K. D. K. College of Engineering, Nagpur

Scheme and Syllabus for
Master of Computer Application

Submitted by
Board of Studies in Computer Application

Vision of the Institute

Service to the Society through Quality Technical Education

Mission of the Institute

M1 Academic excellence in Engineering and Technology through complete dedication to all round growth of young students.

M2 Enable the students to develop into outstanding professionals with technical competence and managerial skills.

M3 Fulfill the expectance of the society and Industry with high ethical standards for developing sustainable solutions.

Vision of the Department

To pursue excellence in High quality education, research and innovation through team work with an emphasis on computer applications/ software development for the advantage of the IT industry, scholars and society.

Mission of the Department

The Department of Master of Computer Application is employed with the mission to excel in imparting best education with devoted and motivated faculty.

1. To provide a dynamic learning environment that nurtures innovation in order to solve the challenges facing the world.
2. Increasing the prospective of the scholars for overall growth with technical skill and administration skills.
3. Empowering scholars to shape proficient career by imbibing societal as well as principled ethics as inner Strength.

Scheme MCA-Second Year											
Semester-III- 2025-26											
Category	**Course Code**	**Theory/ Practical**	**Teaching Scheme (Hours/ Week)**		**Credit**	**Examination Scheme**				
						Theory			**Practical**	
			Th	**P**		**Exam Hrs**	**CA**	**ESE**	**CA**	**ESE**
PCC	3PGMC01T	Python Programming	3	-	3	3	40	60	-	-
PCC	3PGMC01P	Python Lab	-	2	1	-	-	-	25	25
PCC	3PGMC02T	Optimization Technique	3	-	3	3	40	60	-	-
PCC	3PGMC03T	Machine Learning	3	-	3	3	40	60	-	-
PCC	3PGMC03P	Machine Learning -Lab	-	2	1	-	-	-	25	25
PEC	3PGMC04T	Refer Basket (Elective - III)	3	-	3	3	40	60	-	-
PCC	3PGMC05T	Software Testing	2	-	2	2	20	30	-	-
PRJ	3PGMC06P	Industry based Mini Project		6	4	-	-	-	75	75
		Total	**15**	**10**	20	-	180	270	125	125
						Total Marks(Theory & Practical)	**450**		**250**	
						Total Marks IIIrd Sem:	**700**			

Scheme MCA-Second Year										
Semester-IV- 2025-26										
Category	**Course Code**	**Theory/ Practical**	**Teaching Scheme (Hours/ Week)**		**Credit**	**Examination Scheme**				
						Theory			**Practical**	
			Th	**P**		**Exam Hrs**	**CA**	**ESE**	**CA**	**ESE**
CC	4PGMC01T	Distributed System	2	-	2	2	20	30	-	-
CC	4PGMC02T	Artificial Intelligence	2	-	2	2	20	30	-	-
Project	4PGMC03P	Major Project / Internship	-	32	16	-	-	-	300	300
		Total	**4**	**32**	**20**		**40**	**60**	**300**	**300**
					Total Marks(Theory & Practical)		**100**		**600**	
					Total Marks IVth Sem:		**700**			

CREDIT FRAMEWORK STRUCTURE

Semester		I	II	III	IV	Total Credits
Programme Core Course (PCC)	Program Courses	13	6	13	4	36
Programme Elective Course (PEC)		4	3	3	--	10
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	03	3	--	--	6
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	--	--	--	--	--
Entrepreneurship/ Economics/ Management Courses		--	--	--	--	--
Indian Knowledge System (IKS)		--	--	--	--	--
Value Education Course (VEC)		--	--	--	--	--
Research Methodology	Experiential Learning Courses	04	1	--	--	4
Comm. Engg. Project(CEP)/ Field Project (FP)		--	--	--	--	1
Project		--	--	4	16	20
Internship/ OJT		--	4	--	--	4
Co-curricular Courses (CC)	Liberal Learning Courses	--	--	--	--	--
Total Credits (Major)		**24**	**17**	**20**	**20**	**81**

Basket Elective –III

Subject Code	Name of Subject
3PGMC04T-A	Big Data Analytics
3PGMC04T-B	Green Computing
3PGMC04T-C	Data Warehousing and Mining

KDK College of Engineering, Nagpur
Faculty of Science & Technology
Master of Computer Application

Semester III	Subject Code: 3PGMC01T	Name of Subject: Python Programming	
Total Hours Distribution per week			
Total Credit: 3	Lecture (L): 3 Hrs	Tutorial (T): --	Practical (P): --
Examination Scheme			
Continual Assessment	End Sem Examination	Total Marks	Examination Duration:
40 Marks	60 Marks	100 Marks	3 Hours

Course Objectives	
1	Learn the syntax and semantics of Python Programming Language.
2	Write Python functions to facilitate code reuse and manipulate strings.
3	Illustrate the process of structuring the data using lists, tuples and dictionaries.
4	Demonstrate the use of built-in functions to navigate the file system.

Course Outcomes	
After completion of syllabus, the student is able to	
CO1	Ability to execute Python programs interactively and through scripts.
CO 2	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
CO 3	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
CO 4	Work with Databases and Develop GUI Applications
CO 5	Develop basic real-world applications using object-oriented programming concepts in Python.

	Course Competencies
1	A basic understanding of Python's syntax, including variables, data types
2	Proficiency in using lists, tuples, dictionaries, and sets is crucial for organizing and manipulating data within Python programs.
3	Understanding concepts like classes, objects, inheritance, and polymorphism is vital for building complex and maintainable code.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	1	2	3
CO2	3	2	3	2	2	1	2	2
CO3	2	3	2	2	3	1	2	3
CO4	3	2	3	3	3	1	2	3
CO5	3	2	3	2	2	2	1	2

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Python Basics		
Python Basics: Python interpreter, Python idle, dynamically typed and strongly typed features, basic data types, variables, expressions, statements, operators, flow of execution. Input and Output statements.	8	CO1
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else).		
Iteration: while, for, break, continue, pass, implementing 'for' through range(), 'in' and 'not in' operators for sequence traversal. Creatin and executing scripts.		
Unit 2: Python Collections and String Manipulation		
Data Structures: Lists- a end, extend, insert, index, remove, o , count, sort, reverse, slicing, list comprehension,	8	CO2
Copying a list: deep copy, shallow copy. Tuples- index, count, usage, use of tuples as a swap function. Dictionaries-keys, values, tuples, nested dictionaries, dictionary comprehension.		
Strings- Single line and multi-line strings, formatter, isdigit, isalpha, isalnum, islower, istitle, isspace, title, lower, upper, strip, split, splitlines, join etc.		
Sets — union, intersection, subset, superset, difference, symmetric difference, copy, add, remove, discard etc.		
Unit 3: Python Functions and File Operations		
Functions & File Handling: Inbuilt Functions- id, len, chr, ord etc., defining and calling a function, arguments, global versus local variables, defining and using lambda functions, the map(), filter(), reduce() functions.	7	CO3
Working with files: read, write and append modes: r, w, a, r+, w+, a+, reading-read(), readline(), readlines(), writing-write(), writelines(), seek(), tell(). Word count, copy file scripts through file handling concepts.		
Unit 4: Object-Oriented Programming, Exception Handling		
Classes, modules and exceptional handling: Classes: Introduction, Member variables and defining methods, constructor, destructor, data encapsulation, inheritance, multiple inheritance. Exceptional Handling: The try-except-else-finally block, the raise statement, the hierarchy of exceptions, adding exceptions.	7	CO4
Unit 5: Database & GUI Programming		
Database & GUI Programming: importing sqlite, connecting to database, creating table, insert, select, update, delete, drop tables, accessing and modifying tables through python.	6	CO5
Graphical user interfaces: creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.		

Text Books

1. Liang Y. Daniel – "Introduction to Programming Using Python"
2. Charles Dierbach – "Introduction to Computer Science Using Python"
3. Zed A. Shaw – "Learn Python the Hard Way"

References Books

1. "Data Structures and Algorithms in Python"- Michael T. Goodrich
2. "Python Programming: A Modular Approach" – Taneja Sheetal & Kumar Naveen

			June 2025	1.00	Applicable for AY 2025-26 onwards
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Semester III	Subject Code: 3PGMC01P	Name of Subject: Practical 1- Python Lab	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L): -	Tutorial (T): -	Practical (P): 2 Hrs

Examination Scheme		
Continual Assessment	**End Sem Examination**	**Total Marks**
25 Marks	25 Marks	50 Marks

Course Objective	
To enable students to solve problems and develop applications using Python, potentially in areas like data science, web development, or scripting.	
Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	Students will learn the fundamental rules of Python, including variable assignment, data types, and control flow.
CO2	Students will learn to use lists, tuples, dictionaries, and other data structures to organize and manipulate data.
CO3	Students will learn how to define and use functions, and how to import and utilize Python modules.
CO4	Students will gain an understanding of concepts like classes, inheritance, and polymorphism.
CO5	Students will Developing a game activity using Pygame.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	1	2	3
CO2	2	3	3	2	2	2	1	2
CO3	3	2	2	2	3	1	2	3
CO4	3	3	3	3	3	1	2	3
CO5	2	2	3	2	2	1	1	2

Pr. No.	List of Practical's
1	Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2	Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
3	Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
4	Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
5	Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
6	Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
7	Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
8	Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
9	Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
10	Developing a game activity using Pygame like bouncing ball, car race etc.

Text Books

1. Liang Y. Daniel – "Introduction to Programming Using Python"
2. Charles Dierbach – "Introduction to Computer Science Using Python"
3. Zed A. Shaw – "Learn Python the Hard Way"

References Books

1. "Data Structures and Algorithms in Python"- Michael T. Goodrich
2. "Python Programming: A Modular Approach" – Taneja Sheetal & Kumar Naveen

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Semester III	Subject Code: 3PGMC02T	Name of Subject: Optimization Technique	
Total Hours Distribution per week			
Total Credit: 3	Lecture (L): 3 Hrs	Tutorial (T): --	Practical (P): --
Examination Scheme			
Continual Assessment	**End Sem Examination**	**Total Marks**	**Examination Duration:**
40 Marks	60 Marks	100 Marks	3 Hours

	Course Objectives
1	To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
2	Constrained and unconstrained optimization techniques for solving and optimizing electrical and electronic engineering circuits design problems in real world situations.
3	To explain the concept of Dynamic programming and its applications to project implementation.

	Course Outcomes
After completion of syllabus, the student is able to	
CO1	Understand optimization function surface.
CO2	Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem.
CO3	Apply unconstrained optimization and constrained non-linear programming and dynamic programming.
CO4	Formulate optimization problems and explain the need of optimization of engineering systems.
CO5	Understand and apply dynamic programming concepts including multistage decision processes, principle of optimality, and computational procedures to solve problems using tabular and calculus-based methods.

	Course Competencies
1	Students learn to translate real-world scenarios into mathematical optimization models, including defining objective functions, constraints, and decision variables.
2	The course covers various types of optimization problems, such as linear programming, non-linear programming, and multi-objective optimization.
3	The course introduces met heuristic methods like genetic algorithms, simulated annealing, and particle swarm optimization.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	1	-	3	-	-	3
CO2	2	3	1	-	2	-	-	2
CO3	3	2	2	-	3	-	-	3
CO4	2	3	2	-	3	-	-	2
CO5	3	3	2	-	2	-	-	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Introduction and Classical Optimization Techniques		
Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surface – classification of Optimization problems.	8	CO1
Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.		
Unit 2: Transportation & Assignment problem		
Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. Degeneracy.	7	CO2
Assignment problem – Formulation – Optimal solution – Variants of Assignment Problem; Traveling Salesman problem.		
Unit 3: Classical and Nonlinear Optimization Techniques		
Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints: Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints: Kuhn – Tucker conditions. Single Variable Nonlinear Unconstrained Optimization: Elimination methods: Uni Model function-its importance, Fibonacci method & Golden section method.	8	CO3
Unit 4: Nonlinear Optimization and Dynamic Programming		
Multi variable nonlinear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell's, Hooke – Jeeves, Rosenbrock's search methods. Gradient methods: Gradient of function & its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.	7	CO4
Unit 5: Dynamic Programming		
Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution – examples illustrating the tabular method of solution.	6	CO5

Text Books

1. Optimization Techniques & Applications by S.S. Rao, New Age International.
2. Optimization for Engineering Design by Kalyan Moy Deb, PHI
3. Optimization Techniques Theory and Practice by M.C. Joshi, K.M. Moudgalya, NarosaPublications

References Books

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in Operations Research 3rd edition, 2003.
2. H. A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Optimization Techniques by Belegundu & Chandrupatla, Pearson Asia.

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Semester III	Subject Code: 3PGMC03T	Name of Subject: Machine Learning	
Total Hours Distribution per week			
Total Credit: 3	**Lecture (L): 3 Hrs**	**Tutorial (T) : --**	**Practical (P): --**
Examination Scheme			
Continual Assessment	**End Sem Examination**	**Total Marks**	**Examination Duration:**
40 Marks	**60 Marks**	**100 Marks**	**3 Hours**

Course Objectives	
1	Acquire theoretical Knowledge on setting hypothesis for pattern recognition.
2	Apply suitable machine learning techniques for data handling and to gain knowledge from it
3	Evaluate the performance of algorithms and to provide solution for various real world applications.
Course Outcomes	
After completion of syllabus, the student is able to	
CO1	Recognize the characteristics of Machine Learning techniques that enable to solve real world problems
CO2	Recognize the characteristics of machine learning strategies and Apply various supervised learning methods to appropriate problems
CO3	Identify and integrate more than one techniques to enhance the performance of learning & Create probabilistic and unsupervised learning models for handling unknown pattern.
CO4	Analyze the co-occurrence of data to find interesting frequent patterns
CO5	Apply genetic algorithms and evolutionary models to hypothesis space search, utilizing genetic operators, fitness functions
Course Competencies	
1	A basic understanding of Machine Learning techniques that enable to solve real world problems
2	Proficiency machine learning strategies and Apply various supervised learning methods to appropriate problems.
3	Understanding integrate more than one techniques to enhance the performance of learning & create probabilistic and unsupervised learning models.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	3	2	3	2	3
CO2	3	3	2	3	3	3	2	2
CO3	2	3	3	2	3	2	1	3
CO4	3	2	2	3	2	3	2	3
CO5	2	3	2	3	3	2	3	2

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Foundations of Machine Learning and Learning Models	8	CO1
Introduction ,Components of Learning , Learning Models, Geometric Models, Probabilistic Models, Logic Models		
Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised		
Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension.		
Unit 2: Supervised Learning and Classification Techniques	7	CO2
Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression,		
Neural Networks: Introduction, Perception, Multilayer Perception		
Support Vector Machines: Linear and Non-Linear, Kernel Functions, K Nearest Neighbors. Introduction to clustering, K-means clustering, K-Mode Clustering		
Unit 3: Ensemble Methods and Advanced Learning Techniques	8	CO3
Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: Random Forest Trees, Boosting: Adaboost, Stacking.		
Gaussian mixture models – The Expectation-Maximization (EM) Algorithm, Information Criteria,		
Nearest neighbour methods – Nearest Neighbour Smoothing, Efficient Distance Computations: the KD-Tree, Distance Measures.		
Unit 4: Reinforcement Learning and Evolutionary Algorithms	7	CO4
Introduction, Learning Task, Q Learning, Non deterministic Rewards and actions, temporal-difference learning, Relationship to Dynamic Programming, Active reinforcement learning, Generalization in reinforcement learning. Motivation, Basics of Sampling Theory: Error Estimation and Estimating Binomial Proportions, The Binomial Distribution, Estimators, Bias, and Variance		
Unit 5: Models of Evolution and Learning	6	CO5
Motivation, Genetic Algorithms: Representing Hypotheses, Genetic Operator, Fitness Function and Selection, An Illustrative Example, Hypothesis Space Search, Genetic Programming		
Models of Evolution and Learning: Lamarkian Evolution, Baldwin Effect, Parallelizing Genetic Algorithms.		

Text Books

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar " Foundations of Machine Learning", MIT Press,2012.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.
4. MACHINE LEARNING – An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015

References Books

1. Charu C.Aggarwal,"DataClassificationAlgorithmsandApplications",CRCPress,2014
2. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press, 2014.
3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012

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Semester III	Subject Code: 3PGMC03P	Name of Subject: Practical 2- Machine Learning Lab	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L): -	Tutorial (T): -	Practical (P): 2 Hrs
Examination Scheme			

Continual Assessment	End Sem Examination	Total Marks
25 Marks	25 Marks	50 Marks

Course Objective
To provide students with hands-on experience in implementing and applying various machine learning algorithms to solve real-world problems.

Course Outcomes	
After successful completion of this course the students will be able to:	
CO1	Understand the implementation procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Identify and apply Machine Learning algorithms to solve real world problems.
CO5	Understand and implement the fundamental concepts of supervised and unsupervised learning algorithms using suitable programming tools.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	1	2	3
CO2	2	3	2	2	3	1	1	3
CO3	3	3	3	2	3	1	2	2
CO4	3	2	3	3	2	1	2	3
CO5	2	3	3	3	3	1	2	2

Pr. No.	List of Practical's
1	Write a program to Implement Support Vector Machines and Principle Component Analysis
2	Write a program to Implement Principle Component Analysis
3	Exploratory Data Analysis for Classification using Pandas or Matplotlib.
4	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
5	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
6	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
7	Write a program to implement Categorical Encoding, One-hot Encoding
8	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
9	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
10	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set

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Semester III	Subject Code: 3PGMC04T-A	Name of Subject: Big Data Analytics (Elective-III)	
Total Hours Distribution per week			
Total Credit: 3	Lecture (L): 3 Hrs	Tutorial (T) : --	Practical (P): --

Examination Scheme			
Continual Assessment	End Sem Examination	Total Marks	Examination Duration:
40 Marks	60 Marks	100 Marks	3 Hours

	Course Objectives
1	To know the fundamental concepts of big data and analytics.
2	To explore tools and practices for working with big data.
3	To learn about stream computing.
4	To know about the research that requires the integration of large amounts of data.

	Course Outcomes
After completion of syllabus, the student is able to	
CO1	Understand big data phenomena and its applications
CO2	Understand New SQL system concepts and databases.
CO3	Apply Hadoop ecosystem tools to implement big data related case studies Implement distributed storage and big data processing concepts using open-source tools like Hadoop.
CO4	Understanding Eval Function and Cassandra.
CO5	Discuss about Jasper and Cassandra

	Course Competencies
1	Proficiency in languages like Python, R, and SQL for data manipulation and analysis.
2	Understanding and working with relational databases (SQL) and non-relational databases (NoSQL) for data storage and retrieval.
3	Familiarity with tools like Hadoop, Spark, and cloud-based platforms for processing large datasets.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	2	3	3	2	2	3
CO2	3	2	3	2	3	3	3	2
CO3	2	3	2	3	2	2	2	3
CO4	3	2	3	2	3	3	3	2
CO5	2	3	3	2	2	3	3	2

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Introduction to Big Data and Analytics	8	CO1
Introduction to Big Data: Types of Digital Data-Characteristics of Data.		
Evolution of Big Data, Definition of Big Data, Challenges with Big Data, 3V's of Big Data.		
Definitional traits of Big Data, Business Intelligence vs. Big Data, Data warehouse and Hadoop environment, Coexistence.		
Unit 2: NoSQL, NewSQL, and Big Data Technologies with MongoDB	7	CO2
Big Data Analytics: Classification of analytics, Data Science, Terminologies in Big Data, CAP Theorem, BASE Concept. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of big Data Analytics.NewSQL – SQL vs. NOSQL vs NewSQL. Compression. Importance of Big Data, Big Data Technologies		
Data Science, Responsibilities, Soft state eventual consistency, Data Analytics Life Cycle, No SQL databases		
Unit 3: Hadoop Ecosystem and Big Data Processing Tools	8	CO3
No SQL databases Types of Databases, Advantages: Mongo DB: Introduction, Features, Data types, Mongo DB Query language, CRUD operations, Arrays.		
Functions: Count, Sort, Limit, Skip, Aggregate, Map Reduce. Cursors, Indexes, Mongo Import,Mongo Export.		
Map Reduce: Mapper, Reducer, Combiner, Partitioner, Searching. Sorting.Hadoop Eco systems: Hive, Architecture, data type, File format, HQL, SerDe		
Unit 4: Advanced Big Data Tools	7	CO4
User defined functions Pig: Features, Anatomy, Pig on Hadoop, Pig Philosophy, Pig Latin overview – Data types,Running pig, Execution modes of Pig, HDFS commands, Relational operators Eval Functions , Complex data type, Piggy Bank, User defined Functions , Parameter substitution, Diagnostic operator		
Unit 5: JasperReports, and Cassandra	6	CO5
Jasper Report: Introduction, Connecting to Mongo DB, Connecting to Cassandra		
Cassandra: Introduction, Features, Data types, CQLSH, Key spaces, CRUD operations. Collections, Counter, TTL, Alter commands, Import and Export, Querying System tables		

Text Books

1. Big Data and Analytics, by Subhashini Chellappan Seema Acharya
2. Big Data Analytics with Hadoop 3 by Sridhar Alla
3. Harness the Power of Big Data The IBM Big Data Platform by Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan

References Books

1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses" Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, , Wiley, 2013.
2. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", P. J. Sadalage and M. Fowler, Addison-Wesley Professional,2012.
3. Hadoop: The Definitive Guide", Tom White, Third Edition, O'Reilley,2012. 7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012

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Semester III	Subject Code: 3PGMC04T-B	Name of Subject: (Elective-III) GREEN COMPUTING	
Total Hours Distribution per week			
Total Credit: 3	Lecture (L): 3Hrs	Tutorial(T): -	Practical(P):--
Examination Scheme			
Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
40 Marks	60 Marks	100 Marks	3Hours

Course Objectives	
1	To learn the fundamentals of Green Computing.
2	To analyze the Green computing Grid Framework.
3	To understand the issues related with Green compliance.
4	To study and develop various case studies.

Course Outcomes	
After completion of syllabus, the student is able to	
CO1	Discuss Green IT with its different dimensions and Strategies.
CO2	Discuss the definition and scope of green IT.
CO3	Describe Green devices and hardware along with its green software methodologies.
CO4	Discuss the various green enterprise activities, functions and their role with IT.
CO5	Describe The Concepts Of How To Manage The Grid Framework green Compliance With Necessary Components.

	Course Competencies
1	Understanding the principles of designing and managing energy-efficient data centers, including cooling technologies, server optimization, and renewable energy usage.
2	Learning how to measure and reduce the carbon footprint of IT systems and operations.
3	Evaluating the environmental and social impacts of digital technologies across their lifecycle.

CO-PO Articulating Matrix-

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	-	-	-	-	3
CO2	2	2	2	-	-	-	-	3
CO3	3	3	3	-	-	-	-	2
CO4	3	3	2	-	-	-	-	3
CO5	3	2	3	-	-	-	-	2

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Environmentally Responsible Business		
Environmentally Responsible Business: Policies, Practices, and Metrics. Business, IT, and the Environment Concerns and Sustainable Development – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Holistic Approach to Greening IT.	8	CO1
Unit 2: Environmental Sustainability:		
Dimensions, and Goals – Introduction, Environmental, Environmental Impacts of IT, Green IT, , Greening IT, Applying IT for enhancing Environmental sustainability, Green IT Standards and Eco-Labelling of IT, Enterprise Green IT strategy, Green IT: Burden or Opportunity?	7	CO2
Unit 3: Green Devices and Hardware:		
Introduction, Life Cycle of a device or hardware, Reuse, Recycle and Dispose. Green Software: Introduction, Energy-saving software techniques, Evaluating and Measuring software Impact to platform power. Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration	8	CO3
Unit 4: Green Enterprise Architecture:		
Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models. Green Enterprises and the Role of IT Introduction, Organization and Enterprise Greening, Information systems in Greening Enterprises, Greening Enterprise: IT Usage and Hardware, Inter-Organizational Enterprise activities and Green Issues, Enablers and making the case for IT and Green Enterprise.	7	CO4
Unit 5: Grid Framework Virtualization of IT systems:		
Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework. GREEN COMPLIANCE Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.	6	CO5

Textbooks

1. BhuvanUnhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence‖, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012.
3. Harnessing Green IT Principles and Practices , San Murugesan, G.R. Gangadharan Wiley Publication

References Books

1 Alin Gales, Michael Schaefer, MikeEbbers, ―Green Data Center: steps for the Journey‖, Shroff/IBM rebook, 2011. 2. John Lamb, ―The Greening of IT‖, Pearson Education, 2009.

2 Jason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry‖, Lulu.com, 2008

3 Carl speshocky, ―Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010.

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Semester III	Subject Code: 3PGMC04T-C	Name of Subject: DATA WAREHOUSING & DATA MINING (Elective-III)	
Total Hours Distribution per week			
Total Credit:3	**Lecture (L):3Hrs**	**Tutorial(T): -**	**Practical(P):--**
Examination Scheme			
Continuous Assessment	**End Sem Examination**	**Total Marks**	**Examination Duration:**
40 Marks	**60 Marks**	**100 Marks**	**3 Hours**

Course Objectives	
1	To teach principles, concepts and applications of data warehousing and data mining.
2	To introduce the task of data mining as an important phase of knowledge recovery process
3	To inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
4	To inculcate fundamental concepts that provide the foundation of data mining

Course Outcomes	
After completion of syllabus, the student is able to	
CO1	Design a data mart or data warehouse for any organization
CO2	Understand the concepts of Data Cubes and multidimensional data models.
CO3	Extract knowledge using data mining techniques.
CO4	Adapt to new data mining tools.
CO5	Explore recent trends in data mining such as web mining, spatial-temporal mining.

Course Competencies	
1	Students will grasp the fundamental principles of data warehousing, including data modeling, architecture, and the need for data integration.
2	Students will learn to design and implement data warehouses, including data marts and OLAP cubes, using various dimensional modeling techniques.
3	Students will develop skills in data analysis, including data cleaning, preprocessing, and visualization using tools like Power BI.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	3	2	2	-	2	3
CO2	3	3	3	2	2	-	2	3
CO3	3	3	3	2	2	-	2	3
CO4	3	3	3	2	2	-	2	3
CO5	3	3	3	2	2	-	2	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Data warehousing and modelling Need of Data warehouse, The cost of Warehousing Data, Foundation of Data mining, The roots of Data Mining, The Approach to Data Exploration and Data Mining. A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading	8	CO1
Unit 2: Multidimensional Data Modeling and OLAP Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models. Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	7	CO2
Unit 3: Typical OLAP Operations. Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity. Data Mining: What is Data Mining, Online Analytical Processing, Techniques used to mine the data,	8	CO3
Unit 4: Market Basket Analysis Market Basket Analysis, Limitations and challenges to DM - Data Mining unctionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture of a Typical Data Mining Systems- Classification of Data Mining Systems.	7	CO4
Unit5: Data warehousing - Algorithms & operations to create data warehouse: Designing data warehouse - Applications of data warehouse. Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers. Data Analysis and Visualization: Data Analysis: Correlation, Covariance, Rank and Percentile, Histogram and Moving Average. Data Visualization with advance Charts: Stock Chart, Surface Chart, Donut Chart, Bubble Chart and Radar Chart.	6	CO5

Textbooks

1. Jiawei Han, Micheline Kamber and Jian Pei"Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson First. impression,2014.
3. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques,3rd Edition, Morgan Kaufmann Publisher, 2012.

References Books

1. Sam Anahory, Dennis Murray:Data Warehousing in the Real World,Pearson,enth Impression,2012. 2. Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.
2. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007
3. K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice" Easter Economy Edition, Prentice Hall of India, 2006.
4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.

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Semester III	Subject Code: 3PGMC05T	Name of Subject: SOFTWARE TESTING	
Total Hours Distribution per week			
Total Credit: 2	Lecture (L): 2 Hrs	Tutorial (T): --	Practical (P): --
Examination Scheme			
Continual Assessment	End Sem Examination	Total Marks	Examination Duration:
20Marks	30 Marks	50 Marks	2 Hours

Course Objectives	
1	To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods
2	To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing
3	To learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.

Course Outcomes	
After completion of syllabus, the student is able to	
CO1	Understand the fundamental concept of Testing
CO2	Determine the role of testing in SDLC
CO3	Understand and apply black box testing techniques.
CO4	Apply the concept of Software testing and its management tools.

Course Competencies	
1	Understanding the various stages of software development, from requirements gathering to deployment, is crucial for testers to know when and how to integrate testing into the process
2	Learning about different testing methodologies, such as manual testing, automation testing, and agile testing, allows testers to choose the most appropriate approach for different projects.
3	Understanding different levels of testing, including unit, integration, system, and acceptance testing, helps testers plan their testing strategy and prioritize tasks.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Fundamentals of Testing		
Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics	6	**CO1**
Unit 2: Role of Testing in SDLC		
Review of software development models (Waterfall Models, Spiral Model, W Model, V Model) Agile Methodology and Its Impact on testing, Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic)	6	**CO2**
approaches to Testing - I Static Testing Structured Group Examinations Static Analysis Control flow & Data flow, Determining Metrics		
Unit 3: Dynamic Testing		
Dynamic Testing Black Box Testing Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques White Box Testing Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced White Box Techniques, Instrumentation and Tool Support Gray Box Testing, Intuitive and Experience Based Testing	6	**CO3**
Unit 4: Test Management and Tools		
Test Organization Test teams, tasks and Qualifications Test Planning Quality Assurance Plan, Test Plan, Prioritization Plan, Test Exit Criteria Cost and economy Aspects Test Strategies Preventive versus Reactive Approach, Analytical versus heuristic Approach Test Activity Management, Automation of Test Execution, Requirement tracker, High Level Review Types of test Tools Tools for test management and Control, Test Specification, Static Testing, Dynamic Testing, Non-functional testing Selection and Introduction of Test Tools Tool Selection and Introduction, Cost Effectiveness of Tool Introduction	6	**CO4**

Text Books

1. Software Testing: Principles and Practices by Srinivasan D and Gopalswamy R, PearsonEd, 2006
2. Foundations of Software Testing by Aditya P. Mathur – Pearson Education custom edition 2000
3. Testing Object Oriented Systems: models, patterns and tools, Robert V Binder, Addison Wesley, 1996

References Books

1. Software Engineering – A practitioner's approach by Roger S. Pressman, 5th Edition, McGraw Hill
2. The art of software testing by GJ Myers, Wiley.

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Semester III	Subject Code: 3PGMC06P	Name of Subject: Industry based Mini Project	
Total Hours Distribution per week			
Total Credit: 4	Lecture (L): -	Tutorial(T) :-	Practical(P): 6
Examination Scheme			
Continual Assessment	End Sem Examination	Total Marks	Examination Duration:
75 Marks	75 Marks	150 Marks	-

Course Objectives	
1	This course will help to get familiar with the basics of project planning, designing and development. Also, students can learn to understand technology and processes associated in software industries.

Course Outcomes	
On successful completion of the course, students will be able to:	
CO1	Implement comprehensive project planning, designing and development process.
CO2	Acquire and understand Software industry needs.
CO3	Design and develop functional project solutions using appropriate methodologies, tools, and technologies.
CO4	Demonstrate project planning, time management, and teamwork skills through collaborative development efforts
CO5	Apply theoretical knowledge to real-world problems through industry-oriented project work.

Course Competencies	
1	Application of Knowledge: Mini-projects force students to actively use and apply the concepts they've learned in class, solidifying their understanding and practical abilities.
2	Skill Development: By working on a project, students gain experience with various tools, technologies, and methodologies, honing their technical and soft skills.
3	Problem-Solving: Many mini-projects involve identifying challenges and finding creative solutions, which helps students develop critical thinking and analytical abilities.

Syllabus

Project work to be carried out under the supervision of one external guide from industry and one internal guide as appointed by project coordinator.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	2	3	3	3	3
CO2	3	3	2	3	2	2	2	3
CO3	3	2	3	2	3	3	3	2
CO4	2	3	2	3	2	3	3	3
CO5	3	2	3	2	3	3	2	2

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Semester IV	Subject Code: 4PGMC01T	Name of Subject: DISTRIBUTED SYSTEM	
Total Hours Distribution per week			
Total Credit:2	**Lecture (L):2 Hrs**	**Tutorial(T): -**	**Practical(P): --**

Examination Scheme

Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	2 Hours

Course Objectives

1	To provide hardware and software issues in modern distributed systems.
2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
3	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed
4	This course is an introduction to the design of distributed systems and algorithms that support distributed computing. It aims to provide a practical exposure into the design and functioning of existing distributed systems

Course Outcomes

After completion of syllabus, the student is able to

CO1	Understand Distributed Computing techniques, Synchronous and Processes
CO2	Design a distributed system that fulfils requirements with regards to key distributed systems properties.
CO3	Understand Distributed File Systems and Distributed Shared Memory.
CO4	Design and develop distributed applications using appropriate middleware, RPC, RMI, or socket programming.

Course Competencies

1	Students should grasp concepts like distributed computing models, concurre synchronization, consistency, and fault tolerance.
2	Understanding various distributed system architectures, including client-server, peer-to-peer, and cloud-based systems
3	Students should be able to apply design principles to develop scalable, robust, and maintainable distributed systems

CO-PO Articulating Matrix

CO_PO Mapping

	Programme Outcomes							
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	2	-	-	-	3	2
CO2	2	3	3	-	-	-	3	3
CO3	3	2	3	-	-	-	2	3
CO4	3	3	3	-	-	-	3	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Introduction:		
Distributed Computing Models, Software Concepts, Hardware Concepts, The Client-Server model, Issues in design of a distributed operating system. COMMUNICATION: Introduction to Message Passing, Advantages and features of message passing, Message format, Message Buffering, Remote Procedure Call, Extended RPC Models, Remote Object Invocation, Message Oriented Communication.	6	CO1
Unit 2: Processes And Synchronization::		
Threads, code migration, clock synchronization, logical clocks, global state, Election algorithms, mutual exclusion, And Distributed transaction. Distributed Deadlock Detection: System model, Resources vs. communication deadlocks, deadlock prevention, avoidance, detection and resolution, Centralized deadlock detection, distributed deadlock detection, path pushing and edge chasing algorithm	6	CO2
Unit 3: Distributed Shared Memory		
Introduction, General architecture of distributed shared memory, Design and implementation, Issues of DSM, Granularity, structure of shared memory space, consistency models, thrashing, advantages of DSM	6	CO3
Unit 4: File system		
Introduction, Desirable features of good distributed file system, file models, file accessing, sharing, caching methods, file replication, fault tolerance, Case Study: CORBA(CORBA RMI and Services)	6	CO4

Textbooks

1. Andrew Tanenbaum, Maarten Van Steen, "Distributed System- Principals Paradigm",PHI Publication
2. Singhal and Shivratri, "Advanced Concept in Operating Systems", McGraw Hill.

References Books

1. M. Van Steen, A.S. Tanenbaum, Distributed Systems, Third Edition, CreateSpace Independent Publishing Platform, 2017.
2. Ajay D. Kshemkalyani and Mukesh Singhal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2011.
3. .Garg VK. Elements of distributed computing. John Wiley & Sons, 2002
4. .George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, Distributed Systems: Concepts and Design, Fifth Edition, Pearson Education, 2017.
5. .Fokkink W. Distributed algorithms: an intuitive approach, Second Edition, MIT Press, 2018.

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Semester IV	Subject Code: 4PGMC02T	Name of Subject: ARTIFICIAL INTELLIGENCE	
Total Hours Distribution per week			
Total Credit: 2	**Lecture (L): 2Hrs**	**Tutorial(T): -**	**Practical(P):--**
Examination Scheme			
Continuous Assessment	**End Sem Examination**	**Total Marks**	**Examination Duration:**
20 Marks	**30 Marks**	**50 Marks**	**2 Hours**

	Course Objectives
1	Learn the basic AI approaches
2	Develop problem solving agents.
3	Perform logical and probabilistic reasoning.
4	Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

	Course Outcomes
After completion of syllabus, the student is able to	
CO1	Apply the good programming skills to formulate the solutions for computational problems.
CO2	Design and develop solutions for informed and uninformed search problems in AI.
CO3	Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area
CO4	Design and develop an Expert System that operates in a realistic problem domain and communicate effectively in a team or individual and prepare reports.

	Course Competencies
1	This includes grasping the fundamental principles of AI, such as machine learning,
2	Understanding different types of data, data collection techniques, and data analysis methods are crucial for working with AI systems.
3	Understanding the ethical implications of AI, including bias, fairness, and privacy, is essential for responsible AI development and deployment

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	3	2	1	-	-	3	3
CO2	2	2	2	1	-	-	3	2
CO3	3	3	1	2	-	-	2	3
CO4	2	3	1	1	-	-	3	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Introduction: What is AI? History & Applications, Artificial intelligence as representation & Search, Production system, Basics of problem solving: problem representation paradigms, defining problem as a state space representation, Characteristics.	7	CO1
Unit 2:Problem Solving: Heuristic search strategies-heuristic function local search and optimization problem-local search in continuous space-search with non-deterministic action-search in partially observable Environment-online search a gents and unknown environment.	6	CO2
Unit 3:Game Playing and CSP : Game theory-optimal decisions in games-alpha-beta search- monte-carlo tree search-stochastic games-partially observable games. Constraint satisfaction problem-constraint propagation- backtracking search for CSP- local search for CSP- structure of CSP.	5	CO3
Unit 4 :- Knowledge-based agents Knowledge-based agents- propositional logic-propositional theorem proving-propositional modal checking-agents based on propositional logic. First order logic-syntax and semantics-knowledge representation and engineering- inference in first –order logic-forward chaining- Backward chaining – resolution.	6	CO3

Textbooks

1. E.Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008
2. Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers
3. Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3rd Edition

References Books

1. Introduction to Artificial Intelligence – Charniak (Pearson Education)
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)",Jones and Bartlett Publishers, Inc.; 1st Edition, 2008.
3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press,2009.
4. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall,.

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Semester IV	Subject Code: 4PGMC03P	Name of Subject: Major Project/ Internship	
Total Hours Distribution per week			
Total Credit:16	Lecture (L):-	Tutorial(T): -	Practical(P): 32

Examination Scheme

Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
300 Marks	300 Marks	600 Marks	

Course Objectives
This course will help to get familiar with the basics of project planning, designing and development. Also, students can learn to understand technology and processes associated in software industries.

	Course Outcome
	On successful completion of the course, students will be able to:
CO1	Implement comprehensive project planning, designing and development process.
CO2	Acquire and understand Software industry needs.

Syllabus
Project work to be carried out under the supervision of one external guide from industry and one internal guide as appointed by project coordinator.

	Course Competencies
1	Functional competencies: Skills needed for everyday tasks, like cognitive skills, methodological skills, or technical abilities.
2	Interpersonal competencies: Communication skills, like written and verbal communication, as well as the ability to collaborate effectively.
3	Technical competencies: Specific skills related to a particular field or industry, like understanding industry regulations or best practices.

CO-PO Articulating Matrix

CO_PO Mapping								
	Programme Outcomes							
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	3	3	3	3
CO2	2	3	3	3	2	3	3	3
CO3	3	3	3	2	3	2	3	3
CO4	3	2	3	3	3	3	3	3

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