SAINTGITS COLLEGE OF ENGINEERING

Kottukulam Hills, Pathamuttom, Kottayam

AUTONOMOUS COLLEGE AFFILIATED TO

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY,

THIRUVANANTHAPURAM

SAINTGITS

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MCA

SECOND YEAR SYLLABUS – 2021 SCHEME

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Chairman - Academic Council
Saintgits College of Engineering (Autonomous)
Pathamuttom, Kottayam, Kerala - 686 532

MCA DEGREE PROGRAMME

INDEX

SEMESTER III

COURSE DESCRIPTION		
Course Code	21CA301	Course Credit: 4
Course Name	Data Science and Machine Learning	
L-T-J-P	3-1-0-0	
Pre-requisite	21CA106 Python Programming Lab	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To introduce students with data science and visualization methods.
2	To familiarize students with the standard machine learning algorithms.
3	To make students understand how machine learning algorithms actually work.
4	To familiarize students with the various evaluation metrics used in machine learning algorithms.
5	To introduce students with the actual modelling in machine learning world.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Discuss the fundamental concepts of data science and data visualization techniques.	2
CO2	Explain the basics of machine learning and use lazy learning and probabilistic learning algorithms to solve data science problems.	3
CO3	Describe decision trees, classification rules and regression methods and how these algorithms can be applied to solve data science problems.	3
CO4	Solve data science problems using neural networks and support vector machines.	3
CO5	Discuss clustering using k-means algorithm, evaluate and improve the performance of machine learning classification models.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	2	-	-	-	-	-
CO2	2	3	3	2	2	-	2	-	-	-	-	-
CO3	3	3	3	2	2	-	3	-	-	-	-	-
CO4	2	3	3	2	2	-	3	-	-	-	-	-
CO5	3	2	3	2	2	-	3	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction to Data Science - Data Science Process and Data Visualization Techniques - Introduction to Machine Learning - Lazy Learning and Probabilistic Learning - Naïve Bayes Algorithm - Decision Trees and Regression Techniques - Neural Networks and Support Vector Machines - Hyper Planes - Unsupervised Learning and Metrics in ML Algorithms - Evaluating and Improving Model Performance

COURSE CONTENT

Module-I		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Introduction to Data Science and Scikit - Learn**			
Introduction to Data Science - Data Science - Classification		1	2	20%
Data Science Process - Prior Knowledge - Data Preparation - Modelling - Application		1	2	
Data Exploration - Data Sets		1	2	
Descriptive Statistics for Univariate and Multivariate Data		1	2	
Data Visualisation - Histogram - Quartile Plot - Distribution Chart		1	1	
Scatter Plot - Bubble Chart - Density Chart		1	2	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Introduction to Machine Learning - Lazy Learning and Probabilistic Learning**			
Introduction to Machine Learning - How Machines Learn - Data Storage - Abstraction - Generalisation - Evaluation - Machine Learning in Practice - Types of Machine Learning Algorithms		2	2	20%
Lazy Learning - Classification using K- Nearest Neighbour Algorithm		2	2	
Measuring Similarity with Distance - Choice of k - Preparing Data for Use with k- NN		2	1	
Probabilistic Learning - Understanding Naïve Bayes - Conditional Probability and Bayes Theorem		2	2	
Naive Bayes Algorithm for Classification - The Laplace Estimator - Using Numeric Features with Naive Bayes		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Decision Trees and Regression Techniques**			
Decision Tree Learning - Concept of decision trees - Divide and conquer approach		3	2	20%
C5.0 Decision tree algorithm - Choosing the best split - Pruning the decision tree		3	2	
Regression Methods - Concept of Regression - Simple Linear Regression		3	2	
Ordinary Least Squares Estimation		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Neural Networks and Support Vector Machines**			
Neural Network Learning - Artificial Neurons - Activation Functions		4	2	20%
Network Topology - Training Neural Networks with Back propagation		4	2	
Support Vector Machines - Hyper planes - Using Kernels for Nonlinear Spaces		4	2	
Classification using Hyper planes - Maximum Margin Hyper planes in Linearly Separable Data		4	2	
Classification using kernels for nonlinear spaces		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Unsupervised Learning and Metrics in ML Algorithms**			
Clustering - The K-Means Clustering Algorithm - Using Distance to Assign and Update Clusters		5	2	20%
Choosing Number of Clusters		5	1	
Evaluating Model Performance - Confusion Matrices - Precision and Recall -		5	2	

Sensitivity and Specificity - Precision and Recall - F-Measure - ROC Curves			
Cross Validation - K-Fold Cross Validation - Bootstrap Sampling	5	2	
Improving Model Performance - Bagging - Boosting	5	2	
Random Forests	5	1	

TEXT BOOKS	
1	Vijay Kotu, and Bala Desh pande, *Data Science Concepts* and *Practice*, 2nd Edition, Morgan Kaufmann Publishers, 2018, ISBN: 978-0128147610
2	Brett Lantz, *Machine Learning with R*, 2nd Edition, Pack T Publishing, 2015, ISBN: 978-1784393908
3	Jake Vander Plas, *Python Data Science Hand book Essential Tools for Working with Data,*1st Edition, Shroff / O'Reilly, 2016, ISBN-10: 9352134915
4	Michael Steinbach, Pang Ning Tan, and Vipin Kumar, *Introduction to Data Mining*, Pearson, 2016, ISBN: 978-9332571402
REFERENCE BOOKS	
1	Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining Concepts and Techniques*, Morgan Kaufmann Publishers, 2012, ISBN: 978-9380931913
2	Peter Harrington, *Machine Learning in Action*, 1st Edition, Manning Publications, 2012, ISBN: 978-1617290183
3	E. Alpayidin, *Introduction to Machine Learning*, Prentice Hall of India, 2005, ISBN: 978-8120350786
4	Joel Grus, *Data Science from Scratch: First Principles with Python*, 5th Edition, O'Reilly Publishers, 2015, ISBN: 978-1491901427
5	T. Hastie, RT Ibrashiran and J. Friedman, *The Elements of Statistical Learning*, Springer, 2017 Edition, ISBN: 978-0387848570

MODES OF EVALUATION	**SCORE WEIGHTAGE / SPLIT MARKS**
Continuous Internal Evaluation (CIE)	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 30 marks
Part B: 30 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

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A			Total Pages:	3
Register No.:		Name:		

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA301		
Course Name:	Data Science and Machine Learning		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	What is data science?	1	1	3
2.	Explain the different types of data.	1	2	3
3.	Explain how to choose the value of k in k-NN algorithm.	2	2	3
4.	Differentiate between supervised and unsupervised learning algorithms.	2	2	3
5.	Explain entropy and information gain.	3	2	3
6.	Explain the OLS method in regression.	3	2	3
7.	Define activation function. Give two examples.	4	1	3
8.	Define maximum margin hyper plane.	4	1	3
9.	Define precision, recall and F-measure.	5	1	3
10.	Explain bootstrap sampling.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	Discuss the various methods for visualising multivariate data.	1	2	6
	OR			
12.	What are the various processes for preparing a dataset to perform a data science task?	1	3	6
	MODULE II			
13.	From the given attributes determine whether the new product is good or not. Attributes of the new product are x1=3 and x2=7. Assume k=3(Use KNN).	2	3	6

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		Feature1(x1)	**Feture2 (x2)**	**classification**		
		7	7	Bad		
		7	4	Bad		
		3	4	Good		
		1	4	Good		
		OR				
14.	Given the following data on a certain set of patients seen by a doctor, can the doctor conclude that a person having chills, fever, mild headache and without running nose has flu? (Use Naive Bayes classification).				2	2	6

Chills	Running nose	Headache	Fever	Has flu
Y	N	mild	Y	N
Y	Y	no	N	Y
Y	N	strong	Y	Y
N	Y	mild	Y	Y
N	N	no	N	N
N	Y	strong	Y	Y
N	Y	strong	N	N
Y	Y	mild	Y	Y

		MODULE III						
15.	Obtain a linear regression for the data given in the table below assuming that y is the independent variable.						3	3	6

x	55	60	65	70	80
y	52	54	56	58	62

	OR			
16.	What is divide-and-conquer strategy? How well it is utilized in the construction of a decision tree?	3	3	6
	MODULE IV			
17.	Define an artificial neuron. What are the characteristics of an artificial neural network (ANN)?	4	3	6
	OR			
18.	Define linearly separable dataset. Give an example each of a dataset that is linearly separable and of a dataset that is not linear[illegible]ble.	4	2	6

MODULE V				
19.	Suppose 10000 patients get tested for flu; out of them, 9000 are actually healthy and1000 are actually sick. For the sick people, a test was positive for 620 and negative for 380. For the healthy people, the same test was positive for 180 and negative for 8820. Construct a confusion matrix for the data and compute the precision and recall for the data.	5	2	6
OR				
20.	Assume the following: A database contains 80 records on a particular topic of which55 are relevant to a certain investigation. A search was conducted on that topic and50 records were retrieved. Of the 50 records retrieved, 40 were relevant. Construct the confusion matrix for the search and calculate the precision and recall scores for the search.	5	2	6

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COURSE DESCRIPTION		
Course Code	21CA302	Course Credit: 4
Course Name	Design and Analysis of Algorithms	
L-T-J-P	3-1-0-0	
Pre-requisite	21CA102 Advanced Data Structures	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To analyze the performance of algorithms.
2	To choose the appropriate data structure and algorithm design method for a specified application.
3	To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, back tracking and branch and bound.
4	To understand how the choice of data structures and algorithm design methods impacts the performance of programs.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Learn and understand asymptotic notations for performance of different algorithms.	2
CO2	Discuss the basic concepts in computer algorithms and their analysis and design using Divide and Conquer.	3
CO3	Design optimal solution by applying various methods like Dynamic Programming and Greedy Method.	2
CO4	Explain the Branch and Bound technique, Backtracking technique and Lower bounds.	2
CO5	Describe the fundamental concepts of Computational Complexity and Network Flows.	2

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	-	-	2	-	-	-	-	-
CO2	3	3	1	2	-	-	2	-	-	-	-	-
CO3	3	3	1	2	-	-	2	-	-	-	-	-
CO4	3	3	1	2	-	-	2	-	-	-	-	-
CO5	3	3	1	2	-	-	2	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction to Algorithms - Asymptotic Notations - Recurrence Relations - Divide and Conquer Method - Greedy Algorithm - Dynamic Programming - Basic Traversals - Search Techniques and Backtracking - Computational Complexity - Network Flows - NP hard and NP complete

COURSE CONTENT

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction to Algorithm Analysis**			
Algorithm and its Properties – A priori and a posteriori Analysis of Algorithms		1	1	20%
Time and Space Complexity		1	2	
Elementary Operation and Complexity Estimation of Simple Algorithms		1	1	
Asymptotic Notations and their Properties		1	1	
Common Complexity Functions - Recurrence Relations - Solution of Recurrence Relations		1	2	
Iteration Method - Recurrence Tree Method		1	2	
Master's Theorem (Proof not required)		1	1	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Divide and Conquer Method**			
Control Abstraction for Divide and Conquer		2	1	20%
2 - way Merge Sort		2	2	
Quick Sort		2	2	
Binary Search		2	1	
Finding Maximum and Minimum		2	1	
Divide and Conquer STRASSENS Matrix Multiplication		2	1	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Greedy Strategy and Dynamic Programming**			
Control Abstraction for Greedy Strategy		3	1	20%
The Fractional Knapsack Problem		3	2	
Prims' and Kruskal's Algorithms for Minimal Spanning Tree		3	3	
Job Sequencing Problem		3	1	
Control Abstraction for Dynamic Programming		3	1	
All Pair Shortest Path Problem		3	1	
Travelling Sales Person Problem		3	2	
Divide and Conquer Vs Dynamic Programming		3	1	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Algorithm Design by State Space Trees**			
State Space - Bounding Functions - Examples		4	1	20%
Backtracking: Control Abstraction for Backtracking		4	1	
The N Queen's Problem		4	1	
Sum of Subset Problem		4	2	
Branch and Bound: Depth First - Breadth First and Best First Branch and Bound Strategies and their Control Abstractions		4	2	
The N2 -1 Puzzle Problem		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Introduction to Computational Complexity**			
Tractable and Intractable Problems		5	1	20%

Complexity Classes - P and NP Classes	5	1	
SAT and 3-SAT Problems	5	1	
NP- Hard and NP - Complete Classes	5	1	
Study of NP Complete Problems - Travelling Sales Person Problem	5	1	
Knapsack Problem	5	1	
Clique Problem - Vertex Cover Problem	5	1	
Flow Networks and Network Flows Max Flow Min Cut Theorem	5	2	

TEXT BOOKS	
1	Cormen T.H., Leiserson C.E., Rivest R.L. and Stein C., *Introduction to Algorithms,* 3rd Edition, Prentice Hall India, New Delhi, 2009, ISBN: 9788120340077
2	Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, *Fundamentals of Computer Algorithms,* 2nd Edition, Universities Press, Orient Longman, 2008, ISBN 10: 8173716129 ISBN-13: 9788173716126
3	A. Levitin, *Introduction to the Design & Analysis of Algorithms,* 3rd Edition, Pearson Education, 2008, ISBN- 0321358287
REFERENCE BOOKS	
1	Rajesh K. Shukla, *Analysis and Design of Algorithms. A Beginner's Approach*, Wiley, 2015, ISBN-8126554770
2	Richard Neapolitan, Kumarss Naimipour. *Foundations of Algorithms,* 4th Edition, Jones and Bartlett Publishers, Inc, 2011, ISBN-10 : 0763782505, ISBN-13 : 978-0763782504
3	Sara Baase, Allen Van Gelder, *Computer Algorithms: Introduction to Design and Analysis,* 3rd Edition, Pearson India, 2002, ISBN-10: 0201612445
4	Harsh Bhasin, *Algorithms Design and Analysis,* 1st Edition, Oxford University Press, 2015, ISBN: 9780199456666, 9780199456666
5	Dr.R Vijayakumar, Dr.Juby Mathew, *Algorithm Design, Foundation, Analysis and Examples,* 1st Edition, Vimala Books and Publications, 2016, ISBN: 978-93-5267-154-0

MODES OF EVALUATION	**SCORE WEIGHTAGE / SPLIT MARKS**
Continuous Internal Evaluation (CIE)	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 30 marks
Part B: 30 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

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B			Total Pages:	2
Register No.:		Name:		

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA302		
Course Name:	Design and Analysis of Algorithms		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	Solve $T(n) = 2T\left(\frac{n}{2} + 17\right) + n$ using masters theorem.	1	3	3
2.	What is an algorithm? Explain its characteristics.	1	1	3
3.	Write down control abstraction for divide and conquer method.	2	1	3
4.	Define feasible solution and optimal solution.	2	2	3
5.	Explain job sequencing problem.	3	2	3
6.	Explain the control abstraction for greedy strategy.	3	2	3
7.	State sum of subset problem.	4	1	3
8.	Write down DFS algorithm.	4	2	3
9.	Compare tractable and intractable problems.	5	2	3
10.	State an NP hard decision problem that is not NP complete.	5	1	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	With a suitable example, explain the method of solving recurrence equations.	1	2	6
	OR			
12.	Explain time and space complexity with relevant examples.	1	1	6
	MODULE II			
13.	Write down an algorithm for finding minimum and maximum element in a list of numbers. Explain the concept with an example.	2	3	6
	OR			
14.	Explain the concept of merge sort algorithm with example.	2	2	6
	MODULE III			
15.	What is knapsack problem? Solve the following knapsack using greedy method. N=5,m=9, (p1,p2,p3,p4,p5)=(10,10,15,12,4) and (w1,w2,w3,w4,w5)=(2,4,7,4,1).	3	3	6

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	OR			
16.	What is dynamic programming? Explain how this concept is applied to solve travelling sales man problem.	3	2	6
	MODULE IV			
17.	Explain how N-queen's problem is solved using the concept of backtracking.	4	3	6
	OR			
18.	What is N2-1 puzzle problem? With an example solve 15 puzzle problem.	4	3	6
	MODULE V			
19.	Explain NP-Hard and HP-complete classes. Explain Clique problem.	5	1	6
	OR			
20.	Describe vertex cover problem with example.	5	2	6

****

COURSE DESCRIPTION		
Course Code	21CA303-A	Course Credit: 4
Course Name	Business Analytics	
L-T-J-P	3-0-0-1	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To provide the concept of business analytics and its importance to organizations.
2	To describe major business analytical methods and tools.
3	To provide an idea about the application of business analytics for business process improvement.
4	To impart practical knowledge in the area of business analytics using different analytical tools.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Understand the concepts and methods of business analytics.	2
CO2	Gain an understanding on how to manage resources for business analytics.	2
CO3	Apply the descriptive analytics tools and generate solutions.	3
CO4	Familiarize with Predictive Analytics and it's applications.	3
CO5	Obtain the notion of Prescriptive Analytics and how it can lead to business process improvement.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	1	1	2	-	-	-	-	-	-	-
CO4	2	2	1	1	2	-	-	-	-	-	-	-
CO5	2	2	1	1	2	-	-	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

EMBEDDED THEORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	36 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction to Business Analytics - Influence of Business Analytics in Organizational Decision Making - Manage and Tune Resources in an Organization for Business Analytics - Data Quality - Descriptive Analytics for Statistics - Sampling and Estimation - Data Driven Models - Predictive Analytics - Prescriptive Analytics - Non Linear Optimisation using Prescriptive Analytics

COURSE CONTENT- EMBEDDED THEORY

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction to Business Analytics**			
Business Analytics - Terminologies		1	2	20%
Process - Importance		1	2	
Relationship with Organisational Decision Making		1	2	
BA for Competitive Advantage		1	1	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Managing Resources for Business Analytics**			
Managing BA Personnel - Data and Technology		2	2	20%
Organisational Structures Aligning BA		2	2	
Managing Information Policy		2	2	
Data Quality and Change in BA		2	1	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Descriptive Analytics**			
Introduction to Descriptive Analytics - Visualising and Exploring Data		3	2	20%
Descriptive Statistics - Sampling and Estimation		3	2	
Probability Distribution for Descriptive Analytics		3	2	
Analysis of Descriptive Analytics		3	1	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Predictive Analytics**			
Introduction to Predictive Analytics		4	1	20%
Logic and Data Driven Models		4	2	
Predictive Analysis Modeling and Procedure		4	2	
Data Mining for Predictive Analytics		4	2	
Analysis of Predictive Analytics		4	1	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Prescriptive Analytics**			
Introduction to Prescriptive Analytics		5	1	20%
Prescriptive Modeling		5	2	
Non Linear Optimisation		5	2	
Demonstrating Business Performance Improvement		5	2	

TEXT BOOKS

1	Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, *Business Analytics Principles, Concepts, and Applications - What, Why, and How*, Pearson, 2014, ISBN-10: 0133552187 ISBN-13: 978-0133552188
2	Christian Albright S and Wayne L. Winston, *Business Analytics - Data Analysis and Decision Making,* 7th Edition, Cengage Learning, 2019, ISBN-10: 0357109953 ISBN-13: 78-0357109953
3	James R. Evans, *Business Analytics - Methods, Models and Decisions,* 3rd Edition, Pearson Edition, 2020, ISBN-10: 1292339063 ISBN-13: 978-1292339061

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REFERENCE BOOKS	
1	Regi Mathew, *Business Analytics for Decision Making,* 1st Edition, Pearson Education, 2020, ISBN-10: 9353948436 ISBN-13: 978-9353948436
2	R N Prasad, Sema Acharya, *Fundamentals of Business Analytics,* 2nd Edition, Wiley, 2016, ISBN-10: 8126563796 ISBN-13: 978-8126563791
3	U Dinesh Kumar, *Business Analytics: The Science of Data - Driven Decision Making,* Wiley, 2017, ISBN-10: 9788126568772 ISBN-13: 978-8126568772
4	Foster Provost, *Data Science for Business,* 1st Edition, Shroff, 2013, ISBN-10: 935110267X ISBN-13: 978-9351102670
5	Ramesh Sharda, Dursun Delen, Efraim Turban, *Business Intelligence and Analytics: Systems for Decision Support*, 10th Edition, Pearson Education, 2018, SBN-10: 9789352866489 ISBN-13: 978-9352866489

EMBEDDED LABORATORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**12 Hours**
Internal Test	**1 Hour**

COURSE CONTENT - EMBEDDED LABORATORY			
	List of Laboratory Experiments	**COs**	**Hours**
1	Descriptive Statistics	2	2
2	Parametric Test	2	2
3	Non Parametric Test	2	2
4	Correlation Analysis	2	2
5	Regression Analysis	2	2
6	Forecasting	4	2

LABORATORY MANUAL
An internally prepared laboratory manual

REFERENCE BOOKS	
1	Conrad Carlberg, *Business Analysis with Microsoft Excel*, Pearson Education, 5th Edition, 2020
2	Manohar Hansa Lysander, *Data Analysis and Business Modelling Using Microsoft Excel*, PHI, 2016

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE) of Theory	**20**
Internal Test – I	10
Internal Test – II	10
Continuous Internal Evaluation (CIE) of Laboratory	**12**
Day to day performance and documentation	08
Test and viva voce	04
Attendance (Theory and Laboratory together)	**08**
End Semester Examination (ESE) Theory	**60**
Total	**100**
End Semester Examination Pattern	
There will be two parts; Part A and Part B. Part A: 30 marks Part B: 30 marks Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.	

C			Total Pages:	2
Register No.:		Name:		

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA303-A		
Course Name:	Business Analytics		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	What is business analytics?	1	2	3
2.	How business analytics helps in decision making in an organization?	1	2	3
3.	What is the need of data quality in business anaytics?	2	2	3
4.	What is the role of data and technology in business analytics?	2	2	3
5.	What are the different visualizing tools in Descriptive analysis?	3	2	3
6.	What is descriptive statistics?	3	2	3
7.	Write note on predictive analysis.	4	2	3
8.	What is the role of data mining for predictive analytics?	4	2	3
9.	What is prescriptive analytics?	5	2	3
10.	How prescriptive analysis aids business performance improvement?	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	How business analytics helps in organisational decision making?	1	2	6
	OR			
12.	Explain in detail about the process of business analytics.	1	2	6
	MODULE II			
13.	Explain in detail on managing resources for business analytics.	2	2	6
	OR			
14.	What is information policy in business analytics? Explain.	2	2	6
	MODULE III			
15.	Write in detail about Sampling and Estimation.	3	2	6
	OR			
16.	Describe the probability distribution for descriptive anal	3	2	6

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MODULE IV				
17.	What are the different logic and data driven models in predictive analysis? Explain.	4	2	6
OR				
18.	Explain about predictive analysis modeling and procedure.	4	2	6
MODULE V				
19.	Explain prescriptive modeling.	5	2	6
OR				
20.	Write in detail about non-linear optimisation.	5	2	6

****

COURSE DESCRIPTION		
Course Code	21CA303-B	Course Credit: 4
Course Name	Natural Language Processing	
L-T-J-P	3-0-0-1	
Pre-requisite	21CA106 Python Programming Lab	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To understand the algorithms available for the processing of linguistic information and computational properties of natural languages.
2	To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks.
3	To familiarize various NLP software libraries and data sets publicly available.
4	To develop systems for various NLP problems with moderate complexity.
5	To learn various strategies for NLP system evaluation and error analysis.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Describe the concepts of morphology, syntax, semantics of natural language.	2
CO2	Demonstrate the relationship between NLP and statistics and machine learning.	2
CO3	Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.	2
CO4	Develop systems for various NLP problems with moderate complexity.	2
CO5	Discuss NLP systems, identify shortcomings and suggest solutions for these shortcomings.	2

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	-	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	-	2	-	-	-	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

EMBEDDED THEORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	36 Hours
Internal Test (2 Internal assessment tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction to Natural Language Processing - Phases of Natural Language Processing - Language Modelling: N-Gram and Neural Language Modeling - Basics of Neural Networks - Parts of Speech Tagging - Rule-based POS Tagging and Hidden Markov Model based POS Tagging - Parsing - Syntactic Parsing and Semantic Parsing - Semantics - Word Embeddings - Word Net

COURSE CONTENT - EMBEDDED THEORY

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction to Natural Language Processing**			
Introduction and Applications		1	1	20%
NLP Phases - Difficulty of NLP including Ambiguity		1	2	
Spelling Error and Noisy Channel Model		1	2	
Concepts of Parts-of-Speech		1	2	
Formal Grammar of English		1	1	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Language Modelling: N-Gram and Neural Language Modeling**			
Language Modelling with N-Gram - Simple N-Gram Models		2	1	20%
Smoothing (Basic Techniques) - Evaluating Language Models		2	2	
Neural Network Basics		2	2	
Neural Network Training		2	2	
Neural Language Model - Case Study: Application of Neural Language Model in NLP System Development		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Parts of Speech Tagging**			
Parts of Speech (POS) Tagging - Basic Concepts		3	1	20%
Rule-Based POS Tagging - Transformation-Based Learning (TBL)		3	2	
An introduction to Hidden Markov Model (HMM)		3	2	
POS Tagging Using Hidden Markov Model (HMM)		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Parsing**			
Basic Concepts of Parsing - Top-Down Parsing - Bottom-Up Parsing		4	1	20%
Syntactic Parsing		4	1	
Cock-Younger-Kasami (CYK) Parsing		4	2	
Statistical Parsing Basics - Probabilistic Context Free Grammar (PCFG) - Probabilistic CKY		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Semantics**			
Vector Semantics - Words and Vector - Measuring Similarity - Semantics with Dense Vectors		5	2	20%
Embedding's from Prediction - Skip-Gram and Continuous Bag-of-Words (CBOW)		5	2	
Word Sense - Introduction to Word Net		5	2	

TEXT BOOKS

1	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, *Practical Natural Language Processing*, 1st Edition, O'Reilly Media, 2020, ISBN: 978-1492054054
2	Yoav Goldberg, Graeme Hirst, *Neural Network Methods for Natural Language Processing*, Morgan & Claypool Publishers, 2017, ISBN: 978-1627052986

3	Daniel Jurafsky, James H. Martin, *Speech and Language Processing*, 2nd Edition, Prentice Hall, 2008, ISBN: 978-0131873216
REFERENCE BOOKS	
1	Hobson Lane, Hannes Hapke, Cole Howard, *Natural Language Processing in Action,* 1st Edition, Manning, 2019, ISBN: 978-1617294631
2	Jacob Eisenstein, *Introduction to Natural Language Processing*, Illustrated Edition, The MIT Press, 2019, ISBN: 978-0262042840
3	Steven Bird, Ewan Klein, Edward Loper, *Natural Language Processing with Python*, 1st Edition, O'Reilly Media, 2009, ISBN: 978-0596516499
4	Nitin Hardeniya, Jacob Perkins, Deepti Chopra, Nisheeth Joshi,ItiMathur, *Natural Language Processing: Python and NLTK*, Packt Publishing Ltd, 2016, ISBN: 978-1787285101
5	Christopher Manning, Hinrich Schutze, *Foundations of Statistical Natural Language Processing*, The MIT Press, 1999, ISBN: 978-0262133609

EMBEDDED LABORATORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**12 Hours**
Internal Test	**1 Hour**

COURSE CONTENT - EMBEDDED LAB			
	List of Laboratory Experiments	**COs**	**Hours**
1	Parse / Read HTML pages using Beautiful Soup.	1	1
2	Introducing the NLTK; Performing basic pre-processing tasks such as removal of stop-words, digits, punctuations, special characters; Performing Stemming using Martin-Porter Stemming algorithm	3	2
3	Using Text Blob library to do spelling correction; Comparing this with autocorrect library.	3	1
4	Feature Engineering - Converting Text to Numerical Features using One-Hot Encoding.	2	2
5	Generating N-Grams Using One-Hot Encoding and with Text Blob.	2	2
6	Feature Engineering - Converting Text to Numerical Features Using TF alone and TF-IDF (Establish the fact that important as well as less frequently occurring terms are got higher weights with IDF)	2	2
7	Lemmatization using Word Net.	3	2

LABORATORY MANUAL
An internally prepared laboratory manual

REFERENCE BOOKS	
1	Akshay Kulkarni, Adarsha Shivananda, *Natural Language Processing Recipes*, Apress, 2019, ISBN: 978-1484242667
2	Jacob Perkins, *Python 3 Text Processing with NLTK 3 Cookbook*, 2nd Edition, Packt Publishing, 2014, ISBN: 978-782167853

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation(CIE) of Theory	**20**
Internal Test - I	10
Internal Test - II	10
Continuous Internal Evaluation (CIE) of Laboratory	**12**
Day to day performance and documentation	08
Test and viva voce	04
Attendance (Theory and Laboratory together)	**08**
End Semester Examination (ESE) Theory	**60**
Total	**100**
End Semester Examination Pattern	
There will be two parts; Part A and Part B. Part A: 30 marks Part B: 30 marks Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.	

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA303-B		
Course Name:	Natural Language Processing		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARK
1.	What is natural language processing? Discuss with some applications.	1	1	3
2.	Write short notes on the semantics of a natural language, and explain how it differs from the pragmatics.	1	1	3
3.	Distinguish one-gram models and bi-gram models.	2	2	3
4.	Give an account of stemming applied to text.	2	2	3
5.	Give a short description of parts-of-speech tagging of English.	3	2	3
6.	Brief on your understanding on chunking.	3	5	3
7.	Differentiate top-down and bottom-up parsing.	4	2	3
8.	What is context free grammar?	4	1	3
9.	Give your understanding on word embedding's.	5	2	3
10.	Write on word2vec modelling.	5	1	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	Explain the phases of natural language processing.	1	2	6
	OR			
12.	NLP is a powerful tool with huge benefits, but there are still a number of natural language processing limitations and problems. Brief on the ambiguities faced by NLP.	1	2	6
	MODULE II			
13.	Give an account of the various language models known.	2	2	6
	OR			
14.	Explain back-propagation algorithm of artificial neural networks.	2	2	6
	MODULE III			
15.	Elaborate on Transformation Based Learning (TBL).	3	2	6

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OR				
16.	Explain Parts of Speech tagging (POS) using hidden markov modelling.	3	2	6
MODULE IV				
17.	Give your understanding on Cock-Younger-Kasami (CYK) parsing.	4	2	6
OR				
18.	Write about statistical parsing techniques.	4	1	6
MODULE V				
19.	One of the techniques used in feature engineering is one-hot encoding. Give an account of this.	5	2	6
OR				
20.	Give an intuitive idea on skip-gram modeling.	5	2	6

****

COURSE DESCRIPTION		
Course Code	21CA303-C	Course Credit: 4
Course Name	Search Engine Optimization	
L-T-J-P	3-0-0-1	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To gain an understanding of search engine algorithms and how they affect organic search results and websites.
2	To optimize website content for the best possible search engine ranking.
3	To learn the theory behind Google search and other search engine algorithms.
4	To build practical, real-world skills that you can apply to a career in digital marketing or online content development, including on-page and off-page optimization.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Understand the basics of search engine optimization.	2
CO2	Perform a competitive analysis on a webpage.	2
CO3	Analyze On-page Optimization techniques.	3
CO4	Analyze Off-page Optimization techniques.	3
CO5	Apply various search engine optimization tools.	3

CO-PO MAPPING												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	1	-	-	-	-	-	-	-
CO3	1	1	-	2	3	-	-	-	-	-	-	-
CO4	1	-	-	2	3	-	-	-	-	-	-	-
CO5	3	3	3	-	2	-	-	3	-	-	-	-
Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"												

EMBEDDED THEORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	36 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

SYLLABUS

Basics for SEO - Types of SEO Techniques - SEO Research and Analysis - Search Engine Commands - Search Engine Algorithms - On-Page and Off-Page Optimization - Google Analytics - Website Analysis using various SEO Tools - Search Engine Optimization Tools - Comparison Tools - Link Popularity Tools - Site Tools

COURSE CONTENT- EMBEDDED THEORY

Module-I		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Basics for SEO**			
What is Domain - Basic Knowledge of World Wide Web		1	1	20%
Difference between Portal and Search Engines		1	1	
What is SEO - Types of SEO Techniques - Black Hat Techniques - White Hat Techniques		1	2	
How Search Engine works - Page Speed		1	1	
Basics of Search Engine that includes Crawling - Indexing and Caching		1	1	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**SEO Research and Analysis**			
Market Research		2	1	20%
Keyword Research and Analysis - Keyword Opportunity		2	2	
Competitors Website Analysis - SWOT Analysis of Website		2	1	
How to Choose Best Keywords - Tools available for Keyword Research		2	2	
Search Engine Commands - Search Engine Algorithms		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**On-Page and Off- Page Optimization**			
On-page Optimization: Meta Descriptions and Meta Keywords - Headings - Bold Text - Domain Names and Suggestions		3	2	20%
Canonical Tag - Meta Tags		3	1	
Internal Link Building - The Sitemap - Invisible Text		3	2	
Off-page Optimization: Page Rank - Link Popularity		3	1	
Directory Submission - Social Bookmark Submission - Blog Submission		3	2	
Articles - Links Exchange - Reciprocal Linking		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Analytics**			
Google Analytics - Installing Google Analytics - How to Study Google Analytics		4	1	20%
Interpreting Bars and Figures - How Google Analytics Can Help SEO		4	2	
Webmaster Central and Bing/Yahoo - Open Site Explorer		4	1	
Website Analysis using various SEO Tools		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Search Engine Optimization Tools**			
Keyword Density Analyzer Tools		5	1	20%
Google Tools		5	1	
Yahoo / Bing Tools		5	1	
Search Engines Tools		5	1	
Rich Snippet Text Tools		5	1	
Comparison Tools - Link Popularity Tools - Site Tools		5	1	

TEXT BOOKS	
1	Michael H. Fleischner, *SEO Made Simple: Search Engine Optimization Strategies for Dominating the World's Largest Search Engine*, 3rd Edition, United States of America, ISBN-13: 978-1481838061 ISBN-10: 1481838067
2	Karyotakis, M.-A., Lamprou, E., Kiourexidou, M., Antonopoulos, N, *SEO Practices: A Study about the Way News Websites Allow the Users to Comment on Their News Articles*, Future Internet 2019
REFERENCE BOOKS	
1	Enge, Eric, Stephan Spencer, Jessie Stricchiola, and Rand Fishkin.*The Art of SEO: Mastering Search Engine Optimization,* 2nd Edition, O'Reilly Media, 2012, ISBN: 9781449304218
2	Handley, Ann and C.C. Chapman, *Content Rules: How to Create Killer Blogs, Podcasts, Videos, Ebooks, Webinars (and More) that Engage Customers and Ignite Your Business*, Hoboken: John Wiley & Sons, Inc., 2011, ISBN-13: 978-1118232606 ISBN-10: 1118232607
3	Ziakis, C., Vlachopoulou, M., Kyrkoudis, T., Karagkiozidou. M., *Important Factors for Improving Google Search Rank, Future Internet, 2019*

EMBEDDED LABORATORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**12 Hours**
Internal Test	**1 Hour**

COURSE CONTENT - EMBEDDED LABORATORY			
	List of Laboratory Experiments	**COs**	**Hours**
1	Keyword Research [Spy Fu, Moz Keyword Explorer, Google Trends, Google Search Console]	5	2
2	Rank Monitoring [Moz Rank Tracker, Spy fu, SEO Rank Monitor]	5	2
3	Technical Issues [Screaming Frog, Google Analytics, AHREFs]	5	2
4	Site Speed [Web Page test, GT Metrix, Pingdom]	5	2
5	Know Your Customer [Lumentis.io, Google Analytics]	5	2
6	User Experience [Kiss metrics, Hot Jar, Crazy Egg]	5	1
7	Local Rankings [Market Goo, Ahrefs, Keyword Finder]	5	1

LABORATORY MANUAL
An internally prepared laboratory manual

REFERENCEBOOKS	
1	Michael H. Fleischner, *SEO Made Simple: Search Engine Optimization Strategies for Dominating the World's Largest Search Engine*, 3rd Edition, United States of America, ISBN-13: 978-1481838061 ISBN-10: 1481838067
2	https://www.clicklaboratory.com/search-engine-optimization/seo-audit-tools/ Date of Access: 03/02/2022

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)of Theory	**20**
Internal Test – I	10
Internal Test – II	10
Continuous Internal Evaluation (CIE) of Laboratory	**12**
Day to day performance and documentation	08
Test and viva voce	04
Attendance (Theory and Laboratory together)	**08**
End Semester Examination (ESE) Theory	**60**
Total	**100**
End Semester Examination Pattern	
There will be two parts; Part A and Part B. Part A: 30 marks Part B: 30 marks Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.	

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA303-C		
Course Name:	Search Engine Optimization		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	What is Domain? Explain it with suitable examples.	1	2	3
2.	Define crawling.	1	1	3
3.	How to choose best keywords in keyword research?	2	1	3
4.	List and explain search engine commands used for SEO analysis.	2	2	3
5.	Why are page ranking algorithms important?	3	1	3
6.	Explain reciprocal linking.	3	2	3
7.	What is the purpose of google analytics? Explain.	4	2	3
8.	How to interpret bars and figures in google analytics?	4	1	3
9.	What are keyword density analyzer tools? Explain.	5	2	3
10.	Briefly explain different google tools used for search engine optimization.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	List and explain different types of SEO techniques in detail.	1	2	6
	OR			
12.	How search engine works? Explain.	1	2	6
	MODULE II			
13.	What is SWOT analysis of a website? Explain.	2	2	6
	OR			
14.	Explain various tools available for keyword research.	2	2	6
	MODULE III			
15.	Diagrammatically explain in detail about meta descriptions and meta keywords.	3	2	6

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OR				
16.	Explain i) On-page Optimization ii) Off-page Optimization	3	2	6
MODULE IV				
17.	Explain how google analytics helps search engine optimization?	4	2	6
OR				
18.	How website analysis can be done using various SEO tools? Explain with suitable examples.	4	2	6
MODULE V				
19.	Write down various search engines tools and explain in detail.	5	2	6
OR				
20.	Write down various rich snippet text tools and explain in detail.	5	2	6

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COURSE DESCRIPTION		
Course Code	21CA303-D	Course Credit: 4
Course Name	Multimedia and Animation	
L-T-J-P	3-0-0-1	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To introduce fundamentals of multimedia system.
2	To introduce digitalization of audio and video signals.
3	To impart knowledge of image processing, video, sound and animation.
4	To implement multimedia system development.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Understand different types of media and define multimedia system.	2
CO2	Describe the process of digitizing of different analog signals.	2
CO3	Illustrate different multimedia environments like CD,DVI,MME.	2
CO4	Apply tools for image processing, video, sound and animation.	3
CO5	Analyze methodology to develop a multimedia system.	4

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

EMBEDDED THEORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	36 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction - Multimedia Hardware - Software Applications - Media Types - Building Blocks - Hypertext - Image - Animation - Multimedia Environments - CD - DVI - Multimedia PC - Multimedia Programming - Classes - Composition - Synchronisation - Database integration - Advanced Multimedia - Moving Pictures - Virtual Reality - Multimedia Networks

COURSE CONTENT - EMBEDDED THEORY

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction**			
Definition of Multimedia - Multimedia Hardware - Software Applications - Software Environments		1	3	20%
Media Types - Analog and Digital Video - Digital Audio - Music and Animation		1	2	
Analog and Digital Video - Memory Storage - Basic Tools - Authoring Tools		1	2	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Building Blocks**			
Hypertext - Sound - Sound Cards - Standards		2	2	20%
Image - Image Types - Image Compression - JPEG - MPEG - Fractal and Wavelet Compressions - Image File Types		2	3	
Animation - Capture and Playback Techniques (Basic Ideas Only)		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Multimedia Environments**			
The Compact Disc Family - CD - Interactive - Digital Video Interactive		3	3	20%
QuickTime - Multimedia PC - Microsoft Multimedia Extensions		3	3	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Multimedia Programming**			
Framework Overview - Media Classes - Transform Classes		4	2	20%
Format Classes - Component Classes		4	2	
Problems Related to Programming - Composition - Synchronisation		4	2	
Interaction - Database integration		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Advanced Multimedia**			
Moving Pictures - Techniques Realistic Image Synthesis		5	2	20%
Virtual Reality - Full Motion Digital Video - Video Capture Techniques		5	3	
Multimedia Networks - Desktop Video Conferencing - Future Multimedia		5	3	

TEXT BOOKS

1	Simon J. Gibbs, Dionysios C. Tsischritziz, *Multimedia Programming Objects, Environments & Framework*, Addison, Wesley Publishing Co, ISBN: 0201422824 ISBN: 9780201422825
2	Tay Van Ghan, *Multimedia- Making it work*, Osborne Tata Mcgraw Hill

REFERENCE BOOKS

1	Mathew E. Hodger & Russel M. Sasnett, *Multimedia Computing,* Addison Wesley, ISBN-10: 020152029X ISBN-13: 978-0201520293
2	Arch C Luther, *Authoring Interactive Multimedia*, ISBN: 0124604307 ISBN: 9780124604308

3	Winn L. Rosch, Sams , *Multimedia Bible*, ISBN-10: 9780672306709 ISBN-13: 978-0672306709
4	Peter Jellam, *Multimedia Power Tools,* Random house Electronic Pub, ISBN-13: 978-0679791188 ISBN-10: 0679791183
5	Palikom, Integrated Multimedia Systems, The communication Wall Overview

EMBEDDED LABORATORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**12 Hours**
Internal Test	**1 Hour**

COURSE CONTENT - EMBEDDED LABORATORY			
	List of Laboratory Experiments	**COs**	**Hours**
1	Image editing, compression and enhancement	2	4
2	Audio editing, compression and enhancement	2	4
3	Video editing, compression and enhancement	3	4

LABORATORY MANUAL
An internally prepared laboratory manual

REFERENCE BOOKS	
1	Simon J. Gibbs, Dionysios C. Tsischritziz, *Multimedia Programming Objects, Environments & Framework,* Addison-Wesley Publishing Co., ISBN: 0201422824 ISBN: 9780201422825
2	Tay Van Ghan, Multimedia- Making it work, Osborne Tata Mcgraw Hill

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE) of Theory	**20**
Internal Test - I	10
Internal Test - II	10
Continuous Internal Evaluation (CIE) of Laboratory	**12**
Day to day performance and documentation	08
Test and viva voce	04
Attendance (Theory and Laboratory together)	**08**
End Semester Examination (ESE) Theory	**60**
Total	**100**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 30 marks
Part B: 30 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions.
Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

C			Total Pages:	2
Register No.:		Name:		

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA303-D		
Course Name:	Multimedia and Animation		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	Define Multimedia.	1	1	3
2.	What are Authoring tools?	1	1	3
3.	How Sound cards work?	2	2	3
4.	Explain wavelet compression.	2	3	3
5.	Compare CD and DVD.	3	2	3
6.	Describe the features of a multimedia PC.	3	2	3
7.	Elaborate Component classes.	4	2	3
8.	What is Synchronisation?	4	2	3
9.	Illustrate image synthesis.	5	3	3
10.	Give details about Multimedia networks.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	Explain multimedia hardware.	1	2	6
	OR			
12.	With diagram explain digital video format.	1	2	6
	MODULE II			
13.	Explain in detail JPEG.	2	2	6
	OR			
14.	With example and diagram show how compression is done in MPEG.	2	2	6
	MODULE III			
15.	Elaborate digital video interactive.	3	2	6
	OR			
16.	What is microsoft multimedia extensions?	3	2	6

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MODULE IV				
17.	Differentiate media classes and transform classes.	4	3	6
OR				
18.	Explain about database integration in multimedia.	4	2	6
MODULE V				
19.	What all video capture techniques is used in multimedia?	5	3	6
OR				
20.	Give details about desktop video conferencing.	5	2	6

****

COURSE DESCRIPTION		
Course Code	21CA303-E	Course Credit: 4
Course Name	Cloud Computing	
L-T-J-P	3-0-0-1	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To obtain basic information about Cloud computing.
2	To obtain an overview of cloud services and security.
3	To get an idea about virtualization for cloud.
4	To get an idea about cloud collaboration.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Gain an understanding of basic concepts in cloud computing.	2
CO2	Examine various cloud services available and its security.	2
CO3	Discuss about various cloud service models.	2
CO4	Design and implement virtualised cloud environment.	4
CO5	Analyse cloud collaboration.	4

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	2	-	2	-	-	-	-	1
CO2	2	-	-	-	2	-	2	-	-	-	-	1
CO3	2	-	-	-	2	-	2	-	-	-	-	1
CO4	3	2	2	-	3	-	2	-	-	-	-	1
CO5	3	2	2	-	3	-	2	-	-	-	-	1

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

EMBEDDED THEORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	36 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

SYLLABUS

Introduction to Cloud Computing and Cloud Models - Cloud Services - Cloud Models - Standards Security and Licencing in Cloud - Legal and Regulatory Issues - Cloud Security Challenges - Cloud Services and Management - Charging Models - Virtualization for Cloud - Virtual Desktop Infrastructure - Cloud Collaboration - Case study: Amazon Web Services

COURSE CONTENT - EMBEDDED THEORY

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction to Cloud Computing and Cloud Models**			
Introduction to Cloud Computing		1	1	20%
Cloud Services - Infrastructure as a Service - Platform as a Service - Software as a Service		1	2	
Cloud Computing Definition - Benefits and Challenges of Cloud Computing		1	1	
Usage Scenarios and Applications - Uses of Cloud Computing - Example Use Applications		1	2	
Cloud Models-Public Cloud - Private Cloud - Hybrid Cloud - Community Cloud - Public Cloud Versus Private Cloud		1	2	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Standards Security and Licencing in Cloud**			
Introduction - Standards for Security - Standards for Application Developers - Standards for Messaging		2	1	20%
Legal and Regulatory Issues - Third Parties - Data Privacy		2	1	
Cloud Security Challenges - Cloud Data Security - Network Security - Host Security		2	2	
Cloud Data Centre - Moving into the Cloud - Issues in Cloud Computing		2	2	
Know Your Software Licenses - Service Levels of Cloud Applications - Major Players in Cloud Computing		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Cloud Services and Management**			
Introduction to Service - Storage as a Service - Database as a Service - Information as a Service - Process as a Service		3	2	20%
Application as a Service - Platform as a Service - Security as a Service - Testing as a Service - Integration as a Service		3	2	
Infrastructure as a Service		3	1	
Introduction to Cloud Ecosystem - Cloud Management - Cloud Asset Management		3	1	
Charging Models - Metering and Billing - Accessing the Clouds		3	1	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Virtualization for Cloud**			
Introduction - Pros and Cons of Virtualization		4	1	20%
Virtualization Architecture - Virtual Machine - Types of Virtual Machines		4	2	
Types of Virtualization		4	2	
Virtual Desktop Infrastructure		4	1	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Cloud Collaboration**			
Introduction		5	1	20%
Collaborating on Calendars - Schedules and Task Management		5	1	

Collaborating on Project Management - Collaborating on Databases	5	2	
Collaborating on Word Processing and Spread sheets	5	2	
Case Study: Amazon Web Services	5	1	

TEXT BOOKS	
1	M. N. Rao, *Cloud Computing*, PHI Learning, 2015, ISBN: 9788120350731
2	B. Sosinsky, *Cloud computing bible,* Wiley Publ., 2011, ISBN: 9788126529803
3	Michael Miller, *Cloud Computing,* Pearson, 2016, ISBN: 9788131725337
REFERENCE BOOKS	
1	U S Pandey, *Cloud Computing,* S CHAND & CO LTD, 2014, ISBN: 9789383746736
2	Thomas Erl, Zaigham Mahmood and Ricardo Puttini R., *Cloud computing,* Pearson, 2018, ISBN: 9789332535923
3	Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, McGraw Hill Education, 2017, ISBN: 9780070683518
4	Anders Lisdorf, *Cloud Computing Basics,* A Press 2021, ISBN: 9781484269206
5	Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, *Masterin, Cloud Computing,* McGraw Hill Education, 2017, ISBN: 9781259029950

EMBEDDED LABORATORY

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**12 Hours**
Internal Test	**1 Hour**

COURSE CONTENT - EMBEDDED LABORATORY			
	List of Laboratory Experiments	**COs**	**Hours**
1	Introduction to Virtual machines(VM)	4	1
2	Installing Oracle VM Virtual Box and Extension Packs	4	2
3	Running Virtual Machine	4	1
4	Install OS to VM	4	3
5	Cloning VM	4	1
6	Deleting VM	4	1
7	Importing and Exporting Virtual Machines	4	2
8	Snapshots	4	1

LABORATORY MANUAL
An internally prepared laboratory manual.

REFERENCE BOOKS	
1	https://www.virtualbox.org/manual/ch01.html Date of Access: 03/02/2022

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE) of Theory	**20**
Internal Test - I	10
Internal Test - II	10
Continuous Internal Evaluation (CIE) of Laboratory	**12**
Day to day performance and documentation	08
Test and viva voce	04
Attendance (Theory and Laboratory together)	**08**
End Semester Examination (ESE) Theory	**60**
Total	**100**
End Semester Examination Pattern	
There will be two parts; Part A and Part B. Part A: 30 marks Part B: 30 marks Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.	

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA303-E		
Course Name:	Cloud Computing		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	Write notes on private and hybrid cloud.	1	1	3
2.	Explain data privacy.	2	2	3
3.	Define standards for messaging.	2	1	3
4.	Explain platform as a service.	2	2	3
5.	Explain metering and billing in cloud.	3	2	3
6.	List advantages of virtual desktop infrastructure.	4	1	3
7.	Explain need for virtual machine.	4	2	3
8.	Demonstrate cloud security challenges.	3	3	3
9.	List the service levels of cloud applications.	2	2	3
10.	List the advantages of web based word processors.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	Explain cloud-computing models.	1	2	6
	OR			
12.	Explain cloud services.	1	1	6
	MODULE II			
13.	Describe the legal and regulatory issues in cloud computing.	2	2	6
	OR			
14.	Write a note on major players in cloud computing.	2	1	6
	MODULE III			
15.	Elaborate characteristics and disadvantages of SaaS.	3	2	6
	OR			
16.	Explain accessing the clouds.	3	1	6
	MODULE IV			
17.	Discuss virtualization architecture.	4	2	6

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	OR			
18.	Explain different types of virtualization.	4	2	6
	MODULE V			
19.	Analyse the need for collaborating on calendars, schedules and task management.	5	4	6
	OR			
20.	Propose the advantages of collaborating on databases.	5	4	6

****

COURSE DESCRIPTION		
Course Code	21CA304-A	Course Credit: 4
Course Name	Social Network Analysis	
L-T-J-P	3-1-0-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To introduce the components of social networks.
2	To familiarize ontology-based knowledge representation techniques of social networks.
3	To Introduce mining the users in social networks.
4	To understand the structure of the web through the Facebook lens.
5	To know the how search engines like Google are working.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Explain the basic concepts of semantic web and social network analysis.	2
CO2	Describe the ontology-based knowledge representation techniques in social network.	2
CO3	Discuss aggregation of social network information and representation of social individuals and social relationships.	2
CO4	Describe the structure of the Web and Facebook as a graph and the algorithms for searching and community discovery.	2
CO5	Explain the general architecture of a search engine and specifically the Google search engine architecture.	2

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	1	-	-	-	-	-
CO2	2	2	-	-	-	-	1	-	-	-	-	-
CO3	2	2	-	-	-	-	2	-	-	-	-	-
CO4	2	3	-	2	2	2	2	-	-	2	-	-
CO5	2	3	-	2	2	-	2	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction to the Semantic Web and Social Networks - Evolution of Social Network Analysis - Electronic sources for network analysis and Knowledge Representation on the Semantic Web - Relevance of Ontology and Ontology - based Languages - Modelling and aggregating social network data - Reasoning with Social Network Data - Graph Structure of Web and Facebook - Networking - Link Analysis - Search Engines and Crawling for Data

COURSE CONTENT

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction to the Semantic Web and Social Networks**			
The Semantic Web - Limitations of the Current Web		1	1	20%
The Semantic Solution - Development of the Semantic Web		1	2	
Social Network Analysis - Development of Social Network Analysis		1	2	
The Global Structure of Networks		1	2	
The Macro - Structure of Social Networks - Personal Networks		1	2	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Electronic Sources for Network Analysis and Knowledge Representation On the Semantic Web**			
Electronic Discussion Networks		2	1	20%
Blogs and Online Communities - Web-Based Networks		2	2	
Ontologies and their role in the Semantic Web		2	1	
Ontology Languages for the Semantic Web		2	2	
The Resource Description Framework (RDF) and RDF Schema		2	2	
The Web Ontology Language (OWL)		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Modelling and Aggregating Social Network Data**			
Network Data Representation		3	1	20%
Ontological Representation of Social Individuals - Ontological Representation of Social Relationships		3	2	
Aggregating and Reasoning with Social Network Data		3	1	
Representing Identity - On the Notion of Equality		3	2	
Determining Equality - Reasoning with Instance Equality		3	2	
Evaluating Smushing		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Graph Structure of Web and Facebook**			
Breadth First Search (BFS) Algorithm		4	1	20%
Strongly Connected Components (SCC) Algorithm - Weakly Connected Components (WCC)Algorithm		4	2	
Connected Components - Zipf's Law		4	2	
Spid - Degree Distribution - Path Length.		4	2	
Component Size - Clustering Coefficient and Degeneracy		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Link Analysis**			
Search Engine - Search Engine Architecture - Crawling		5	2	20%
Indexing - Ranking - HITS Algorithm		5	2	
Page rank algorithm - Random walk - SALSA Algorithm - Bayesian Algorithm		5	2	
Google - Google Architecture - Data Structures - Crawling		5	2	
Searching - Web Spam Pages		5	2	

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TEXT BOOKS	
1	Krishna Raj P. M., Ankith Mohan, K.G., Srinivasa, *Practical Social Network Analysis with Python,* 1st Edition, Springer, 2018, ISBN: 978-3319967455
2	Charu C. Aggarwal, *Social Network Data Analytics,* 1st Edition, Springer, 2014, ISBN: 978-1441984616
3	Peter Mika, *Social Networks and the Semantic Web,* Springer, 2007, ISBN: 978-0387518176
REFERENCE BOOKS	
1	Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, *Computational Social Network Analysis: Trends, Tools and Research Advances*, Springer, 2012, ISBN: 978-1848822283
2	Borko Furht, *Handbook of Social Network Technologies and Applications,* 1st Edition, Springer, 2011, ISBN: 978-1489994004
3	Lee Giles, Mark Smith, John Yen, *Advances in Social Network Mining and Analysis,* Springer, 2010, ISBN: 978-3642149306
4	Guandong Xu, Yanchun Zhang, Lin Li, *Web Mining and Social Networking, Techniques and Applications,* 1st Edition, Springer, 2012, ISBN: 978-1461427186
5	Przemyslaw Kazienko, Nitesh Chawla, *Applications of Social Media and Social Network Analysis,* Springer, 2015, ISBN: 978-3319190020

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 30 marks
Part B: 30 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	**21CA304-A**		
Course Name:	**Social Network Analysis**		
Max. Marks:	**60**	**Duration:**	**3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	What is meant by semantic web?	1	1	3
2.	Write notes on personal networks.	1	1	3
3.	Define electronic discussion networks.	2	1	3
4.	List out the features of blogs that can be used for social network extraction.	2	1	3
5.	Explain how the reasoning with instance equality is done in social network data.	3	2	3
6.	What is meant by evaluating smushing?	3	1	3
7.	Define “power law”.	4	1	3
8.	What is “spid”? How it is used to differentiate web-network and social network?	4	1	3
9.	What are the basic functions of the storage repository of a search engine?	5	1	3
10.	How can we identify web spam pages?	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	List and explain various measures in network analysis.	1	1	6
	OR			
12.	Describe the macro-structure of social networks.	1	2	6
	MODULE II			
13.	What is meant by ontology-based knowledge representation? Explain its role in the semantic web.	2	1	6
	OR			
14.	Compare the features of Web Ontology Language (WOL) and Extensible Markup Language (XML).	2	2	6
	MODULE III			
15.	Describe how aggregating and reasoning can be done on social network data.	3	2	6

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	OR			
16.	Discuss the ontological representation of social relationships.	3	2	6
	MODULE IV			
17.	Define the following with suitable example: i) Rank exponent ii) Hop plot exponent iii) Eigen exponent	4	1	6
	OR			
18.	Explain how to generate in-degree and out-degree distributions on the graph of the Web crawl.	4	2	6
	MODULE V			
19.	Describe how the web crawler module in a search engine does the pages election and page refresh.	5	2	6
	OR			
20.	Draw the architecture of Google search engine and comment on each of its components.	5	1	6

****

COURSE DESCRIPTION		
Course Code	21CA304-B	Course Credit: 4
Course Name	Deep Learning	
L-T-J-P	3-1-0-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To understand the context of neural networks and deep learning.
2	To implement, train, and validate a neural network.
3	To design layered networks using deep learning principles.
4	To solve real world problems with deep learning algorithms.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Illustrate the basic concepts of deep learning.	2
CO2	Design neural networks using Tensor flow.	3
CO3	Experiment real world problems with CNN.	3
CO4	Solve real world problems with RNN.	3
CO5	Demonstrate the concepts of GAN.	2

CO-PO MAPPING												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	3	-	3	-	-	-	-	-
CO3	3	3	3	-	3	-	3	-	-	-	-	-
CO4	3	3	3	-	3	-	3	-	-	-	-	-
CO5	2	3	-	-	2	-	2	-	-	-	-	-
Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"												

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

SYLLABUS

Review of Neural Networks - Perceptrons - Training Neural Networks and Data Visualization - Introduction to Tensor Flow - Convolutional Neural Networks - Recurrent Neural Networks - Gated Recurrent Units (GRUs) - Generative Adversarial Networks (GAN) - Discriminative and Generative Models

COURSE CONTENT

Module-I		COs	Hrs.	ESE Marks
Module Title	**Review of Neural Networks**			
Model of a Biological Neuron - McCulloch Pitts Neuron		1	2	20%
Activation Functions		1	1	
Perceptrons		1	1	
Perceptron Learning Algorithm and Convergence - Multilayer Perceptrons		1	2	
Back Propagation - Learning XOR		1	1	
Sigmoid Neurons - Gradient Descent		1	1	
Feed forward Neural Networks		1	1	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Training Neural Networks and Data Visualization**			
Initialization - Dropout - Batch Normalization - Drop out - Over fitting		2	2	20%
Under fitting - Training and Validation Curves - Data Visualization: Feature and Weight Visualisation - TSNE		2	2	
Introduction to Tensor Flow - Graphs - Nodes		2	2	
Tensor Data Structure Rank Shape - Type - Building Neural Networks with Tensor Flow		2	2	
Introduction to Keras		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Convolutional Neural Networks**			
Convolution Operation		3	2	20%
Convolutional Layers in Neural Network		3	2	
Pooling - Fully Connected Layers		3	2	
Case Study: Architecture of Lenet		3	2	
Alexnet and VGG 16		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Recurrent Neural Networks**			
Back Propagation: Vanishing Gradients		4	2	20%
Exploding Gradients - Truncated Back propagation through time		4	2	
Gated Recurrent Units (GRUs)		4	1	
Long Short Term Memory (LSTM) Cells		4	2	
Solving the vanishing gradient problem with LSTMs		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Generative Adversarial Networks (GAN)**			
Auto encoders - Variational Auto encoders		5	2	20%
Discriminative and Generative Models		5	2	
GAN Discriminator - GAN Generator		5	2	
up sampling - GAN Training		5	2	
GAN Challenges - Loss Functions Cross Entropy Mini -Max Loss Wasserstein Loss		5	2	

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TEXT BOOKS	
1	David Foster, *Generative Deep Learning*, 1st Edition, O'Reilly Media Inc; 2019, ISBN: 9781492041948
2	Ian Good fellow, Yoshua Bengio, Aaron Courville, *Deep Learning,* MIT press, Illustrated Edition, 2016, ISBN10: 0262035618 ISBN-13: 9780262035613
3	AurelienGeron, *Hands–On Machine Learning with Scikit, Learn and Tensor Flow,* 1st Edition, O'Reilly, 2017, ISBN-10: 149196229 ISBN-13: 978-1491962299
4	Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, *Dive Deep into machine learning,* Online book, https://d2l.ai/
REFERENCE BOOKS	
1	Kevin Murphy, *Probabilistic Machine Learning: An Introduction,* The MIT Press, Illustrated Edition, 2022, ISBN: 10: 0262046822 ISBN-13: 978-0262046824
2	Ragav Venkatesan, Baoxin Li, *Convolutional Neural Networks for Visual Computing: A Concise Guide,* 1st Edition, *CRC press,* 2017, ISBN: 13: 978-1138747951
3	Jakub Langr, Vladimir Bok, *GANs in Action: Deep Learning with Generative Adversarial Network,* 1st Edition, Manning Publications, 2019, ISBN-10: 1617295566 ISBN-13: 978-1617295560
4	David Foster, *Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play,* 1st Edition, O'Reilly Media, 2019, ISBN-13: 978-1492041948

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 30 marks
Part B: 30 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

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D		Total Pages:	2
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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA304-B		
Course Name:	Deep Learning		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	Describe sigmoid activation functions.	1	2	3
2.	Write the gradient descent algorithm.	1	2	3
3.	Explain with an example how graphs are stored and represented in Tensor flow.	2	2	3
4.	Explain how graph representation can accelerate computing models.	2	2	3
5.	Explain the VGG 16 architecture.	3	2	3
6.	What is max pooling in the context of CNN?	3	2	3
7.	Explain ReLU.	4	2	3
8.	Explain the problem of vanishing gradients.	4	2	3
9.	Write a note on auto encoders.	5	2	3
10.	Explain the idea behind cross entropy.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I					
11.	a)	Describe the model of a biological neuron.	1	2	3
	b)	Explain perceptron learning algorithm.	1	2	3
OR					
12.		With a suitable example, explain how back propagation works.	1	2	6
MODULE II					
13.		Explain the role of batch normalization in training a neural network.	2	2	6
OR					
14.		Explain the ideas of rank, shape, type with an example in the context of a tensor data structure.	2	2	6
MODULE III					
15.		With a suitable numerical example, illustrate convolution operation.	3	2	6

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	OR			
16.	Explain the architecture of Alex Net.	3	2	6
	MODULE IV			
17.	Explain the idea of truncated back propagation through time.	4	2	6
	OR			
18.	Describe how LSTM works.	4	2	6
	MODULE V			
19.	Distinguish between generative and discriminative models.	5	2	6
	OR			
20.	Explain how a GAN is trained.	5	2	6

****

COURSE DESCRIPTION		
Course Code	21CA304–C	Course Credit: 4
Course Name	Artificial Intelligence	
L-T-J-P	3–1–0–0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To provide a strong foundation of fundamental concepts in Artificial Intelligence.
2	To provide a basic exposition to the searching methods of Artificial Intelligence.
3	To learn the basics of knowledge representation and learning.
4	To apply Artificial Intelligence techniques in solving problems of a particular domain.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Illustrate the basic concepts and state–of–the–art techniques of artificial intelligence.	2
CO2	Analyze and apply the different types of control and heuristic search methods to solve problems.	4
CO3	Formulate knowledge representation and transform the real life information in different representation.	3
CO4	Apply feasible learning techniques to solve non–trial problems.	3
CO5	Apply ANN systems to solve real world problems.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	2	-	-	-
CO2	3	3	-	-	-	-	-	-	2	-	-	-
CO3	3	3	-	-	-	-	-	-	2	-	-	-
CO4	3	3	3	-	-	-	3	-	2	-	2	2
CO5	3	3	3	-	-	-	3	-	2	-	2	3

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction to Artificial Intelligence - Agents and Environments - Production and Non Production Systems - Search Strategies - Uninformed and Informed search Strategies - Alpha–Beta Pruning - Knowledge Representation - Techniques of Knowledge Representation in AI - Learning - Knowledge in Learning - Learning using Relevance Information - Learning with Hidden Variables - Artificial Neural Networks - Applications of ANN - Introduction to Various Artificial Neural Networks

COURSE CONTENT

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction to Artificial Intelligence**			
What is AI - Why AI - Applications of AI		1	1	20%
Problem Solving Approach to Typical AI Problems - Turing Test		1	1	
Expert Systems - Components		1	1	
Characteristics - Applications		1	1	
Agents and Environments - Characteristics of Intelligent Agents		1	1	
Typical Intelligent Agents Forward and Backward Chaining		1	1	
Production and Non Production Systems		1	1	
Components of a Production System		1	1	
Characteristics of Production System		1	1	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Search Strategies**			
Problem Solving by Search - Defining the problem as a State Space		2	1	20%
Well - Defined Problems and Solutions		2	1	
Uninformed and Informed search Strategies		2	1	
DFS - BFS		2	1	
Heuristic Search - Need for heuristics - Heuristic Functions		2	1	
Heuristic Search Techniques - Hill Climbing		2	1	
Simulated Annealing - Best First Search		2	1	
Blind Search		2	1	
Game Playing		2	1	
Alpha - Beta Pruning		2	1	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Knowledge Representation**			
Definition and Importance of knowledge		3	1	20%
Knowledge Based Systems		3	1	
Representation of Knowledge		3	1	
Types of Knowledge		3	2	
Acquisition of Knowledge		3	1	
Cycle of Knowledge Representation in AI		3	1	
Techniques of Knowledge Representation in AI		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Learning**			
Introduction - Learning from Observations - Inductive Learning		4	1	20%
Learning Decision Trees - Assessing the Performance of the Learning Algorithm		4	1	
Noise and Over fitting - Ensemble Learning		4	1	

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Logical Formulation of Learning	4	1	
Knowledge in Learning - Explanation Based Learning	4	1	
Learning using Relevance Information	4	1	
Statistical Learning - Learning with Complete Data	4	1	
Learning with Hidden Variables	4	1	
EM Algorithm	4	1	
Instance Based Learning	4	1	
Module-V	**COs**	**Hrs.**	**ESE Marks**
Module Title **Artificial Neural Networks**			
Biological Neuron - Artificial Neural Networks - Artificial Neuron Model (McCulloch - Pitts Model)	5	1	
Thresholding Logic - Types of ANN	5	1	
Feed forward Neural Networks - Feedback Neural Networks	5	1	
Learning in ANN	5	1	
Back Propagation and Bayesian Networks	5	1	20%
Multilayer Perceptrons (MLPs)	5	1	
Applications of ANN	5	1	
Convolutional Neural Networks	5	1	
Recurrent Neural Networks	5	1	
Introduction to Alex Net - Google Le Net - Res Net	5	1	

TEXT BOOKS	
1	George F Luger, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving*, 6th Edition, Pearson Education, 2008, ISBN-13: 978–0–321–54589–3 ISBN-10: 0–321–54589–3
2	E. Rich, K. Knight, S B Nair, *Artificial Intelligence*, 3rd Edition, McGraw Hill Education, 2008, ISBN–10: 0070087709 ISBN-13: 9780070087705
3	Stuart Russel and Peter Norvig, *Artificial Intelligence A Modern Approach, 3rd* Edition, Pearson Education, 2014, ISBN: 978–81–7758–367–0 ISBN: 9789332543515 ISBN: 9789332518698
REFERENCE BOOKS	
1	Peter Jackson, *Introduction to Expert Systems*, 3rd Edition, Pearson Education, 1998, ISBN–10: 0201876868 ISBN–13: 9780201876864
2	Dan W. Patterson, *Introduction to AI and ES,* 1st Edition, Pearson Education, 2007, ISBN: 9789332551947 ISBN: 9332551944
3	B. Yegnanarayana, *Artificial Neural Networks*, Prentice–Hall of India Pvt. Ltd, ISBN: 9788120312531 ISBN: 9788120312531
4	K. Boyer, L. Stark, H. Bunke, *Applications of AI, Machine Vision and Robotics*, Indian Edition, World Scientific Pub Co., 1995, ISBN–10: 9810221509 ISBN–13: 978–9810221508
5	David L. Poole and Alan K. Mackworth, *Artificial Intelligence: Foundations of Computational Agents,* 1st Edition, Cambridge University Press, 2010, ISBN–10: 0521519004 ISBN–13: 978–0521519007

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**
End Semester Examination Pattern	
There will be two parts; Part A and Part B. Part A: 30 marks Part B: 30 marks Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.	

D			Total Pages:	2
Register No.:		Name:		

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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA304–C		
Course Name:	Artificial Intelligence		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	List the application areas in AI.	1	2	3
2.	What is the Turing test?	1	2	3
3.	Explain the significance of heuristic search.	2	2	3
4.	List the disadvantages of hill climbing.	2	2	3
5.	How is knowledge represented?	3	2	3
6.	List the properties of a good knowledge representation system.	3	2	3
7.	Define noise.	4	2	3
8.	What is inductive learning?	4	2	3
9.	Compare single–layer perceptrons and multilayer perceptrons.	5	3	3
10.	Differentiate CNN and RNN.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	Discuss the architecture of an expert system with a suitable diagram. Give its three application areas.	1	2	6
	OR			
12.	Elaborate on the components and characteristics of production systems.	1	2	6
	MODULE II			
13.	Differentiate depth first search and breadth first search.	2	2	6
	OR			
14.	Explain blind search category in detail.	2	2	6
	MODULE III			
15.	List and explain the knowledge representation methods in AI.	3	2	6
	OR			
16.	Discuss the different types of knowledge acquisition techniques.	3	2	6

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MODULE IV				
17.	Explain the various types of learning methods in problem solving.	4	2	6
OR				
18.	How is the performance of a learning algorithm assessed? Draw a learning curve for the decision tree algorithm.	4	3	6
MODULE V				
19.	Discuss the architecture of ANN with a diagram.	5	2	6
OR				
20.	Describe how the basic Back-Propagation Learning Algorithm for Multi-Layer Perceptron (MLP) networks is related to gradient descent learning.	5	2	6

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COURSE DESCRIPTION		
Course Code	21CA304-D	Course Credit: 4
Course Name	Blockchain Technologies	
L-T-J-P	3-1-0-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To describe the basic understanding of Blockchain technology.
2	To understand Bit coin and Crypto currency.
3	To analyse the applications of Blockchain.
4	To gain a basic idea about solidity programming.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	To understand the basics of blockchain and crypto currency.	2
CO2	Understand and explore the working of Blockchain technology.	2
CO3	Analyse the working of smart contract.	4
CO4	Understand and analyse the working of Hyperledger.	2
CO5	Apply the learning of solidity and de-centralized apps on Ethereum.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	1	2	2	-	2	-	-	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	-	2	-	-	-	-	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Introduction of Cryptography - Blockchain and digital signature - Brief idea about Bit Coin - Cryptocurrency and EVM - Understand Ethereum and Blockchain Applications - Introduction to Hyperledger - Solidity Programming

COURSE CONTENT

Module-I		COs	Hrs.	ESE Marks
Module Title	**Introduction of Cryptography and Blockchain**			
What is Blockchain - Blockchain Technology Mechanisms and Networks		1	2	20%
Blockchain Origins - Objective of Blockchain - Blockchain Challenges		1	2	
Transactions And Blocks - P2P Systems		1	2	
Keys As Identity - Digital Signatures		1	2	
Hashing - Public key cryptosystems - Private vs Public Blockchain		1	2	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Bit Coin and Crypto currency**			
What is Bitcoin - The Bitcoin Network - The Bitcoin Mining Process		2	2	20%
Mining Developments - Bitcoin Wallets		2	2	
Decentralization and Hard Forks		2	2	
Ethereum Virtual Machine (EVM)		2	2	
Transactional Blocks - Impact of Blockchain Technology on Cryptocurrency		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Introduction to Ethereum and Blockchain Applications**			
What is Ethereum - Introduction to Ethereum		3	2	20%
Consensus Mechanisms		3	2	
How Smart Contracts Work		3	1	
Blockchain Applications: Internet of Things		3	2	
Medical Record Management System		3	1	
Domain Name Service and Future of Blockchain - Alt Coins		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Introduction to Hyperledger**			
What is Hyperledger		4	2	20%
Distributed Ledger Technology and its Challenges		4	2	
Hyperledger and Distributed Ledger Technology		4	2	
Hyperledger Fabric		4	1	
Hyperledger Composer		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Solidity Programming**			
Solidity		5	1	20%
Language of Smart Contracts		5	1	
Installing Solidity and Ethereum Wallet		5	1	
Basics of Solidity - Layout of a Solidity Source		5	2	
File - Structure of Smart Contracts		5	2	
General Value Types (Int,Real, String, Bytes, Arrays, Mapping, Enum, address)		5	2	

TEXT BOOKS

1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction,* Illustrated Edition, Princeton University Press, 2016, ISBN: B01GGQJ2XW

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2	Andreas Antonopoulos, *Mastering Bitcoin-Unlocking Digital Cryptocurrencies*, 2nd Edition, O'Reilly Publications, ISBN-13: 978-1491954386 ISBN-10: 1491954388
3	Antonopoulos and G. Wood, *Mastering Ethereum Building Smart Contracts and D Apps,* O'Reilly Publications, 2018, ISBN-10: 1491971940 ISBN-13: 978-1491971949
4	D. Drescher, *Blockchain Basics,* A press Publications, 2017, ISBN-10: 1484226038 ISBN-13: 978-1484226032
REFERENCE BOOKS	
1	Chris Burniske*, Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond,* 1st Edition, McGraw Hill, 2017, ISBN-10: 1260026671 ISBN-13: 978-1260026672
2	Don Tapscott*, Blockchain Revolution,* 1st Edition, Penguin Publications, 2018, ISBN-10: 0241237866 ISBN-13: 978-0241237861
3	Antony Lewis*, The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them,* 1st Edition, Mango Media, 2018, ISBN-10: 1633538001 ISBN-13: 978-1633538009
4	Melanie Swan*, Blockchain: Blueprint for a New Economy*, 1st Edition, O'Reilly Publications, 2015, ISBN-10: 9351109925 ISBN-13: 978-9351109921

MODES OF EVALUATION	**SCORE WEIGHTAGE / SPLIT MARKS**
Continuous Internal Evaluation (CIE)	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 30 marks
Part B: 30 marks
Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

D			Total Pages:	2
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THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA304-D		
Course Name:	Blockchain Technologies		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	What is Blockchain?	1	2	3
2.	List out blockchain challenges.	1	2	3
3.	Define Cryptocurrency.	2	2	3
4.	What are Merkle trees? How important are Merkle trees in Blockchains?	2	2	3
5.	Explain how smart contracts work.	3	2	3
6.	What is Ethereum?	3	2	3
7.	Differentiate Blockchain and Hyperledger.	4	2	3
8.	Define Hyper ledger composer.	4	2	3
9.	Explain the layout of a solidity source.	5	2	3
10.	Explain any three general value type used for solidity programming.	5	2	3

PART B

(Answer one full question from each module, each question carries 6 marks)

	MODULE I			
11.	Briefly explain digital signature with examples.	1	2	6
	OR			
12.	Explain blockchain architecture in detail.	1	2	6
	MODULE II			
13.	List and explain the parts of EVM memory.	2	2	6
	OR			
14.	Explain bitcoin network.	2	2	6
	MODULE III			
15.	Elaborate different consensus mechanisms.	3	3	6
	OR			
16.	Analyse the applications of blockchain technology.	3	3	6

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MODULE IV				
17.	Briefly explain the challenges of hyperledger technology.	4	2	6
OR				
18.	Explain Hyperledger and distributed ledger technology.	4	2	6
MODULE V				
19.	What is solidity programming? Explain the installation Steps.	5	2	6
OR				
20.	Explain file and structure of smart contracts.	5	2	6

****

COURSE DESCRIPTION		
Course Code	21CA304-E	Course Credit: 4
Course Name	IPR and Cyber Laws	
L-T-J-P	3-1-0-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To familiar with the social and intellectual property issues emerging from 'cyberspace.
2	To gain deep knowledge of information technology act and legal frame work of right to privacy, data security and data protection.
3	To develop an understanding of relationship between commerce and cyberspace.
4	To impart quality legal education, leading to excellence and innovation.

COURSE OUTCOMES (COs)		REVISEDBLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Illustrate the fundamentals of IPR and patents.	2
CO2	Apply intellectual property related tools such as trademark and copyright to real problems.	3
CO3	Elaborate Industrial designs, trade secret and geographic Indications.	3
CO4	Examine laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security.	3
CO5	Summarize different types of cybercrimes and penalties under IT Act.	2

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	1	-	-	-	-	-	-
CO2	3	3	2	1	-	1	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	1	-	-	-	-	-	-
CO5	2	2	1	1	-	1	-	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours
Internal Test (2 Assessment Tests of two-hour duration)	4 Hours

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SYLLABUS

Fundamentals of IPR - Patents - Trademarks - Copyright - Industrial Designs - Cyber Law - Product of copyright on Cyberspace - Geographic Indications - Information Technology Act and Punishments

COURSE CONTENT

Module-I		COs	Hrs.	ESE Marks
Module Title	**Fundamentals of IPR**			
Fundamentals of IPR - Introduction - Intellectual property - Need for Protection of Intellectual Property		1	2	20%
WIPO - Intellectual Property Rights and Development		1	2	
Rationale of Protection -TRIPS Agreement		1	1	
Patents - Introduction		1	1	
Patentable and Non - Patentable Invention - Types of Patent Applications		1	2	
Guidelines for Registration of Patent - Patent Filing - Grant of Patent - Types of Patent Documents		1	2	
Module-II		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Trademarks**			
Trademarks - Introduction - Guidelines for Registration		2	2	20%
Requirements for Filing Trademarks - Trademark Infringement - Protection of Trademarks		2	1	
Copyright - Introduction - Rights Conferred by Copyright - Registration		2	2	
Ownerships - Terms - Transfer of Copyrights - Copyright Infringement - Databases and Copyright		2	1	
Software Copyright - Introduction - Need of Software Copyright - Classification of Software According to Copyright		2	2	
Software Auditing - Copyright Notice - Transfer of Copyright		2	2	
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Industrial Designs**			
Industrial Designs - Introduction - Need for Protection of Design		3	2	20%
Requirements for Registration of Designs - Design Act 2000 - Duration of Registration of Design - Application Procedure		3	2	
Geographic Indications - Introduction - Filing Granting		3	2	
Protection of Geographic Indications		3	2	
Trade Secret - Definition - Discovering and Protecting of Trade Secret		3	2	
Module-IV		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Cyber Law**			
Cyber Law - Need for Cyber Laws - Historical Perspective		4	2	20%
Cyberspace - Deception by Squatting in Cyberspace		4	1	
Protection of Copyright on Cyberspace - Infringement of Copyright on Cyberspace		4	2	
Linking - Hyper Linking and Framing		4	1	
ISP in Cyberspace - Cyberspace and Protection of Patents in India		4	2	
Module-V		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Information Technology Act and Punishments**			
Information Technology Act and Punishments - Introduction to IT Act 2000 - Amendments on IT Act		5	2	20%
Violation of the right of privacy in Cyberspace/ Internet - Punishment for Violation of privacy		5	2	
Breach of confidentiality and Privacy Under IT act Terrorism on Cyberspace		5	2	

Overview of Cybercrimes			
Offences by intermediaries - offences related to protected system offences of misrepresentation	5	2	
Punishment for Abetment and Attempt to commit offences under the IT act	5	2	

TEXT BOOKS	
1	Dr. R. Radhakrishnan and Dr. S. Balasubramanian, *Intellectual Property Rights: Text and Cases,* Excel Books, ISBN: 20108174466096
2	Harish Chander, *Cyber Law and IT Protection,* PHI Learning Pvt. Ltd, 2012, ISBN: 8120345703
3	B.L. Wadehra, *Law Relating To Intellectual Property,* 5th Edition, Universal Law Publishing - An imprint of LexisNexis, 2016, ISBN: 9350350300
REFERENCE BOOKS	
1	D.Bainbridge, *Introduction to Computer Law,* Pearson Education
2	RohasNagpal, *Cyber Crime & Corporate Liability,* CCH, 2008

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation	**40**
Internal Test – I	10
Internal Test – II	10
Assignments / Tutorial / Seminars etc.	12
Attendance	08
End Semester Examination (ESE)	**60**
Total	**100**
End Semester Examination Pattern	
There will be two parts; Part A and Part B. Part A: 30 marks Part B: 30 marks Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.	

D			Total Pages:	2
Register No.:		Name:		

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(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER MCA DEGREE EXAMINATION, MONTH AND YEAR

Course Code:	21CA304-E		
Course Name:	IPR and Cyber Laws		
Max. Marks:	60	Duration:	3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

	Question	CO	BTL	MARKS
1.	Define IPR. Why should we protect intellectual properties?	1	2	3
2.	Write short note on TRIP agreement.	1	2	3
3.	Discuss various kinds of software copyright infringement.	2	2	3
4.	State the differences between trademark and trade name.	2	3	3
5.	What are the recent legal developments in the protection of trade secrets?	3	1	3
6.	Explain the provisions for the protection of geographical indications.	3	1	3
7.	Briefly describe the liabilities of ISP under the IT act.	4	2	3
8.	Explain how we can deal with cyber squatting of domain names.	4	2	3
9.	What is breach of confidentiality and privacy under IT act and its penalties?	5	2	3
10.	Under what circumstances, intermediaries cannot be held liable under the Act?	5	3	3

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I					
11.	a)	Describe various types of patent applications in India.	1	2	2
	b)	What role does WIPO play with regard to patents?	1	2	4
OR					
12.		Discuss in detail about criteria of patentable and non-patentable inventions.	1	2	6
MODULE II					
13.		Explain the guidelines for the registration of trademark.	2	2	6
OR					
14.	a)	Why copyright is considered so important in the digital era?	2	2	2
	b)	Explain about the rights conferred by the copyright.	2	2	4
MODULE III					
15.		Describe the essential requirements for the registration of design.	3	3	6

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OR					
16.		Explain the various stages in filing and granting of geographical indications in India.	3	2	6
MODULE IV					
17.		Describe the various remedies for the infringement of copyright on cyberspace.	4	3	6
OR					
18.	a)	List out the rights of software copyright owners.	4	2	2
	b)	Discuss about the protection of copyright on cyberspace.	4	3	4
MODULE V					
19.		Explain in detail about IT Act 2000 and its amendments.	5	2	6
OR					
20.		Explain about various types of cybercrimes and its punishments.	5	2	6

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COURSE DESCRIPTION		
Course Code	21CA306	Course Credit: 2
Course Name	Mobile Application Development Lab	
L-T-J-P	0-1-3-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To execute mobile application development programming in android platform.
2	To familiarize Android Studio and its features to develop a mobile application.
3	To design user interfaces using basic building blocks, UI components, layouts, themes and preferences.
4	To implement interactive applications using intents, menus, spinner and dialogs.
5	To develop interactive applications using SQLite.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Design and develop user interfaces for mobile apps using basic building blocks, UI components and application structure using Emulator.	3
CO2	Analyse and create small applications using the concepts of UI design, layouts.	3
CO3	Develop applications with multiple activities using intents, array adapter, exceptions and options menu, preferences.	3
CO4	Discover activities with dialogs, spinner, fragments and navigation drawer by applying themes.	3
CO5	Develop mobile applications using SQLite.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3	2	3	-	-	-	-	-
CO2	3	3	3	2	3	2	3	-	-	-	-	-
CO3	3	3	3	2	3	2	3	-	-	-	-	-
CO4	3	3	3	2	3	2	3	-	-	-	-	-
CO5	3	3	3	2	3	3	3	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

TUTORIAL

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	12 Hours

SYLLABUS

Fundamentals - Basic Building blocks - UI Components - Application Structure - Activity lifecycle - Emulator - Android Virtual Device - Emulator shortcuts - Basic UI design - Preferences - Shared Preferences - Preferences from xml - Menu - Option menu-Context menu - Intents - Explicit Intents - Implicit intents - UI design -Tabs -Tab Activity Styles and Themes - Content Providers - SQLite Programming - Fragments - Navigation drawer

COURSE CONTENT- TUTORIAL

	List of Laboratory Experiments	COs	Hours
1	Fundamentals: Basic Building blocks - Activities, Services, Broadcast Receivers and Content providers, UI Components - Views and notifications Components for communication - Intents and Intent Filters	1	1
2	Application Structure: Android Manifest.xml, user-permission - sdk, Resources and R.java, Assets, Layouts and Drawable Resources, Activities and Activity lifecycle	1	1
3	Emulator - Android Virtual Device: Launching emulator, Editing emulator settings, Emulator shortcuts, Log cat usage, Introduction to DDMS	2	1
4	Basic UI design: Form widgets, Text Fields, Validation of Edit Text, Layouts, [dip, dp, sip, sp]versus px	3	1
5	Preferences: Shared Preferences, Preferences from xml	3	1
6	Menu: Option menu, Context menu, menu from xml, menu via code	3	1
7	Intents: Explicit Intents, Implicit intents	3	1
8	UI design: Time and Date, Images and media, Android Adapter and List View, Composite, Alert Dialogs and Toast	4	1
9	Popup, Fragments, Navigation drawer	4	1
10	Tabs, Tab Activity Styles & Themes: styles.xml, drawable resources for shapes, gradients(selectors)	4	1
11	Style attribute in layout file, Applying themes via code and manifest file	4	1
12	Content Providers: SQLite Programming, SQLite Open Helper, SQLite Database, Cursor, Reading and updating Contacts, Reading bookmarks	5	1

PROJECT

COURSE IMPLEMENTATION CLOCK (IN HOURS)

Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**36 Hours**
Internal Test	**2 Hours**

COURSE CONTENT – PROJECT

	List of projects including below but not limited to	COs	Hours
1	Develop a student management system in Android.	5	3
2	Create a parental control application using Android.	5	3
3	Develop a employee management system in Android.	5	3
4	Create a simple Calculator using Grid Layout and Cascaded Linear Layout.	4	3
5	Develop a doctor appointment system.	5	3
6	Attendance monitoring system in Android.	5	3
7	Quiz App In Android.	5	3
8	Food Ordering Android App.	5	3
9	Create Tic Tac Toe Game App in Android Studio.	5	3
10	Create SMS Android App Using Android Studio.	5	3

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11	Develop Android app for learning of alphabets for kids.	4	2
12	Online Shopping Application in Android.	5	4

LABORATORY MANUAL
An internally prepared laboratory manual

TEXT BOOKS	
1	Joseph AnnuzziJr Lauren Darcey, Shane Condor, *Introduction to Advanced Android Application Development,* 4th Edition, *Developers Library*, Addison Wesley, 2015, ISBN-10: 013438945X- ISBN-13: 978-0134389455
2	Paul Deitel, Harvey Deitel, Alexander Wald, *Android 6 for Programmers: An App,* 3rd Edition, 2015, *Driven Approach Prentice Hall,* ISBN-10: 0134289366 ISBN-13: 978-0134289366
REFERENCE BOOKS	
Bill Phillips and Brian Hardy. *Android Programming,* 1st Edition, The Big Nerd Ranch Guide Big Nerd Ranch, 2013	

MODES OF EVALUATION	**SCORE WEIGHTAGE / SPLIT MARKS**
Continuous Internal Evaluation (CIE) of Project	**16**
Review - I	08
Review - II	08
Continuous Internal Evaluation (CIE) of Laboratory	**16**
Day to day performance and documentation	08
Test and viva voce	08
Attendance (CIE Project and CIE Laboratory)	**08**
End Semester Examination (ESE)	**60**
Program logic and code	20
Output	10
Viva	10
Project presentation	20
Total	**100**

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COURSE DESCRIPTION		
Course Code	**21CA307**	**Course Credit: 2**
Course Name	**Data Science Lab**	
L-T-J-P	**0-0-0-4**	
Pre-requisite	**21CA106 Python Programming Lab**	
Year of Introduction	**2021**	

COURSE OBJECTIVES	
1	To introduce students with data science and visualization methods.
2	To familiarize students with the standard machine learning algorithms.
3	To make students understand how machine learning algorithms actually work.
4	To introduce students with the actual modelling in machine learning world.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Use different python packages to perform numerical calculations, statistical computations.	2
CO2	Do data pre-processing and visualization techniques.	3
CO3	Use different packages and frameworks to implement regression, and classification algorithms.	2
CO4	Implement convolutional neural network algorithm using Keras framework.	4
CO5	Use different packages and frameworks to implement k-means clustering.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	2	-	-	-	-	-
CO2	3	2	3	2	3	2	3	-	-	-	-	-
CO3	3	3	2	2	2	1	3	-	-	-	-	-
CO4	3	3	3	2	2	1	3	-	-	-	-	-
CO5	3	3	3	2	2	1	3	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**48 Hours**
Internal Test	**3 Hours**

COURSE CONTENT

	List of Laboratory Experiments	COs	Hours
1	Review of python programming, Matrix operations, Programs using matplotlib / plotly/ bokeh / seaborn for data visualisation and programs to handle data using pandas.	1	8
2	Program to implement k-NN classification using any standard dataset available in the public domain and find the accuracy of the algorithm.	2	2
3	Program to implement Naïve Bayes Algorithm using any standard dataset	2	2

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	available in the public domain and find the accuracy of the algorithm.		
4	Program to implement linear regression technique using any standard dataset available in the public domain and evaluate its performance	3	5
5	Program to implement decision trees using any standard dataset available in the public domain and find the accuracy of the algorithm	4	5
6	Program to implement multiple regression techniques using any standard dataset available in the public domain and evaluate its performance.	4	6
7	Program to implement text classification using Support vector machines.	4	2
8	Program on convolutional neural network to classify images from any standard dataset in the public domain using Keras framework.	5	6
9	Program to implement k-means clustering technique using any standard dataset available in the public domain.	5	6
10	Program to implement a simple web crawler and scrapping web pages.	5	6

LABORATORY MANUAL:
An internally prepared laboratory manual

REFERENCE BOOKS:	
1	Drew Conway, *Machine Learning for Hackers: Case Studies and Algorithms to Get You Started*, 1st Edition, O'Reilly Publishers, 2012, ISBN: 978-1449303716
2	Bing Liu, *Web Data Mining - Exploring Hyperlinks, Contents and Usage Data,* Springer, 2011, ISBN: 978-3642194597

MODES OF EVALUATION	**SCORE WEIGHTAGE / SPLIT MARKS**
Continuous Internal Evaluation (CIE)	**40**
Day to day performance and documentation	16
Test and viva voce	16
Attendance	08
End Semester Examination (ESE)	**60**
Program logic and code	30
Output	20
Viva	10
Total	**100**

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COURSE DESCRIPTION		
Course Code	21CA308	Course Credit: 2
Course Name	Mini Project	
L-T-J-P	0-0-2-2	
Pre-requisite	21CA103 Advanced Software Engineering	
Year of Introduction	2021	

COURSE OBJECTIVE	
1	To get knowledge to identify and discuss the technical aspects of a chosen project.
2	To develop a software product using the Agile methodology.
3	To apply the software engineering principles on a real software project.
4	To learn to work as team and communicate the project related activities and findings.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Practice acquired knowledge within the chosen area of technology for project development.	3
CO2	Identify, discuss and apply the technical aspects of the chosen project with a comprehensive and systematic approach.	3
CO3	Reproduce, improve, refine and develop technical aspects for engineering projects using the Agile methodology.	3
CO4	Work as an individual or in a team in development of technical projects.	3
CO5	Communicate and report effectively project related activities and findings.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	3	3	-	-	2	2
CO2	3	3	3	3	2	-	3	3	-	-	2	2
CO3	3	3	3	3	2	-	3	3	-	-	3	2
CO4	3	3	3	3	2	-	3	3	-	-	2	2
CO5	3	3	3	3	2	-	3	3	-	-	3	2

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	48 Hours

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COURSE CONTENT

Students can take up any application or system oriented real life problems of relatively minor intensity and scope for the design and development of project prototypes. Problems from different domains can be considered to do the project. Some of the domains include but not limited to finance, e-governance, healthcare, education, transportation and logistics, online services etc., Viable projects can be identified from the list provided by the guide or it can be decided by the student himself/herself. Projects will make progress in different phases or milestones. At the end of each phase, there will be a review, discussion, presentation and evaluation of the project by the guide or by a panel of examiners, if required. Before the cut-off date of the project duration, students are required to submit a detailed project report in the prescribed format for the final evaluation by the guide. Mini project is a team/group task. The maximum size of the team is 4. Students who share a common vision and idea about a social problem can form a team/group and start developing a solution.

Mini project period can be used as a springboard by the students to elevate their technical, project management, communication and inter personnel skills. Mini project will give good opportunity for the students to shoulder the responsibilities one must master to carry out the main project which is an individual task. Mini project period is an ideal time for the students to develop and deploy socially relevant and automated solutions in the form of a software.

WEEK	SCHEDULE
I	Finalize and approve project topic or problem with the guide. Introduce the team. Start feasibility analysis or project study.
II	Formulate the project prototype requirements and specifications in the form of a storyboard. Use UML to do storyboard. Discuss the requirements with the guide (scrum master), team leader (student) and team members. Freeze the requirements.
III	Familiarize with software development tools and technologies which are required to develop the prototype. Experiment with IDE and test driven development. Figure out project deliverables.
IV	Create GIT repository for the project which is accessible to scrum master, tem leader and members. Complete database and GUI design.
V - IX	Project development and creating builds. First scrum review. This phase onwards, scrum reviews are conducted every week.
X	Project presentation and interim evaluation based on GIT check-ins.
XI	Project presentation and final evaluation based on previous presentation, review feedback and GIT history.
XII	Submission of the project report along with project diary.

GUIDELINES

- Students shall identify real life problems or projects which are innovative and relevant to the society and industry.
- Project development is an in-house activity. Class room and laboratory facility can be used for this purpose.
- Project will follow an agile software development methodology.
- Attendance as per MCA Academic Regulations 2021 is applicable for final evaluation.
- If the project prototype is developing for a customer, he/she will be the product owner who will also be designated as the external guide.A faculty from the department will act as the internal guide. If there is no customer, the guide himself/herself shall act as the product owner.
- The guide of a team is a faculty member assigned by the department. The guide shall also act as a scrum master to continuously monitor the project development.
- Project progress will be assessed based on regular scrum meetings of 15 minutes duration.
- Set a sprint as two weeks. There will be biweekly reviews. A review shall not exceed 30 minutes. A demo of the prototype to the product owner is mandatory from first scrum review onwards.

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- The team lead shall maintain a project diary to record various proceedings of the project namely, team discussions, design layouts, flowcharts and algorithms, data validation scripts, test cases, prototype versions etc.,
- A test driven development methodology may be practiced for tracking and classifying the intensity of bugs.
- GIT shall be used for version control. GIT commit history may be verified as part of project evaluation.
- Document type setting software namely, LaTeX or an equivalent tool may be used for preparing presentations and project report.
- Internal project evaluation will be done based on rubrics set by MCA Academic Regulations 2021.
- End semester project evaluation will be done based on MCA Academic Regulations 2021 lead by an expert committee.

MODES OF EVALUATION	SCORE WEIGHTAGE /SPLITMARKS
Continuous Internal Evaluation(CIE)	**40**
Work Assessment by the Guide	16
Review	08
Attendance	08
Project Report	08
End Semester Examination (ESE)	**60**
Project Evaluation by the panel	40
Presentation and Evaluation by the panel	20
Total	**100**

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COURSE DESCRIPTION		
Course Code	21CA309	Course Credit: P/F
Course Name	Domain Expertise Workshop	
L-T-J-P	0-1-0-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To deepen the understanding of various domain areas, its goals, and the unique issues and challenges.
2	To identify the level of knowledge necessary in each domain areas for a better performance in the industry.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Understand the latest software development methodologies. used for development.	2
CO2	Learn how to generate market requirements document for a product in a particular domain.	2
CO3	Gain an understanding of software product development life cycle used in Fortune 500 companies and Start-ups adhere to.	2

CO-PO MAPPING												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	2	2	1	-	2	-
CO2	-	-	-	-	-	-	2	2	1	-	2	-
CO3	-	-	-	-	-	-	2	2	1	-	2	-
Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"												

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	1 Hour
Course content delivery hours	12 Hours
Internal Test (1 Assessment Test of two-hour duration)	2 Hours

SYLLABUS
Agile Scrum Essentials - Business Analysis Basics - Product Management - Digital marketing - Introduction to Compliance Risk Management

COURSE CONTENT				
Module-I		COs	Hrs.	ESE Marks
Module Title	Agile Scrum Essentials			
Understand the Background - Need and Working of Agile and Scrum Methodologies		1	4	40%

Module-II		COs	Hrs.	ESE Marks
Module Title	**Business Analysis Basics**			
Learn who a Business Analyst is - what they do - and how they do it		2	4	30%
Module-III		**COs**	**Hrs.**	**ESE Marks**
Module Title	**Product Management**			
Understand the Modern Product Development Process that both Fortune 500 companies and startups adhere to		3	4	30%

TEXT BOOKS	
1	K. S. Rubin, *Essential Scrum: A Practical Guide to the Most Popular Agile Process,* Pearson Education, 2015, ISBN-10: 9332546177 ISBN-13: 978-9332546172
2	U Dinesh Kumar, *Business Analytics: The Science of Data - Driven Decision Making* , Wiley, January 2017, ISBN-10: 9788126568772 ISBN-13: 978-8126568772
3	B Lawley and P Schure, *Product Management For Dummies, For Dummies;* 1st Edition, 2017

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**20**
Attendance	04
Internal Test (minimum one)	08
Assignment/Report	08
End Semester Examination (ESE)	**30**
Total	**50**

End Semester Examination Pattern

There will be two parts; Part A and Part B.
Part A: 15 marks
Part B: 15 marks
Part A contains 30 multiple choice questions having 0.5 marks for each question. Part B contains 15 multiple choice questions based on a passage / case studies / application problem having 1 mark for each question. Students should answer all questions. There is no negative mark.

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SEMESTER IV

COURSE DESCRIPTION		
Course Code	21CA401	Course Credit: 6
Course Name	Comprehensive Viva-Voce	
L-T-J-P	0-0-0-0	
Pre-requisite	Nil	
Year of Introduction	2021	

COURSE OBJECTIVES	
1	To assess the overall knowledge acquired by a student in the field of computer science and information technologies over the last two years of study by pursuing MCA programme.
2	To gauge the potential of the students to face interviews both in the academic and industrial sector.
3	To evaluate competence and confidence of the students to articulate and express technical concepts or fundamentals logically and convincingly.
4	To provide an insight to the students on the depth of technical knowledge, skill and ability one possess and to create an awareness on what they lack and subsequent corrective steps to be taken.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Demonstrate the technical knowhow on information and communication technology (ICT) courses learned throughout this programme.	4
CO2	Communicate and express the technical abstracts, concepts and fundamentals in a lucid, precise and impressive manner by interpreting the questions clearly.	3
CO3	Display corporate etiquette and dignity expected from an information technology professional.	3
CO4	Assess the strength and weakness in ICT concepts, logic and emotions.	5
CO5	Provide a platform to measure and scale the quality of technical training and mentoring meted out in shaping the professional buddy.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	2	-	2	-	3	-	-	-
CO2	3	3	1	2	3	2	3	-	3	-	-	-
CO3	1	2	-	-	-	2	2	-	3	-	-	-
CO4	3	3	-	-	-	2	-	1	3	-	-	-
CO5	3	2	3	2	2	3	3	-	2	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

GUIDELINES

- Viva-Voce shall be conducted by a panel of examiners consisting of:
  1. Senior faculty member / Head of the Department - Chairman
  2. A faculty member of the Department
  3. External expert appointed by the Controller of Examinations (CoE)
- Viva-Voce shall be conducted for each student for a minimum of 20 minutes

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- Knowledge level of the student shall be assessed on the following courses.

  - 21CA102 - Advanced Data Structures
  - 21CA103 - Advanced Software Engineering
  - 21CA104 – Advanced Computer Networks
  - 21CA201 - Advanced Database Management Systems
  - 21CA202 – Web and Database Security
  - 21CA301 - Data Science and Machine Learning
  - 21CA302 - Design and Analysis of Algorithms

  - Code snippets in Java or Python to write computer programs.
  - Technologies used in the project work.
  - Recent developments in the field of computer science.

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**0**
End Semester Examination (ESE)	**100**
Knowledge of professional core courses and modern technologies	50
Reasoning and logic ability	20
Communication, presentation and emotional skill	20
Professionalism	10
Total	**100**

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COURSE DESCRIPTION		
Course Code	**21CA402**	**Course Credit: 2**
Course Name	**Seminar**	
L-T-J-P	**0-2-0-0**	
Pre-requisite	**Nil**	
Year of Introduction	**2021**	

COURSE OBJECTIVES	
1	To conduct comprehensive survey, study and analysis on a topic that lies in the most modern trailblazing thrust areas in the field of information and communication technologies.
2	To present the findings of the study and its application among the peers and faculty for productive discussion and knowledge sharing.
3	To improve research, exploratory, presentation and communication skills.
4	To enhance self learning capacity by guiding probe into latest and innovative technologies.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Acquire the knowledge and awareness on state-of-the-art technologies and techniques which fall outside the conventional curriculum and syllabus.	3
CO2	Provide a venue to improve the research, presentation, oral and written communication and documentation skills.	2
CO3	Create an ideal setting to explore hidden frontiers of knowledge and thrust areas.	5
CO4	Explore theoretical concepts and algorithms which will become useful while integrate a solution for real life problem.	4
CO5	Impart an opportunity to understand the merits and demerits of a particular technology when formulating a digitalized solution.	2

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	3	-	-	-	-	3
CO2	3	1	-	1	-	-	3	-	3	-	-	-
CO3	3	2	-	1	-	-	3	-	-	-	-	3
CO4	3	3	-	1	-	-	3	-	-	-	-	3
CO5	3	1	-	1	-	-	3	-	-	-	-	-

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

COURSE IMPLEMENTATION CLOCK (IN HOURS)	
Course introduction with thorough briefing of Course Objectives and expected Course Outcomes	**1 Hour**
Course content delivery hours	**24 Hours**

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GUIDELINES

- Student shall conduct detailed study on a technically relevant and recent topic in Computer Science / Information Technology under the supervision of a faculty guide and present it as a seminar at the end of the study.
- The study may be conducted based on
    - Article / work / paper published in reputed journals/ IT magazines / conference proceedings
    - Recent developments in Computer Science / Information Technology
    - Latest research and development activity in a research lab
    - New version release of software tool or framework
- Seminar is an individual task.
- Student shall submit an abstract on identified topic and get prior approval from the faculty Guide before the detailed study begins.
- The student shall submit a seminar report, based on the study and their findings. The report shall not be a reproduction of original paper or manual.
- The study and its findings shall be presented in the class. Its duration is 15-20 minutes. There shall be question and answer session of 5 minute after the presentation.
- Any office automation or productivity tool shall be used for making presentations and seminar report.
- Approved seminar topics which are highly innovative and ingenious in nature shall be encouraged to publish in reputed journals.
- A committee consisting of three senior faculty members shall be constituted by the Head of the Department. This committee shall evaluate the seminar presentation.

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**50**
Work assessment by the guide	
Scope and Relevance of the Topic	10
Seminar Report	10
Evaluation by an internal expert committee	
Presentation	10
Technical Content	10
Depth of Knowledge	10
End Semester Examination (ESE)	**0**
Total	**50**

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COURSE DESCRIPTION		
Course Code	**21CA406**	**Course Credit: 12**
Course Name	**Main Project**	
L-T-J-P	**-**	
Pre-requisite	**Nil**	
Year of Introduction	**2021**	

COURSE OBJECTIVE	
1	To carry out software project development by make use of techniques, technologies and methods learned over the last two years of study by pursuing MCA programme.
2	To bring out the technical knowledge and skills garnered to build a software product prototype.
3	To set an environment to apply problem solving ability to a real life challenge and task.
4	To amplify the potential of an individual to manage a software project single handedly.
5	To learn the execution of a project within constraints and limits.

COURSE OUTCOMES (COs)		REVISED BLOOM'S TAXONOMY LEVEL
At the end of the course students will be able to:		
CO1	Solve a real life problem with the help of information and communication technologies through a systematic and comprehensive approach.	4
CO2	Deploy the acquired knowledge and skills within the chosen field of study for the development of software product prototype.	4
CO3	Employ agile development methodology to complete the product development quickly and on time by adhering to a project schedule.	3
CO4	Work as an individual efficiently and effectively to create the project deliverables and artifacts.	6
CO5	Communicate project progress, project related activities and findings based on periodical reviews and meetings.	3

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3	3	3	3	3	1	3	3
CO2	3	3	3	1	3	3	3	3	3	1	3	3
CO3	3	3	3	1	3	3	3	3	3	1	3	3
CO4	3	3	3	1	3	3	3	3	3	1	3	3
CO5	3	3	3	1	3	3	3	3	3	1	3	3

Correlation levels: 1- Low; 2-Medium; 3-High; No Correlation- "-"

REFERENCE BOOKS

1	Alistair Cockburn, *Agile Software Development: The Cooperative Game*, 2nd Edition, Addison Wesley, 2006, ISBN-10: 0321482751 ISBN-13: 978-032148275
2	Andrew Hunt, David Thomas, *The Pragmatic Programmer: From Journeyman to Master*, 1st Edition, Pearson India, 2008, ISBN-10: 8131722422 ISBN-13: 978-8131722428
3	Ken Schwaber, Mike Beedle, *Agile Software Development with Scrum*, 1st Edition, Pearson, 2008, ISBN-10: 0132074893 ISBN-13 978-0132074896

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4	Lisa Crispin, Janet Gregory, *Agile Testing: A Practical Guide for Testers and Agile Teams*, 1st Edition, Addison Wesley Professional, 2008, ISBN-13: 978-0321534460
5	Pressman, R.S., *Software Engineering: A Practitioner's Approach*, 7th Edition, McGraw Hill SE, 2010, ISBN-10: 0071267824 ISBN-13 978-0071267823
6	Ryan Hodson, *Ry's Git Tutorial,* (Free e-book), RyPress, 2014

COURSE CONTENT

Students can take up any application or system oriented real life problems of relatively moderate intensity and scope for the design and development of project prototypes. Students shall consider project problems which has the potential and scope to work around intensely for about three to four months. Problems from different domains can be considered to do the project. Some of the domains include but not limited to finance, e-governance, healthcare, education, transportation and logistics, online services, retail etc., Viable projects can be identified from the list provided by the guide or it can be decided by the student himself/herself. Projects will make progress in different phases or milestones. At the end of each phase, there will be a review, discussion, presentation and evaluation of the project by the guide or by a panel of examiners, if required. Before the cut-off date of the project duration, students are required to submit a detailed project report in the prescribed format for the final evaluation by the guide. Main project is an individual task. The project duration is one semester.

Attendance as per MCA regulations 2021 is applicable for determining the eligibility to appear for the final viva-voce. However, the guide deserve the right to give consent to outstanding student to do his/her project in industry or Corporate / Government Institutions / IT or Non-IT companies where the main project phases can be carry out. Training institutes which offer live projects shall not be permitted. Students can do the main project also in the Department by making use of class room and laboratory facilities. Students who do the project in-house will be under the direct supervision of one's own guide.

GUIDELINES

- Students shall identify real life problems or projects which are innovative and relevant to the society and industry.
- Project development is an off-campus / in-house activity. Class room and laboratory facility can be used for in-house project development.
- Project will follow an agile software development methodology.
- Attendance as per MCA Academic Regulations 2021 is applicable for final evaluation.
- If the project prototype is developing for a customer, he/she will be the product owner who will also be designated as the external guide. A faculty from the Department will act as the internal guide. If there is no customer, the guide himself / herself shall act as the product owner.
- The guide of a student is a faculty member assigned by the department. The guide shall also act as a scrum master to continuously monitor the project development.
- Project progress will be assessed based on review meetings, presentation and evaluation.
- The student shall maintain a project diary to record various proceedings of the project namely, team discussions, design layouts, flowcharts and algorithms, data validation scripts, test cases, prototype versions etc.,
- A test driven development methodology may be practiced for tracking and classifying the intensity of bugs.
- GIT shall be used for version control. GIT commit history may be verified as part of project evaluation.
- Any document type setting software shall be used for preparing presentations and project report.
- Project works which are innovative or technically outstanding shall be encouraged to publish in reputed journals.
- Project evaluation will be done based on rubrics set by MCA Academic Regulations 2021.
- End semester project evaluation will be done based on MCA Academic Regulations 2021 lead by an expert committee.
- Submission of project report duly certified by the Head of the Department is mandatory to appear for End Semester Examination.

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END SEMESTER PROJECT EVALUATION PANEL
The project evaluation board shall consist of the following members. • Senior faculty member / Head of the Department – Chairman • Member : Project guide of the student • A faculty member of the Department / Project Coordinator • An external expert, either from an academic / Government Institutions / industry.

MODES OF EVALUATION	SCORE WEIGHTAGE / SPLIT MARKS
Continuous Internal Evaluation (CIE)	**40**
Project evaluation by the guide	20
Evaluation by the committee	20
End Semester Examination (ESE)	**60**
External expert evaluation	
Domain and technical knowledge of the project	20
Coding, validation and test	20
Communication and presentation skill	10
Project Report	10
Total	**100**

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