIONoperation.)
3. Createaviewthatfindsthesalesmanwhohasthecustomerwiththehighestorderofaday.
4. DemonstratetheDELETEoperationbyremovingsalesmanwithid1000.Allhisordersmustalsobedeleted.

Reference:
https://www.youtube.com/watch?v=AA-KL1jbMeY
https://www.youtube.com/watch?v=7S_tz1z_5bA

Design, develop, and implement the specified queries for the following problems usingOracle,MySQL,MSSQLServer,oranyotherDBMSunderLINUX/Windowsenvironment. Create Schema and insert at least 5 records for each table. Add appropriatedatabaseconstraints.DemonstratetheconceptsofJOINoperations.

Program:ConsidertheschemaforMovieDatabase:
ACTOR(Act_id, Act_Name, Act_Gender)DIRECTOR(Dir_id,
Dir_Name,
Dir_Phone)MOVIES(Mov_id,Mov_Title,Mov_Year,Mov_Lang,Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)RATING(Mov_id,Rev_Stars)

WriteSQLqueriesto

1. Listthetitlesofallmoviesdirectedby'Hitchcock'.
2. Findthemovienameswhereoneormoreactors actedintwoormoremovies.
3. Listallactorswhoactedinamoviebefore2000andalsoinamovieafter2015(useJOINoperation).
4. Findthetitleofmoviesandnumberofstarsforeachmoviethathasatleastoneratingand find the highest number of stars that movie received. Sort the result by movietitle.
5. Updateratingofallmoviesdirectedby'StevenSpielberg'to5.

Reference:https://www.youtube.com/watch?v=hSiCUNVKJAohttps://www.youtube.com/watch?v=Eod3aQkFz84

Design, develop, and implement the specified queries for the following problems usingOracle,MySQL,MSSQLServer,oranyotherDBMSunderLINUX/Windowsenvironment. Create Schema and insert at least 5 records for each table. Add appropriatedatabaseconstraints. Demonstrate the core concepts on table like nested and correlatednestingqueriesandalsoEXISTSandNOTEXISTSkeywords.

Program:ConsidertheschemaforCompanyDatabase:
EMPLOYEE(SSN,Name,Address,Sex,Salary,SuperSSN,DNo)DEPARTMENT(DNo,DName,MgrSSN,MgrStartDate)DLOCATION(DNo,DLoc)
PROJECT(PNo,PName,PLocation,DNo)WORKS_ON(SSN,PNo,Hours)

WriteSQLqueriesto

1. Makealistofallprojectnumbersforprojectsthatinvolveanemployeewhoselastnameis'Scott',eitherasaworkeror asamanagerofthedepartmentthatcontrolstheproject.
2. Showtheresultingsalariesifeveryemployeeworkingonthe'IoT'projectisgivena10percentraise.
3. Findthesumofthesalariesofallemployeesofthe'Accounts'department,aswellasthemaximumsalary,theminimumsalary,andtheaverage salaryinthisdepartment
4. Retrievethenameofeachemployeewhoworksonalltheprojectscontrolledbydepartmentnumber5(useNOTEXISTSoperator).
5. For eachdepartmentthat has more thanfive employees,retrieve the department numberandthenumberofitsemployeeswhoaremakingmorethanRs.6,00,000.

Reference:
https://www.youtube.com/watch?v=Dk8f3ejqKts

Miniproject: For any problem selected, make sure that the application should have five or more tables.Indicativeareasinclude:Organization,healthcare,Ecommerceetc.

Course Outcomes

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

CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
CO 2. Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation.
CO 3. Design and build simple database systems and *relate* the concept of transaction, concurrency control and recovery in

database

CO 4. Develop application to interact with databases, relational algebra expression.

CO 5. Develop applications using tuple and domain relation expression from queries.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks:100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks:100. Reduced to 50 Marks			

Suggested Learning Process

Textbooks

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6th EditionTata Mcgraw Hill Education Private Limited.

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=3EJlovevfcA
2. https://www.youtube.com/watch?v=9TwMRs3qTcU
3. https://www.youtube.com/watch?v=ZWl0Xow304I
4. https://www.youtube.com/watch?v=4YilEjkNPrQ
5. https://www.youtube.com/watch?v=CZTkgMoqVss
6. https://www.youtube.com/watch?v=Hl4NZB1XR9c
7. https://www.youtube.com/watch?v=EGEwkad_llA
8. https://www.youtube.com/watch?v=t5hsV9lC1rU

RESEARCHME

		THODOLOGY&INTELLECTUALPROPERTYRIGHTS		
Course Code	**Credits**		**Exam Duration**	**Course Type**
21CIP68	2		3Hours	PCC

Course objectives:

1. To give an overview of the research methodology and explain the technique of defining a research problem
2. To explain the functions of the literature review in research.
3. To explain carrying out a literature search, its review,developing theoretical and conceptual frame works and writing a review and research reports.
4. To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment.
5. To discuss leading International Instruments concerning Intellectual Property Rights.

Syllabus

Module-I

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Module-II

Reviewing the literature: Place of the literature review in research, bringing clarity and focus toresearch problem, improving research methodology, broadening knowledge base in research area,enabling contextual findings, Review of the literature, searching the existing literature, reviewing theselected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research

Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.
Module-III
Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **Measurement and Scaling:** Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Sca ling Technics, Multidimensional Scaling, Deciding the Scale. **Data Collection**: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.
Module-IV
Building Intellectual Property Rights, Law of Patents, **Fundamentals of Patent Law** - Evolution of the patent system, Patentability Requirements; Patentable Subject Matter; Industrial Applicability/Utility; Novelty; Anticipation by publication; Anticipation by public knowledge and public use; Anticipation by public display; Anticipation by sale; Inventive Step/Non-Obviousness; Novelty Assessment; Inventive Step Assessment; Specification, **Drafting of A Patent Specification** - Introduction Patent Specification; Provisional Specification Complete Specification, Parts of the complete specification; **Patent Procedure in India** - PATENT PROCEDURE; Registration and Renewal fee payment; **Patent Infringement** - Infringement of a patent; Literal Infringement; Equivalence Infringement; Indirect Infringement; Defenses - Experiment - Research or Education - Bolar Exemption- Government use- Patent Exhaustion Patent

Misuse- Inequitable Conduct - Remedies- Injunction- Account of profits- Costs; **International Patent Regimes** - International Instruments; Paris Convention; TRIPS AGREEMENT; PCT; BUDAPEST TREATY, **Patenting Biotechnology Inventions** - Unique nature of Biotechnology; Patentability Requirements and Biotechnology Inventions; Patentable Subject Matter- USA- Europe- India; **Patentability of Software Inventions** - Patentability of Software Inventions in USA; Patentability of software inventions in Europe; Patentability of Software Inventions in India.

Module-V

Law of Copyright and Designs, Understanding Copyright Law - Historical Overview - Justification For Copyright Law - The Natural Law Justification - The Economic Rationale of Copyright Clause, Basic Concepts Underlying copyright of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. **Term of Protection, Subject - Matter of Copyright** - Literary Works - Dramatic Works - Musical Work - Artistic Works - Cinematograph Films and Sound recordings, **Acquisition of Copyright in India,** Rights of the Copyright Owner - Economic Rights - Moral Right or Droid Moral Right of Authorship or Paternity Rights - Rights against Distortion or Mutilation of the Original Works or Integrity Rights - Limitations - Limitations set under International Regime - Berne Convention - Rome Convention - Trips Agreement - Three Step Test, Infringement of Copyright -Transfer of copyright - License and Assignment - License and consent -Duration of a License Form and Content - Disputes in Respect of Licence -Types of Licenses - Exclusive and Non-Exclusive Licenses.

Course Outcomes (Course Skill Set)

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

CO1. Explain the meaning of engineering research.

CO2. Explore the procedure of Literature Review and Technical Reading.

C03. Explain the fundamentals of patent laws and drafting procedure.

CO4. Explore the copyright laws and subject matters of copyrights and designs

CO5. Comprehend the basic principles of design rights.

Textbooks

1	Research Methodology: Methods and Techniques	C. R. Kothari, G aurav Garg	New Age Internat ional	4th Edition, 2019

2	Engineering Research Methodology: A Practical Insight for Researchers	Dipankar Deb, Rajeeb Dey, Valentina E. Balas	Intelligent Systems Reference Library	1st Edition, 2019
ReferenceBooks				
1	"Research Methods for Engineers"	David V. Thiel	Cambridge University Press	2020

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
2. https://archive.nptel.ac.in/courses/127/106/127106227/
3. https://onlinecourses.swayam2.ac.in/cec20_hs17/preview
4. https://archive.nptel.ac.in/courses/110/105/110105139/

Ability Enhancement Course – Fuzzy Logic Lab			
Course Code	21CIL581	CIEMarks	50
Teaching Hours /Week(L:T:P)	(0:0:2:0)	SEEMarks	50
Credits	01	Exam Hours	01

Course objectives:

- Understand the basic concepts of Fuzzy Logic.
- Gain the knowledge of Fuzzy matching operation.
- Understand the working of Mamdani and Takagi-sugeno fuzzy inference system
- Understand the working of fuzzy controller concept in various applications.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method(L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at-least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world and when that's possible, it helps Improve the students' understanding.

Fuzzy Logic Laboratory

1) Use python language to write programs for various membership functions.

2) Write a program to Implement the Fuzzy relation operations
   a) Union
   b) Intersection
   c) Complement
   d) Difference

3) Write a program to implement the Min – Max Composition of Fuzzy Relations

4) Write a program for fuzzy string matching operation. Design the search engine with the help of Fuzzy matching operations using Levenshtein Distance method.

5) Write a program to implement the Mamdani Fuzzy inference system for an application.

6) Write a program to implement the Takagi-Sugeno fuzzy model for a classification application.

7) Implement the concept of Fuzzy C – means Clustering for an application.

8) Design the automation program for the washing machine using Fuzzy controller.
9) Design the automation program for the traffic light management system using Fuzzy controller.
10) Assume the room contains two sensors to read temparatures at various locations. Write a program for automatic room temperature control using fuzzy logic for the air conditioner.

Course outcomes:
At the end of the course, the student will be able to:
CO1: Solve simple problems using fuzzy set and relational operations.
CO2: Simulate the basic search engine model with fuzzy string matching operations.
CO3: Create the program for solving complex problems using fuzzy inference system.
CO4: Implement the automation concept in various applications using fuzzy controllers.

SINo	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text book				
1	George J. Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic-Theory and Applications	Prentice Hall.	1996
2	Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications	S.Rajasekaran, G.A.Vijayalakshmi Pai,	PHI Learning Pvt.Ltd.	2017
3	First course on Fuzzy Theory and Applications	S.N.Sivanandam , S.N.Deepa	Wiley India Pvt.Ltd	2ndEdition,2011
Reference Books				
1	First course on Fuzzy Theory and Applications	Kwang H.Lee	Springer	2005
2	Neuro-Fuzzy and Soft Computing	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani	Prentice-Hall of India	2002
3	Fuzzy Logic for Beginners	Masao Mukaidono	World Scientific	2001

Web links and Video Lectures:
1. https://nptel.ac.in/courses/108104157
2. https://www.digimat.in/nptel/courses/video/127105006/L01.html
3. https://www.studocu.com/my/document/kolej-universiti-poly-tech-mara-kuala-lumpur/corporate-governance-and-business-ethics/lab-manual-ann-19cs3026-regular/31502586

CO- PO Mapping :

POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1					3										
CO2	2	2	2		3										
CO3	3	3	3		3										
CO4	3	3	3		3										

INTERNET OF THINGS LAB			
Course Code	21CIL582	CIE Marks	50

Teaching Hours /Week(L:T:P)	(0:0:2:0)	SEE Marks	50
Credits	01	Exam Hours	01

Courseobjectives:

- Knowledge of various IOT models in problem-solving.
- It provides an overview of the IoT systems' aspects including embedded intelligence, connectivity, interaction with the physical world, etc.
- It covers the main design and implementation issues for IoT devices and their applications. These issues challenge the students to tailor smart techniques to optimize the embedded software on IoT devices to meet the constrained resources.
- The students gain in-depth practical experiences in embedded system design with a focus on IoT applications as well as communication in connected devices.

Teaching-Learning Process (General Instructions)

- Lecturer method(L) need not be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain the functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at-least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
- Introduce Topics in manifold representations.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps
- Improve the understanding**.**

Neurocomputing and Applications Laboratory

- Sense the Available Networks Using Arduino
- Measure the Distance Using an Ultrasonic Sensor and Make Led Blink Using Arduino
- Detect the Vibration of an Object Using Arduino.
- Connect with the Available Wi-FiUsing Arduino
- 5. Sense a Finger When It is Placed on Board Using
- Arduino
- 6. Temperature Notification Using Arduino
- 7, LDR to Vary the Light Intensity of LEDU sing Arduino
- 8. My SQL Database Installation in Raspberry Pi
- 9. SQL Queries by Fetching Datafrom Databasein Raspberry Pi
- Switch Light On and Off Based on the Input of
- User Using Raspberry Pi

Course Outcomes

- Solving the problems using various IOT models.
- overview of the IoT systems' aspects including embedded intelligence, connectivity, and interaction with the physical world.
- The smart techniques to optimise and analyse the embedded software on IoT devices to meet the constrained resources.
- The students apply practical experiences in embedded system design with a focus on IoT applications as well as communication in connected devices.

Text Book:

1. Adrian McEwen, Hakim Cassimally- Designing the Internet of Things, Wiley publications,2012

Reference Books:

1. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, UniversitiesPress,2014.
2. The Internet of Things, Enabling technologies and use cases – PethuruRaj, Anupama C. Raman,CRCPress.

Reference sites:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/

CO- PO Mapping :

POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2		3										
CO2	3	2	3		2										
CO3	3	3	2		3										
CO4	3	3	3		2										

ANDROID PROGRAMMING LAB			
Course Code	21CIL583	CIEMarks	50
Teaching Hours /Week(L:T:P)	(0:0:2:0)	SEEMarks	50
Credits	01	Exam Hours	01

Course objectives:

- Outline the Android SDK features and the Development Framework and understanding Activities.
- Learn adaptive, responsive user interfaces that work across a wide range of devices.
- Identify background work and long-running tasks in Android applications
- Describe the concepts of Storing, sharing and retrieving data in Android applications
- Learn permissions, security and performance affect applications.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method(L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at-least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world and when that's possible, it helps Improve the students' understanding.

Data Mining Laboratory
11) Installation of Android studio.
12) Development Of Hello World Application
13) Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button
14) Create a screen that has input boxes for User Name, Password, Address, Gender(radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button (use any layout)
15) Design an android application to create page using Intent and one Button and pass the Values from one Activity to second Activity
16) Design an android application Send SMS using Internet
17) Create an android application using Fragments
18) Design an android application Using Radio buttons
19) Design an android application for menu
20) Create a user registration application that stores the user details in a database table.

Course outcomes:

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

- **Comprehend the basic features of Android Platform and Create Activities in Android.**
- **Demonstrate the design concepts of user interface using components and views in Android.**
- **Create and use databases for Android Application.**
- **Implement messaging services in Android.**
- **Deploy mobile applications in various market place for distribution**

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text book				
1	Beginning Android Application Development	Wei – Meng Lee	Wiley publications	2007
2	Professional Android 4 Application Development	Alex Berson and Stephen J. Smith	**Wiley publications**	2012
Reference Books				
1	Beginning Android 3	Mark Murphy	Apress Springer India Pvt. Ltd	1st Edition, 2011
2	Pro Android 4	Sayed Hashimi, Satya Komatineni, Dave MacLean	Apress Springer India Pvt Ltd	1st Edition, 2012
3	Professional Android 2 Application Development	Reto Meier	Wiley India Pvt. Ltd	1st Edition,2012

Web links and Video Lectures:

1) https://developers.google.com/training/adf
2) https://goo.gl/ADKvq8
3) https://innovator.samsungmobile.com

CO- PO Mapping :

POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1					3										
CO2	2	2	2		3										
CO3	3	3	3		3										
CO4	3	3	3		3										

Ability Enhancement Course – Neurocomputing and Applications Lab			
Course Code	21CIL584	CIEMarks	50
TeachingHours /Week(L:T:P)	(0:0:2:0)	SEEMarks	50
Credits	01	Exam Hours	01

Course objectives:

- Knowledge of various artificial neural network models in problem solving.
- Knowledge of gradient descent algorithms to improve the accuracy of neural network for an application.
- Understand the working of self organizing map, simulated annealing and RBM model.
- Understand the working of convolutional neural network for image processing application.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

9. Lecturer method(L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
10. Use of Video/Animation to explain functioning of various concepts.
11. Encourage collaborative (Group Learning) Learning in the class.
12. Ask at-least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
13. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
14. Introduce Topics in manifold representations.
15. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
16. Discuss how every concept can be applied to the real world and when that's possible, it helps Improve the students' understanding.

Neurocomputing and applications Laboratory

1. Write a program to create and manipulate the artificial neural network for Iris classification problem.
2. Implement the multi-layer perceptron for the application of minimum 5 class problem.
3. Build an multilayer perceptron by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Develop and implement the batch gradient descent algorithm for the drug dataset classification problem. https://www.kaggle.com/prathamtripathi/drug-classification
5. Develop and implement the stochastic gradient descent algorithm using the following dataset for carrying out drug-type classification. https://www.kaggle.com/prathamtripathi/drug-classification
6. Apply the simulated Annealing optimization algorithm to an objective / loss function such as a simple one-dimensional X^3 having bounds [-4, 4]. Create the line plot of the response surface of the function for a grid of input values and mark the optima at f(0,0)=0.0 with a blue line. Show the convergence of the algorithm.
7. Generate a self-organizing map of the size (20x20) neurons arranged in a two-dimensional lattice structure based on the input IRIS dataset. Apply normalization to the input data and train the SOM initially with 100 iterations. Plot in various colours and overlay the plot of the weights of the winner neurons. Retrain the SOM using 50000 iterations and observe the difference in the resulting plots.
8. Design the RBM Model automation program with using PyTorch , then train and test the model with the movies dataset from Kaggle. (Https:www.kaggle.com/rounakbanik/the-movies-dataset)
9. Implement a Convolutional neural network model to efficiently recognize and classify handwritten digits using the MNIST dataset.

Course Outcomes

1. Solve the problems using various artificial neural network models.
2. Apply the gradient descent models to improve the performance of neural network algorithms in drug type classification problem.
3. Design the automation program using simulated annealing, self organizing map and RBM model for applications.

4. Apply convolutional neural network model for image processing applications.

Text book

Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Fundamentals of Neural Networks: Architectures, Algorithms and Applications	Laurene Fausett	Pearson	2004
Neural Networks for Pattern Recognition	Bishop, C. M.	Oxford University Press	1995
FUNDAMENTALS OF DEEP LEARNING: Designing Next-Generation Machine Intelligence Algorithms	Nikhil Buduma and Nicholas Locascio	O'Reilly	2017

Reference Books

Neural Networks: A Comprehensive Foundation	Simon Haykin	Low Price Edition	Second Edition, 1997
Soft Computing	D.K Prathikar	Narosa Publishing House	2008
Neural Networks,Fuzzy Logic and Genetic Algorithms : Synthesis and Applications	S.Rajasekaran and G.A. Vijayalakshmi Pai	PHI Publisher	2013

Web links and Video Lectures:

4. Introduction to Artificial Neural Network: https://nptel.ac.in/courses/117105084
5. Artificial Neural Network: https://www.academia.edu/703095/Artificial_Neural_Networks_Web_course
6. Deep Learning: http://www.cse.iitm.ac.in/~miteshk/CS7015_2018.html
7. Fuzzy Logic and Neural Network: http://www.nitttrc.edu.in/nptel/courses/video/127105006/L12.html
8. Neural Network: https://intellipaat.com/blog/tutorial/machine-learning-tutorial/introduction-deep-learning/

CO- PO Mapping :

POS / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	2		3										
CO2	3	3	3		3										
CO3	3	3	3		3										
CO4	3	3	3		3										

VI th Semester Syllabus

INFORMATION & NETWORK SECURITY			
Course Code	21CIT61	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Prerequisites : Computer Networks

Course objectives :

The Student will:

1. Define about security goals, security attacks, security services and security mechanism.
2. Describe conventional encryption algorithms& public-key encryption algorithms, digital Signature and issues of key Management
3. Explain authentication application & discuss how PGP and S/MIME can provide security services fore-mail.
4. Discuss IP security, Web Security.
5. Discuss system level security issues include threats, Intruders, Intrusion detection system and firewalls.

Module 1:

Introduction: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non- repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs**.**

Understanding Attacks: Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks**.**

Module 2:

Symmetric Encryption and Message Authentication: Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution.

Public-Key Cryptography and Message Authentication: Approaches of Message Authentication, Secure Hash Functions and HMAC Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates, Certificate Authority and key management.

Module 3:

Authentication Applications: Kerberos, X.509 Directory Authentication Service.
Electronic Mail Security: Pretty Good Privacy (PGP) and Secure /Multipurpose Internet Mail Extension (S/MIME)

Module 4:

IP Security: IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and KeyManagement. Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction(SET).

Module 5:

Network Management Security: Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3. System Security: Intruders, Viruses and related threats. Firewall Design principles, Trusted Systems. Intrusion Detection Systems.

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course outcomes:

The Student will be able to:

1. Analyze the security goals, security attacks, security services and security mechanism, cryptography.
2. Compare how conventional encryption algorithms &public key cryptography can be used to ensure the Identity

of the sender of an encrypted message.

3. Identify authentication application & discuss how PGP and S/MIME can provide security services fore- mail.
4. Identify IP security, Web security using Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction(SET).

Apply system level security includes threats, Intruders, Intrusion detection System and Firewalls.

Text Books:

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech

Reference Books:

1. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning.
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Cryptography and network Security, Third edition, Stallings,PHI/Pearson.

E - Resources:

1. WilliamStallings.com/Crypto3e.html
2. WilliamStallings.com/StudentSupport.html

Deep Learning

Course Code:	21CII62	CIEMarks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50
Total Hours of Pedagogy	40T+20 P	TotalMarks	100
Credits	04	ExamHours	03

Description of the course:

In this course students are introduced to the architecture of deep neural networks, algorithms that are developed to extract high-level feature representations of data. In addition to theoretical foundations of neural networks, including backpropagation and stochastic gradient descent, students get hands-on experience building deep neural network models with Python

Prerequisite:

Goodprogrammingskillsanddebuggingskills.

Knowledgeon neural networks.

CourseLearningObjectives:

This course will enable students to:

The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets. They will also uncover various deep learning methods in NLP, Neural Networks etc. Several libraries and datasets publicly available will be used to illustrate the application of these algorithms. This will help students in developing skills required to gain experience of doing independent research and study.

Syllabus

Module– I

Introduction to Deep Learning: Introduction to Deep Learning, Brief History of Deep Learning, AI, Machine Learning and Deep Learning, Statistical Learning, Bayesian Learning, Decision Surfaces, Success stories of Deep Learning.

08hours

Teaching Learning Methodology: Chalk & Talk

Module–II

Linear Classifiers: Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization, Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

08hours

Teaching Learning Methodology: Chalk & Talk

Module– III

Neural Network: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, LSTM Networks, NN in python.

08hours

Teaching Learning Methodology: Chalk & Talk

Module– IV

Deep Neural Net: Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization,Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN, CNN in Python
08hours

Teaching Learning Methodology: Chalk & Talk

Module– V

Practical areas of Deep Learning: Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection, Generative Modeling with DeepLearning,VariationalAutoencoder, Generative Adversarial Network, Object recognition with Python.

08 hours

Teaching Learning Methodology: Chalk & Talk

CourseOutcomes:

On completion of this course, the students will be able to:

Expert knowledge in solving real world problems using state-of-art deep learning techniques

SlNo	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text book				
1	Deep Learning	Ian Goodfelllow, YoshuaBenjio, Aaron Courville	MITPress	2016
2	Pattern Classification	Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley &SonsInc.	‘A wiley-Interscie nce Publication	2nd Edi tion
Reference Books				
1	Deep Learning: A Practitioner's Approach	Josh Patterson & Adam Gibson	OReilly Press	2017
2	Python Deep Learning: Exploring deep learning techniques and neural network architectures with PyTorch, Keras, and TensorFlow	Ivan Vasilev	Pakt Publication	2nd Edition
3	Deep learning with Python	Francois Chollet	Manning Publications.	2017

E-RESOURCES:

- https://nptel.ac.in/courses/106/105/106105215/
- https://www.slideshare.net/LuMa921/deep-learning-a-visual-introduction
- https://yiqiaoyin.files.wordpress.com/2018/02/deep-learning-notes.pdf

CO-PO Mapping:

	PROGRAM OUTCOMES (PO’s)												**PROGRAM SPECIFIC OUTCOMES (PSO’S)**		
COURSE OUTCOMES (CO’s)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	3							2	3	2	3
CO2	3	3	2	2	3							1	3	2	3

CO3	3	3	2	2	3							2	3	2	2
CO4	3	3	3	3	3							2	3	2	3
CO5	3	2	2	2	3							1	3	2	2
Avg	3	2.8	2.2	2.2	3							1.6	3	2	2.6

ADVANCED STATISTICS

Course Code	21CIT63	**CIE Marks**	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40T	**Total Marks**	100
Credits	03	**Exam Hours**	03

Pre-Requisites:
1.Basic concepts of algebra and its applications
2.Basic concepts of probability and set theory.

Course objectives:
The Student will:
1. To expose students to concepts of Statistics and Operations Research.
2. To inculcate an analytical approach to the subject matter.
3. To stimulate the students interest by showing the relevance and use of Statistical knowledge.
4. To study and critically analyze statistical reasoning to problems of business.
5. To boost quantitative thinking and develop numerical abilities.
6. To enlighten the student abilities to apply concepts of Statistics and Operations Research to real life problems

Syllabus

Module I

Statistical Hypothesis:

Large sample tests: Test statistic in case of testing for population mean and equality of means of two populations, population proportion and equality of proportions of two populations. Applications, one tailed and two tailed tests. c) Small sample tests: i) t- test: test procedure along with test statistic (one tailed and two tailed). for testing of population mean, equality of means and paired t – test and its applications. ii) Chi square test for testing of population variance, goodness of fit and independence of attributes in a 2x2 contingency table and its applications

Module II

THEORETICAL DISTRIBUTIONS : Bernoulli distribution - definition through p.m.f., examples of occurrence of Bernoulli distribution, expressions for mean and variance, features, applications. Bernoulli trials. Binomial Distribution- Definition throug p.m.f., examples of occurrence of Binomial distribution, expression for mean and variance, features. Given mean and variance, finding the parameters. Computing probabilities. Recurrence relation between successive probabilities and frequencies. Fitting a Binomial distribution (The case of given p and estimated p), obtaining expected frequencies. Poisson distribution - definition through p.m.f., examples of occurrence of Poisson distribution, Expressions for mean and variance, features. Computing probabilities for large n and small p, for the given . Recurrence relation between successive probabilities and frequencies. Finding for given two successive probabilities or frequencies. Fitting a Poisson distribution to the given frequency distribution and finding expected

frequencies. Normal distribution - definition through p.d.f., examples of occurrence of Normal distribution, properties, problems on p.d.f and properities. Definition of SNV, standard normal distribution through p.d.f. Finding probabilities and expected numbers when mean and variance are given. Finding the probabilities within one, two and three ? (sigma) limits.

Module III

Introduction to Operations Research (O.R.)

a) Meaning of O.R., its definition and scope. b) Definition of an LPP – examples, statement of the general linear programming problem. Definition or explanation(as the case may be) of the terms: Objective function, decision variable, non negativity restrictions, solution to an LPP, feasible solution, optimal solution, unique optimal solution, multiple solution, unbounded solution and no solution. Formulation of LPP in case of 2 variables and graphical solutions to the problems . Examples of the cases of unique, multiple, unbounded (max./min.) and no solutions. c) Transportation Problem- Statement of T. P., Feasible, basic feasible solution, degenerate solution, non degenerate solution and optimal solution of T. P. Balanced and unbalanced T.P. Finding initial basic feasible solution by North-West Corner Rule and Method of matrix minima (lowest cost entry method). Determine the initial total transportation cost. d) Game Theory: Meaning of a competitive game, examples and statement of the characteristics of a competitive game. Explanation of a n-person game, a two – person game, a two – person zero – sum game (a rectangular game), strategy, pure and mixed strategies. Pay off matrix, meaning of maximin and minimax, saddle point; solving a rectangular game with maxmin - minimax principle and dominance principle.

Module IV

Network Analysis by CPM/PERT:

Concept CPM and PERT. Differentiation between CPM and PERT. CPM: Definitions of Project, Activity, Event, Completion time of activity, Project completion time, Slack time, Critical Activity, Critical Path, Earliest Start (ES) time, Earliest Finish (EF) time, Latest Start (LS) time, Latest Finish (LF) time, Dummy activity. Construction of Network and its rules. Calculations of ES, LS, EF, LF and project completion time . PERT : Definitions of Optimistic time, Pessimistic time, Most likely time. Calculations of expected completion times of activities and their variances, expected completion time of the project and its variance. Numerical problems on CPM and PERT

Module V

Introduction to the basic terms of designs of Experiments:

Experimental Units, Treatments, Randomization, Replications, Local Control, choice of size and shape of plot for uniformity trials. Analysis of variance: Analysis of variance for one - way classification: Mathematical model, assumptions basic hypothesis and ANOVA table. Analysis of variance for two -way classification: mathematical model, assumptions basic hypothesis, ANOVA table. Numerical problems.

Teaching Learning Process : Chalk & Board

Text Books

1. Cochran & Cox : Experimental designs(Module 1,2,5)
2. Goel And Mithal : Operations Research(Module 3,4)
3. S.D. Sharma : Operations Research(Module 3, 4)
4. Gupta and Kapoor : Applied Statistics(Module 1,2)

References Books:

1. Cochran & Cox : Experimental designs(Module 1,2,5)
2. Goel And Mithal : Operations Research(Module 3,4)
3. S.D. Sharma : Operations Research(Module 3, 4)
4. Gupta and Kapoor : Applied Statistics(Module 1,2)

Course outcomes:

The Student will be able to:

1. Student will have developed intelligence by recognizing statistical techniques in decision making.
2. Understand the role of Statistics and Operations Research in taking various commercial decisions
3. Understand components of Statistics and Operations Research in Business.

BUSINESS INTELLIGENCE			
CourseCode	21CIT641	**CIEMarks**	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	**SEEMarks**	50
TotalHoursofPedagogy	40	**TotalMarks**	100
Credits	03	**ExamHours**	03
Prerequisites:MIS, Database.			

Course Objectives:

The Course Objectives are to:

1. Introduce a managerial perspective of Business Intelligence (BI), and Analytics and Decision Support.
2. Provide introduction to three levels of analytics: descriptive, predictive and prescriptive,
3. Provide exposure to analytics techniques and their applications,
4. Introduce to specific software tools that can be used for developing applications
5. Provide introduction to emerging technologies that are likely to impact on the development and use BI applications.

Teaching-LearningProcess(GeneralInstructions)

ThesearesampleStrategies;whichteacherscanuseto acceleratetheattainmentofthevariouscourseoutcomes.

1. Lecturermethod(L)neednottobeonlyatraditionallecturemethod,butalternativeeffectiveteachingmethodscould beadoptedto attaintheoutcomes.
2. UseofVideo/Animationtoexplainfunctioningofvariousconcepts.
3. Encouragecollaborative(GroupLearning)Learningintheclass.
4. AskatleastthreeHOT(HigherorderThinking)questionsintheclass,whichpromotescriticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills,develop design thinking skillssuch asthe abilitytodesign, evaluate,generalize, andanalyze informationratherthan simplyrecallit.
6. IntroduceTopicsinmanifoldrepresentations.
7. Showthedifferentwaystosolvethesameproblemwithdifferentcircuits/logicandencouragethestudentsto comeupwith theirowncreativewaystosolvethem.
8. Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible,it helpsimprovethestudents'understanding.

Module - I

An Overview of Business intelligence, Analytics and Decision Support: Changing Business Environments and Computerized Decision Support; Framework for Business intelligence (BI); Intelligence Creation, Use, and BI Governance; Transaction Processing versus Analytic Processing; Successful BI Implementation; Analytics Overview; and Introduction to Big Data Analytics.
08 Hours

Module - II

Data Warehousing: Data Ware Housing (DW) Definitions and Concepts; DW Process Overview, Architectures; Data Integration, and the Extraction, Transformation and Load (ETL) Processes; DW Development; DW Implementation Issues; Real Time DW; and DW Administration, Security Issues and Future Trends. Business Reporting, Visual Analytics and Business Performance Management Business Reporting Definitions and Concepts: Data and Information Visualization; Different Types of Charts and Graphs; Emergence of Data Visualization and Visual Analytics; Performance Dash Boards; Business Performance Management; Performance Measurement; Balanced Score Boards; and Six Sigma as a Performance Measurement System.**08 Hours**

Module III

Data mining: Data Mining (DM) Concepts and Applications; DM Processed Methods Software Tools; and DM Privacy Issues, Myths and Blunders. **08 Hours**

Module IV

Text and Web Analytics: Text Analytics (TA) and Text Mining (TM) Overview; Natural Language Processing; TM Applications' Process; Sentiment Analysis; Web Mining (WM) Overview; Search Engines; Web Usage Mining (Web Analytics); and Social Analytics. **08 Hours**

Module V

Big Data Analytics: Definition of Big Data; Fundamentals of Big Data Analytics; Big Data Technologies; Data Scientist; Big Data and Warehousing; Big Data Vendors; Big Data and Stream Analytics; and Applications of Stream Analytics.
Business Analytics (BA) – Emerging trends and Future Impacts: Location-Based Analytics for Organizations; Analytics Applications for Consumers; Recommendation Engines; Web 2.0 Revolution and Online Social Networking; Cloud Computing and BI; Impacts of Analytics in Organizations – An Overview; Issues of Legality, Privacy and Ethics; and an overview of Analytics Ecosystem. **08 Hours**

Teaching-Learning Processforall modules	Chalkandboard,ActiveLearning,PPTBasedpresentation,Video

Course Outcomes:

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

CO1:Outline of Business intelligence, Analytics and Decision Support
CO2:Summarize the concepts of warehousing and descriptive level of analytics as business
CO3:Explain the predictive level of analytics through datamining
CO4:Design and implement the ETL process (CIT c)
CO5:Understand the people, process and politics with BI (CIT e)

Assessment Details (both CIE and SEE)

Component		**Weightage(%)**	
	CIE15thweek	20	

CIE's	CIE2 10th week	20	60
	CIE3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks:100.Reduced to 50Marks			
Semester End Examination(SEE) Total Marks:100. Reduced to 50Marks			

Text books:

1. Ramesh Sharda, DursunDelen, Efraim Turban, etal, ,Business Intelligence: A Managerial Perspective on Analytics, 3rd Ed, Pearson India Education Inc, IndianSubcontinentReprint2018(ISBN978-93-528-6271-9

Reference Books:

Jiawei Han and Michelinekambe, Jian Pei, ,Data Mining: Concepts and Techniques, 3rded. The Morgan Kaufmann Publishers.
Michael Steinbach, Pang-Ning Tan, and Vipin Kumar, ,Introduction To Data Mining', Pearson International Edition,2006.
James Allen,' Natural Language Understanding', 2nd Ed., The Benjamin/Cummings Publishing Company Inc.
Daniel Jurafsky, James.H.Martin,, Speech and Language Processing', 2nd Edition, Pearson Education Inc.

DATA SCIENCE THROUGH R PROGRAMMING

Course Code	21CIT642	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40T	Total Marks	10
Credits	03	Exam Hours	03

Prerequisites : NIL

Course objectives:

The Student will:

1. Know about the fundamental concepts of Data Science.

2. Explore Data Analysis and the Data Science Process and Linear Regression.
3. Investigate the various methods of Data Analysis.
4. Understand the Basics of R Environment.
5. Develop the Data Science analysis using R programming and Data Visualization.

Module 1: Introduction to Data Science

What is Data Science? - Big Data VS Data Science, Datafication, Current landscape of perspectives and Skill sets needed. Statistical Inference, Populations and samples, Statistical modeling, probability distributions, fitting a model.

Module 2: Exploratory Data Analysis and the Data Science Process

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process.
Simple Linear Regression, Multiple Linear Regression, other Considerations in the Regression Model, The Marketing Plan, Comparison of Linear Regression with K- Nearest Neighbors

Module 3: Classification

An Overview of Classification, Why Not Linear Regression? Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods. Cross- Validation and The Bootstrap.

Module 4: The R Environment

Command Line interface, R Studio, Installing R Packages. Basics of R: Basic math, variables, data types, vectors, calling function, missing data, data frames, lists, matrices, arrays.
Reading CSVs, Excel Data. Base Graphs, ggplot2. Writing R functions, control statements – if and else, switch, compound tests, for loops, while loops

Module – 5 Group manipulation and Data Reshaping

Unit 1: Apply Family, aggregate, plyr, data.table. Data Reshaping: cbind, rbind, joins, reshape2. Strings: paste, sprint, extracting text, regular expressions. *Doing math and simulations in R: Math Functions:* Calculating a Probability, cumulative sums and products, minima and maxima, calculus, sorting, set operations

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

The Student will be able to:

1. Analyze the fundamental concepts of Data Science.
2. Evaluate the Data analysis and Data Science Process and Linear Regression.
3. Analyze the various methods of Data Analysis.
4. Apply the Basics of R in its Environment.
5. Evaluate the Data Science analysis using R programming and Data Visualisation.

Text Books:

1. Gareth James, Daniela Witten, Trevor Hatie, Roberst Tibhirani , "An Introduction to Statistical Learning with Applications in R",
2. Jared P. Lander, R for Everyone, Addison Wesley Data & Analytics Series, Pearson,2014.

Reference Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk FromThe Frontline. O'Reilly.2014.
2. Mark Gardener, "Beginning R: The statistical programming language",2012.
3. Norman Matloff, The Art of R Programming, No Strach Press, San Francisco2011.

Evolutionary Algorithms

Course Code	21CIT643	**CIE Marks**	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	**SEE Marks**	50

Total Hours of Pedagogy	40T	**Total Marks**	100
Credits	03	**Exam Hours**	03

Description of the course:

This subject provides students with a basic understanding of the working and applications of evolutionary algorithms. It also introduces students to the state of the art in genetic algorithm, particle swarm optimization, ant colony optimization and cover the principles involved.

Prerequisite: Basic mathematics, Basic learning algorithms

Course Learning Objectives:

This course will enable students to:

- Understand the concepts behind the working of evolutionary algorithms
- Understand the working of operators in different algorithms
- Solve problems using genetic algorithm and swarm intelligence algorithm.
- Optimize the solutions using evolutionary algorithms

Syllabus

Module– I

Introduction: Paradigm, Representation of solutions, Fitness function, Initial population, Selection operators, Reproduction operators, General evolutionary algorithm, Evolutionary computing vs classical optimization

08 hours

Teaching Learning Methodology: Chalk & Talk**,** Python IDE

Module–II

Genetic Algorithms: Random search, General genetic algorithm, Chromosome representation, Cross-over, Mutation, Island genetic algorithm, Routing optimization application, Genetic programming.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– III

Evolutionary Programming: General Evolutionary programming algorithm, Mutation and selection, Evolutionary programming examples, Evolutionary strategies: Evolutionary strategy algorithm, Chromosome representation, Crossover operators, mutation operator, selection operator, Differential Evolution

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– IV

Cultural Evolution: Belief space, General cultural algorithms, cultural algorithm application, Coevolution: Coevolutionary algorithm, Competitive fitness – Relative fitness evaluation, fitness sampling, hall of fame, Cooperative coevolutionary genetic algorithm

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– V

Particle Swarm Optimization: Social network structure, Particle swarm optimization algorithm, PSO system parameters, Modification of PSO, Cooperative PSO, Ant colony optimization: The invisible manager, The pheromone, Ant colonies and optimization, Ant colonies and clustering, Applications of ACO, Case study: Hybrid algorithms

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Course Outcomes:

On completion of this course, the students will be able to:

1. Solve the problems using evolutionary algorithms
2. Determine the appropriate parameter settings to make different evolutionary algorithms work well.
3. Optimize the solutions of various applications using coevolution techniques.
4. Design new evolutionary operators, representations and fitness functions for specific practical and scientific applications.

Text Books:

3. Andries P Engelbrecht, “Computational Intelligence: An Introduction”, Wiley Publications, 2002.

4. Dario Floreano and Claudio Mattiussi, “Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies”, MIT press, 2008.

Reference Books:

6. D E Goldberg, “Genetic Algorithm in search, Optimization and Machine Learning”, Addison Wesley, 1989
7. W Banzhaf, P Nordin, R E Keller & Frank D Francone, “Genetic Programming: An Introduction”, Morgan Kaufmann, 1999
8. T Baeck, B. Fogel and Z Michalewicz, “Handbook on Evolutionary Computation”, IOP Press, 1997.

E-RESOURCES:

- https://nptel.ac.in/courses/112103301
- https://archive.nptel.ac.in/noc/courses/noc21/SEM1/noc21-me43/
- https://towardsdatascience.com/introduction-to-evolutionary-algorithms-a8594b484ac

- https://link.springer.com/article/10.1007/s11042-020-10139-6
- https://www.section.io/engineering-education/the-basics-of-genetic-algorithms-in-ml/

CO-PO Mapping:

COURSE OUTCOMES (CO's)	PROGRAM OUTCOMES (PO's)												PROGRAM SPECIFIC OUTCOMES (PSO'S)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3		3		3								3	3	3
CO2	3	2	2	3	3								3	3	3
CO3	3	2	2	3	3								3	3	3
CO4	3		3		3								3	3	3
Avg	3	2	2.5	3	3								3	3	3

CLOUD COMPUTING

Course Code	21CIT644	**CIE Marks**	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40T	**Total Marks**	100
Credits	03	**Exam Hours**	03

Course Objectives:

This course will enable students to

1. Identify the Cloud infrastructure components and service management processes
2. Explain the fundamentals of cloud computing
3. Gain the knowledge about virtualization and its techniques.
4. Illustrate the cloud application programming and Aneka platform
5. Differentiate Various cloud platforms used in industry

Prerequisite: Computer Networks, Database Management System, Operating system.

Syllabus

Module– I

Introduction: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0,Service-Oriented Computing, Utility- Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Google App Engine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjra soft Aneka.

08Hours

Module– II

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure /Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects. Aneka: Cloud Application Platform, Framework Overview. Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode.

08Hours

Module– III

Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread, Thread APIs, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs Common Threads. High-Throughput Computing: Task Programming, Task Computing, characterizing a Task, Computing Categories, Frameworks for Task Computing, Task-based Application Models, Embarrassingly Parallel Applications, Parameter Sweep Applications, Workflow Applications with Task Dependencies.

08Hours

Module– IV

Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing? Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms.

08Hours

Module– V

Cloud Platforms in Industry: Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google App Engine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. Cloud Applications: Scientific Applications, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.

08Hours

Laboratory

List of Experiments

1) Installation and Configuration of Just cloud.
2) Working in Cloud 9 to demonstrate different language.
3) Working and installation of Google App Engine.
4) Working and installation of Microsoft AZURE.
5) Working with Mangra soft Aneka Software.
6) Create an application (Ex: Word Count) using Hadoop Map/Reduce

Course Outcomes

On completion of this course, the students will be able to:

CO1: Explain cloud computing, classify services of cloud computing
CO2: Illustrate architecture and programming in cloud
CO3: Demonstrate data intensive computing.
CO4: Apply cloud computing services to commercial systems for deploying cloud.
CO5: Analyzing different Cloud platform in industry and their applications

Text Books:

1) Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN:9780124095397

Reference Books:

1) Dan C Marinescu, "Cloud Computing Theory and Practice", Morgan Kaufmann, Elsevier2013.
2) Thomas Erl : "Cloud Computing", Pearson Education, 1st Edition, 2014, ISBN-13:978-9332535923.

Reference Online Resources:

1) http://index-of.co.uk/Cloud-Computing-Books/Mastering%20Cloud%20Computing%20-%20Rajkumar%20Buyya.pdf
2) http://nptel.ac.in/courses/106105033/41
3) http://video.mit.edu/watch/mitef-nyc-cloud-computing-8347/

INTRODUCTION TO JAVA PROGRAMMING			
Course Code	**21CIT651**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Pre-requisite: OOPS concepts, C++.

Course Objectives:

This course will enable students to:

- Learn the basic concepts of object-oriented programming.
- Understand the basics of JAVA Programming using classes and objects.
- Gain the knowledge of Inheritance and packages.
- Expose to the concepts of exceptions that occur while programming in JAVA.
- Acquire the knowledge of multi-threaded programming in JAVA.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to Object Oriented Concepts: Procedure–Oriented Programming system, Object Oriented Programming System, Comparison of Object Oriented Language with C.
Introduction to Java: Java‟s magic, The Byte code, Java Development Kit (JDK), Java Buzzwords, Object- oriented programming, IO Streams, Data types, variables and arrays, reference variables, Operators, Control Statements. Simple Java programs.

08 Hours

Module - II
Classes: Classes fundamentals, Declaring objects, this keyword, garbage collection. **Methods**: Method Prototyping, Member functions and data members, Constructors, Objects and methods, Method Overloading, Objects and arrays, Access modifiers, Setters and getters, Nested classes, Console I/O. **08 Hours**
Module - III
Inheritance: Inheritance basics, using super, creating multi-level hierarchy, method overriding, using Abstract classes, using final. **Packages:** Packages: Access Protection, Importing Packages. **08 Hours**

Module - IV

Interfaces, **Exceptions, Applets:** Interfaces, Exception handling fundamentals, exception types, uncaught exceptions, using try and catch, using multiple catch clauses, nested try statements, throw, throws, finally, Exception handling in Java, Applets, Types of Applets, Applet basics and class, Applet Architecture.

08 Hours

Module - V

Event Handling and Multi-Threaded Programming : Two event handling mechanisms, The delegation event model, Event classes, Sources of events, Event listener interfaces, Using the delegation event model, Adapter classes, Inner classes. Multi-Threaded Programming: What are threads? How to make the classes threadable, Extending threads, Implementing runnable, Synchronization, Changing state of the thread, Bounded buffer problems, read-write problem.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Case studies

Course Outcomes

On completion of this course, the students will be able to:

- Explain the difference between Procedure and Object Oriented Programming.
- Develop basic JAVA programs.
- Apply Inheritance properties and packages in solving real world problems.
- Use exception handling methods efficiently.
- Demonstrate the programs by using multithreaded concepts.

Assessment Details (both CIE and SEE)

Text Books:

1. Herbert Schildt, “Java The Complete Reference”, 7th Edition, Tata McGraw 2013,ISBN-**13:** 978-0072263855,(Chapters 1-11).

Reference Books:

1. Herbert Schildt, “The Complete Reference C++”, 4th Edition, Tata McGraw Hill, 2013,ISBN- 13: 978-0072226805.

2. E Balagurusamy, “Programming with Java-A primer”, 2nd Edition, Tata McGraw Hill companies,2009, *ISBN*-13: 978-9351343202.

E-Resources:

1. www.geeksforgeeks.org/java/

2. www.tutorialspoint.com/java/index.htm

INTRODUCTION TO CYBER SECURITY			
Course Code	21CIT652	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	03

Pre-requisite: Networking, Cryptography, Hacking.

Course Learning Objectives

CLO 1. To familiarize cybercrime terminologies and ACTs
CLO 2. Understanding cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention
CLO 3. Understand the motive and causes for cybercrime, cybercriminals, and investigators
CLO 4. Understanding criminal case and evidence, detection standing criminal case and evidence.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to Cybercrime:
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes,
Cybercrime: The Legal Perspectives,
Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000.
Textbook1:Ch1 (1.1 to 1.8). **08 Hours**

Module - II

Cyber offenses:
How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes.
Botnets: The Fuel for Cybercrime, Attack Vector
Textbook1: Ch2 (2.1 to 2.7). **08 Hours**

Module - III

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, Attacks on Wireless Networks.

Textbook1: Ch4 (4.1 to 4.9, 4.12). **08 Hours**

Module - IV

Understanding the people on the scene: Introduction, understanding cyber criminals, understanding cyber victims, understanding cyber investigators.
The Computer Investigation process: investigating computer crime.
Understanding Cybercrime Prevention: Understanding Network Security Concepts, Understanding Basic Cryptography Concepts, Making the Most of Hardware and Software Security
Textbook 2:Ch3,Ch 4, Ch 7. **08 Hours**

Module - V

Cybercrime Detection Techniques: Security Auditing and Log Firewall Logs, Reports, Alarms, and Alerts, Commercial Intrusion Detection Systems, Understanding E-Mail Headers Tracing a Domain Name or IP Address.
Collecting and preserving digital Evidence: Introduction, understanding the role of evidence in a criminal case, collecting digital evidence, preserving digital evidence, recovering digital evidence, documenting evidence.
TextBook 2:Ch 9, Ch 10. **08 Hours**

Teaching-Learning Process for all modules	Chalk and board, Case studies

Course Outcomes:

At the end of the course the student will be able to:
CO 1. Describe the cyber crime terminologies
CO 2. Analyze cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention
CO 3. Analyze the motive and causes for cybercrime, cybercriminals, and investigators
CO 4. Apply the methods for understanding criminal case and evidence, detection standing criminal case and evidence.

Assessment Details (both CIE and SEE)

Textbooks

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2013

2. Debra Little John Shinder and Michael Cross, "Scene of the cybercrime", 2nd edition, Syngress publishing Inc, Elsevier Inc, 2008

Reference Books:

1. Robert M Slade, "Software Forensics", Tata McGraw Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
3. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
4. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", Tata McGraw -Hill, New Delhi, 2006.

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=czDzUP1HclQ
2. https://www.youtube.com/watch?v=qS4ViqnjkC8
3. https://www.trendmicro.com/en_nz/ciso/21/h/cybercrime-today-and-the-future.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Demonstration of projects related to Cyber security.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Course Code	21CIT653	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40T	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

CLO 1. Gain a historical perspective of AI and its foundations
CLO 2. Become familiar with basic principles of AI toward problem solving
CLO 3. Familiarize with the basics of Machine Learning & Machine Learning process, basics of Decision Tree, and probability learning
CLO 4. Understand the working of Artificial Neural Networks and basic concepts of clustering algorithms

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Prerequisite: Learner algebra,Probability,Statistics.

Syllabus

Module– I

Introduction: What is AI? Foundations and History of AI Problem-solving: Problem-solving agents, Example problems, Searching for Solutions, Uninformed Search Strategies: Breadth First search, Depth First Search,
Textbook 1: Chapter 1- 1.1, 1.2, 1.3
Textbook 1: Chapter 3- 3.1, 3.2, 3.3, 3.4.1, 3.4.3
Teaching-Learning Process Chalk and board, Active Learning. Problem based learning

08Hours

Module– II

Informed Search Strategies: Greedy best-first search, A*search, Heuristic functions. Introduction to Machine Learning , Understanding Data
Textbook 1: Chapter 3 - 3.5, 3.5.1, 3.5.2, 3.6
Textbook 2: Chapter 1 and 2
Teaching-Learning Process Chalk and board, Active Learning, Demonstration.

08Hours

Module– III

Basics of Learning theory, Similarity Based Learning , Regression Analysis
Textbook 2: Chapter 3 - 3.1 to 3.4, Chapter 4, chapter 5.1 to 5.4
Teaching-Learning Process Chalk and board, Problem based learning, Demonstration

08Hours

Module– IV

Decision Tree learning : Applications of Artificial Neural Networks, Attribute Selection Measures
Advantages and dis advantages of decision tree.,Bayesian Learning : Types of Naïve Bayes Classifiers , Advantages of Naïve Bayes, Limitations of Naïve Bayes

08Hours

Module– V

Artificial neural Network:Types of ANN, Applications of Artificial Neural Networks
,Clustering Algorithms : Conceptual Clustering, COBWEB and the Structure of Taxonomic Knowledge

Textbook 2: Chapter 10 and 13
Teaching-Learning Process Chalk and board, Active Learning.

08Hours

Course Outcomes (Course Skill Set)

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

CO 1. Apply the knowledge of searching and reasoning techniques for different applications.

CO 2. Have a good understanding of machine leaning in relation to other fields and fundamental issues and challenges of machine learning.

CO 3. Apply the knowledge of classification algorithms on various dataset and compare results

CO 4. Model the neuron and Neural Network, and to analyze ANN learning and its applications.

CO 5. Identifying the suitable clustering algorithm for different pattern

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together .

Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester

2. Second test at the end of the 10th week of the semester

3. Third test at the end of the 15th week of the semester Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester

5. Second assignment at the end of 9th week of the semester Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)** OR Suitable Programming experiments based on the syllabus contents can be given to the students to submit the same as laboratory work(for example; Implementation of concept learning, implementation of decision tree learning algorithm for suitable data set, etc…)

6. At the end of the 13th week of the semester The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module. The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson,2015

2. S. Sridhar, M Vijayalakshmi "Machine Learning". Oxford ,2021

Reference:

1. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rdedition, Tata McGraw Hill,2013

2. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011

3. Tom Michel, Machine Learning, McGrawHill Publication.

Weblinks and Video Lectures (e-Resources):

1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3. https://nptel.ac.in/courses/106/105/106105077/
4. https://www.javatpoint.com/history-of-artificial-intelligence
5. https://www.tutorialandexample.com/problem-solving-in-artificial-intelligence
6. https://techvidvan.com/tutorials/ai-heuristic-search/
7. https://www.analyticsvidhya.com/machine-learning/
8. https://www.javatpoint.com/decision-tree-induction
9. https://www.hackerearth.com/practice/machine-learning/machine-learning-algorithms/mldecision-tree/tutorial/
10. https://www.javatpoint.com/unsupervised-artificial-neural-networks

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Role play for strategies– DFS & BFS, Outlier detection in Banking and insurance transaction for identifying fraudulent behaviour etc. Uncertainty and reasoning Problem- reliability of sensor used to detect pedestrians using Bayes Rule

INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS			
Course Code	21CIT652	**CIE Marks**	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	**SEE Marks**	50
Total Hours of Pedagogy	40	**Total Marks**	100
Credits	03	**Exam Hours**	03

Pre-requisite: Data Structures.

Course Learning Objectives

CLO 1. Understand the basic concepts and the applications of database systems. CLO 2. Understand the relational database design principles.

CLO 3. Master the basics of SQL and construct queries using SQL.

CLO 4. Familiar with the basic issues of transaction processing and concurrency control.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Examples

Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7 **08 Hours**

Module - II

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1:,ch5.1 to 5.3, 8.1 to 8.5, 9.1; 08 Hours

Module - III

SQL:SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database

Textbook 1: Ch 6.1 to 6.5, 7.1 to 7.4; Textbook 2: 6.1 to 6.6; 08 Hours

Module - IV

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

Textbook 1: Ch 14.1 to -14.7, 15.1 to 15.6 08 Hours

Module - V

Transaction management and Concurrency –Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.

Textbook 1: Ch 20.1 to 20.6, 21.1 to 21.7; 08 Hours

Teaching-Learning Process	Chalk& board, Problem based learning, Demonstration, MOOC

Course Outcomes

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

CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
CO 2. Use Structured Query Language (SQL) for database manipulation. CO 3. Design and build simple database systems
CO 4. Develop application to interact with databases.

Assessment Details (both CIE and SEE)

Textbooks

1. Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=3EJlovevfcA
2. https://www.youtube.com/watch?v=9TwMRs3qTcU
3. https://www.youtube.com/watch?v=ZWl0Xow304I
4. https://www.youtube.com/watch?v=4YilEjkNPrQ
5. https://www.youtube.com/watch?v=CZTkgMoqVss
6. https://www.youtube.com/watch?v=Hl4NZB1XR9c
7. https://www.youtube.com/watch?v=EGEwkad_llA
8. https://www.youtube.com/watch?v=t5hsV9lC1rU

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Developing and demonstration of models / projects based on DBMS application

VII Semester Syllabus

NATURAL LANGUAGE PROCESING

Course Code	21CIT71	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40T	Total Marks	100
Credits	03	Exam Hours	03

Description of the course:

This subject provides students with a basic understanding of the fundamentals and applications of neural networks algorithms in Natural Language Processing

Prerequisite:

Basic Probability concepts, Linear Algebra, Machine Learning

Course Learning Objectives:

This course will enable students to:

- Explain the core concepts in the designing of Artificial neurons.
- Understand the difference between supervised and unsupervised algorithm and able to design for complex algorithms.
- Understand the working nature of Radial basis network.
- Understand and explain the restricted boltzmann algissues

Syllabus

Module– I

Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages-NLP Applications Information Retrieval. Language Modeling: Various Grammar-based Language Models - Statistical Language Model.

08 hours

Teaching Learning Methodology: Chalk & Talk**,** Python IDE

Module–II

Word level and syntactic analysis: Word Level Analysis: Regular Expressions-Finite-State Automata- Morphological Parsing – Spelling Error Detection and correction- Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context- free Grammar – Constituency – Parsing –Probabilistic Parsing.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– III

Extracting Relations from Text: From Word Sequences to DependencyPaths: Introduction,SubsequenceKernelsforRelationExtraction,ADependency-PathKernelforRelationExtractio nand ExperimentalEvaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction,

DomainKnowledgeandKnowledgeRoles,FrameSemanticsandSemanticRoleLabeling,LearningtoAnnotateCaseswithKnowle dgeRolesandEvaluations.

A Case Study in Natural Language Based Web Search: In Fact System Overview, The Global Security.org Experience.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– IV

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation ofFeedbackSystems,TextualSignatures:IdentifyingText-TypesUsingLatentSemanticAnalysistoMeasuretheCohesionof TextStructures:Introduction,Cohesion,Coh-Metrix,ApproachestoAnalyzingTexts,LatentSemanticAnalysis,Predictions, ResultsofExperiments.
AutomaticDocumentSeparation:ACombinationofProbabilisticClassificationandFinite-StateSequenceModeling:Introd uction,RelatedWork,DataPreparation,DocumentSeparationasaSequenceMappingProblem,Results.
EvolvingExplanatoryNovelPatternsforSemantically-BasedTextMining:RelatedWork,ASemantic allyGuidedModelforEffectiveTextMining.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– V

Restricted Boltzmann Machines: Introduction, Hopfield networks, The Boltzmann machines, Restricted Boltzmann machines, Applications of restricted Boltzmann machines, Using RBM beyond binary datatypes, Stacking RBM.

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Course Outcomes:

On completion of this course, the students will be able to:

- Design neural network using basic concepts for simple applications.
- Solve the problems using neural network in supervised and unsupervised fashion.
- Design radial basis network for providing solution to the problem.
- Solve the problem by constructing the restricted Boltzmann machine

Text Books:

5. Andries P Engelbrecht, "Computational Intelligence: An Introduction", Wiley Publications, 2002.

6. Charu C. Agarwal, "Neural Networks and Deep Learning", Springer, 2018.

Reference Books:

9. Tom M Mitchell, "Machine Learning", McGraw-Hill, 1997
10. Rudolph Russell, Machine Learning Step by step guide to implement machine learning algorithms with python
11. Aaron Courville, Ian Goodfellow, and Yoshua Bengio, Deep Learning, MIT Press,2015, ISBN:9780262035613
12. Ethem Alpaydın, Introduction to Machine Learning, MIT press 4th edition ISBN: 9780262043793.
13. C Agarwal, Machine Learning for Text, Pearson Education - 2006 (2 & 4). ISBN – 15:34519801.

E-RESOURCES:

- https://cs.stanford.edu/people/eroberts/courses/soco/projects/neural-networks/Sources/index.html
- https://onlinecourses.nptel.ac.in/noc19_ee53/preview
- https://onlinecourses.nptel.ac.in/noc22_ge04/preview
- http://www.digimat.in/nptel/courses/video/117105084/L35.

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												**PROGRAM SPECIFIC OUTCOMES (PSO'S)**		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1					3								3		3
CO2	3	2	3	3	3								3	3	3
CO3	2	2	3	3	3								3	3	3
CO4	2	2	3	3	3								3	3	3
Avg	2.3	2	3	3	3								3	3	3

REINFORCEMENT LEARNING

CourseCode:	21CIT72	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50
TotalHoursofPedagogy	40T	TotalMarks	100
Credits	03	ExamHours	03

Description of the course:

In this course, we will explore how an agent (via interactions with the environment) can learn by trial and error. This is quite different from supervised machine learning and comes close to how humans learn by interactions. Reinforcement Learning (RL) deals with problems that require sequential decision making. This course will explore the foundations of reinforcement learning. We will study different algorithms for RL and later in the course, we will explore how functional approximation in RL algorithms could be done using neural networks giving rise to deep reinforcement learning.

Prerequisite:

Understanding of Machine Learning, Theoretical and practical knowledge of Deep Learning, Proficiency in Linear Algebra, Probability and Statistics, Proficiency in Python Programming.

CourseLearningObjectives:

This course will enable students to:

- Understand the statistical learning techniques and the importance and challenges of learning agents
- Formalize problems as Markov Decision Processes
- Understand value functions
- Understand how to implement dynamic programming as an efficient solution approach to an industrial control problem
- Start using Reinforcement Learning for real problems

Syllabus

Module– I

Introduction to Reinforcement Learning: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe, Tabular Solution Methods, An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits)

08hours

Teaching Learning Methodology: Chalk & Talk

Module–II

Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks,The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions.Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration,

08hours

Teaching Learning Methodology: Chalk & Talk

Module– III

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control, Importance Sampling on Truncated Returns, Temporal-Difference Learning:TD Prediction, Advantages of TD Prediction Methods, Optimality of TD(0), Sarsa: On-Policy TD Control, Q-Learning: Off-Policy TD Control

08hours

Teaching Learning Methodology: Chalk & Talk,

Module– IV

Eligibility Traces: n-Step TD Prediction, The Forward View of TD(λ), The Backward View of TD(λ), Sarsa(λ), Watkins's Q(λ), Off-policy Eligibility Traces using Importance Sampling, Planning and Learning with Tabular Methods: Models and Planning, Integrating Planning, Acting, and Learning, When the Model Is Wrong, Prioritized Sweeping

08hours

Teaching Learning Methodology: Chalk & Talk,

Module– V

On-policy Approximation of Action Values: Value Prediction with Function Approximation, Gradient-Descent Methods, Linear Methods, Control with Function Approximation, Off-policy Approximation of Action Values, Actor–Critic Methods, Eligibility Traces for Actor–Critic Methods, R-Learning and the Average-Reward Setting

08 hours

Teaching Learning Methodology: Chalk & Talk,

CourseOutcomes:

On completion of this course, the students will be able to:

- Learn the basic concepts of Reinforcement learning
- Identification of suitable learning tasks to which these learning techniques can be applied
- Appreciation of some of the current limitations of reinforcement learning techniques
- Investigate Reinforcement techniques and derive effectively learning rules.
- Appreciation of some of the current limitations of reinforcement learning techniques

Text Books:

7. Reinforcement Learning An Introduction by Richard S. Sutton and Andrew G. Barto, Second Eddition
8. Algorithms for Reinforcement Learning by CsabaSzepesv´ari

Reference Books:

14. Algorithms for Reinforcement Learning" CsabaSzepesvari, Ronald Brachman, Thomas Dietterich

15. Markov Decision Processes: Discrete Stochastic Dynamic Programming (9780471727828): Martin L. Puterman

E-RESOURCES:

- https://www.learn.ed.ac.uk/webapps/blackboard/content/listContent.jsp?course_id=_98846_1&content_id=_7260062_1
- https://www.coursera.org/specializations/reinforcement-learning
- https://www.deepmind.com/learning-resources/reinforcement-learning-lecture-series-2021
- https://www.youtube.com/playlist?list=PLoROMvodv4rOSOPzutgyCTapiGlY2Nd8u

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												**PROGRAM SPECIFIC OUTCOMES (PSO'S)**		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	3							2	3	2	3
CO2	3	3	2	2	3							1	3	2	3
CO3	3	3	2	2	3							2	3	2	2
CO4	3	3	3	3	3							2	3	2	3
CO5	3	2	2	2	3							1	3	2	2
Avg	3	2.8	2.2	2.2	3							1.6	3	2	2.6

ChatBot			
CourseCode:	21CIT731	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50
TotalHoursofPedagogy	40T	TotalMarks	100
Credits	03	ExamHours	03

Description of the course:

In this course, we will explore how an agent (via interactions with the environment) can learn by trial and error. This is quite different from supervised machine learning and comes close to how humans learn by interactions. Reinforcement Learning (RL) deals with problems that require sequential decision making. This course will explore the foundations of reinforcement learning. We will study different algorithms for RL and later in the course, we will explore how functional approximation in RL algorithms could be done using neural networks giving rise to deep reinforcement learning.

Prerequisite:

Understanding of Machine Learning, Theoretical and practical knowledge of Deep Learning, Proficiency in Linear Algebra, Probability and Statistics, Proficiency in Python Programming.

CourseLearningObjectives:

This course will enable students to:

- Understand Chatbot both in business and developers perspective
- Become familiar with tools and methods used when NLP is needed with real time examples
- Build Chatbot in easy way by using Dialogflow
- Build chatbots in-house from scratch and how to train chatbots using machine learning algorithms
- Learn how to showcase your chatbots to the world using Facebook and Slack and, finally, integrate them on your own website

Syllabus

Module– I

The Beloved Chatbots: Popularity of Chatbots Usage, The Zen of Python and Why It Applies to Chatbots, The Need for Chatbots, Industries Impacted by Chatbots, Brief Timeline of Chatbots , What Kind of Problems Can I Solve Using Chatbots , A QnA Bot, Decision Trees in Chatbots, The Best Chatbots/Bot Frameworks, Components of a Chatbot and Terminologies used

08hours

Teaching Learning Methodology: Chalk & Talk, problem based learning

Module–II

Natural Language Processing for Chatbots: Why Do I Need to Know Natural Language Processing to Build a Chatbot?, What Is spaCy?, Features of spaCy, Fundamental Methods of NLP for Building Chatbots, Good to Know Things in NLP for Chatbots

08hours

Teaching Learning Methodology: Chalk & Talk, practical learning and demonstration

Module– III

Building Chatbots the Easy way: Introduction to Dialogflow, Getting started, Building a Food Ordering Chatbot, Deploying Dialogflow Chatbot on the Web, Integrate Dialogflow Chatbot on Facebook Messenger,Fullfilment.

08hours

Teaching Learning Methodology: Chalk & Talk,

Module– IV

Building Chatbots the Hard Way: What Is Rasa NLU? , Training and Building a Chatbot From scratch, Dialog Management Using Rasa core, Writing Custom Actions of the Chatbot, Data Preparation for Training the Bot, Testing the bot,

08hours

Teaching Learning Methodology: Chalk & Talk, Problem based learning, Demonstration

Module– V

Deploying Your Chatbot: First Steps, Rasa's Credential Management, Deploying the Chatbot on Facebook, Deploying the Chatbot on Slack, Deploying the Chatbot on Your Own.

08 hours

Teaching Learning Methodology: Chalk & Talk, Problem based learning, Demonstration

CourseOutcomes:

On completion of this course, the students will be able to:

- Apply Chatbot both in business
- Design and implement chatbot using dialogflow
- Apply machine learning algorithms to develop chatbot.
- Showcase your chatbots to the world using Facebook and Slack and, finally, integrate them on your own website

Text Books:

1. Sumith Raj, Building Chatbots with Phython, Using Natural Language processing and machine learning

Reference Books:

1. Cathy Pearl, Designing Voice User Interfaces: Principles of conversational experience,
2. Amir Shevat, Designing Bots: Conversational Experience

E-RESOURCES:

- https://www.udemy.com/course/the-complete-chatbot-course-using-rasa-python-nlp/?utm_source=adwords&utm_medium=udemyads&utm_campaign=DSA_Catchall_la.EN_cc.INDIA&utm_content=deal4584&utm_term=_._ag_82569850245_._ad_533220805577_._kw__._de_c_._dm__._pl__._ti_dsa-93451758763_._li_9147684_._pd__._&matchtype=&gclid=CjwKCAjw3ueiBhBmEiwA4BhspHd7ttL5TEu1Lcd3aLjiMt6m9shS0LAYr8IDqtg_gx9DZSUCDOXPwhoCW-UQAvD_BwE
- https://www.youtube.com/watch?v=_uFBROvCC7g
- https://www.youtube.com/watch?v=dv0lDslB-wE
- https://www.classcentral.com/course/building-ai-powered-chatbots-13637
- https://www.classcentral.com/course/conversational-experiences-dialogflow-12529
- https://www.classcentral.com/course/ccai-virtual-agent-development-in-dialogflow-cx-f-55074

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												**PROGRAM SPECIFIC OUTCOMES (PSO'S)**		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	3							2	3	2	3
CO2	3	3	2	2	3							1	3	2	3
CO3	3	3	2	2	3							2	3	2	2
CO4	3	3	3	3	3							2	3	2	3
CO5	3	2	2	2	3							1	3	2	2
Avg	3	2.8	2.2	2.2	3							1.6	3	2	2.6

BLOCK CHAIN TECHNOLOGY			
CourseCode	21CI732	**CIEMarks**	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	**SEEMarks**	50
TotalHoursofPedagogy	40	**TotalMarks**	100
Credits	03	**ExamHours**	03

Prerequisite: Network Security and Information Security

Course Objectives:

- Understand about Symmetric and Asymmetric Encryption, block chain and Bit coin concepts
- Analyse the Working of Block Chain System.
- Design, build, and deploy smart contracts and distributed applications
- Evaluate security, privacy, and efficiency of a given block chain system.
- Cognize about 'digital' currency, Storage and Currency Exchange Services.

Teaching-LearningProcess(GeneralInstructions)

ThesearesampleStrategies;whichteacherscanuseto acceleratetheattainmentofthevariouscourseoutcomes.

1. Lecturermethod(L)neednottobeonlyatraditionallecturemethod,butalternativeeffectiveteachingmethodscould beadoptedto attaintheoutcomes.
2. UseofVideo/Animationtoexplainfunctioningofvariousconcepts.
3. Encouragecollaborative(GroupLearning)Learningintheclass.
4. AskatleastthreeHOT(HigherorderThinking)questionsintheclass,whichpromotescriticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills,develop design thinking skillssuch asthe abilitytodesign, evaluate,generalize, andanalyze informationratherthan simplyrecallit.
6. IntroduceTopicsinmanifoldrepresentations.
7. Showthedifferentwaystosolvethesameproblemwithdifferentcircuits/logicandencouragethestudentsto comeupwith theirowncreativewaystosolvethem.
8. Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible,it helpsimprovethestudents'understanding.

Module - I

Introduction to Block chain: Back story of Block chain, what is Block chain? Centralized vs. Decentralized Systems, Layers of Block chain, why is Block Chain Important? Limitations of Centralized Systems, Block chain Adoption So Far, Block chain Uses and Use Cases How Block chain Works-1: Laying the Block Chain Foundation, Cryptography, Symmetric Key Cryptography, Cryptographic Hash Functions.

08 Hours

Module - II

Cryptography and Transactions: Asymmetric Key Cryptography, Diffie-Hellman Key Exchange, Symmetric vs. Asymmetric Key Cryptography, Merkle Trees, Putting It All Together, Properties of BlockChain Solutions, Block chain Transactions, Distributed Consensus Mechanisms, Block chain Applications, Scaling Block chain, Off-Chain Computation, Sharding Block Chain State.

08 Hours

Module - III
Bitcoin Works: The History of Money, Dawn of Bitcoin, What Is Bitcoin? Working with Bitcoins, The Bitcoin Blockchain, Block Structure, The Genesis Block, The Bitcoin Network, Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Block Propagation, Bitcoin Scripts, Bitcoin Transactions Revisited, Scripts. **08 Hours**

Module - IV

Ethereum and Crypto Currencies: Ethereum Introduction, Ethereum Blockchain, Elements of Ethereum Blockchain and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges**,** Cryptographic Hash Functions**,** Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Crypto currency.

08 Hours

Module - V

How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

08 Hours

Teaching-LearningProcessforallmodules	Chalkandboard,ActiveLearning,PPTBasedpresentation,Video

Course Outcomes
After the completion of this course, student will be able to

- Gain Knowledge in Symmetric Encryption, Asymmetric Encryption, Block Chain System and Crypto currencies.
- Analyze the working of Block Chain System, Ledger Transaction and Mining mechanism.
- Design and Implement Ethereum block chain contract.
- Pertain to ethical and legal usage of Block chain applications.
- Use of Bitcoins, online wallets, Currency Exchanges and payment services.

AssessmentDetails (both CIE andSEE)

Text Books:

1. Beginning Block chain: A Beginner's Guide to Building Block Chain Solutions by BikramadityaSinghal, GautamDhameja and PriyansuSekhar Panda.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bit coin and Crypto-currency Technologies: A Comprehensive Introduction, Princeton University Press (July 19,2016).

Reference Books:

1. Mastering Bit coin by Andreas M. Antonopoulos
2. Block chain Technology: Crypto-currency and Applications by S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press 2019.
3. Imran Bashir, Mastering Blockchain: Deeper Insights into Decentralization, Cryptography, Bitcoin, and Popular Blockchain Frameworks, Packt Publishing, 1st Edition, 2017.

E-Resources:

1. NPTEL online course: https://nptel.ac.in/courses/106/104/106104220/#
2. Udemy: https://www.udemy.com/course/build-your-blockchain-az/
3. EDUXLABS Online training://eduxlabs.com/courses/blockchain technology- training/?tab=tab-curriculum

BIG DATA ANALYTICS

Course Code	21CIT733	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40T	Total Marks	100
Credits	03	Exam Hours	03

Prerequisites : NIL

Course objectives

As a student will be able to learn:

- Understand fundamentals of Big Data analytics
- Explore the Hadoop framework and Hadoop Distributed File system
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
- Employ MapReduce programming model to process the big data
- Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis..

Module – I

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies. 08 HOURS

Module – II

Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools.

Hadoop Distributed File System Basics (T2): HDFS Design Features, Components, HDFS User Commands.
08 HOURS

Module – III

NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.
08 HOURS

Module – IV

MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig
08 HOURS

Module – V

Machine Learning Algorithms for Big Data Analytics: Introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations,
Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining.

Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics:
08 HOURS

Teaching-LearningProcessforallmodules	Chalkandboard,ActiveLearning,PPTBasedpresentation,Video

Course Outcomes:

The Student will be able to:

- Understand fundamentals of Big Data analytics.
- Investigate Hadoop framework and Hadoop Distributed File system.
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
- Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
- Use Machine Learning algorithms for real world big data.
- Analyze web contents and Social Networks to provide analytics with relevant visualization tools.

Text Books:

1. Kamal and PreetiSaxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966, **Chapter 1: 1.2 -1.7, Chapter 2 :2.1-2.6, Chapter 3: 3.1-3.7, Chapter 4: 4.1-4.6, Chapter 6: 6.1 to 6.5, Chapter 9: 9.1 to 9.5,**
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education, 2016. ISBN- 13: 978-9332570351, **Chapter 3, Chapter 7 (except walk throughs),**

Reference Books:

1. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O‟Reilly Media, 2015.ISBN-13: 978- 9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions",1st Edition, Wrox Press, 2014ISBN-13: 978-8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1st Edition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
4. ArshdeepBahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

Reference Online Resources:

https://www.goodreads.com/book/show/50207239-big-data-analytics-introduction-to-hadoop-spark-and-machine-learning

Cognitive System

CourseCode:	21CIT735	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50
TotalHoursofPedagogy	40T	TotalMarks	100
Credits	03	ExamHours	03

Description of the course:

This course provides an introduction of study of the operations of the mind, some of the neural mechanisms that may be underlying performance. To simulate some of these capabilities on computational systems to understand the internal mechanics of these systems. Questions of how an infant learns, and particularly, issues of modeling meaning in language. Finally, some philosophical issues about what it means to represent something.

Cognitive science explores the nature of cognitive processes such as perception, reasoning, memory, attention, language, decision making, emotion, motor control, and problem solving. The goal of cognitive science, stated simply, is to understand how minds work, in humans, animals, and machines

Prerequisite:

Good programming skills and debugging skills.

Knowledge on neural networks.

Course Learning Objectives:

This course will enable students to:

1. Develop skills in analysing, interpreting, and assessing the empirical data and research techniques that contribute to cognitive science.
2. Investigate topics in cognitive science from at least three different disciplinary perspectives that in combination include quantitative, qualitative, and lab work.
3. Understand central modelling techniques in cognitive science, including traditional computational approaches, neural network/deep learning approaches, and dynamical approaches.

Syllabus

Module– I

Introduction: The prehistory of cognitive science, The reaction against behaviorism in psychology, The theory of computation and the idea of an algorithm, Linguistics and the formal analysis of language, Information-processing models in psychology, The discipline matures: Three milestones: Language and micro-worlds, How do mental images represent?, An interdisciplinary model of vision

08 hours

Teaching Learning Methodology: Chalk & Talk

Module–II

The turn to the brain : Cognitive systems as functional systems , The anatomy of the brain and the primary visual pathway , Extending computational modeling to the brain , Mapping the stages of lexical processing ,THE INTEGRATION CHALLENGE, Cognitive science and the integration challenge; Cognitive science: An interdisciplinary endeavor, Levels of explanation: The contrast between psychology and neuroscience, The integration challenge, Local integration I: Evolutionary psychology and the psychology of reasoning, Local integration II: Neural activity and the BOLD signal.

08 hours

Teaching Learning Methodology: Chalk & Talk

Module– III

INFORMATION-PROCESSING MODELS OF THE MIND , Physical symbol systems and the language of thought ; The physical symbol system hypothesis , From physical symbol systems to the language of thought , The Chinese room argument , Applying the symbolic paradigm ; Expert systems, machine learning, and the heuristic search hypothesis , ID3: An algorithm for machine learning . **08 hours**

Teaching Learning Methodology: Chalk & Talk

Module– IV

Neural networks and distributed information processing ; Neurally inspired models of information processing , Single- layer networks and Boolean functions , Multilayer networks, Information processing in neural networks: Key features, Neural network models of cognitive processes; Language and rules: The challenge for information-processing models, Language learning in neural networks, Object permanence and physical reasoning in infancy. **08 hours**

Teaching Learning Methodology: Chalk & Talk

Module– V

THE ORGANIZATION OF THE MIND , How are cognitive systems organized?; Architectures for intelligent agents , Fodor on the modularity of mind , The massive modularity hypothesis , Strategies for brain mapping ; Structure and function in the brain , Studying cognitive functioning: Techniques from neuroscience , Combining resources I: Thelocus of selection problem.

08 hours

Teaching Learning Methodology: Chalk & Talk

Course Outcomes:

On completion of this course, the students will be able to:

- Synthesize and analyze information from a variety of sources concerning foundational concepts and arguments in cognitive science and philosophy.
- Engage in philosophical discussion and debate on the various philosophical issues relating to cognitive science.
- Critically assess arguments about the nature of cognition, the methodology of cognitive science and the role of cognitive sciences in society.
- Clearly articulate their own position with respect to contemporary real world debates about philosophy and cognitive science.
- Critically evaluate evidence from a broad range of disciplines including cognitive science,
- Psychology and neuroscience.

Text Books:

An Introduction to the Science of the Mind , Jose Luis Bermudez , Cambridge University Press Second Edition

Reference Books:

16. Reisberg "Cognition" , W. W. Norton & Co. price Publisher, 2005 edition
17. Kurzban "Why Everyone (Else) Is a Hypocrite" , Princeton University Press; ISBN: 978-0-691-15439-8., 2012 edition

E-RESOURCES:

- https://www.academia.edu/28943710/Psychology_Gleitman_8th_Edition
- https://silo.tips/download/cognitive-science-2013
- https://nptel.ac.in/courses/109103134
- https://www.digimat.in/nptel/courses/video/109103134/L01.html

Full Stack Development			
CourseCode	21CIT734	**CIEMarks**	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	**SEEMarks**	50
TotalHoursofPedagogy	40	**TotalMarks**	100
Credits	03	**ExamHours**	03

Prerequisites: MIS, Database.

Course Objectives:

This course will enable students to,

- Use HTML, CSS and Javascript in web page design.
- Access the DOM objects, filters, forms in Javascripts query.
- Write programs using Hooks, components and Events in ReactJS.
- Create basic web applications with Node.js, ExpressJS.
- UnderstandwiththedatabaseconnectivityandreactiveformsusingJavaScript‘s

Teaching-LearningProcess(GeneralInstructions)

ThesearesampleStrategies;whichteacherscanuseto acceleratetheattainmentofthevariouscourseoutcomes.

9. Lecturermethod(L)neednottobeonlyatraditionallecturemethod,butalternativeeffectiveteachingmethodscould beadoptedto attaintheoutcomes.
10. UseofVideo/Animationtoexplainfunctioningofvariousconcepts.
11. Encouragecollaborative(GroupLearning)Learningintheclass.
12. AskatleastthreeHOT(HigherorderThinking)questionsintheclass,whichpromotescriticalthinking.
13. Adopt Problem Based Learning (PBL), which fosters students’ Analytical skills,develop design thinking skillssuch asthe abilitytodesign, evaluate,generalize, andanalyze informationratherthan simplyrecallit.
14. IntroduceTopicsinmanifoldrepresentations.
15. Showthedifferentwaystosolvethesameproblemwithdifferentcircuits/logicandencouragethestudentsto comeupwith theirowncreativewaystosolvethem.
16. Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible,it helpsimprovethestudents'understanding.

Module - I

Javascript:Basics:Variables,Operator,DOM,Arrays,Functions,ArrowFunctions,Classes,Objects,Event Handling, Map, Babbel JS ,React Introduction, React Installation.Simple React programs and CSS styling

08 Hours

Module - II

React J S: Functional Component, Class Component, Event Based Component, Props, States, Set state ,Event Handling, Binding Event Handler, Life Cycle Methods, Lists & Keys, Forms and user inputs, Rendering: Conditional Rendering, List Rendering.

08 Hours

Module - III

Hooks: use State, use Menu, use Effect, Axios Package, useRef ,use Context, useReducer, useCallback useInput, React Router,APIs, Practical React: icons, video player, credit card, model, chart, count up

08 Hours

Module - IV

Introduction to Node.js: What is Node.js?, Features of Node.js, Setup Development Environment-Installing, Node.js, Working with REPL, Node.js Console, Node.js Module, Node Package Manager, Node.js Basics, File System, HTTP and HTTPs, Creating Web Server- Handling http request, Node.js Callbacks, Node.js Events

08 Hours

Module - V

Database Connectivity and Reactive Forms: Promises, Express.js, Database Connectivity – Connecting to RDBMS and NoSQL database, Performing CRUD operations, What is Reactive Forms, Syncing of HTML and Form, Form Control Arrays, Relative Forms, Value changes and Reacting to status, CreateReactiveformthroughcode,AddingValidation,AddingValidation,Grouping,CustomValidators

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

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

- Develop programs in HTML, JavaScript.
- Design programs using ReactJS components.
- Test and deploy web pages using React Hooks .
- Develop programs in NodeJS, ExpressJS.
- Design programs using ReactJS with database connectivity.

AssessmentDetails (both CIE andSEE)

Textbooks:

1. Brad Dayley — Node.js,MongoDB, and AngularJS Web Development, 2018,ISBN-13: 9789352865505

Reference Books:

1. Adam Freeman,— ProAngular JS, Apress Publications, 2nd Edition, 2017,ISBN-13: 9781484223062.
2. Learning React Functional Web Development with React and Redux By Alex Banks , EvePorcello· 2017

E-Resources:

1. https://reactjs.org/docs/getting-started.html
2. https://www.mongodb.com/resources
3. .https://youtube.com/playlist?list=PLC3y8rFHvwgg3vaYJgHGnModB54rxOk3

Quantum Computing

Course Code	21CIT741	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40T	Total Marks	100
Credits	03	Exam Hours	03

Pre-Requisites:

1. Knowledge on ―Probability and Statistics.

Course objectives:

The Student will:

1. Introduce basics of Quantum Computing.
2. Discuss the concepts of Quantum gates.
3. Illustrate the importance of Shor's algorithm & Grover's algorithm.
4. Explore the applications of Quantum Computing.

Syllabus

Module I

Introduction to Quantum computing: Introduction, From Bits to Qubits, Power of Quantum computing, How quantum physics differs from classical physics. Qubits, Quantum Mechanics and Computer Science Perspectives: Quantum mechanics, Quantum bits (Qubits), Multiple Qubits, Computer science perspectives.

Module II

Quantum gates: Single qubits gates, Multiple qubit gates, Matrix representation of quantum gates & circuits, Bell states

Module III

Shor's Algorithm and Quantum Fourier Transform: Shor's Algorithm simplified through examples, Quantum fourier transform, Implementation Quantum fourier transform using Quantum gates, Phase estimation, Shor's Algorithm Using Phase estimation, Order finding and factoring explained further.

Module IV

Grover's Algorithm (Quantum search Algorithm): what is in an ORACLE?, Steps in Grover's Algorithm, Geometrics visualization of Grover's Algorithm, order of Grover's Algorithm.

Module V

Physical Realization of Quantum Computers: Basic representation for quantum computation, harmonic oscillator quantum computer, quantum computer, optical photon quantum computer, optical cavity quantum electrodynamics, Ion Taps, Nuclear magnetic resonance, Silicon quantum computers,

Text Books

1. **Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008.**
2. **Vishal sahni."Quantum Computing",TMH,2007**

References Books:

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication2008.
2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge

University Press2010.
3. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey1995.

E - Resources:

1. http://patrickjmt.com/
2. https://homepages.cwi.nl/~rdewolf/qcnotes.pdf
3. https://homes.cs.washington.edu/~oskin/quantum-notes.pdf
4. https://nptel.ac.in/courses/104/104/104104082/

Course outcomes:

After successful completion of the course, the students are able to

1. Describe vital applications using Quantum computing principles and Practices.
2. Design simple circuits using Quantum gates.
3. Apply Shor's and Grover's algorithm in Quantum computing.
4. Make use of the Quantum computing for applications.

CO-PO Mapping

COURSE OUTCOMES (CO's)	PROGRAM OUTCOMES (PO's)												PROGRAM SPECIFIC OUTCOMES (PSO'S)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		3		1									3		
CO2	2	2	3											3	
CO3	3	2	2	2										3	
CO4		3		2										3	
Avg	2.5	2.5	2.5	1.7									3	3	

PRECISION AGRICULTURE			
Course Code	**21CIT742**	**CIE Marks**	**50**

Teaching Hours/Week(L:T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite:
Basic Computer Knowledge Linear Algebra Statistics and Probability Calculus Graph Theory Programming Skills – Language such as Python, R, MATLAB, C + + or Octave Data, Hardware

Course Objectives:

This course will enable students to:

- Detailed description of latest tools and technologies available for the Agriculture 5.0.
- Describe different type of hardware, platforms and techniques for use in smart farming.
- Learn different modeling techniques in precision agriculture.
- Make data driven based decision making & support systems.
- Learn policies and regulations for adopting AI & ML techniques in Agriculture.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which hteacherscanuseto acceleratetheattainmentofthevariouscourseoutcomes.

1. Lecturermethod(L)neednottobeonlyatraditionallecturemethod,butalternativeeffectiveteachingmethodscould beadoptedto attaintheoutcomes.
2. UseofVideo/Animationtoexplainfunctioningofvariousconcepts.
3. Encouragecollaborative(GroupLearning)Learningintheclass.
4. AskatleastthreeHOT(HigherorderThinking)questionsintheclass,whichpromotescriticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills,develop design thinking skillssuch asthe abilitytodesign, evaluate,generalize, andanalyze informationratherthan simplyrecallit.
6. IntroduceTopicsinmanifoldrepresentations.
7. Showthedifferentwaystosolvethesameproblemwithdifferentcircuits/logicandencouragethestudentsto comeupwith theirowncreativewaystosolvethem.
8. Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible,it helpsimprovethestudents'understanding.

Module - I

Introduction to Precision Agriculture:
History of Precision Agriculture and its Global, Precision Agriculture – Introduction, Need and Scope of Precision Agriculture, Components of Precision Agriculture, Tools and Techniques, Site-Specific Crop Management (SSCM, Variable Rate Application (VRA) and Variable Rate Technology (VRT, Adoption of Smart Precision Agriculture, Some Misconceptions about Precision Agriculture, Smart Intelligent Precision Agriculture: Modern Day Agriculture, Digitization of Agriculture-Digital Farming, Transition to Smart Intelligent Precision Agriculture, Benefits of Smart Intelligent Precision Agriculture.

08 Hours

Module - II

Adoption of Wireless Sensor Network (WSN) in Smart Precision Agriculture: Sensors and Wireless Sensor Network, Evolution of Wireless Sensor Networks, Introduction of WSN in Agriculture, Features of Agriculturally Based Sensors, Types of Sensors Used for WSN Agricultural System, Intelligent Sensors Versus Smart Sensors, Impact of the Wireless Sensors on Traditional Agriculture, Sensor Based Variable Rate Application,, Applications of WSN in Precision Agriculture, Security Issues and Challenges for WSN Implementation. **IoT (Internet of Things) Based Agricultural Systems:** Introduction, Architecture of IoT, Brief Overview of IoT Network, Characteristics of Internet of Things, Inter-Operability Challenges, Applications of IoT in Smart Agriculture, Challenges for the Implementation of IoT in Smart Farming, Security and Privacy Issues of an IoT, Fusion of Cloud Platform with IoT.

08 Hours

Module - III

AI (Artificial Intelligence) Driven Smart Agriculture: Artificial Intelligence (AI) – Introduction, Categories of AI, Subsets of AI,Life Cycle of an Artificial Intelligence-Based, Prerequisites for Building an ML/AI-Based Agricultural

Model, Advantages of A.I in Agriculture. **Machine Learning (ML) Driven Agriculture:** Cognitive Technologies, Introduction to Machine Learning, Types of ML, Artificial Neural Networks and Deep Learning, General Applications of Machine Learning, Scope of Artificial Intelligence and Machine Learning in Agriculture, Applications of A.I and M.L in Agriculture..

08 Hours

Module - IV

Data-Driven Smart Farming: Introduction, Collection and Management of Real-Time Agricultural Big Data, Transforming Field Data into Meaningful Insights, Processing and Predictive Analysis of Agricultural Data, Predictive Modeling. Decision-Making and Decision-Support Systems: Introduction, Intelligent Agricultural Decision Support Systems (ADSS), Features and Workings of an Intelligent Agricultural Decision Support System (ADSS), Intelligent Decision-Making using AI, ML, and IoT for Farmers.

08 Hours

Module - V

Agriculture 5.0 – The Future: Introduction to Agriculture 4.0, Nanotechnology and Smart Farming, Block chain -Securing the Agriculture Value Chain, Edge-Fog Computing for Smart Farming, Role of Big Data in Agriculture, Transition to Agriculture. Social and Economic Impacts: Societal and Economic Impact of AI, ML, and IoT in Intelligent Precision Farming, Existence of Forums for Innovation and Commercialization of Intelligent Precision Farming Technology (IPFT). Environmental Impact and Regulations: Potential Impact on the Environment with Different IPFT, Policy Making and Governance.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

COURSE OUTCOMES:

On completion of the course, students will be able to:

- Describe about Artificial Intelligence in precision agriculture
- Analyze the WSN and IoT based Agricultural systems
- Design AI and ML Driven system for agriculture
- Apply the key aspects of data driven and decision making & support systems.in agrkiculture
- Discuss AI, its current scope and limitations, and societal implications.

AssessmentDetails (both CIE andSEE)

Component		**Weightage(%)**	
CIE's	CIE15thweek	20	60
	CIE210thweek	20	
	CIE315thweek	20	
AAT's	AAT-110thweek	10	
	AAT-2	10	
	AAT-3	20	
ContinuousInternalEvaluationTotalMarks:100.Reducedto50Marks			
SemesterEndExamination(SEE)TotalMarks:100.Reducedto50 Marks			

TEXT BOOKS:

1. Latief Ahmad and FirasathNabi:Agriculture 5.0, Artificial intelligence, IoT and machine learning, Taylor & Francis,1st edition,2021.
2. Rajesh Singh, Anita Gehlot, Mahesh Kumar Prajapat, Bhupendra Singh, Artificial Intelligence In Agriculture, 2021.

REFERENCE BOOKS:

1. K.C. Ting, S. Panigrahi : Artificial Intelligence for Biology and Agriculture, 1998.
2. Gurjit Kaur, Pradeep Tomar : Artificial Intelligence and IoT-Based Technologies for Sustainable Farming and Smart Agriculture, 2019.

WEB REFERENCES:

1. https://www.digimat.in/nptel/courses/video/126104002/L05.html
2. https://www.cropin.com/precision-agriculture
3. https://eos.com/blog/precision-agriculture/
4. https://www.nifa.usda.gov/grants/programs/precision-geospatial-sensor-technologies-programs/precision-agriculture-crop-production
5. https://www.mccormick.it/as/precision-farming/

CO- PO Mapping :

POS / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3		3										
CO2	2	3		3	3								2	2	3
CO3	3		3		3								3	2	3
CO4	3		3		3								3	2	3
CO5	3	3		3											

Social Media Analytics

Course Code:	21CIT743	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50
TotalHoursofPedagogy	40T+20 P	TotalMarks	100
Credits	03	ExamHours	03

Description of the course:

This course will introduce concepts and approaches to mining social media data. It focuses on obtaining and exploring those data, mining networks, and mining text from social platforms. Students will learn how to apply previously learned data mining concepts to a domain that will likely be familiar to all of them: social media. Students will learn to explore, model, and predict with network and textual data from existing social platforms.

Prerequisite: GraphTheory, DataMining,Python/Rprogramming

CourseLearningObjectives:

This course will enable students to:

- Familiarizethelearners withtheconceptofsocialmediaanalyticsandunderstand itssignificance.
- Enablethelearnersto developskillsrequiredfor analyzingtheeffectivenessof socialmedia.
- Familiarizethelearnerswithdifferenttoolsofsocialmediaanalytics.
- Familiarizethelearnerwithdifferentvisualizationtechniquesforsocialmedia analytics.
- Examinetheethicalandlegalimplicationsofleveragingsocialmediadata

Syllabus

Module– I

SocialMediaAnalytics:AnOverview:

CoreCharacteristicsofSocialMedia,TypesofSocialMedia,Socialmedia landscape, Need for Social Media Analytics (SMA), SMA insmall&largeorganizations.

Purpose of Social Media Analytics, Social Media vs. TraditionalBusiness Analytics, Seven Layers of Social Media Analytics, TypesofSocialMediaAnalytics,SocialMediaAnalyticsCycle,ChallengestoSocial MediaAnalytics, Social MediaAnalytics Tools **08 hours**

Module–II

SocialNetworkStructure,Measures&Visualization

Basics of Social Network Structure - Nodes, Edges & TieDescribing the Networks Measures - Degree Distribution, Density,Connectivity,Centralization, TieStrength&Trust

NetworkVisualization-Graph Layout,VisualizingNetworkfeatures,ScaleIssues.

Social Media Network Analytics - Common Network Terms,Common Social Media Network Types, Types of Networks,CommonNetworkTerminologies,NetworkAnalyticsTools.**08hours**

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– III

SocialMediaText,Action&HyperlinkAnalytics AnalysisTools

SocialMediaActionAnalytics-What IsActions Analytics?CommonSocialMediaActions,ActionsAnalytics Tools

Social Media Hyperlink Analytics - Types of Hyperlinks, Types ofHyperlinkAnalytics, Hyperlink AnalyticsTools.

08hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– IV

SocialMediaLocation&SearchEngineAnalytics Location Analytics - Sources of Location Data, Categories ofLocationAnalytics,LocationAnalyticsandPrivacyConcerns,LocationAnalytics Tools

SearchEngineAnalytics-TypesofSearchEngines,SearchEngineAnalytics,Search EngineAnalyticsTools

08hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

Module– V

SocialMediaAnalyticsApplicationsandPrivacysocial mediainthe publicsector –Analyzingpublicsectorsocialmedia,analyzingindividual users, casestudy. BusinessuseofSocial Media -Measuringsuccess,Interactionandmonitoring,casestudy. Privacy - Privacy policies, data ownership and maintaining privacyonline

08 hours

Teaching Learning Methodology: Chalk & Talk, Python IDE

CourseOutcomes:

On completion of this course, the students will be able to:

- Understandthe conceptofsocialmedia
- UnderstandtheconceptofsocialmediaAnalytics anditssignificance
- Learnerswillbeableto analyzethe effectiveness ofsocialmedia
- Learnerswillbeabletousedifferentsocialmedia analyticstoolseffectivelyand
- Efficiently
- LearnerswillbeabletousedifferenteffectiveVisualizationtechniquestorepresent socialmediaanalytics

Text Books:

1. Seven LayersofSocialMediaAnalytics_MiningBusinessInsightsfrom SocialMediaText,Actions,Networks,Hyperlinks,Apps,SearchEngine,andLocationData,Gohar F.Khan,(ISBN-10:1507823207).
2. Analyzingthe Social Web 1stEdition byJenniferGolbeck
3. MiningtheSocialWeb_AnalyzingData fromFacebook,Twitter, LinkedIn,and OtherSocialMediaSites,MatthewARussell, O'Reilly

References:

1. SocialMediaAnalytics[2015],Techniquesand InsightsforExtractingBusinessValue OutofSocialMedia,MatthewGanis,AvinashKohirkar,IBMPress
2. SocialMediaAnalyticsStrategy_UsingDatatoOptimizeBusinessPerformance,Alex Gonçalves,APressBusinessTeam
3. SocialMediaDataMiningandAnalytics, Szabo,G., G.Polatkan, O. Boykin&A.
4. Chalkiopoulus(2019),Wiley, ISBN978-1-118-82485-6

UsefulLinks

https://cse.iitkgp.ac.in/~pawang/courses/SC16.html
https://onlinecourses.nptel.ac.in/noc20_cs78/preview
https://nptel.ac.in/courses/106106146
https://7layersanalytics.com

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												**PROGRAM SPECIFIC OUTCOMES (PSO'S)**		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	2	3							2	3	2	3
CO2	3	2	2	3	3							3	2	2	2
CO3	3	2	3	2	2							2	3	3	2
CO4	3	3	2	2	3							2	2	2	3
CO5	3	3	2	3	2							2	3	3	2
Avg	3	2.6	2.2	2.4	2.6							2.2	2.6	2.4	2.4

ROBOTIC PROCESS AUTOMATION			
Course Code	**21CIT744**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P:S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Basic Programming Concepts, Electronic Circuits

Course Objectives:

Tounderstand the RPA and the ability to differentiate it from other types of automation
To model the sequences and the nesting of activities.
To make use of exception handling techniques to handle the log errors.
To carry out experiment with workflow in a manner to get the optimized output from a Bot.

Teaching-Learning Process (General Instructions)

ThesearesampleStrategies;whichteacherscanuseto acceleratetheattainmentofthevariouscourseoutcomes.

1. Lecturermethod(L)neednottobeonlyatraditionallecturemethod,butalternativeeffectiveteachingmethodscould beadoptedto attaintheoutcomes.
2. UseofVideo/Animationtoexplainfunctioningofvariousconcepts.
3. Encouragecollaborative(GroupLearning)Learningintheclass.
4. AskatleastthreeHOT(HigherorderThinking)questionsintheclass,whichpromotescriticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills,develop design thinking skillssuch asthe abilitytodesign, evaluate,generalize, andanalyze informationratherthan simplyrecallit.
6. IntroduceTopicsinmanifoldrepresentations.
7. Showthedifferentwaystosolvethesameproblemwithdifferentcircuits/logicandencouragethestudentsto comeupwith theirowncreativewaystosolvethem.
8. Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible,it helpsimprovethestudents'understanding.

Module - I

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. **RPA BASICS:** History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

08 Hours

Module - II

RPA TOOL INTRODUCTION AND BASICS: Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.

08 Hours

Module - III

ADVANCED AUTOMATION CONCEPTS & TECHNIQUES: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

08 Hours

Module - IV

HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING: What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. **EXCEPTION HANDLING:** Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

08 Hours

Module - V

DEPLOYING AND MAINTAINING THE BOT: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.

08 Hours

Teaching-LearningProcessforallmodules	Chalkandboard,ActiveLearning,PPTBasedpresentation,Video

COURSE OUTCOMES:

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

CO 1: Describe RPA, where it can be applied and how it's implemented.

CO 2: Describe the different types of variables, Control Flow and data manipulation techniques.

CO 3: Identify and understand Image, Text and Data Tables Automation.

CO 4: Describe how to handle the User Events and various types of Exceptions and strategies.

CO 5: Understand the Deployment of the Robot and to maintain the connection

AssessmentDetails (both CIE andSEE)

Component		**Weightage(%)**	
CIE's	CIE1 15th week	20	60
	CIE2 10th week	20	
	CIE3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
ContinuousInternalEvaluationTotalMarks:100.Reducedto50Marks			
SemesterEndExamination(SEE)TotalMarks:100.Reducedto50 Marks			

TEXT BOOKS:

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, 2018.

REFERENCES:

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, 1st Edition 2018.
3. SrikanthMerianda,"Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software

robots and automate business processes", Packt Publishing, 1st Edition 2018.

WEB REFERENCES:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

DATA VISUALIZATION					
CourseCode:	21CIT745	CIEMarks	50		
TeachingHours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50		
TotalHoursofPedagogy	40T	TotalMarks	100		
Credits	03	ExamHours	03		

Course Description:
In this course, you will learn the Grammar of Graphics, a system for describing and building graphs, and how the ggplot2 data visualization package for R applies this concept to basic bar charts, histograms, pie charts, scatter plots, line plots, and box plots.

Prerequisites:
Basic knowledge of programming, data handling and various graphs.

Objectives:
As a student will be able to:
1) Learn how to generate basic visualizations.
2) Understand the limitations and advantages of using certain visualizations.
3) Develop interactive visualizations and applications.
4) Understand various data exploratory functions in R.
5)Learn ways of presenting the data to our audience.

Syllabus

Module – I

Introduction to R Programming: A Simple Guide to R: Installing packages and getting help in R, Data types & Special values in R, Matrices and editing in R, Data frames and editing in R, Importing and exporting data in R, Writing function and inbuilt functions in R, Loops and control statements in R, Using par to beautify and saving plots in R. Basic and Interactive Plots: Introducing a scatter plot, Scatter plots with texts, labels, and lines, Connecting points and generating interactive scatter plot, Simple and interactive bar plot, Simple line plot, Generating an interactive Gantt/timeline chart in R, Merging histograms, Making an interactive bubble plot, Constructing a waterfall plot in R. **8 Hours**

Teaching Learning Methodology: Chalk & Talk

Module – II

Maps and Dendrograms: Heat Maps and Dendrograms: Introduction, Constructing a simple dendrogram, Creating dendrograms with colors and labels, Creating and generating heat map with customized colors, Generating an integrated dendrogram and a heat map, Creating a three-dimensional heat map and a stereo map, Constructing a tree map in R, Maps: Introduction, Regional maps, Choropleth maps, A guide to contour maps, Constructing maps with bubbles, Integrating text with maps, Introducing shape files, Creating cartograms **8 Hours**

Teaching Learning Methodology: Chalk & Talk

Module – III

The Pie Chart and Adding 3D: The Pie Chart and its alternatives: Introduction, generating a simple pie chart, constructing pie charts with labels, creating donut plots and interactive plots, generating a slope chart, Constructing a fan plot. Adding the Third Dimension: Introduction, constructing a 3D scatter plot, generating a 3D scatter plot with text, a simple 3D pie chart, a simple 3D histogram, generating a 3D contour plot, integrating a 3D contour and a surface plot, Animating a 3D surface plot. **8 Hours**

Teaching Learning Methodology: Chalk & Talk

Module – IV

Higher Dimensions Data and Visualization: Data in Higher Dimensions: Introduction, constructing a sunflower plot, creating a hexbin plot, generating interactive calendar maps, Creating Chernoff faces in R, constructing a coxcomb plot in R, constructing network plots, constructing a radial plot, Generating a very basic pyramid plot. Visualizing Continuous Data: Introduction, generating a candlestick plot, generating interactive candlestick plots, generating a decomposed time series, plotting a regression line, constructing a box and whiskers plot, generating a violin plot, generating a quantile-quantile plot (QQ plot), Generating a density plot, Generating a simple correlation plot.

8 Hours

Teaching Learning Methodology: Chalk & Talk

Module – V

Visualizing Text and Creating Applications: Visualizing Text and XKCD-style Plots: Introduction, generating a word cloud, constructing a word cloud from a document, generating a comparison cloud, constructing a correlation plot and a phrase tree, generating plots with custom fonts, Generating an XKCD-style plot. Creating Applications in R: Introduction, creating animated plots in R, creating a presentation in R, a basic introduction to API and XML, constructing a bar plot using XML in R, Creating a very simple shiny app in R.
8 Hours

Teaching Learning Methodology: Chalk & Talk

Course Outcomes:

Students will be able to:

- Implement different methods of Data visualization.
- Describe and design maps and dendrograms using R.
- Create and generate the pie chart and 3D plots.
- Describe high dimensional data and visualize continuous data.
- Visualize the text and create applications in R.

Textbooks:

1) R Data Visualization Cookbook – AtmajitsinhGohil, Published by Packet Publishing Ltd., January 2015
2) The Book of R – Tilman M. Davies, No Starch Press, Inc.

Reference Books:

1) Data Visualization with R - Rob Kabacof, Open source publications, 2018
2) R for Dummies - Andrie de Vries and JorisMeys, Published by: John Wiley & Sons, Inc., 2015
3) Data Visualization with R – Thomas Rahlf, Springer publications, 2014
4) Data Analysis and Graphics using R – John Malndonald and W John Braun, Cambridge University Press Publications, 3rd Edition, 2010.

E-RESOURCES:

https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/

https://www.youtube.com/watch?v=49fADBfcDD4

https://www.datakwery.com/resources/data-visualization-with-r/

Deep Learning

CourseCode:	21CIT753	CIEMarks	50
TeachingHours/Week(L:T:P:S)	3:0:0:0	SEEMarks	50
TotalHoursofPedagogy	40T+20 P	TotalMarks	100
Credits	04	ExamHours	03

Description of the course:

In this course students are introduced to the architecture of deep neural networks, algorithms that are developed to extract high-level feature representations of data. In addition to theoretical foundations of neural networks, including backpropagation and stochastic gradient descent, students get hands-on experience building deep neural network models with Python

Prerequisite:

Goodprogrammingskillsanddebuggingskills.

Knowledgeon neural networks.

CourseLearningObjectives:

This course will enable students to:

The main objective of this course is to make students comfortable with tools and techniques required in handling large amounts of datasets. They will also uncover various deep learning methods in NLP, Neural Networks etc. Several libraries and datasets publicly available will be used to illustrate the application of these algorithms. This will help students in developing skills required to gain experience of doing independent research and study.

Syllabus

Module– I

Introduction to Deep Learning: Introduction to Deep Learning, Brief History of Deep Learning, AI, Machine Learning and Deep Learning, Statistical Learning, Bayesian Learning, Decision Surfaces, Success stories of Deep Learning.

08hours

Teaching Learning Methodology: Chalk & Talk

Module–II

Linear Classifiers: Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization, Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

08hours

Teaching Learning Methodology: Chalk & Talk

Module– III

Neural Network: Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, LSTM Networks, NN in python.

08hours

Teaching Learning Methodology: Chalk & Talk

Module– IV

Deep Neural Net: Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization,Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN, CNN in Python

08hours

Teaching Learning Methodology: Chalk & Talk

Module– V

Practical areas of Deep Learning: Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection, Generative Modeling with DeepLearning,VariationalAutoencoder, Generative Adversarial Network, Object recognition with Python.

08 hours

Teaching Learning Methodology: Chalk & Talk

CourseOutcomes:

On completion of this course, the students will be able to:

Expert knowledge in solving real world problems using state-of-art deep learning techniques

SlNo	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text book				
1	Deep Learning	Ian Goodfelllow, YoshuaBenjio, Aaron Courville	MITPress	2016
2	Pattern Classification	Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley &SonsInc.	'A wiley-Interscience Publication	2nd Editio n
Reference Books				
1	Deep Learning: A Practitioner's Approach	Josh Patterson & Adam Gibson	OReilly Press	2017
2	Python Deep Learning: Exploring deep learning techniques and neural network architectures with PyTorch, Keras, and TensorFlow	Ivan Vasilev	Pakt Publication	2nd Edition
3	Deep learning with Python	Francois Chollet	Manning Publications.	2017

E-RESOURCES:

- **https://nptel.ac.in/courses/106/105/106105215/**
- https://www.slideshare.net/LuMa921/deep-learning-a-visual-introduction
- https://yiqiaoyin.files.wordpress.com/2018/02/deep-learning-notes.pdf

CO-PO Mapping:

	PROGRAM OUTCOMES (PO's)												PROGRAM SPECIFIC OUTCOMES (PSO'S)		
COURSE OUTCOMES (CO's)	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	3	2	2	3							2	3	2	3
CO2	3	3	2	2	3							1	3	2	3
CO3	3	3	2	2	3							2	3	2	2
CO4	3	3	3	3	3							2	3	2	3
CO5	3	2	2	2	3							1	3	2	2
Avg	3	2.8	2.2	2.2	3							1.6	3	2	2.6