B.Sc. Data Science

Syllabus

AFFILIATED COLLEGES

Program Code:

2023 - 2024 onwards



BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC, Ranked 21st among Indian Universities by MHRD-NIRF)

Coimbatore - 641 046, Tamil Nadu, India

	B.Sc. Data Science Curriculum & Syllabus					
Program	mme Educational Objectives (PEOs)					
	Sc. Data Science program describe accomplishments that graduates are expected to within five to seven years after graduation.					
PEO1	Our graduates will excel with professional skills, fundamental knowledge, and advanced futuristic technologies to become Data Scientists, Data Analyst, AI Research Scientists, or Entrepreneurs					
PEO2	Our graduates will establish their knowledge by adopting Data Science Technologies to solve complex real-world problems with accurate, thoughtful solutions					
PEO3	Our graduates will engage in lifelong learning to excel in their profession with social and ethical awareness and responsibility					



Progra	Programme Specific Outcomes (PSOs)						
After t	After the successful completion of B.Sc. Data Science program the students are expected to						
PSO1	Ability to design, develop, implement and apply Analytical skills related to Research and Real-world problems						
PSO2	Ability to apply tools and techniques to provide successful solutions in the multidisciplinary field						
PSO3	Ability to critique the role of information and analytics for a innovative career, research activities and consultancy						



Progra	amme Outcomes (POs)						
On suc	ccessful completion of the B.Sc. Data Science						
PO1	Apply analytical and critical thinking to identify, formulate, analyze, and solve Complex real-world problems in order to reach nuanced authenticated conclusions						
PO2	Possess the ability to demonstrate advanced independent critical enquiry, analysis and reflection of modern statistical methodology and computing						
PO3	Have a set of flexible and transferable skills for different types of employment, both within the Information Technology sector and beyond, in both global and local organizations						
PO4	Develop and implement data analysis strategies base on theoretical principles, ethical considerations, and deep, detailed and broad knowledge of the underlying data and its implications in the context from which the data was taken						
PO5	Be critical and creative thinkers, with an aptitude and appreciation for continued self-directed learning in the evolving world of data science, artificial intelligence and social media						
PO6	Design and develop research-based solutions for complex problems with specified needs with appropriate ethical consideration for public health, safety, culture, society, and the environment.						
PO7	Establish the ability to listen, read, proficiently communicate and articulate nuanced data and information through traditional and digital channels to audiences with diverse perspectives						
PO8	Articulate and evaluate appropriate legal and ethical standards pertaining to all forms of communications, network security and human rights.						
PO9	Showcase an understanding of the interdisciplinary nature of data, information and community and its influence innovation and progress within the current local or global context						
PO10	Be able to initiate and implement constructive change in their communities with their skills in data and information, including various professions and workplaces						
	EpinoVIE 10 EFENZIE						

BHARATHIAR UNIVERSITY, COIMBATORE-641 046

(For the students admitted from the academic year 2023-2024 onwards)

B.Sc. Data Science (CBCS pattern)

SCHEME OF EXAMINATIONS

			/ ory)		Exa	minati	ons	_
Part	Study Components	Ins. hrs / week(Theory)	Dur. Hrs.	CIA	End Sem Exam	Total	Credits	
	SEMESTER –I							
I	Language-I		4	3	25	75	100	4
II	English-I		4	3	25	75	100	4
III	Core 1: Computer Funda Programming	mentals and Python	5	3	25	75	100	4
III	Core 2: Database Manage SQL	ement System with	5	3	25	75	100	4
III	Core Lab 1: Python Prog	gramming & SQL Lab	5	3	25	75	100	4
III	Allied Paper I: Descriptiv	ve Statistics	5	3	12	38	50	4
IV	Environmental Studies #	2	3	-	50	50	2	
		30		137	463	600	26	
	SEMESTER –II	To THIAR UNIVERS	900					
I	Language-II	Combature Col	4	3	25	75	100	4
II	English-II	FOULATE TO ELEVATE	4	3	25	75	100	4
III	Core 3: Data Analytics		5	3	25	75	100	4
III	Core Lab 2: Advanced E	Excel Lab	4	3	25	75	100	4
III	Core Lab 3: Internet Basi	cs Lab	4	3	20	30	50	2
III	Allied Paper II: Mathema for Machine Learning	ntical Foundations	5	3	12	38	50	4
IV	Value Education – Huma	n Rights #	2	3	-	50	50	2
	NaanMuthalvan - Skill C English http://kb.naanmudhalvan idge_Course_Details.pdf	.in/images/c/c7/Cambr	2	2	12	38	50	2
		Total	30		144	456	600	26
SEMESTER –III								
I	Language – III		4	3	25	75	100	4
II	English-III		4	3	25	75	100	4
III	Core 5: Data Engineering		4	3	25	75	100	3
III	Core 6: Artificial Intellig		4	3	25	75	100	3
III	Core 7: Applied Data Str	uctures	3	3	25	75	100	2
III	Core Lab 5: ETL Lab		3	3	20	30	50	2
III	Allied Paper III: Inferen	tial Statistics	4	3	12	38	50	3

F	T			1		1 1	
IV	Skill based Subject-1: Mini project using Python Programming / Advanced Excel	2	3	20	30	50	2
IV	Tamil @ / Advanced Tamil # (or) Non-Major Elective—I: Yoga for Human Excellence # / Women's Rights # Constitution of India #	2	3	-	50	50	2
	Total	30		177	523	700	25
	SEMESTER -IV			I			
I	Language – IV	4	3	25	75	100	4
II	English-IV	4	3	12	38	50	4
III	Core 8: R Programming	3	3	25	75	100	4
III	Core 9: Machine Learning Techniques	4	3	25	75	100	4
III	Core Lab 6: R Programming Lab	3	3	20	30	50	2
III	Allied Paper IV: Digital Marketing	4	3	12	38	50	3
IV	Skill based Subject-2: Optimization Techniques	4	3	20	30	50	2
IV	Tamil @ / Advanced Tamil # (or)	2	3	_	50	50	2
	Non-major elective -II: General Awareness #		3		50	50	
	NaanMuthalvan – Skill Course Office						
	Fundamentals - Lab	2	3	20	30	50	2
	http://kb.naanmudhalvan.in/Bharathiar_Univer						
	sity_(BU)						
	Total	30		159	441	600	27
	SEMESTER –V						
III	Core 10: Data Visualization	6	3	25	75	100	4
III	Core 11: Deep Learning	³ 6	3	25	75	100	4
III	Core Lab 7: Data Visualization Lab	6	3	20	30	50	2
III	Elective—I:	6	3	25	75	100	3
IV	Skill based Subject-3: Social Media Analytics	6	3	20	30	50	2
	Total	30		115	285	400	15
	SEMESTER -VI						
III	Core 12: Natural Language Processing	5	3	25	75	100	4
III	Core Lab 8: Natural Language Processing Lab	4	3	20	30	50	2
Ш	Core 13: Project Work Lab %%	6	3	25	75	100	4
Ш	Elective –II:	5	3	25	75	100	3
III	Elective –III:	5	3	25	75	100	3
	Skill based Subject-4: Capstone Project using						
IV	Python or R Programming, Data Visualization	3	3	20	30	50	2
	Tools.						
V	Extension Activities@	-	-	50	-	50	1
	Naan Muthalvan - Skill Course Cyber Security	2	2		38	50	2
	@			(or)	(or)		
	http://kb.naanmudhalvan.in/images/7/71/Cyber			20	30		
	security.pdf (or) Machine Learning #						
	http://kb.naanmudhalvan.in/images/1/19/PBL_ Google.pdf (or) Android APP Development \$						
	http://kb.naanmudhalvan.in/images/0/08/Andro						
	id_App_Dev.pdf						
	10_11pp_D01.pu1			<u> </u>		<u> </u>	

Total	30	202/ 210	398/ 390	600	21
Grand Total		920/	2580/		
		942	2558	3500	140

[#] No Continuous Internal Assessment (CIA). Only University Examinations.

^{➤ #}Govt – Non-Autonomous Colleges, \$ Aided – Non-Autonomous Colleges, @ Self - Financing Colleges (Non –Autonomous) (For theory: CIA – 12, CEE – 38; For Practical: CIA – 20, CEE – 30).

List of Elective Papers (Colleges can choose any one of the paper as electives)						
A Marketing Analytics						
Elective – I B Data Security and Compliance						
	C	Computer Vision				
	A Supply Chain and Logistics Analytics					
Elective – II B Business and Financial Analytics						
	C	Recommender system				
	A	HR Analytics				
Elective - III B Data Mining						
	C	Big Data and Cloud Computing				

[@] No University Examinations. Only Continuous Internal Assessment (CIA).



Course	Course Code TITLE OF THE COURSE L									
Cor	Core 1 Computer Fundamentals and Python 5						4			
	 	Programming								
Pre-rec	quisite			llabus ersion	2	2022 - 23				
Course Ol	Course Objectives:									
		es of this course are to:								
		l about number systems, algorithms and	d OOP conc	epts.						
		I the basic Python programming constr		ta struc	tures					
		how to use files, modules and packages	S							
		Outcomes: completion of the course, student will be a	hla							
On the su		number systems and OOPs concepts for a		roblem						
1.	solving					K2,	K3			
2.		op simple Python programs in interactive a l statements	and script mo	ode usin	g	K2, 1	К3			
3.		ruct Python programs using functions and	strings.			K3	3			
		use of Python lists, set, tuples, dictionaries		t						
4.		ound data.	1			K3,F	\$4			
		evelop python programs to handle exceptions, packages and erform K3								
5.	perform	0.5.5.10								
T74 D		ocessing	77 F D	1	7.6					
KI - Ren		K2 - Understand; K3 - Apply; K4 - Analy				eate				
UNIT:1		UTER FUNDAME <mark>NT</mark> ALS, ALG <mark>ORI</mark> TI NG AND OOP CONCEPTS	HMIC PRO	BLEM		10 Ho	urs			
	Introdu	uction to number systems- Algorithn	ns, building	g block	s of	algorit	hms			
		nents, control flow, functions), pseudo c				nic prob	olem			
	solving	g, simple strategies for developing algorith	hms (iteratio	n, recur	sion).					
	OOD	concents: Overview of Object eviented or	ogramming	0 222 000	h Cho	rootorio	tion of			
		concepts: Overview of Object oriented propriented languages-Classes fundamentals								
		ers of class, Initialization of class objects:				ct, Acc	Cosing			
UNIT:2		CS OF PYTHON PROGRAMMING	(= 0.11.5.11.40.001	, = 35010		9 Ho	urs			
	Introdu	action-Python interpreter- interactive a				and	types,			
	_	ors, expressions, statements, precedence	e of operate	ors, Mu	ıltiple	assign	ments,			
TINITE.	comments.									
UNIT:3	1	TROL STATEMENTS AND FUNCTION on al (if), alternative (if-else), chained continued to the continued of the co			se). Ita	9 Hor				
		or, break, continue, pass;	onomionai (I	0111 01	<i>50)</i> , 10	uu 011.	siaic,			
		· · · · · · · · · · · · · · · · · · ·	defined fun	ctions	nassin	o naran	neters			
	Functions: Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion.									
UNIT:4										
		s: string slices, immutability, string metho		rations;	Lists:					
		erations, list methods, mutability, aliasing								
	functions; list processing: list comprehension, searching and sorting, Sets: creating sets,									
	set operations									
UNIT:5	DATA	DATA STRUCTURES: TUPLES, DICTIONARIES 10 Hours								

	Tuples: Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value; Dictionaries: operations and methods, Nested Dictionaries. Files and exception: text files, reading and writing files, format operator, exception handling, modules, packages					
	Total Lecture hours 48 hours					
Text Boo	ok(s)					
1.	Ashok Namdev Kamthane, Amit Ashok Kamthane, Programming and Problem Solvi with Python, Mc-Graw Hill Education, 2018	ing				
2.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.					
3.	Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem Solving Focus, Wiley India Edition, 2013.					
Reference	ce Books					
1.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.					
2.	Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2015.					
3.	Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.					
Related	Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]					
1.	www.mhhe.com/kamthane/python					
2.	Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	DUCATE IN EVATE	S	L	L	L	L
CO2	S	S	S	M	M	L	L	M	L	L
CO3	S	M	M	M	M	L	L	M	L	M
CO4	S	S	S	M	M	L	M	L	L	L
CO5	S	S	S	M	M	L	L	L	L	L

^{*}S-Strong; M-Medium; L-Low

Course	Code	TITLE OF THE COURSE	L	T	P	C	
Core	2	Database Management System with SQL 5					4
Pre-req	llabus ersion	2	022 – 2	3			
	Course Objectives:						
	-	es of this course are to:					
		the significance and fundamentals of			ent sys	tems.	
		the Database design and query optimi	ization techn	niques.			
		the database security concepts					
Expected			1.1				
On the suc		completion of the course, student will be					
1.		be the fundamental elements of relational	database			K1, I	ζ2
2		ement systems				1/2 1	72
2.		relational schema using database design				K2, I	
3.	-	n the concepts of transaction processing,	dasic databas	e		K2	,
		e structures and access techniques	40 33000	4.a. C .a		K3,k	<u>.</u> 4
4.		indexing techniques to access and genera	ite user repor	ts for a		K2, I	ζ 3
5.	databas		т				
		ng Web Applications using Python & SQ		1 T	7.6 Cm	K4,k	<u></u>
K1 - Rem		K2 - Understand; K3 - Apply; K4 - Analy ODUCTION TO DATABASE AN	D RELATION		70 – Cr	eate	
UNIT:1	MODE		D KELATI	UNAL		10 Ho	urs
LINUTE	Query	onal Databases: Relational model, Data Languages	base schema	a, Keys	, Form		
UNIT:2		BASE DESIGN		1 '	ED 1	10 Ho	
		I Database Design: Different approache ons, Steps in ER modeling. Physical dat					
	Relatio	onal Database Design, Normalization -Final: multi-valued dependency and 4th Normalization	Functional D	epende	_		
UNIT:3	QUER		IIZATION, TRANSACTION PROCESSING				urs
		Standards – Data types – Database Object	ts- DDL-DMI	L-DCL-T	CL-En	nbedded	SOL-
	Static Vs Dynamic SQL. Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization. Transactions: Concept and purpose, ACID properties and their necessity. Concurrency Control: lock-based protocols, 2-phase locking, Timestamp based protocols. Deadlock handling						l Cost ACID
UNIT:4	2:4 STORAGE AND INDEXING 9					9 Ho	
		e and File structure: File Organization, R lustered Indices, B-tree and B+-tree. Bas					ed and
UNIT:5							urs
	Statistic	assification-Threats and risks — Database cal Databases Distributed Databases-Ausing and Mining-Classification-Association	rchitecture-T	ransact	ion Pro	cessing	g. Data
			Total Lectu	re hour	s	48 ho	urs
Text Boo	k(s)				ı		

1.	Abraham Silberschatz, Henry Korth, and S. Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill.2011						
2.	R. Elmasri and S. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011						
3.	Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3nd Edition, McGraw Hill, 2003						
Reference	ee Books						
1.	Thomas M. Connolly and Carolyn E. Begg, "Database Systems - A Practical Approach						
1.	to Design, Implementation and Management", Fifth edition, Pearson Education, 2010.						
2.	C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems",						
2.	Eighth Edition, Pearson Education, 2006.						
Related (Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1.	https://onlinecourses.nptel.ac.in/noc17_cs33/course						
2.	http://nptel.ac.in/courses/IIT- MADRAS / Intro_to_Database_Systems_Design						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	L	M	M	M	L
CO2	S	S	S	S	S	L	L	L	M	L
CO3	S	S	S	M	M	L	L	L	M	L
CO4	S	S	S	M	M	L	M	M	M	L
CO5	S	S	S	S	லக்க \mathbf{S} க $_{\mathcal{L}_{\mathcal{L}_{\mathcal{L}}}}$	L	M	M	M	L



Course (Code	TITLE OF THE COURSE		L	T	P	С	
Core L	ab 1	Python Programming & SQL	Lab	5	-	4	4	
Pre-requ	uisite	None		llabus ersion	20	022 – 2	3	
Course Obj	ectives:		<u> </u>					
		es of this course are to:						
		pasic Python programming constructs a	nd data stru	ctures.				
		oncepts, create modules and packages						
		ta using Python						
Expected (outcomes: completion of the course, student will be a	hla:					
		roblems using various control statements, fund		ngs in		K3		
1.	Python	various control statements, rain	ctions and stri	1155 111		IX	'	
2.	Make u	se of Python lists, set, tuples, dictionaries to r	represent comp	pound		K4	F	
3.	Descril	be the fundamental elements of relational of	latabase			K1, I	Κ2	
٥.		ement systems						
4.		relational schema using database design p				K2, l		
5.		n the concepts of transaction processing, b	asic database	:		K2	,	
1/1 D		structures and access techniques	V	4 T Z	(C	K3,F	<u>.4</u>	
		K2 - Understand; K3 - Apply; K4 - Analyz RAMMING LAB	ze; K5 - Evai	uate; K	6 – Cre	ate		
EXERCI		Introduction to Python			6			
	nd condi	pressions and input and output statement tional statements Functions	nts. Programs	s using	opera	tors, bu	111t ii	
			TD.		•	<u> </u>		
numbers	sing Fu	nctions-Programs to find square root, GC	D, sum an a	array oi				
EXERCI		Data Structures: Strings and Lists				6		
Programs programs (Selection a		ng all string operations - perform opertion sort)	rations on l	ists- So	orting	of ele	ment	
EXERCI	SE 4	Data Structures: Tuples, Dictionaries,	Sets			6		
		tionaries and sets – Tuples						
EXERCI	SE 5	Files, Modules, Packages and Data Ana	alysis			6		
SQL LAB								
LIST OF E						15		
		f a database and writing SQL queries to ret	rieve inform	ation fr	om the			
	abase.							
	_	elational database to set various constraints		J 17:	:	مساء		
	_	g Insertion, Deletion, Modifying, Altering, onditions.	Opdating an	a viewi	ing rec	orus		
		n TCL, DCL commands						
	_	Plationship between the databases.						
<i>J.</i> CIC	Juliig IC	nationismp between the databases.		Total N	/Jarks	: 45		
Text Book	x(s)					<u> </u>		
		Budd, Exploring Python, Mc-Graw Hill E	ducation (Inc	dia) Priv	ate Lt	d., 201	5	
		dev Kamthane, Amit Ashok Kamthane, Pro						
		c-Graw Hill Education,2018	-			-		

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. Infosys Foundation Program: Module 2
2. https://onlinecourses.nptel.ac.in/noc17_cs33/course
3. http://www.db-book.com
4. http://nptel.ac.in/courses/IIT-
5. MADRAS/Intro_to_Database_Systems_Design
6. http://www.iitg.ernet.in/awekar/teaching/cs344fall11/
7. www.w3schools.com/sql/

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	L	L	L	L	L
CO2	S	S	M	M	M	L	L	L	L	L
CO3	S	S	M	M	M	L	L	L	L	L
CO4	S	M	M	M	S	M	L	L	L	L
CO5	S	M	M	M	M	M	L	L	L	L

^{*}Strong; M-Medium; L-Low



Course Code	TITLE OF THE COURSE	L	Т	P	С
Allied 1	Descriptive Statistics	5	-	-	4
Pre-requisite	Basic level on Mathematical Computation		Syllabus Version	2022	2-23

Course Objectives:

The main objectives of this course are to:

- 1. Understand the significance and computational aspects of statistical analysis
- 2. Understand the patterns of distribution of data
- **3.** Understand the concepts of predictive analytics

Expected Course Outcomes:

On the successful completion of the course, student will be able:

1	Understand the scope and necessity of Statistics and the representation of data	K1, K2
2	Tabulate and represent the data in diagrams and graphs	K2, K3
3	Apply the formula and calculate descriptive measures of statistics	K2, K3,K4
4	Analyze the nature of data and interpret the measures	K2, K3,K4
5	Analyze the data and predict the future values using regression	K4,K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6- Create

UNIT:1 Status of Statistics and collection of data

9 hours

Origin, scope, definition, limitations of Statistics. Data-Types- Primary and Secondary Data-Methods of data Collection

UNIT:2 Classification, Tabulation and graphical representation

9 hours

Classification of data, preparation of tables, Diagrammatic representation of data: One dimensional and Two dimensional diagrams – Graphical representation: Line diagram, Frequency polygon, Frequency curve, Histogram

UNIT:3 Measures of Central Tendency and location

10 hours

Measures of Central Tendency: Mean, Median, Mode, Geometric Mean and Harmonic Mean-Properties with Merits and Demerits- Empirical Relation between means. Partition values: Quartiles, Deciles and Percentiles.

UNIT:4 Measures of Dispersion

10 hours

Absolute and Relative Measures Range, Mean deviation, Quartile deviation and Standard deviation – Measures of Skewness - Pearson's and Bowley's Coefficient of Skewness, Coefficient of Skewness based on moments – Kurtosis and its significance

UNIT:5 Measures of Variation, correlation and regression

10 hours

Measures of Variation : Standard, Mean and Quartile deviations-Co efficient of variation. Simple Correlation - Karl Pearson's Co-efficient of correlation - Rank correlation - Regression lines.

	Total Lecture hours	48 hours					
Text Boo	oks:						
1	Agarwal, B. L. (2021). Basic Statistics, New Age International Private Limi India	ted, New Delhi,					
2	Gupta, S.C., and Kappor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons, New Delhi, India						
Referen	ce Books						
1	Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics, Routledge, New York, US.						
Related	Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1	https://nptel.ac.in/courses/111/104/111104120/						
2	https://www.iiserpune.ac.in/~bhasbapat/phy221_files/curvefitting.pdf						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	M	S	M	M
CO2	S	S	M	S	S	M	M	S	M	M
CO3	S	S	M	M	S	M	S	S	M	M
CO4	S	S	M	M	S	M	M	S	M	M
CO5	S	S	S	M	S	E M	M	S	M	M

^{*}S-Strong; M-Medium; L-Low



	Course Code	TITLE OF THE COURSE		L	T	P	C			
	Core 3	Data Analytics		5	0	0	4			
	Pre - requisite	None	Syll	abus v	ersion	2022	2022-23			
Course Objectives										
macl and s	hine learning approac	rse is to help students learn, understand, and phes, which include the study of modern comarning techniques focusing on industry								
Expe	cted Course Outcome	es								
1	•	implement machine learning techniques and c suitable for the application.	compu	iting		K1	, K2			
2	Ability to identify the data and unstructured	e characteristics of datasets and compare the tr I data	rivial			K2	, K3			
3		d and apply scaling up machine learning techni outing techniques and technologies	iques			K2, K3				
4	Ability to recognize and implement various ways of selecting suitable									
5	Ability to integrate r with modern technol	nachine learning libraries and mathematical and logies	d stati	istical t	ools	K2	, K3			
K1 -	– Remember K2 – Ui	nderstand K3 <mark>– apply K4- An</mark> alyze K5 – eva	luate	K6-Cr	eate					
		DDUCTION TO DATA ANALYSIS					2			
		Platform – Challenges of conventional syste ytic processes and tools, Analysis vs reporting –								
UN	IT II DATA	ANALYSIS TECHNIQUES				1	2			
Supp	_	ltivariate analysis, Bayesian modeling, inferel methods, Analysis of time series: linear.			-					
UNI		AR METHODS FOR REGRESSION AND SIFICATION				1	2			
	rview of supervised larger subset so	earning, Linear regression models and least election,	squa	res, M	ıltiple	regre	ssion			
UNI	T IV BASIC	CANALYSIS TECHNIQUES				1	2			
	ysis of variance, Corr	s, Statistical hypothesis generation and test relation analysis, Maximum likelihood test, Pro-								

UNIT V	MODEL ASSESSMENT AND SELECTION	12
	I model complexity, Bias-variance trade off, Optimism of the trople prediction error, Effective number of parameters	raining error rate

	Total Lecture Hours	60 Hours						
Text Book(s)								
1.	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2	2007.						
Reference Boo	Reference Book(s)							
1.	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datas University Press, 2012	sets,Cambridge						
2.	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnousko							
3.	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on 1st Edition, VPT, 2014.	n-Approach)",						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	M	L	L	L	L
CO2	S	M	S	S	M	M	M	L	L	L
CO3	S	M	M	M	S	M	L	L	M	L
CO4	M	S	M	\mathbf{M}_{\sim}	NBB Sali,	M	L	L	M	L
CO5	M	S	M	M	S	M	L	L	M	L
*S-Stro	*S-Strong; M-Medium; L-Low									

Course Code	TITLE OF THE COURSE	L	T	P	C
Core Lab 2	Advanced Excel Lab	4	0	4	4
Pre - requisite	None	Syllabu versior		/ / 11	22-23
	Course Objectives			u	
 Construct for Convert text 	of this course are to: mulas, including the use of built-in functions, and relative and and validate and consolidate data. ables and charts.	l abso	lute r	eferen	ces.
	Expected Course Outcomes	1			
1 Develop or	ganized data format using sorting and filtering components		K.	3, K4	
2 Design adv	anced graphic presentations on stored data]	K3,K4	
3 Sort, search	, and extract knowledge from historical data		K3	,K4, k	ζ5
K1 – Remen	ber K2 – Understand K3 – apply K4- Analyze K5 – evalua	te K	6- Cr	eate	
EXERCISE 1	INTRODUCTION TO SPREADSHEETS			()
functions	readsheets, reading data, manipulating data. Basic spreadsh		opera		
EXERCISE 2	DATA CLEANING AND WORKING WITH CONDITION USING EXCEL	ONS		9)
Concatenate function of I Selecting	ext: Conditional expression (IF and nested IF), Logical Functions in Excel-Left, Right, Upper and Lower, Data filtering callivot Tables to organize data and introduction to charts in Information Into a Range, Using AutoFill	pabil	ities (of Exc	el, th
EXERCISE 3	DATA MANIPULATION USING EXCEL			1	0
Using AutoSum,	Formula Functions – Sum, Average, if, Count, max, min, I Vlookup, VlookUP with Exact Match, Approximate Mat Countif, Text, Trim				
EXERCISE 4	DATA ANALYSIS			1	0
What-if-Analysis	Goal Seek, Data Table, Scenario Manager, Formatting Cha	arts, 3	3D G	raphs,	
EXERCISE 5	ADVANCED GRAPHING AND CHARTING				.0
\mathcal{L}	omizing Pivot tables, Using advanced options of Pivot tables, s, , Scatter plots, Histograms	Pivo	t cha	rts, Lii	ie,
	Total Pra	actica	l Ho	urs	48

Text 1	Book(s)
1	Microsoft Excel 2019 Data Analysis and Business Modeling, Wayne Winston, 2019
Refer	ence Book(s)
2	https://www.coursera.org/learn/excel-data-analysis#syllabus
3	https://www.coursera.org/learn/analytics-excel#syllabus
4	https://kristujayanti.edu.in/pdf/2018/VAC-Data-Analysis-using-spreadsheet-Syllabus.pdf
5	https://online.rice.edu/courses/excel-data-analysis/
6	https://www.digitalvidya.com/certified-data-analytics-course/
7	https://www.zsem.hr/media/2017/12/Syllabus_Big-Data-Analytics-using-Excel-Business-Intelligence-and-Power-BI-tools_20172018.pdf

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	L	L	L	L
CO2	S	M	M	M	லக்க M ம்	S	L	L	L	L
CO3	S	M	L	L	M	S	L	L	L	L

^{*}S-Strong; M-Medium; L-Low

Co	urse code	TITLE OF THE C	OURSE	L	T	P	C
Co	ore Lab 3	Internet Basics	Lab	4	-	2	2
Pre	-requisite	None	Syllabus Version			2022-	23
Course Ob	jectives:				1		
2. Impart ka 3. Find, eva 4. Use Goo	nowledge and esso aluate, and use onl gle Apps for educ	<u> </u>		arious o	compo	nents.	
	Course Outcomes						
1 Ap	pply the predefined	procedures to create Gmail account,	check and receive	e messa	ges	K3	
2 Ap	ply the predefined	procedures to perform various basic	operations on inte	ernet		К3	
for	ms, google meet an					K3	
K1 – Reme	ember; K2 – Unde	rstand; K3 – Apply; K4 – Analy	ze; K5 – Evaluat	e; K6 –	Create	е	
PROGRAM	- 1						1
students for	your college fest,	nail. Using the account created con enclose the invitation as attachmentions accountingly.					
PROGRAM	Ise CC and BCC op	tions accordingly					1
		account created, check the mail re	accived from you	r poor f	rom of	hor	
college invit	ing you for his col	lege fest, and download the invitation and the mail to other friends					
PROGRAM		Tap Table	1				1
	you are studying by portal and upload	in final year of you <mark>r graduation an</mark> your resume.	d are eagerly look	king for	a job.		
PROGRAM	•	EDUCATE TO ELEVATE					1
		the calendar and share meeting in the meeting id is generated.	d to the attendee	s. Tran	sfer th	ie	
PROGRAM							1
Create a labo	el and upload bulk o	contacts using import option in Goog	gle Contacts				
PROGRAM	- 6						2
Google class		oom and invite all your friends through drive. Create a separate folder for					
PROGRAM	- 7						1
	share a folder in Colder by your friend	Google Drive using "share a link" ls only.	option and set th	e permi	ssion 1	0	
PROGRAM							1
		nother tongue by using voice recogn	ition facility of Go	oogle D	ocs		
PROGRAM							1
	<u>- </u>	your Department Seminar or Confer	rence using Googl	e Forms	١.		
PROGRAM							1
Create a que Google Form		nultiple choice types of questions for	or a subject of you	ur choic	e, usin	g	
PROGRAM							1
C	et using Google C	alendar and record the meet using	Google Meet. C	Create a	Goog	le	

slides fo	or a topic and share the same with your friends.		
PROGR	AM - 12		1
Create to	emplate for a seminar certificate using Google Slides.		
PROGR	AM - 13		1
	a sheet to illustrate simple mathematical calculations using Google Sheets. Create student's mark statement and share the Google sheets via link.	S	
	Total Lecture hours	14 l	hours
	Text Book(s)		
1	Ian Lamont, Google Drive & Docs in 30 Minutes, 2nd Edition.		
	Reference Books		
1	Sherry Kinkoph Gunter, My Google Apps, 2014.		

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	L	L	L	L	L	L	L	M
CO2	S	M	L	L	L	L	L	L	L	L
CO3	S	S	S	L	L	L	L	L	L	L

*S-Strong; M-Medium; L-Low



Course code	21CSEGC06	MATHEMATICAL FOUNDATIONS FOR MACHINE LEARNING	L	T	P	C
Core/Elec	tive/Supportive	Core	5		0	4
Pre-requ	isite	Basic Mathematics	Sylla Versi		202 202	

Course Objectives:

The main objectives of this course are to:

- 1. To understand linear programming methods.
- 2. To understand Dynamic programming approach.
- 3. To understand concepts basics concepts of Linear Algebra
- 4. To understand concepts of vector spaces and matrices
- 5. To understand the applications of Linear Algebra in Machine Learning

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Solve linear programming techniques to optimization problems arising in all	K3
	Computer fields	
2	Use Dynamic programming approach to real time problems.	К3
3	Understand the basics of Linear Programming constructs	K2
4	Apply vector spaces and their applications in Machine Learning	К3
5	Understand the concepts of matrix, Gaussian Elimination and differential equations	K2,
	and Apply the concepts of Linear Algebra in Machine Learning Algorithms	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit:1 Linear Programming Problem

10 hours

Introduction to Operations Research: Basics definition - scope - objectives - phases - models - limitations of Operations Research - Linear Programming Problem - Formulation of LPP - Graphical solution of LPP - Simplex Method - Artificial variables - Big-M method - Two-phase method - Degeneracy - Unbound solutions - Duality in Linear Programming Problems - Dual Simplex - Introduction to optimization - gradient descent method - convex optimization.

Unit:2 Dynamic Programming

12 hours

Introduction - Characteristics of dynamic programming – Dynamic programming approach for Priority Management employment smoothening – capital budgeting – Stage Coach/Shortest Path – cargo loading and Reliability problems.

Unit:3Geometry Linear Equations and Vector Spaces12 hoursThe Geometry of Linear Equations - An Example of Gaussian Elimination- Matrix Notation and
Matrix Multiplication - Triangular Factors and Row Exchanges- Inverses and Transposes.Vector Spaces and Subspaces - Solving Ax=0 and Ax=b - Linear Independence, Basis and
Dimension- The Four Fundamental Subspaces- Graphs and Networks- Linear Transformations.

Unit:4 Determinants, Eigenvalues and Eigenvectors

12 hours

Determinants: Introduction- Properties of the Determinant- Formulas for the Determinant – Applications of Determinants. Eigenvalues and Eigenvectors: Introduction- Diagonalization of a Matrix .- Difference Equations and Powers A k- Differential Equations and e At - Complex Matrices- Similarity Transformations – A - Applications of Machine Learning – Use cases.

Unit:5 Positive Definite Matrices

12 hours

Minima, Maxima, and Saddle Points - Tests for Positive Definiteness - Singular Value Decomposition - Machine Learning Applications - Use cases.

Unit:6 | Contemporary Issues

2 hours

Use Linear and Dynamic programming approach to real time problems. Apply the concepts of Linear Algebra in Machine Learning Algorithms

Expert lectures, online seminars – webinars

Press, ISBN: 9780980232776, 2017.

	V	Total Lecture hours 60 hours
Text l	Book(s)	
1	J K Sharma, "Operations	Research Theory & Applications" 6th Edition, Laxmi
	Publications, 2017.	Signification of the state of t
2	Gilbert Strang, Linear Algeb	ora and Its Application, 5 th Edition, Wellesley Cambridge

Reference Books : EBooks

- P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2017
- David C. Lay, Steven R. Lay, Judi J. McDonald, "Linear Algebra and Its Applications" 5th Edition, Pearson Education, 2016.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

	Course Title	Duration	Provider
1.	Operations Research	15 Weeks	Swayam
2.	Linear Algebra	12 Weeks	Swayam
Web l	ink		

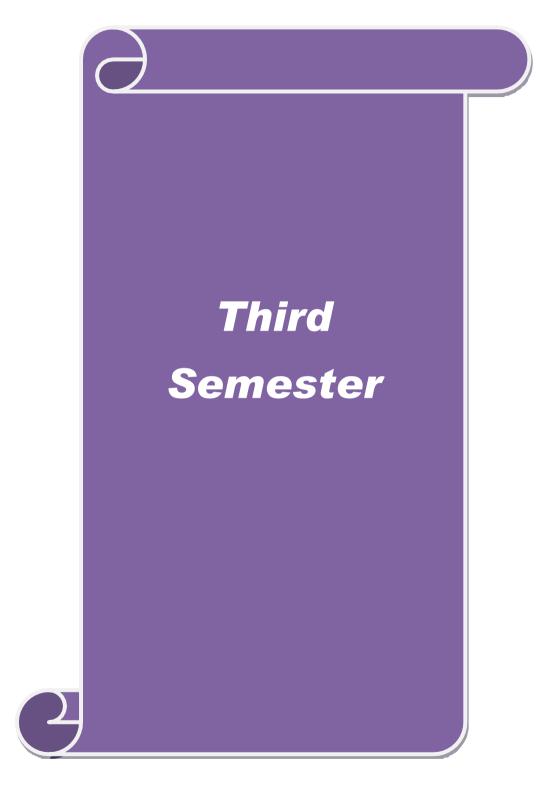
- 1. https://stemez.com/subjects/science/1HOperationsReseach/1HOperationsReseach.php
- 2. https://www.khanacademy.org/math/linear-algebra

Course Designed by: Mr. Moorthy, Dr. T. Devi

Mappi	ng with	Progran	nme Out	comes						
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	M	S	S	M	S
CO2	S	S	S	S	M	M	S	S	M	S
CO3	M	M	M	S	S	M	M	S	L	S
CO4	S	M	S	S	S	M	S	S	L	S
CO5	M	M	M	S	S	M	M	S	L	S

^{*}S-Strong; M-Medium; L-Low





Course Co	ue		TITL	E OF T	HE COU	RSE		L	T		P	C
Core 5			I	Data Eng	gineering			4	-			3
Pre-requis	site						_	abus sion		2	2022-	23
Course Obje							'		I			
Engir 2. Apply	tify bas neering y data	ic concepts	, terminations su	ology, th ch as ag	gregation	and filter	ing for vi	sualiz	ation	ı	f Dat	a
Expected Co												
On the succes	ssful co	ompletion of	f the cour	rse, stude	ent will be	able:				1		
1 A	Acquire	knowledge	on vario	ous phase	es of data	engineering					K1,	K2
2 Id	dentify	necessity o	f data pre	e-process	sing and a	pply the app	propriate]	proced	lure		K2,	K3
.)	Demons pplicat	trate data w ions.	arehouse	e schema	and proce	ess of data 1	etrieval f	or real	time	e	K2, K	X3,K4
K1 - Remem	1 774					V 5 D	ivaluata: I	76 Cr	·anta			
1101110111	ber; K 2	2 - Understa	ınd; K3 -	Apply;	K4 - Anal	yze, K5 - E	varuate, 1	X 0-C1	Cale			
UNIT:1	DATA	ENGINEE	RING II	NTROD	UCTION						8 Ho	
	DATA ess – Kapplicat ng over	ENGINEE inds of data ions targete	RING II can be led — Issu	NTROD mined – les in da	UCTION Kind of p ta mining	o <mark>a</mark> tterns can - Data Ob	be mined	l – Te Attril	chno	olog Ty	gies u	sed – Data
WNIT:1 RDD Proce Kinds of A preprocessing and Discreti	DATA ess – Kapplicat ng over ization	ENGINEE inds of data ions targete	RING II can be led — Issu a Cleanin	NTROD mined – les in da	UCTION Kind of p ta mining	o <mark>a</mark> tterns can - Data Ob	be mined	l – Te Attril	chno	olog Ty ran	gies u	ısed – Data
WNIT:1 RDD Proce Kinds of A preprocessing and Discreti	ess – Kapplicating over ization DATA LOUISE –	ENGINEE inds of data ions targete view – Dat WAREHO Basic Cond	can be a can be a can be a Cleania can be a Cleania can be a cusing	mined – les in da ng – Dat	Kind of pta mining a Integrat	oatterns can - Data Obion – Data be and OLA	be mined bjects and Reduction AP – Data	l – Te Attril n – Da	chno bute ita Ti	Tyran	gies u ypes - nsform	used - Data
WNIT:1 I KDD Proce Kinds of A preprocessin and Discrete UNIT:2 I Data wareh Design and	ess – Kapplicating over ization DATA ouse – d Usag	ENGINEE inds of data ions targete view – Dat WAREHO Basic Cond	can be a led — Issue Cleaning OUSING Cepts —Mentatio	mined – les in da ng – Dat	Kind of pta mining a Integrat	oatterns can - Data Obion – Data be and OLA	be mined bjects and Reduction AP – Data	l – Te Attril n – Da	chno bute ita Ti	Dlog Ty ran	gies u ypes - nsform	nsed – Datanation Tours Lion.
WNIT:1 I KDD Proce Kinds of A preprocessin and Discret UNIT:2 I Data wareh Design and	para ess – Kapplicating over ization para ouse – d Usag para n to da	ENGINEE inds of data ions targete view – Dat WAREHO Basic Conce – Imple MODELI ata modelir	can be a led — Issue Cleaning CUSING Cepts — Mentation Cusing Cus	mined – les in da ng – Dat lodeling n – Dat	Kind of pta mining a Integrate of the In	patterns can - Data Ob ion – Data be and OLA	be minecests and Reduction AP – Data Attribut	l – Te Attril n – Da n ware te Ori	chno bute ita Ti hous	Dlog Ty ran	gies uypes - nsform 10 H	Datanation ours ion.
WNIT:1 I KDD Proce Kinds of A preprocessin and Discreti UNIT:2 I Data wareh Design and UNIT:3 Introduction Quality-Pro	ess – Kapplicating over ization DATA ouse – d Usag DATA n to day	ENGINEE inds of data ions targete view – Dat WAREHO Basic Conce – Imple MODELI ata modelir	can be a can be a can be a cleaning outsing cepts –M mentation of the cepts of the	mined – les in da ng – Dat lodeling n – Dat	Kind of pta mining a Integrate of the In	patterns can - Data Ob ion – Data be and OLA	be minecests and Reduction AP – Data Attribut	l – Te Attril n – Da n ware te Ori	chno bute ita Ti hous	Dlog Ty ran	gies uypes - nsform 10 H	ours ion. Data
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WNIT:1 I KDD Proce Kinds of A preprocessin and Discreti UNIT:2 I Data wareh Design and UNIT:3 Introduction Quality-Pro UNIT:4 ETL basic mechanisms basic query-	ess – Kapplicating over ization DATA louse – de Usage DATA n to da oduction DATA ess –Exss-ETL -advance	ENGINEE inds of data ions targete rview – Dat WAREHO Basic Cond e – Imple MODELI ata modelin data Pipel PROCESS traction of Tools-Load	can be a led — Issue a Cleaning of Cleaning and chema metal of Cleaning and Cleaning	mined – les in da ng – Dat lodeling n - Dat onal dat Extraction Transfo	WCTION Kind of pta mining a Integrat - Data culta General a models n Methodormation.	be and OLA lization by -NoSQL d ds-Transpo	be mined bjects and Reduction AP – Data Attribute at a mode creation of the control of the con	l – Te Attril n – Da n ware te Ori ls-Dat	chnobute ta Ti	ologoran Tyran ee d I pel	gies uypes - nsform 10 H Induct 10 H Innsporerform	ours ours Data ours ours tation
WNIT:1 I KDD Proce Kinds of A preprocessin and Discreti UNIT:2 I Data wareh Design and UNIT:3 Introduction Quality-Pro UNIT:4 ETL basic mechanisms basic query-	ess – Kapplicating over ization DATA ouse – de Usage DATA n to da oduction DATA ess – Exs-ETL advance DATA ization:	ENGINEE inds of data ions targete view – Dat WAREHO Basic Cone e – Imple MODELI ata modelin data Pipeli PROCESS traction of Tools-Load ced query-S VISUALIZ	can be a can	mined — les in da les in d	ta mining a Integrat - Data culta General a models n Methodormation. techniques	be and OLA dization by -NoSQL d ds-Transport Data Captus s-Analysis a	be mined ojects and Reduction AP – Data Attribute ata mode rtation of are-Data vand Report	l – Te Attril n – Da a ware te Ori ls-Dat f data warehoting-C	chnobute ta Ti house a Pi a- Touse DLAF	pel Transpel	gies uypes - nsform 10 H Induct 10 H Innsporerform	ion. Ours Data ours tours tation ance-
UNIT:1 I KDD Proce Kinds of A preprocessin and Discreti UNIT:2 I Data wareh Design and UNIT:3 Introduction Quality-Pro UNIT:4 ETL basic mechanisms basic query- UNIT:5 D Data visuali	ess – Kapplicating over ization DATA ouse – de Usage DATA n to da oduction DATA ess – Exs-ETL advance DATA ization:	ENGINEE inds of data ions targete view – Dat WAREHO Basic Cone e – Imple MODELI ata modelin data Pipeli PROCESS traction of Tools-Load ced query-S VISUALIZ	can be a can	mined — les in da les in d	ta mining a Integrat - Data culta General a models n Methodormation. techniques	be and OLA distribution by -NoSQL d ds-Transport Data Captus s-Analysis a	be mined ojects and Reduction AP – Data Attribute ata mode rtation of are-Data vand Report	I – Te Attril n – Da a ware te Ori ls-Dat f data warehoting-C	chnobute ta Ti house a Pi a- Touse DLAF	pel ta	gies uypes - nsform 10 H Induct 10 H Innsporerform	ion. ours ours tours tation ance- Hours
WNIT:1 I KDD Proce Kinds of A preprocessin and Discreti UNIT:2 I Data wareh Design and UNIT:3 Introduction Quality-Pro UNIT:4 ETL basic mechanisms basic query- UNIT:5 D Data visual encodings, I Text Book(s)	ess – Kapplicating over ization DATA ouse – de Usage DATA n to de oduction DATA ess – Exis-ETL advance DATA ization: Retinal	ENGINEE inds of data ions targete view – Dat WAREHO Basic Cone e – Imple MODELI ata modelin data Pipeli PROCESS traction of Tools-Load ced query-S VISUALIZ	can be a can	mined— les in da	ta mining a Integrat - Data culta General a models or mation. techniques to encodi	continue of the continue of th	be mined bjects and Reduction AP – Data Attribute at a mode at a mode artation of the control of	I – Te Attril n – Da a ware te Ori ls-Dat f data warehotting-C zation gs.	chnobute thouse a Pi a- Touse DLAF	pel ta	gies uypes - nsform 10 H Induct 10 H Insporerform 10 H types	ion. ours ours tours tation ance- Hours

1 7	Jiawei Han, MichelineKamber, Jain Pei "Data Mining: Concepts and Techniques", Third edition, Elsevier, Morgan Kaufmann Publishers, 2012.
Reference	Books
	Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	M	L	M	M
CO2	S	S	S	S	L	M	L	M	L	M
CO3	S	S	M	M	L	M	S	M	M	M

*S-Strong; M-Medium; L-Low



Course C	ode	TITLE OF THE COURSE	L	T	P	C
Core 6	6	ARTIFICIAL INTELLIGENCE	3	-	-	3
Pre-requi	isite	Syllal	bus V	ersion	202	2-23
Course Ob	jecti	ves:				
The main o	bject	ives of this course are to:				
1. Understa	and th	ne fundamentals of artificial intelligence and working of problem-	-solvi	ng agei	nts.	
		ne logical agents and knowledge representation using First Order				
		ne concept of uncertainty and building principles of decision-mak	ing ag	gents.		
		se Outcomes:				
		al completion of the course, student will be able:				
		rate fundamentals of artificial intelligence (AI) and problem sing different search methods			K3	
		about adversarial search and constraint satisfaction problem			K3	
solvi		about adversariar search and constraint satisfaction problem			113	
		knowledge about logic representations for making inferences.			K2	
		rate the decision-making techniques to handle uncertainty.			K2	
	ly AI	principles to develop solutions and applications to solve			K3	
		; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K 0	6– Cre	eate		
Unit: 1		INTRODUCTION AND PROBLEM SOLVING			8 H	ours
Example pr	roble	AI - Intelligent Agents - Problem solving by searching: Proms - Search for solutions - Uninformed search strategies - Information - Python AI search implementation.				
Unit: 2		ADVERSARIAL SEARCH AND CSP			10 H	Iour
decisions.	Cons	rch: Games- Optimal decisions in games – Alpha-beta pruning traint Satisfaction Problems (CSP): Defining CSP problems-CPs - Backtracking search for CSPs.				
Unit: 3		LOGICS AND KNOWLEDGE REPRESENATION			10 H	Iour
simple logi	ic-Pro	Knowledge-based agents – The Wumpus world. Logic – Propositopositional theorem proving. First order logic: Representation – S – Using first order logic-PROLOG basics. Inference in first order	yntax	and se	manti	ics o

Unit: 4 UNCERTAINITY AND DECISION MAKING 10 Hours

versus first order inference—Unification and lifting—Forward chaining—Backward chaining—

Resolution.

Making Simple Decisions-Combining beliefs and desires under Uncertainty-Utility Theory-Utility Functions-Multi-attribute utility functions- Quantifying uncertainty: Acting under uncertainty - Probability basics — Bayes' Rule and its use. Probabilistic reasoning: Representing knowledge in uncertain domain- The semantics of Bayesian networks - Decision networks- The value of information-Decision theoretic expert systems.

Ţ	Unit:5	AI APPLICATIONS	10 Hours
Futu	re of Artific	ial Intelligence - Natural Language Processing - Speech Recognition –	
Robo	otics – Expe	ert Systems - AI Application Case Studies.	
		Total Lecture hours	48 hours
Text	Book(s)		
1		ussell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education / Prentice Hall of India, 2015.	, 3rd
2		ch, Kevin Knight, Shivashankar.B. Nair, "Artificial Intelligence", Tata Mc Gition, 2009	raw Hill,
Refer	ence Books		
1	Nils J. Nil	lsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 200	0.
2		Luger, "Artificial Intelligence-Structures and Strategies For Complex Proble Pearson Education / PHI, 2002	m
3		Poole, Alan K. Mackworth, "Artificial Intelligence: Foundations of Computat Cambridge University Press, 2010.	ional
Rela	ted Online	Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://aima.	cs.berkeley.edu	
2	http://nptel.	ac.in/courses/106106126/4	
3		dium.freecodecamp.org/an-introduction-to-q-learning- ent-learning-14ac0b4493cc	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	[®] M	S	M	M	M
CO2	S	S	M	M	M	M	M	M	M	M
CO3	S	S	M	M	HARMINE	M	M	M	M	M
CO4	S	S	S	Solie Si	S	\$ S	M	M	M	M
CO5	S	S	S	S	DUCATE TO SEVATE	M	L	M	L	L

^{*}S-Strong; M-Medium; L-Low

Course code		TITLE OF THE PAPER	L	Т	P	C
Core 7		Applied Data Structures	3	0	0	2
Pre-requisi	ite	None		llabus ersion		2022-23 Onwards
Course Object						
1. Master the	e impl	of this course are to: ementation of linked data structures such as st ppropriate data structure for a specific applica-		ueues, lir	nked lis	ts, trees etc.
Expected Cour	rse O	utcomes:				
On the succes	sful co	ompletion of the course, student will be able to):			
Construct	and a	nalyze Linked list operations with illustrations			K2,	K3
2 Construct	and a	nalyze stack operations with illustrations			K2,	K3
Enhance to	he kn	owledge of Queue and Hashing.			K2,	K3
4 Demonstr	ate th	e concept of trees and its applications			K2,	K3
		e concept of Graph and its applications			K2,	*
K1 - Rememb	er; K	2 - Understand; K3 - Apply; K4 - Analyze; K	5 - Ev	aluate; K	26 − Cre	eate
Unit:1 LIN	KED	LIST			8 hou	rs
-		Pointers- Linked lists - Types- Operations - Linked List operations	Crea	ntion, Ins	ertion,	Deletion,
Unit:2 STA	ACK	EDUCATE TO ELEVATE			10 ho	urs
		mplemented using arrays and Linked list – Ap Postfix Conversion, Postfix Expression Evalu		ions of S	tack – E	Balancing
Unit:3 QU	EUES	S AND HASHING		10	hours	
-		on Queues, Circular Queue – Operations, Dou solution strategies	ble er	nded quei	ıe – Pri	ority queue
Unit:4 TRI	EES			10	hours	
General Trees R operations – B-7	-	entation – Tree Traversals – Binary Trees- Ex – B+Trees.	pressi	on trees -	- Binary	y Search Tre
Unit:5 GR	APH	S		10	hours	
		esentation: BFS, DFS – Shortest Path Algorith Free – Topological Sorting	nms –	Dijikstra	's Algo	rithm –
***************************************					T	4 1 TT

Total Hours: 45

References:

- 1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, Hyderabad, 2008.
- 2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second edition, Pearson Education Asia, 2007.
- 3. Jean Paul Tremblay and Paul G. Sorenson, An introduction to data structures with applications 2nd edition, Tata McGraw-Hill, 20014
- 4. Gilberg and Ferouzan, Data Structures using C, Pearson Education 2004.
- 5. Robert L. Kruse, Clovis L. Tondo, Bruce P. Leung, 'Data Structures and Program Design in C', PHI, 1996.
- 6. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures & Algorithms, Education, New Delhi, 2009.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	L	L	M
CO2	S	S	S	S	M	S	L	L	L	L
CO3	S	M	M	M	S	S	M	L	L	M
CO4	M	M	M	M	M	M	M	L	L	M
CO5	M	M	M	M	M	M	S	M	L	M

S-Strong; M-Medium; L-Low

C	ourse Code	TITLE OF THE COURSE	L	T	P	C		
	Allied 2	Inferential Statistics	4	-	-	3		
P	re-requisite	Basics of sampling technique	S	Syllabus Version	202	22-23		
	Objectives:							
	objectives of this c							
	_	thods of testing statistical hypothesis.						
2. Unders	stand the meaning ar	nd applications of tests of significance						
Expected	l Course Outcomes	•						
On the su	ccessful completion	of the course, student will be able:			ı			
1	1 Understand testing of statistical hypothesis							
2	Understand the co	istributions	K2, K3	3				
3	Understand the co		K2, K3	3,K4				
4	Analyze the test of		K2, K3,K4					
5		K4,K5						
Unit:1	Tests of Hypothe	eses (San San San San San San San San San San			8 Hours			
	e of Testing hypothers the power of a hyp	esis –two types of errors – critical regio pothesis test	n-Two	- tailed and o	one- taile	ed tests		
Unit:2	Estimation	ATHIAR UNING			10 Ho	urs		
	s of a good estimato n of successes	r, Tests of significance of attributes-tes	sts for n	umber of suc	cesses a	ınd		
Unit:3	Tests of significa	nce for large samples			10 Ho	urs		
	e between small and standard deviations	d large samples-two tailed test for diffe	rence b	etween mean	s of two	,		
Unit:4	Test of significan	nce for small samples			10 Ho	urs		
Assumpti distribution		dent's t-distribution-Properties of t-dis	tributio	n-Application	n of t-			
Unit:5	Sampling Distrib	butions			10 Ho	urs		
Chi-squar	 re distribution, Fishe	er's z distribution and F-test						
			To	tal Lecture h	ours:4	8 Hour		

Text Book	x(s)							
1	Gupta, S.C., and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand & Sons (Publisher), New Delhi, India							
2	Gupta S.P (2018), Statistical Methods, 45 th revised edition, Sultan Chand & Sons, New Delhi							
Reference	Books							
1	Agarwal, B. L. (2006). Basic Statistics, New Age International Private Limited, New Delhi, India							
Related O	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]							
1	https://nptel.ac.in/courses/111/104/111104120/							

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	M	M	M	M	M
CO2	M	S	M	M	M	M	S	S	M	M
CO3	S	M	S	S	S	M	S	M	S	M
CO4	S	M	M	M	M	M	M	S	S	M
CO5	S	S	M	M	M	M	M	M	M	M

^{*}S-Strong; M-Medium; L-Low



Co	urse Code	TITLE OF THE COURSE	L	T	P	C					
Co	ore Lab 5	ETL Laboratory	-	-	3	2					
Pre	e-requisite	Syl	labus V	ersion	20	022-23					
Course	e Objectives:										
The ma	ain objectives	of this course are to:									
	•	tanding of core concepts and technologies of data sci	ence.								
		tanding of data pre-processing techniques									
		ents to prepare the data for visualization									
	Expected Course Outcomes:										
On the		mpletion of the course, student will be able:			ı						
1	Acquire k	nowledge on various phases of data engineering			K1, K	2					
2	Identify no procedure	ecessity of data pre-processing and apply the appropr	iate		K2, K	.3					
3	Demonstratime appli	ate data warehouse schema and process of data recations.	trieval 1	for real	K2, K	3,K4					
K1 - R	emember; K2	- Understand; K3 - Apply; K4 - Analyze; K5 - Eval	uate; K	6– Crea	te						
1	Data Migratio	on (Informatica)									
2	Identification	and Retrieval of dataset. (Kaggle/UCI Repository)									
3	Statistical De	scriptions of Data (R/Python)									
4		g of datasets using data mining tools.									
5	Exploratory A										
6	Data Visualiz	ation									
		Total Practi									
		ne Contents [MOOC, SWAYAM, NPTEL, Websi									
1	https://www.udacity.com/course/data-engineer-nanodegreend027										
2		datacamp.com/courses/introduction-to-data-engineeri	ng								
3	https://www.d	dataquest.io/path/data-engineer/									

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	L	L	M
CO2	M	S	S	S	S	M	M	L	L	L
CO3	M	S	S	M	M	M	L	L	M	M

^{*}S-Strong; M-Medium; L-Low

Course Code	Mini project I using Python Programming / Advanced Excel	Т	P	С	
Supportive	Skill based Subject-1	-	2	2	
Pre-requisite	Students should have a good understanding of Python Program Advanced Excel		Syllal Versi	bus ion	2022-23

Course Objectives:

The main objectives of this course are to:

- 1. To understand and select the task based on their core skills
- 2. To get the knowledge about analytical skill for solving the selected task
- 3. To get confidence for implementing the task and solving the real time problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able:

1	Illustrate a real world problem and identify the list of project requirements	К3
2	Judge the features of the project including forms, databases and reports	K5
3	Design code to meet the input requirements and to achieve the required output	K6
4	Compose a project report incorporating the features of the project	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6- Create

Aim of the project work

- 1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied
- 2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application-oriented concepts
- 3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

- 1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 75 marks at the last day of the practical session.
- 2. Out of 75 marks, 45 marks for project report and Viva Voce and 30 Marks for Internal Assessment.

Project Work Format

PROJECT WORK TITLE OF THE DISSERTATION Bonafide Work Done by STUDENT NAME REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of Name of the Degree> of Bharathiar University, Coimbatore-46.

College Logo

Signature of the Guide

Signature of the HOD

Submitted for the Viva-Voce Examination held on _____

Internal Examiner

External Examiner

Month - Year

Acknowledgement Contents

Synopsis

- 1. Introduction
 - 1.1 Organization Profile
 - 1.2 System Specification
 - 1.2.1 Hardware Configuration
 - 1.2.2 Software Specification
- 2. System Study
 - 2.1 Existing System
 - 2.1.1 Drawbacks
 - 2.2 Proposed System
 - 2.2.1 Features

3. System Design and Development

- 3.1 File Design
- 3.2 Input Design
- 3.3 Output Design
- 3.4 Database Design
- 3.5 System Development
 - 3.5.1 Description of Modules (Detailed explanation about the project work)

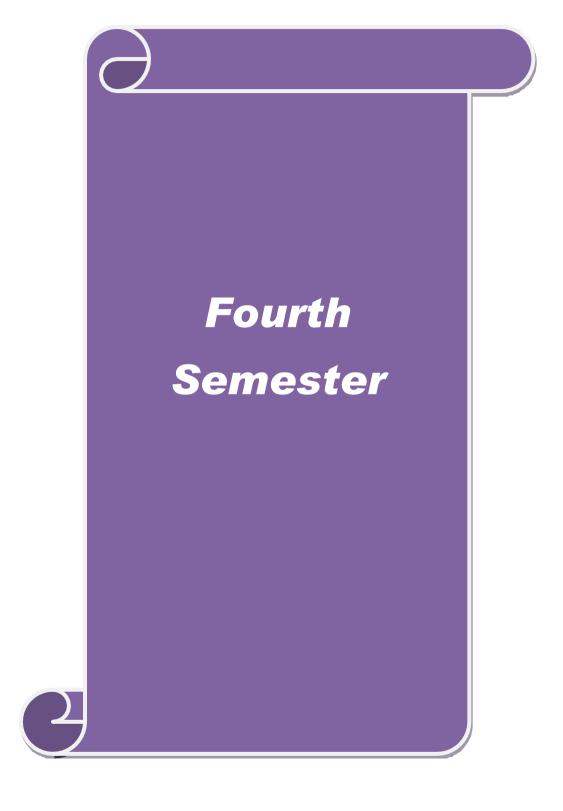
4 Software Testing and Implementation Conclusion

Bibliography Appendices

- A. Data Flow Diagram
- B. Table Structure
- C. Sample Coding
- D. Sample Input
- E. Sample Output

Mapping	Mapping with Programme Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10			
CO1	S	S	S	S	S	L	L	L	L	L			
CO2	S	S	S	S	S	L	L	L	L	L			
CO3	S	S	S	S	S	M	M	L	L	L			
CO4	S	S	S	S	S	M	M	L	L	L			

^{*}S-Strong; M-Medium; L-Low



	Course Code	TITLE OF THE COURSE	L	P	C	
1	Core 8	R Programming	3	0	0	4
	Pre - requisite	None		labus rsion	202	22-23
		Course Objectives	ı			
•	To expose the student sot	the fundamental concepts of R Programming				
	1	Expected Course Outcomes			-	
1	Understand the basics in string functions	n R programming in terms of constructs, control	ol stat	temen	ts,	K2
2	Understand the use of R					K2
3	Apply R programming for					K3
4		R programming from a statistical perspective				K3
]	K1 – Remember K2 – Un	derstand K3 – apply K4- Analyze K5 – evalua	ate K	.6- Cr	eate	
UNIT	I Introducing to R				1	12
Recyc		ctures – Help Functions in R – Vectors – Sca Operations – Using all and any – Vectorized of Element names				
UNIT		Element names.			1	12
and de Dimer	eleting rows and columns -	rations – App <mark>lying Functions to Matrix Rows and Vector/Matrix Distinction – Avoiding Dimensionating lists – General list operations – Accessing</mark>	on Red	ductio	n - H	Higher
UNIT	III Data Frames	sts – re <mark>cursive lists.</mark>			1	12
UNIT Creat funct factor Arith Value UNIT	ting Data Frames ting Data Frames – Mata tions to Data Frames – Factors – Working with tables ametic and Boolean operates – Functions are objects TIV Classes	rix-like operations in frames – merging Data etors and Tables – Factors and levels – Common – Other factors and table related functions – ors and values – Default Values for arguments	ı fram n Fun Cont s – Re	nes – ctions rol sta turnin	App used atement g Bo	olying d with ents – polean
UNIT Creat funct factor Arith Value UNIT S3 Cla readin Graph	ting Data Frames ting Data Frames — Mata tions to Data Frames — Factors — Working with tables tes — Functions are objects IV Classes asses — S4 Classes — Mana g and writing files — acces s— Customizing Graphs — S	rix-like operations in frames — merging Data etors and Tables — Factors and levels — Common — Other factors and table related functions — ors and values — Default Values for arguments — Recursion	fram n Fun Cont s – Re	nes – ctions rol staturnin d and Creati	Apr used atements g Bo mon mon	olying d with ents – polean
UNIT Creat funct factor Arith Value UNIT S3 Cla readin Graph . UNIT	ting Data Frames ting Data Frames – Matrions to Data Frames – Factors – Working with tables ametic and Boolean operates – Functions are objects TV Classes asses – S4 Classes – Manage and writing files – access – Customizing Graphs – Sacretary – Modelling in R	rix-like operations in frames — merging Data ctors and Tables — Factors and levels — Common — Other factors and table related functions — ors and values — Default Values for arguments — Recursion ging your objects — Input/output — accessing ke sing the internet — String Manipulation — Graph Saving Graphs to files — Creating Three-Dimension	fram n Fun Cont s – Re eyboar ics – (ional p	nes – ctions rol staturnin d and Creatiolots	Apr used atement g Bo mon ng	plying d with ents – polean 12 itor –
UNIT Creat funct factor Arith Value UNIT S3 Cla readin Graph . UNIT	ting Data Frames ting Data Frames — Mata tions to Data Frames — Factors — Working with tables ametic and Boolean operates — Functions are objects IV Classes asses — S4 Classes — Mana g and writing files — acces s— Customizing Graphs — S IV Modelling in R cing R to other languages —	rix-like operations in frames — merging Data etors and Tables — Factors and levels — Common — Other factors and table related functions — ors and values — Default Values for arguments — Recursion ging your objects — Input/output — accessing ke sing the internet — String Manipulation — Graphic	fram n Fun Cont s – Re eyboar ics – (ional p	nes – ctions rol staturnin d and Creatiolots	Apr used atement g Bo mon ng	plying d with ents – polean 12 itor –
UNIT Creat funct factor Arith Value UNIT S3 Cla readin Graph . UNIT	ting Data Frames ting Data Frames — Mata tions to Data Frames — Factors — Working with tables ametic and Boolean operates — Functions are objects IV Classes asses — S4 Classes — Mana g and writing files — acces s— Customizing Graphs — S IV Modelling in R cing R to other languages —	rix-like operations in frames — merging Data ctors and Tables — Factors and levels — Common — Other factors and table related functions — ors and values — Default Values for arguments — Recursion ging your objects — Input/output — accessing ke sing the internet — String Manipulation — Graph Saving Graphs to files — Creating Three-Dimension — Parallel R — Basic Statistics — Linear Model — Gen	r fram n Fun Cont s – Re eyboar ics – C ional p	nes – ctions rol staturnin d and Creati plots	Approximate Approx	plying d with ents – polean 12 itor –
UNIT Creat funct factor Arith Value UNIT S3 Cla readin Graph . UNIT	ting Data Frames ting Data Frames — Mata tions to Data Frames — Factors — Working with tables ametic and Boolean operate tes — Functions are objects TV Classes Sasses — S4 Classes — Mana g and writing files — acces s— Customizing Graphs — Secondary TV Modelling in R tening R to other languages — inear Models — Time Series	rix-like operations in frames — merging Data ctors and Tables — Factors and levels — Common — Other factors and table related functions — ors and values — Default Values for arguments — Recursion ging your objects — Input/output — accessing ke sing the internet — String Manipulation — Graph Saving Graphs to files — Creating Three-Dimension — Parallel R — Basic Statistics — Linear Model — Gen and Auto-Correlation — Clustering.	r fram n Fun Cont s – Re eyboar ics – C ional p	nes – ctions rol staturnin d and Creati plots	Approximate Approx	plying d with ents – polean 12 itor – 12 nodels
UNIT Creat funct factor Arith Value UNIT S3 Cla readin Graph . UNIT Interfac – Non-l	ting Data Frames ting Data Frames — Mata tions to Data Frames — Factors — Working with tables tes — Functions are objects IV Classes tasses — S4 Classes — Mana g and writing files — acces s— Customizing Graphs — Security TV Modelling in R ting R to other languages — inear Models — Time Series Book(s)	rix-like operations in frames — merging Data ctors and Tables — Factors and levels — Common — Other factors and table related functions — ors and values — Default Values for arguments — Recursion ging your objects — Input/output — accessing ke sing the internet — String Manipulation — Graph Saving Graphs to files — Creating Three-Dimension — Parallel R — Basic Statistics — Linear Model — Gen and Auto-Correlation — Clustering.	r fram n Fun Cont s – Re eyboar ics – (ional peralize	nes — ctions rol staturnin d and Creati plots ed Lin	Approximate Approx	plying d with ents — polean 12 itor — 12 nodels Hours

Refere	enceBook(s)					
1	Mark Gardner, -Beginning R − The Statistical Programming Language II, Wiley, 2013.					
2	Robert Knell, -Introductory R: A Beginner's Guide to Data Visualisation, Statistical Anal	ysis				
	and programming in RI, Amazon Digital South Asia Services Inc, 2013. Richard					
	Cotton(2013). Learning R, O'Reilly Media.					
3	Garret Grolemund (2014). Hands-on Programming with R. O'Reilly Media, Inc.					
4	Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.					
	Related Online Contents (MOOC, SWAYAM,NPTEL, Websites etc)					
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview					
2	https://onlinecourses.swayam2.ac.in/arp19 ap79/preview					
Cours	se Designed by :					

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	M	L	L	L	L
CO2	S	S	M	M	M	S	L	L	L	L
CO3	S	M	M	S	M	M	L	L	L	L
CO4	S	S	M	M	M	S	L	L	L	L

*S-Strong; M-Medium; L-Low



Course co	ode	TITLE OF THE COURSE	L	T	P	С				
Core 9)	MACHINE LEARNING TECHNIQUES	4	-	-	4				
Pre-requi	isite	None Sylla	bus Vei	sion	2022-23					
Course Obj					I					
The main o	bjecti	ves of this course are to:								
1. Unde	erstan	d the significance and basic concepts of machine lea	rning.							
2. Unde	erstan	d different forms/methods of learning and its algorit	nmic pe	rspecti	ve.					
3. Unde	erstan	d the various applications of machine learning.								
Expected C	Course	e Outcomes:								
On the succ	cessfu	l completion of the course, student will be able:								
1	Unde	erstand the fundamentals and different forms of mach	ine lear	ning.	K2					
2		onstrate various parametric and semi parametric mac iiques.	hine lea	arning	K2					
3	Dem	Demonstrate various non- parametric machine learning techniques. K2								
4	-	ain about the concepts of computational learning the insionality reduction	ory and		K2					
5		elop applications using appropriate machine learning eal life problems	approac	ches	К3					
K1 - Reme	mber;	K2 - Understand; K3 - Apply; K4 - Analyze; K5 -	Evaluat	e; K6 –	Create					
Unit:1	INT	RODUCTION AND SUPERVISED LEARNING			12 hou	ırs				
Introduction	n to N	Machine Learning – basic concepts in machine lear	ning – 1	Forms	of Lear	ning -				
_		achine learning applications - Supervised Learning —Learning Multiple Classes—Perspectives and Issue	_	_						
Unit:2	PAR	AMETRIC AND SEMI-PARAMETRIC METHO	DDS		12 hou	ırs				
Multivariat Normal Di	e Me stribu	ification – Regression–Tuning Model Complexity–Mathods: Data–Parameter Estimation–Estimation of Mation–Multivariate Classification and Regression - ectation–Maximization Algorithm - Self Organizing	lissing Semi	Values param	–Multiv	ariate				
Unit:3	NON	I-PARAMETRIC METHODS			12 hou	ırs				
Nonparametric Methods: Nonparametric Density Estimation and Classification-Generalization to Multivariate Data—Condensed Nearest Neighbour—Smoothing Models. Decision Trees: Univariate Trees—Pruning—Rule Extraction—Learning Rules—Multivariate Trees.										
Unit:4	COMPUTATIONAL LEARNING 12 hours									

Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting, Dimensionality reduction: Principal component Analysis, feature selection and visualization.

Unit:5 ML APPLICATIONS AND CASE STUDY

Unit:5	ML APPLICATIONS AND CASE STUDY						
Automated	d knowledge acquisition, pattern recognition, program synthesis, text and	12 hours					
language p	processing, internet-based information systems, human computer						
interaction	, semantic web, and bioinformatics.						
	Total Lecture hours	60 hours					
Text Book	$\mathbf{x}(\mathbf{s})$						
1	Ethem Alpaydin, - Introduction to Machine Learning 3e (Adaptive Computation Machine Learning Series), Third Edition, MIT Press, 2014.	and					
2	Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.						
3	Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013						
4	Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Pres	ss, 2009.					
Reference	Books						
1	Jason Bell, - Machine Learning – Hands on for Developers and Technical professionals, First Edition, Wiley, 2014.						
2	Peter Flach, - Machine Learning: The Art and Science of Algorithms that Sense of Data, First Edition, Cambridge University Press, 2012.	Make					
Related O	online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1	https://onlinecourses.nptel.ac.in/noc21_cs24/preview						
2	https://www.coursera.org/learn/machine-learning						

	PO1	PO2	PO3	PO4	PO5 WITE TO ELEVATE	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	S	L	L	M	L
CO2	S	M	S	M	S	S	M	L	L	L
CO3	S	M	S	S	M	S	L	L	L	L
CO4	S	M	S	M	M	S	L	L	M	M
CO5	S	S	S	M	S	S	L	M	M	L

^{*}S-Strong; M-Medium; L-Low

Course	e code	TITLE OF THE COURSE	L	T	P	C	
Core l	Lab 6	R Programming Lab	-	-	3	2	
Pre-rec	_	None			Syllabus Version 2022-2		
Course							
		etives of this course is to:					
		he concepts in descriptive and inferential statistic	es to sol	ve proble	ems us	ing R	
	Studio	on Outcomes					
		se Outcomes: ful completion of the course, student will be able:					
1		stand the basics in R programming in terms of co			K2		
-		l statements, string functions	11001000	,	112		
2		stand the use of R for Big Data analytics		K2			
3		R programming for Text processing			К3		
4	Appre perspe	ciate and apply the R programming from a statistictive	ical		K3		
K1 – Re	ememb	er; K2 – Understand; K3 – Apply; K4 – Analyze	; K5 – I	Evaluate;	; K6 –	Create	
		List of Programs					
5. I 6. V 7. (Lists an						
		Total	Lecture	e hours	48 ho	ours	
	Text B						
1		M. James, Daniela Witten, Trevor Hastie, Robical Learning: With Applications in R, 2017	ert Tib	shirani, <i>A</i>	An Inti	oduction t	
2	Mark	Gardner, —Beginning R – The Statistical Program	mming l	Languago	e∥, Wi]	ley, 2013	
3	Roger	D.Peng (2018). R Programming for Data Science	e. Lean l	Publishir	ng		
		nce Books					
1	Garret	Grolemund (2014). Hands-on Programming with	n R. OʻF	Reilly Me	edia, Iı	nc.	
2	Analy	t Knell, —Introductory R: A Beginner's Guide to sis and programming in RI, Amazon Digital Souted Cotton (2013).					
	Learnin						
		g R, O'Reilly Media.	sites et	c.]			
Related	Onlin		sites et	c.]			

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	S	L	L	L	L
CO2	M	S	S	M	M	M	M	L	L	L
CO3	S	M	S	M	M	S	M	L	L	L
CO4	S	S	M	M	M	M	M	L	L	L

^{*}S-Strong; M-Medium; L-Low



Course Code	TITLE OF THE COURSE	L	T	P	С
Allied Paper 4	DIGITAL MARKETING	4	-		3
Pre-requisite	None		Syllabus Version	20	022-23

Course Objectives:

The main objectives of this course are to:

- 1. Understand the major digital marketing channels online advertising: Digital display, video, mobile, search engine, and social media
- 2. Learn and develop, evaluate, and execute a comprehensive digital marketing strategy and plan
- 3. Learn how to measure digital marketing efforts and calculate ROI
- 4. Explore the latest digital ad technologies

Expected Course Outcomes:

1	Define and explain various terminologies associated with Digital Marketing.	K1, K2
2	Apply the knowledge of Digital marketing concepts.	K2, K3
3	Construct an appropriate marketing model.	K2, K3
4	Analyze role and importance of digital marketing in a rapidly changing business landscape.	К3
5	Implement the key elements of a digital marketing strategy.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit:1 INTRODUCTION TO DIGITAL MARKETING

9 hours

Digital marketing, Marketing v/s Sales, comparison between digital and traditional marketing, Benefits of Digital marketing, Digital marketing platforms and Strategies, Defining Marketing Goals, Latest Digital marketing trends, Case studies of Digital Campaigns

Unit:2 SEARCH ENGINE OPTIMIZATION(SEO)

9 hours

Components of Search Engines, SEO Keyword Planning, Meta Tags and Meta Description, Website Content Optimization, Back Link Strategies, Internal and External Links, Optimizing Site Structure Keywords in Blog and Articles, On Page SEO, Off Page SEO, Local SEO, Mobile SEO, Ecommerce SEO, optimizing with Google Algorithms, Using Web Master Tool, Measuring SEO Effectivenes

Unit:3 SOCIAL MEDIA MARKETING (SMM)

10 hours

Introduction to social Media Marketing, Benefits of using SMM, Social Media Statistics, Social Media Strategy, Facebook Marketing, Word Press blog creation, Twitter marketing, LinkedIn Marketing, Google plus marketing, Social Media Analytical Tools

Unit:4 | SEARCH ENGINE MARKETING (SEM)

10 hours

Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM, GMM and EM

Unit:5 APPLICATION

10 hours

Google Analytics, Online	Reputation Management, E-Mail Marketing, Affiliate
Marketing, Social Media An	alytics, Ad designing

	Total Lecture hours	48 hours
	Total Lecture nours	TO HOUIS
	Text Book(s)	
1	Ryan Deiss and Russ Hennesberry, "Digital Marketing forDummies",2017	
2	Puneet singh bhatia, "Fundamentals of DigitalMarketing",2017	

References

- Introduction to Programmatic Advertising ByDominikKosorin,2016
- Blogging: A Practical Guide to Plan Your Blog: Start Your Profitable Home-Based Business with a Successful Blog by Jo and DaleReardon, 2015
- Email Persuasion: Captivate and Engage Your Audience, Build Authority and Generate More Sales With Email Marketing By IanBrodie, 2013
- Social Media Marketing All-In-One for Dummies By Jan Zimmerman and Deborah Ng,2017

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	M	S	M	M
CO2	M	S	S	S	S	\EL	M	S	M	M
CO3	S	S	M	M	S	SEL I	S	M	M	S
CO4	M	M	S	S	M	M	M	M	M	M
CO5	M	M	M	M	HAR MINE	M	M	L	L	L

^{*}S-Strong; M-Medium; L-Low

	Course code		TITLE OF THE COURSE	L	Т	P	С		
Sk	ill based Subj	ect-2	Optimization Techniques	4	-	-	2		
	Pre-requisite	e	Nil	Syllabu Version		2022-23			
Cou	ırse Objective	s:		1					
The	main objective	e of th	is course is to make the students to gain k	nowledge	about	vario	us		
con	cepts of Opera	tions F	Research and to identify and develop oper	ational res	earch	model	ls		
fror	from the verbal description of the real system and train them to apply the operations								
rese	earch tools that	are ne	eded to solve optimization problems.						
•	oected Course								
On	the successful	compl	etion of the course, student will be able to	:					
1 Define and formulate linear programming problems and evaluate their applications						K1			
To understand concepts and terminology of Linear Programming from formulation of mathematical models to their optimization using Simplex Method									
3	To comprehe initial		concept of a Transportation Model and d	evelop the		K2			
4		strateg	gies of ga <mark>me</mark> theory and to <mark>ma</mark> ke better dec	cisions wh	ile	K3			
5	Use critical p	ath an	alysis and programming evaluation and re	eview		K3			
	techniques fo	or time	ly project scheduling and completion.						
K 1	- Remember; I	K2 - U	nderstand; K3 - Apply; K4 - Analyze; K5	5 - Evaluat	e; K6	- Crea	ate		
Uni	t:1		RODUCTION TO OPERATION EARCH	9]	hours				
Intr	oduction to Op	eratio	ns Research – Meaning – Scope – Applica	tions - Lir	nitatio	ons.			
Lin	ear programmi	ng-Ma	thematical Formulation-Application in m	anagemen	t decis	sion			
mak	king - Graphica	al Metl	nod-Simplex Method.						
Uni			PORTATION AND IMENT PROBLEMS	9	hours				
Tra	nsportation pro	oblems	s: Introduction- Finding Initial Basic Fe	easible sol	utions	s- mov	ving		
tow	ards optimalit	y (no	n degenerate only) - Maximization in	transport	tation	probl	em-		
Unł	palanced trans	sportat	ion problem. Assignment problem:	Introduction	on –	Hunga	rian		
	Assignment method – Maximization in Assignment problem – Unbalanced Assignment problem.								
Prot	J10111.								
Uni	t:3		GAME THEORY		9	hour	'S		

Game theory: Concept of Pure and Mixed strategies – solving 2 x 2 matrices with and without saddle point. Graphical solution - mx2 and 2xn games. Solving games by Dominance Property.

Unit:4	NETWORK ANALYSIS	9hours

CPM-Principles-Construction of network- Critical path -Forward pass-Backward pass computations-PERT - Time scale analysis - probability of completion of project - types of floats.

Unit:5 SEQUENCING PROBLEM AND REPLACEMENT THEORY 10 --hours

Theory of Replacement – Introduction - Replacement models –Replacement of items that deteriorates gradually (value of money does not change with time)

Unit:6	CONTEMPORARY ISSUES	02-hours

Expert lectures, online seminars – webinars

Note: Theory and problem shall be distributed as 20% and 80% respectively.

Total Lecture hours	48hours

Text Book(s)

- P. K. Gupta, Man Mohan, Kanti Swarup: "Operations Research", Sultan Chand, 2008.
- J. K. Sharma: Operations Research Theory & Applications, Macmillan India Limited, fifth edition.2013

Reference Books

- 1 Kanti Swarup, P.K.Gupta and Man Mohan Operations Research
- 2 Sundaresan V, Ganapathy K.S, Ganesan K, Resource Management Technique- Lakshmi Publications, 2003.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

- 1 https://nptel.ac.in/courses/111/105/111105077/
- 2 https://nptel.ac.in/content/syllabus_pdf/111105077.pdf

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	M	M	S	S	S	M	M	S	S
CO4	M	S	M	S	M	M	S	M	S	M
CO5	S	S	S	S	M	S	S	S	S	M

^{*}S-Strong; M-Medium; L-Low



Course Co	ode	TITLE OF THE COURSE	L	T	P	C			
Core 10)	Data Visualization	6	-	-	4			
Pre-requis	site	None Syllabus	Syllabus Version						
Course Obje									
	•	tives of this course are to:							
		ne fundamentals of visualization concepts and its impo							
		ssential design principles to design and develop effect							
	3. Understand planning and visual analytics through advanced visualization techniques. Expected Course Outcomes:								
On the successful completion of the course, student will be able: 1 Understand foundational visualization concepts K2									
	Understand foundational visualization concepts								
		onstrate visualizations principles to enhance data visua		1	K2				
		ze and apply essential design principles to data explorization	ration and	l	N.)			
		n appropriate charts, tables, maps and dashboards			K3	2			
		tively create and tell a story based on visualized data			K3				
		; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - E	Svaluatari	K6 (
KI - Keillei	HUCI	, K2 - Oliderstand, K3 - Appry, K4 - Anaryze, K3 - 1	zvaruate, .	IXU— (JICai	C			
Unit: 1 V	/ISI	ALIZATION FUNDAMENTALS			10	hours			
, ,	100				10	nours			
Visualizing	Dat	data visualization-Need for data visualization an a-Methods of visualizing data-Overview of modern via formats - Basic chart types.							
		ES TRAININGE S							
Unit: 2 D)AT	A VISUALIZATION FOR HUMAN PERCEPTIO	N		14	hours			
The Human	n B	rain and Data Visualization-Cognitive vs Percept	ıal Desig	gn Di	stino	ction-			
		Effective and Ineffective Visuals-Types of Visuali							
		d Ethics in Data Visualization-Ineffective Visuals a							
Perception a	and (Cognitive Principles- Strategic Use of Pre-Attentive A	Attributes	- De	-Clu	ttering.			
Unit: 3 D	ESI	GN AND EXPLORATORY ANALYSIS			14	hours			
Introduction	n-Fv	ploratory and Explanatory Analysis -Identifying Outl	ers-Cons	tructi	10 9	Control			
		For Purpose-Data, Relationships, and Design-S			_				
_	_	Multiple, Connected View, Language, Labelling, and							
Cognitive Bias- Case Study.									
Unit: 4 V	ISU	AL ANALYTICS AND PLANNING			16	hours			
Basics of V	isua	l Analytics -Charts- Colours, Shapes, and Sizes-Du	al Line C	harts	Bar	Charts,			
		e Charts-Scatter Plots, Gantt Charts, Bubble Charts-							
Heat Maps and Highlight Tables-Dates-Discrete vs. Continuous Dates-Basics of table									

calculations-Maps. Introduction to Planning and Preproduction for Visualizations-A Design

Checklist-understanding Stakeholders-Prioritizing, Optimizing, and Designing

Unit:5	DASHBOARD AND STORY TELLING	
		10.1
Creating and Future Modulate	rd Design Principles-Hierarchies, Actions, Filters, and Parameters-Dashboards. The Story of the data-The Art of Storytelling (Past, Present, re)-Storytelling and the Human Brain-Bringing Data to Life-Emotion ors-Framing and Format-False Narratives and Data Storytelling-on of the Story Points – Case Study	18 hours
	Total Lecture hours	72 hours
	Text Book(s)	
1	Colin Ware and Kaufman M,, Visual thinking for design, Morgan Kaufmann Publishers, 2008	
2	Ben Fry, "Visualizing data", O'Reily,2007	
	Reference Books	
1	Chakrabarti, S, —Mining the web: Discovering knowledge from hypertext data —, Morgan Kaufman Publishers, 2003.	
Related	Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.coursera.org/learn/data-visualization-tableau? specialization=data-visualization	
2	Essential Design Principles for Tableau: https://www.coursera.org/learn/dataviz-design?specialization=data-visualization	
3	Visual Analytics with Tableau :https://www.coursera.org/learn/dataviz-visual-analytics?specialization=data-visualization	
4	Creating Dashboards and Storytelling with Tableau: https://www.coursera.org/learn/dataviz- dashboards? specialization=data-visualization	
5	Data Visualization with Tableau Project: https://www.coursera.org/learn/dataviz-project	
6	Data Visualization with Tableau Specialization: https://www.coursera.org/specializations/data-visualization	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	M	M	S	M	M	M
CO2	S	M	S	S	M	S	S	M	M	M
CO3	S	S	S	S	M	S	S	M	M	M
CO4	S	S	S	S	M	M	S	M	M	M
CO5	S	S	S	S	S	M	S	S	S	S

^{*}S-Strong; M-Medium; L-Low

Course C	ode	TITLE OF THE COURSE	L	Т	P	C						
Core 1	1	Deep Learning	6	-	-	4						
Pre-requi	site	None		Syllabus Version	20	22-23						
Course Ob	jectives:				•							
	U	f this course are to:										
		damentals of neural networks and deep	networks									
		cs of Tensorflow										
		ne architectures and applications of Dee	ep Learnin	g								
	Course Outc		10.									
		pletion of the course, student will be ab the basics of neural networks and deep			V2	V2						
1	Understand	the basics of neural networks and deep	networks		K2	, K3						
2	Develop small applications using Tensorflow											
		about the major architectures of Deep N	Networks		K2,	113						
		applications of Deep Learning	· · · · · · · · · · · · · · · · · · ·		K3,	K4						
		T S			- ,							
K1 - Reme	ember; K2 -	Understand; K3 - Apply; K4 - Analyz	e; K5 - Ev	aluate; K6 – C	reate							
Unit:1	Introducti	on to Learning			10 hours							
		aining Neural networks-Activation fund	ctions-Los	s functions-								
Hyperpara		Sept.										
Unit:2	Fundament	tals of Deep Ne <mark>tworks</mark>			14 ł	nours						
Defining I of Deep N		ng-Common architectural principles of	Deep Net	works- Buildii	ng blo	ocks						
	Tensorflow	EDUCATE TO ELEVATE			14 ł	nours						
Tensorflov Visualizati		es – Operations – Placeholders – Sessio	ns – Shari	ng Variables –	Graj	phs –						
		itectures of Deep Networks			16 ł	nours						
Unsupervi		ed networks- Convolution Neural Netw	orks- Rec	urrent neural n	etwo	rks-						
Unit:5	Application	us .			18 ł	nours						
		rning–Computer Vision- Speech Recogner Applications	nition – N	atural Langua	ge							
			Total L	ecture hours	72 l	nours						
			,	Text Book(s)								
1	Josh Patters Media, 2019	son & Adam Gibson, Deep Learning- A	A Practitio	ner's approacl	1, O'I	Reilly						
2	Rajiv Chopi	ra, Deep Learning-A practical approach blishing, 2020.	(Using Py	thon), Second	Edit	ion,						
3	Charles Die	rbach, Introduction to Computer Scienc lving Focus, Wiley India Edition, 2013		ython: A Com	putati	onal						
	Reference I	<u>-</u>										
		Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning (Adaptive nputation and Machine Learning series), MIT Press, 2017.										

2			•		,			Learning lia, 2017.	, .	ing Next		
3	Li De: 2014	ng , Dong	g Yu, De	ep Learni	ing: Meth	nods and	Applicat	ions, Nov	w Publish	ers,		
Related	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]											
1	https:/	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview										
2	https:/	/onlineco	ourses.sw	ayam2.ac	c.in/arp19	_ap79/pr	review					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	S	S	M	M	M	S	L	L	L	L		
CO2	S	S M M S L L L										
CO3	S	S M M S L L M L										
CO4	S	S	M	M	M	M	M	L	M	L		

^{*}S-Strong; M-Medium; L-Low



	Course Code	TITLE OF THE COURSE	L	T	P	C			
	Core Lab 7	Data Visualization Laboratory	0	0 0		4			
	Pre - requisite	None	_	labus rsion	202	22-23			
	Course Objectives								
		of data visualization concepts and basic char les to design and develop effective visualiza	• •						
		Expected Course Outcomes							
1	Understand concepts and	basic charts using data visualization tools and	d techni	ques.		K2			
2	Analyze and apply essenti	al design principles to data exploration and	visualiza	ation.		K4			
3	Apply appropriate charts,	plots, tables, and maps for complex data ana	lysis.			К3			
	K1 – Remember K2 – Und	lerstand K3 – apply K4- Analyze K5 – eva	luate K	6- Cr	eate				
List of	Experiments				60 h	ours			

- 1. Create a basic visualization using Google Sheets.
- 2. Demonstrate proper use of the design principles used: "pop-out" or "pre-attentive" attributes, Gestalt Principles, cognitive load and clutter, and static or interactive format.
- 3. Analyze customer's purchases and how much the company is profiting from each customer by create a scatter plot
- 4. Create a table showing total sales by product category, broken down by Year and Month -sales spotlight.
- 5. Create a dual layer map showing total profit by postal code, colorized by profit ratio, and sized by total sales.
- 6 Provided any dataset, create a dashboard consisting of at least 2 KPIs.
- 7. Create a story consisting of at least three story points and must explicitly answer the business question(s) in the project .

Total Practical Hours 72 Hours

Text Book (s)

- 1 Colin Ware and Kaufman M., Visual thinking for design, Morgan Kaufmann Publishers, 2008.
- 2 Chakrabarti, S, "Mining the web: Discovering knowledge from hypertext data ", Morgan Kaufman Publishers, 2003.
- 3 Ben Fry, "Visualizing data", O'Reily, 2007.

ONLINE COURSES AND VIDEO LECTURES:

- https://www.coursera.org/learn/data-visualization-tableau? specialization=data-visualization
- 2 Essential Design Principles for Tableau:
 - https://www.coursera.org/learn/dataviz-design?specialization=data-visualization
- 3 Visual Analytics with Tableau :https://www.coursera.org/learn/dataviz-visual-analytics?specialization=data-visualization
- 4 Creating Dashboards and Storytelling with Tableau: https://www.coursera.org/learn/dataviz-dashboards?

- specialization=data-visualization
- 5 Data Visualization with Tableau Project: https://www.coursera.org/learn/dataviz-project
- Data Visualization with Tableau Specialization: https://www.coursera.org/specializations/data-visualization

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	M	M	S	M	M	M
CO2	S	S	S	S	M	S	S	M	M	M
CO3	S	S	S	S	M	S	S	M	M	M

^{*}S-Strong; M-Medium; L-Low



Course code	TITLE OF THE COURSE	L	Т	P	C						
Skill based Subject-3:	Social Media Analytics	6	-	-	2						
Pre-requisite	None		Syllabus Version	20	022-23						
Course Objectiv	es:										
The main objecti	ves of this course are to:										
 Give 	an overview of social networks and its imp	ortance.									
• Und	erstand the social network concepts and var	ious metl	hods of analy	sis.							
visua	ose and train on various tools and technique alizing social media networks.	s for anal	yzing and								
Expected Cours											
	completion of the course, student will be a			L							
1 Analyze	Analyze social network data using various software packages. K1, F										
	Implement statistical models of social networks to analyze network formation and evolution. K2, K3										
3 Impleme social sci	nt the basic concepts and theories of networiences.	k analys	is in the	K2,	, K3						
4 Use stati	stical software to vi <mark>sualize networks</mark> and an	alyze the	ir properties.	K2							
K1 - Remember;	K2 - Understand; K3 - Apply; K4 - Analyz	ze; K5 - I	Evaluate; K6 -	- Cr	eate						
Unit:1 INTRO	DUCTION TO SOCIAL NETWORKS A	ND SNA		10	hours						
	d – Networks: Actors, Relations and Attri			Info	rmatio						
	s as Conduits – Leaders and Followers										
	 Basic building Blocks - Brief history 	of Socia	1								
Network Analysis											
	ORK CONCEPTS				hours						
Social Networks-	pers of the Network – Sociological Question Distributions – Multiplexity – Roles and Po - Notations for Social Network Data	s about I ositions –	Relationships - Network Seg	– W gmei	⁷ hole ntation						
TT 14 2	L NETWORK ANALYSIS FUNDAMEN	ΓALS		14	hours						
	Density – Centrality and Centralization – Cs and Clusters – Dimensions and Displays.	ompone	nts, Cores and	l Cli	ques						
	ODS OF SOCIAL NETWORK ANALYS	SIS		18	hours						
Equivalence – Vi – Affiliation netv	es – Relationship Measures – Centrality and sual Displays – Book models – Network Po works – Lattices- Levels of Analysis	_	-								
Unit:5 TOO	LS AND TECHNOLOGIES										

Twitter Analytics – Facebook Analytics – Google+ Analytics – Google+ Ripples – 18 hours R for Social Network Analysis – Pajek – Network Visualization Tools –

Total Lecture hours 72 hours

Analyzing Social Media Networks with NodeXL.

								Text B
, and	, Concepts,	cial Networks: Theo						1
		,2011	ress,USA,	ersity Pr	rd Univ	gs", Oxfo	Finding	
, SAGE	2 nd Edition, S	Network Analysis	"Social	Yang,	Song	Knoke,	David	2
		•		٥,		ations,200		
							nces	Refere
	Theory	ysis: History,	Anal	etwork	Social N	Prell, "S	na l	Christi
	•	ns Ltd, 2012.	ublication	SAGE P	Edition,	gy", 1st E	thodolog	and Me
		ns Ltd, 2012.	Publication	SAGE P	Edition,	gy", 1st E	thodolog	and Mo

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	M	S	M	M
CO2	M	S	S	S	S	M	M	S	M	M
CO3	M	S	S	S	S	M	M	S	M	M
CO4	M	M	S	S	M	M	M	M	M	M

^{*}S-Strong; M-Medium; L-Low





Course co	de	TITLE OF THE COURSE	L	T	P	C				
Core 12	,	Natural Language Processing	5	-	-	4				
Pre-requis	site	None		Syllabus Version	2	022-23				
Course Ob	jecti	ives:								
The main o	bjec	tives of this course are to:								
		he significance of NLP tasks								
		bout syntax parsing and semantic analysis method	S							
		he application domains of NLP								
		se Outcomes: ful completion of the course, student will be able:								
		-		- toolso in	V	l, K2				
		nonstrate an understanding of Natural Language Patax, semantics, and pragmatics.	TOCESSIII	g tasks III	K	1, K 2				
	Demonstrate an understanding of Morphology and Part of Speech Tagging.									
3	Sho		K2, K3,K4							
4	Exp	lain the use of semantic analysis methods.			K2, K3					
5	Rela	ate a few applications of NLP.			ΚΔ	1,K5				
K1 - Remer	mbe	r; K2 - Understand; K3 - Apply; K4 - Analyze; K 5	5 - Evalu	nate; K6 – C	reat	i.e				
Unit:1	Intr	roduction			10	hours				
	igua	ge Processing tasks in syntax, semantics, and prag	matics –	Issues - A						
		achine learning - Probability Basics –Information t								
Language N	Mode	els - Estimating parameters and smoothing - Eva	aluating l	language m	ode	els.				
Unit:2	Mo	rphology and Part of Speech Tagging			14	hours				
speech Tag	ging	ntials - Lexical syntax- Morphology and Finit g - Rule-Based Part of Speech Tagging - Mark Isformation based Models - Maximum Entropy	ov Mod	lels - Hidd	en	Markov				
Unit:3	Syn	tax Parsing			14	hours				
•	_	- Grammar formalisms and tree banks - Parsing Unification -Statistical parsing and probabilist								
	Sen	nantic Analysis			16	hours				
Representin	ng N	Meaning – Semantic Analysis -Lexical semantics Dictionary based and Unsupervised Approache			mbi	guation				
Semantic		ole Labeling and Semantic Parsing-Di		-						

Unit:5	Applications	18 hours
Named en	ntity recognition and relation extraction- IE using sequence	labeling-
Machine T	Franslation (MT) -Basic issues in MT-Statistical translation-word	alignment-
phrase-bas	ed translation – Question Answering	
	Total Lecture hours	72 hours
	Text Book(s)	
1	Daniel Jurafsky and James H. Martin, "Speech and Language	
	Processing", Second Edition, Prentice Hall, 2008.	
	Reference Books	
1	Holcomb, Z. C. (2017). Fundamentals of Descriptive Statistics,	
	Routledge, New York, US.	
2	Steven Bird, Ewan Klein and Edward Loper, "Natural Language	
	Processing with Python", O'Reilly Media, First Edition, 2009.	
3	Roland R. Hausser, "Foundations of Computational Linguistics:	
	Human- Computer Communication in Natural Language",	
	Paperback, MIT Press, 2011.	
Related O	nline Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	NLTK – Natural Language Tool Kit - http://www.nltk.org/	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	M	M	L	L	L
CO2	S	S	M	M sof	M a	M	L	L	L	L
CO3	S	S	M	M	M	E.S	M	L	L	L
CO4	S	S	M	M	M	To S	L	L	L	L
CO5	S	S	M	M	M	₹ S	L	L	L	L

^{*}S-Strong; M-Medium; L-Low

LTP

Cu	arse code				, IIII	COUNDI	•			1		C
Co	ore Lab 8		Natu	ıral Lang	guage Pro	ocessing l	Lab		0	0	4	2
Pr	erequisite			N	None				•	abus sion	202	2-23
				Cours	se Object	tives						
•	To introduce	the fund	amental c	concepts a	and techn	iques of n	atural lar	nguage	proce	essing	(NLP	")
			F	xpected (Course C	Outcomes						
1	Understand t	the funds		_				2001120	e nro	cessi	nσ	K2
	(NLP)							anguag	,c pro	CCSSI		
2	Understandin											K2
3	Demonstrate algorithms for					ıral langu	ages and	the cor	nmor	ıly us	ed	K2
4	Understandin	ng seman	tics and p	pragmatic	s of lang	uages for	processir	ng				K2
]	K1 – Rememb	oer K2 –	Underst	and K3 -	- apply K	4- Analy	ze K5 –	evaluat	te K	6- Cro	eate	
				LIST O	F PROG	RAMS						
1.	Implementing	g word si	milarity									
2.	Implementing	g simple	problems	related to	o word di	sambigua	ition					
3.	Simple demo	nstration	of part o	f speech t	tagging.							
4.	Lexical analy	zer.	M									
5.	Semantic Ana	alyzer.		E RAPAIHI	AR UNIVERSI							
6.	Sentiment Ar	nalysis.		OHEDISE BISEL	Coimbatore Juneon Quit is all ATT TO SERVATE	3,67						
			Tot	tal Lectu	re Hours						36 H	ours
				Te	xt Book(s)						
1	Daniel J and	James H	I. Martin,	speech a	nd langu	age proce	ssing∥ an	introdu	action	to na	atural	
	language pro	cessing,	computa	tional ling	guistcs&	speech re	cognition	prenti	ce hal	1,200	9	
	•			Refer	ence Boo	ok(s)						
1	Lan H Writt	ten and	Elbef,Ma	ırkA.Hall	,∥data mi	ning: pra	ctical m	achine	learn	ing t	ools	and
	techiniques,	Morgan	Kaufman	ın,2013		_				-		
	Related Onl	ine Con	tents (M	OOC, SV	VAYAM	,NPTEL,	Website	s etc)				
1	https://onlin											
2	https://onlin	ecourse	s.swayan	n2.ac.in/a	rp19 ap	79/previ	ew_					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P	O9	PO1	0
CO		S	M	M	M	S	L	L		L	L	
	O2 S	M	S	M	M	S	L	L		L	L	
CO	O3 S	\mathbf{S}	M	S	S	M	L	L		L	L	

TITLE OF THE COURSE

CO₄

Course Code

M

M

M

^{*}S-Strong; M-Medium; L-Low

K6

Course Code	TITLE OF THE COURSE	L	T	P	C
Core 13	Project Work Lab	0	0	6	4
Pre-requisite	Students should have the strong knowledge in any one of the programming languages in this course.	Sylla	abus sion	202	22-23

Course Objectives

- To understand and select the task based on their core skills.
- To get the knowledge about analytical skill for solving the selected task.
- To get confidence for implementing the task and solving the real time problems.
- Express technical and behavioral ideas and thought in oral settings.
- Prepare and conduct oral presentations

 Functed Course Outcomes

	Expected Course Outcomes	
On th	ne successful completion of the course, student will be able to:	
1	Formulate a real world problem and develop its requirements develop a design solution	К3
	for a set of requirements	
2	Test and validate the conformance of the developed prototype against the original	K5
	requirements of the problem	
3	Work as a responsible member and possibly a leader of a team in developing software	K3
	solutions	
4	Express technical ideas, strategies and methodologies in written form. Self-learn new	K1-
	tools algorithms and techniques that contribute to the software solution of the	K4

K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create

Aim of the project work

1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied.

Generate alternative solutions, compare them and select the optimum one

- 2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts.
- 3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

project

5

- 1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 200 marks at the last day of the practical session.
- 2. Out of 200 marks, 160 marks for project report and 40 marks for Viva Voce.

Project Work Format

PROJECT WORK

TITLE OF THE DISSERTATION

Bonafide Work Done by STUDENT NAME REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of <Name of the Degree> of Bharathiar University, Coimbatore-46.

College Logo

Signature of the Guide Signature of the HOD Submitted for the Viva-Voce Examination held on

Internal Examiner

External Examiner

Month – Year

CONTENTS Acknowledgement Contents Synopsis

1. Introduction

- 1.1 Organization Profile
- 1.2 System Specification
 - 1.2.1 Hardware Configuration
 - 1.2.2 Software Specification

2. System Study

- 2.1 Existing System
- 2.1.1 Drawbacks
- 2.2 Proposed System
 - 2.2.1 Features

3. System Design and Development

- 3.1 File Design
- 3.2 Input Design
- 3.3 Output Design
- 3.4 Database Design
- 3.5 System Development
 - 3.5.1 Description of Modules (Detailed explanation about the project work)

4. Testing and Implementation

5. Conclusion Bibliography Appendices

- A. Data Flow Diagram
- B. Table Structure
- C. Sample Coding
- D. Sample Input
- E. Sample Output

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	M	M	M
CO2	S	S	S	S	M	S	M	M	M	M
CO3	S	S	S	So S	R UM	ale M	M	M	M	M
CO4	S	S	S	S' Bissi	பாரை M ர்த் ^{தி}	M	M	M	M	M
CO5	S	S	S	S	M	M	M	M	M	M

^{*}S-Strong; M-Medium; L-Low

Course code	TITLE OF THE COURSE	L	Т	P	C
Skill based Subject-4:	Capstone Project using Python or R Programming, Data Visualization Tools	•	-	3	2
Pre-requisite	Students should have completed Project I & II Phase – I Strong coding skills in any one programming paper		Sylla Vers		2022-23

Course Objectives:

The main objectives of this course are to:

- 1. To understand and select the task based on their core skills
- 2. To get the knowledge about analytical skill for solving the selected task.
- 3. To get confidence for implementing the task and solving the real time problems.

	~	^
Expected	C'ourse.	Outcomes:

On the successful completion of the course, student will be able:

	······································	
1	Select appropriate input, output, form and table design	К3
2	Design code to meet the input requirements and to achieve the required output	K6
3	Compose a project report incorporating the features of the project	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6- Create

Aim of the project work

- 1. The aim of the project work is to acquire practical knowledge on the implementation of the programming concepts studied
- 2. Each student should carry out individually one project work and it may be a work using the software packages that they have learned or the implementation of concepts from the papers studied or implementation of any innovative idea focusing on application oriented concepts
- 3. The project work should be compulsorily done in the college only under the supervision of the department staff concerned.

Viva Voce

- 1. Viva-Voce will be conducted at the end of the semester by both Internal (Respective Guides) and External Examiners, after duly verifying the Annexure Report available in the College, for a total of 75 marks at the last day of the practical session.
- 2. Out of 75 marks, 30 marks for project report and 45 Marks for Viva Voce

Project Work Format

PROJECT WORK TITLE OF THE DISSERTATION Bonafide Work Done by STUDENT NAME REG. NO.

Dissertation submitted in partial fulfillment of the requirements for the award of Name of the Degree of Bharathiar University, Coimbatore-46.

College Logo

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Signature of the HOD

Submitted for the Viva-Voce Examination held on _____

Internal Examiner External Examiner

Month - Year

Acknowledgement

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Synopsis

- 1. Introduction
 - 1.1 Organization Profile
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 - 3.5.1 Description of Modules (Detailed explanation about the project work)

4 Software Testing and Implementation

Conclusion

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Appendices

- A. Data Flow Diagram
- B. Table Structure
- C. Sample Coding
- D. Sample Input
- E. Sample Output

	Mapping with Programme Outcomes												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
	CO1	S	S	S	S	S	M	M	M	M	M		
ſ	CO2	S	S	S	S	S	S	M	M	M	M		
	CO3	S	S	S	S	S	M	M	M	M	M		

^{*}S-Strong; M-Medium; L-Low



	1	L	Т	P				
Course code	TITLE OF THE COURSE	6	-	-	3			
Elective I	Marketing Analytics		1					
Pre-requisite	Optimization Techniques	Syllabi Versio						
Course Object		1						
	tives of this course are to:							
1.To provide kno	owledge on elements of market analysis							
2. To use marke	ting analytics to predict outcomes and systematically all	ocate reso	urces.					
Expected Cour	se Outcomes:							
	ful completion of the course, student will be able to:							
	solid understanding of key marketing concepts and skil	ls	K2 level					
	Ty and demonstrate the dynamic nature of the environme							
	ch marketing decisions are taken and appreciate the imp		K3 leve	el				
	rketing analytics strategy determination and implement							
3 Devel	op the students' skills in applying the analytic perspectiv	es,						
decision tools, and concepts of marketing to decisions involving. K3 level								
segmentation, targeting and positioning.								
4 Develop an understanding of the underlying concepts, strategies and the K2-K3 level								
	involved in the exchange of products and services and o							
	ting mix variables in order to achieve organizational go		770.1					
	p strong marketing plans and apply the concept of Sales mmerce sales and metrics	analytics	K3 leve	el				
	er; K2 - Understand; K3 - <mark>Apply; K4 - Analyze; K5 - E</mark>	valuate; K						
Unit:1	INTRODUCTION Special control of the little o		10 hc					
	alytics, Models and metrics- Market Insight – Market da		_		LΕ			
trend analysis,	and porter five forces analysis - Market segment identi	fication ar	nd positio	oning				
Unit:2	COMPETITIVE ANALYSIS AND BUSINESS ST	RATEGY	7: 14 ho	ours				
Competitor ide		av_ Analy	tice base	d etre	atem			
-	trategic models and metrics, Forecasting, balanced so				٠.			
factors.	trategic moders and metrics, rorceasting, baraneed se	orccaru, a	ina critic	ai su	JCCS			
ractors.								
Unit:3	PRODUCT, SERVICE AND PRICE	14 hour						
Omt.3	ANALYTICS:	14 Hour	S					
Conjoint analysis	s model, decision tree model, portfolio resource allocatio	n, Pricing	techniqu	es, pri	cing			
assessment, prici	ng for business markets, price discrimination							
Unit:4	DISTRIBUTION AND PROMOTION ANALYTICS:	16 hour	S					
Retail location so	election, distribution channel evaluation, and multi-char	nel distrib	ution, Pr	omoti	on			
budget estimatio	n and allocation, promotion metrics for traditional medi	a and soci	al media.					
T I.a.\$4.5	CALECAMALYTICS	101						
Unit:5	SALES ANALYTICS	18 hou	rs					

E Commerce sales mode, sales metrics, profitability metrics and support metrics.

Total hours: 60

References:

- .1. Stephan Sorger, —Marketing Analytics Strategic Models and Metrics I, Admiral Press, 2013.
- 2. Mark Jeffery, —Data Driven Marketing: The 15 Metrics Everyone in Marketing should knowl,

Wiley, 2013.

3. Paul W. Farris, Neil T. Bendle, Phillip E. Pfeifer, David J. Reibstein —Marketing Metrics: The

Definitive Guide to Measuring Marketing Performancell, Pearson FT press, 2012.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	L	S	M	M	M	M
CO2	S	M	M	M	S	M	L	L	M	L
CO3	M	M	S	M	S	S	M	M	M	M
CO4	S	M	M	S	S	S	L	M	M	L
CO5	S	M	M	L	லக்ச \mathbf{S} கும்	M	M	M	L	L

S-Strong; M-Medium; L-Low

Course co	de	TITLE OF THE COURSE	L	T	P	C			
Elective	I	Data Security and Compliance	6	0	0	3			
Pre-requi	isite	Basic Information System exposure	Syllal Versi	2022- 23					
Course Objective	es:			<u> </u>					
The main objective									
		curity and privacy awareness.							
		tem security risk for organizations.							
3. Know the se	curity and p	rivacy compliance requirements and standards							
Expected Course	e Outcomes	:							
_		on of the course, student will be able to:							
1 Understand the Security requirements, components, and processes									
2 Understand	the various	s needs, risks and issues related to Information Sec	curity		K2	2			
3 To plan information security risk management K									
4 Understand Physical, Operational and Personnel Security K2									
5 Comprehend the Information Security and Privacy Compliance Requirements K2									
K1 - Remember	; K2 - Unde	erstand; K3 - Apply; K4 - Analyze; K5 - Evaluate	; K 6 –	Create	e				
		**woogen							
Unit:1	Introduc				0 hou				
	tem - Secui	on Security? - CIA requirements- security model ring the components - Balancing security and ac							
Unit:2	Needs, l	nformation Threats, Attacks and Issues		1	4 hou	rs			
Need for securit	y - Business	s needs - Threats — Attacks — Legal - Ethical and p	rofessi	onal is	ssues				
Unit:3	Risk Ma	anagement		1	4 hou	rs			
Planning for Secrisk.	urity, Risk ı	management: Identifying and assessing risk - Asse	essing a	nd co	ntroll	ing			
Unit:4	Physica	l, Operational and Personnel Security		1	06hoı	ırs			
User-Defined Fu	unctions: Int	roduction – Need and Elements of User-Defined	Functio	ns- D	efiniti	on-			
		es - Function Calls – Declarations – Category of							
		- Information Security Management Systems			8 hou	rs			
Establishing, Im	plementing	ose and Objectives, Process Approach, Processes, Operating, Monitoring, Reviewing, Maintaining 27001, ISO/IEC 27701, GDPR, Data Protection B	and Im	provii	ng ISI	MS.			
		· · · · · · · · · · · · · · · · · · ·		tal ho	ours:	72			
References:									
		and Herbert J Mattord, "Principles of Information	Securit	y", Si	xth				
Edition (engage I ea	rning 2017							

- Edition, Cengage Learning, 2017
- 2. Alan Calder, Steve Watkins, "IT Governance: An International Guide to Data Security and ISO27001/ISO27002", Kogan Page; 6th edition, 2015
- 3. ISO/IEC 27701 PIMS:

https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE3uDwE

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO-10
CO1	M	L	M	M	L	S	L	M	M	L
CO2	M	M	M	M	L	M	M	M	L	M
CO3	M	M	M	M	M	S	L	L	L	M
CO4	S	L	S	M	M	M	M	L	L	M
CO5	S	M	S	M	M	S	L	L	L	M

*S-Strong; M-Medium; L-Low



The main objectives of this course are to: 1. Identify basic concepts, terminology, theories, models and methods in the field of computer vision 2. To give an understanding of image processing for computer vision 3. Focus on early processing of images and the determination of structure: edges, lines, shapes. Expected Course Outcomes: On the successful completion of the course, student will be able: 1	Course Code	TITLE OF THE COURSE	L	T	P	С					
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K3,K4 K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6— Create Unit:1 INTRODUCTION	2 Design and deploy	various image formation models			K2,	K3					
Unit:1 INTRODUCTION Image Processing-Computer Vision-Low Level-Mid Level-High Level-Overview of diverse computer vision applications: Document Image Analysis, Biometrics, Object Recognition, Tracking ,Medical Image Analysis, Content Based Image Retrieval, Video data Processing, Mutimedia, Virtual Reality and Augmented Reality Unit:2 IMAGE FORMATION MODELS Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Iohours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	3 Apply the technique	ues of motion estimation and object re	cogni	tion.		K4					
Image Processing-Computer Vision-Low Level-Mid Level-High Level-Overview of diverse computer vision applications: Document Image Analysis, Biometrics, Object Recognition, Tracking ,Medical Image Analysis, Content Based Image Retrieval, Video data Processing, Mutimedia, Virtual Reality and Augmented Reality Unit:2 IMAGE FORMATION MODELS Il 4 hours Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Il 6 hours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	K1 - Remember; K2 - Uno	derstand; K3 - Apply; K4 - Analyze;	K5 - I	Evaluate; K	6– C	reate					
computer vision applications: Document Image Analysis, Biometrics, Object Recognition, Tracking ,Medical Image Analysis, Content Based Image Retrieval, Video data Processing, Mutimedia, Virtual Reality and Augmented Reality Unit:2 IMAGE FORMATION MODELS 14 hours Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION 14 hours Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION 16 hours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Unit:1 INTRODUCTIO	N SS C			10 hours						
computer vision applications: Document Image Analysis, Biometrics, Object Recognition, Tracking ,Medical Image Analysis, Content Based Image Retrieval, Video data Processing, Mutimedia, Virtual Reality and Augmented Reality Unit:2 IMAGE FORMATION MODELS 14 hours Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION 14 hours Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION 16 hours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Image Processing-Comput	er Vision-Low Level-Mid Level-Hig	h Lev	el-Overviev	v of	diverse					
Tracking ,Medical Image Analysis, Content Based Image Retrieval, Video data Processing, Mutimedia, Virtual Reality and Augmented Reality Unit:2 IMAGE FORMATION MODELS Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Iohours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians											
Processing, Mutimedia, Virtual Reality and Augmented Reality Unit:2 IMAGE FORMATION MODELS Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians					•						
Monocular Imaging System-Camera Model and Camera calibration-Binocular Imaging System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection MOTION ESTIMATION	Processing, Mutimedia, V	irtual Rea <mark>lity and Augmented Reality</mark>									
System, Multiple views geometry, Structure Determination, Shape from Shading-Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Unit:2 IMAGE FORMA	ATION MODELS			14 ł	nours					
Construction of 3D model from images. Image Processing and Feature Extraction-Image representation, Edge detection Unit:3 MOTION ESTIMATION Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians											
Motion Estimation 14 hours 14 hours Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION 16 hours											
Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION 16 hours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Construction of 3D mod	lel from images. Image Processing	g and	d Feature	Ext	raction-					
Optical Computation, Structure from motion. Shape Representation and Segmentation-Contour based representation, Region based representation, Deformambale curves and surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION 16 hours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians											
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Surfaces, multiresolution analysis Unit:4 OBJECT RECOGNITION Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Optical Computation, Stru	acture from motion. Shape Represen									
Unit:4 OBJECT RECOGNITION 16 hours Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	_	, ,	Jefori	nambale ci	irve	s and					
Hough transforms and other simple object recognition methods, shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. Image Understanding-Pattern recognition methods-HMM,GMM and EM Unit:5 APPLICATIONS 18 hours Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians		<u>·</u>			1 (1						
unit:5 APPLICATIONS Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians			1 1								
Unit:5 APPLICATIONS Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians											
Unit:5 APPLICATIONS Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	1			r recognitio	n. II	nage					
Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Understanding-Pattern rec	ognition methods-HMM,GMM and E	EIVI								
Photo album-face detection-Face recognition-Eigen faces-Surveillance-foreground-background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians	Unit:5 APPLICATIO	NS			18	hours					
background separation-particle filters-chamfer matching, tracking-occlusion-combining views from multiple cameras-locating roadway-road makings-identifying road signs-locating pedestrians											
signs-locating pedestrians	background separation-	particle filters-chamfer match	ing,	tracking	-occ	lusion-					
· · · · · · · · · · · · · · · · · · ·	_	ultiple cameras-locating roadway-roa	ad ma	kings-ident	ifyir	ıg road					
Total Lecture hours 72	signs-locating pedestrians										
		Tota	al Lec	ture hours	72						

	Text Book(s)									
1	Computer Vision – A modern approach ,by D.Forsyth and J.Ponce Prentice Hall Robot Vision, by B.K.P.Horn. McGraw-Hill									
2	Introductory Techniques by 3D Computer Vision, by E.Trucco and A.Verri, Publisher: Prentice Hall									
3	R.C.Gonzalez, R.E.Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992									
4	Richard Szeliski, Computer Vision: Algorithms and Applications.Springer,2010									
	Reference Books									
1	R.H.Ballard, C.M.Brown, Computer Vision, Prentice Hall ,Englewood Cliffs ,1982									
Rela	ted Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]									
1	https://nptel.ac.in/courses/106/105/106105216/									

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	S	L	L	L	M
CO2	M	S	S	S	ுக் தேதுத்	S	M	L	M	L
CO3	S	S	M	M	S	S	L	M	M	L

^{*}S-Strong; M-Medium; L-Low

Cours	se code	TITLE OF THE COURSE	L	Т	P	C						
Elect	tive II	Supply Chain and Logistics Analytics	5	-	-	3						
Pre-re	quisite			Syllabus Version	2022-23							
Course Objectives:												
		e Outcomes:										
	On the successful completion of the course, student will be able:											
1	Understand of the role and importance of Supply chain management.											
2	Underst	Understand the concepts of planning systems										
3	Underst	and the concepts of Logistics management			K2	2,						
K1 - Re	member	; K2 - Understand; K3 - Apply; K4 - Analyze; K	5 - Eva	luate; K6 – C	reat	e						
Unit:	Introdu	Introduction										
Basics	of Supply	Chain Management Supply Chain Management	– An C	Overview Sur	ply	Chain						
Unit:	Analysis Types of Supply Chains Advanced Planning Unit: Concepts of Advanced Planning Systems											
2	2.1.1					7.5						
	g, Dema	anced Planning Systems, Strategic Network Planning Coordination,										
Unit:		nenting Supply Chain Project			12 hours							
	enting A entation	dvanced Planning Systems, The Definition of a S Process	upply (Chain Project	, Tł	ne						
Unit:		cs Management			12	2 hours						
Definiti		volution -Achievement of competitive advantages Management-Integrated Logistics Management	U									
activitie	_	o namingement integrated Logistics management	1,1000	71 110 11 01 1	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							
Unit: 5		cs Strategy			12	hours						
	c role of	logistics – Definition-role of logistics managers is	n strate	gic decisions	: St	rategy						
		rategy, Agile Strategies & Other strategies: Desig				J.						
logistic	logistical strategy.											
			tal Le	cture hours	60	hours						
1	Text Book(s)											
1	Stadler Hartmut and Kilger Christoph (2005), "Supply Chain Management and Advance Planning: Concepts, Models, Software and Case Studies", Third Edition, Springe ISBN-3-540-22065-8.											
2	Márquez Adolfo Crespo (2010) "Dynamic Modelling for Supply Chain Manageme Dealing with Front-end, Back-end and Integration Issues", Springer											

3	Simchi-Levi, David, Chen, Xin, Bramel, Julien (2014), "The Logic of Logistics
	Theory, Algorithms, and Applications for Logistics Management", Third Edition,
	Springer, ISBN- 978-1- 4614-9149-1
4	Tang Christopher S, Teo Chung-Piaw and Wei Kwok-Kee (Eds) (2008), "Supply Chain
	Analysis: A Handbook on the Interaction of Information, System and Optimization",
	Springer, ISBN-13: 978-0- 387-75239-6

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	L	L	L	L
CO2	S	S	S	M	M	M	L	L	L	L
CO3	S	S	S	M	M	M	L	L	L	L

^{*}S-Strong; M-Medium; L-Low



Course o	code	TITLE OF THE COURSE	L	T	P	C				
Elective	e II	Business and Financial Analytics	5	-	-	3				
Pre-requ	isite	Basic Analytical Tools	5	Syllabus Version	2	2022-23				
Course Ob	jective	es:								
The main of	objecti	ves of this course are to:								
		e significance and fundamentals of Business an	alytics							
		e basic models of analytics.								
		e Financial analytics concepts								
		e Outcomes: I completion of the course, student will be able:								
1		erstand the basics on Business Intelligence.			K.	1, K2				
1					IX.	I, KZ				
2	Desc	ribe the essentials on Business Analytics model	S		K	2, K3				
3	Unde	erstand the importance of Business Analytics for	Managers	S	K	2,				
						3,K4				
4	Expl	ain the role and importance of Financial Analyt	ics.		K	2, K3				
5	Understand the role of Business Analyst and Data Science in business K4,									
K1 - Reme	ember;	K2 - Understand; K3 - Apply; K4 - Analyze; l	K5 - Evalu	ate; K6 – C	rea	te				
Unit: 1	Busi	ness Intelligence (B <mark>I)</mark>			12	hours				
MIS and E for past,	Digital Presen	gence - Definitions - Evolution of Business Interdash boards-Difference between ERP and Business and Future. Business Intelligence Applicants-Business Intelligence Roles and Responsibility	iness Intellations-tech	ligence-nee	d fo utio	or BI-BI ons and				
Unit: 2	Esse	ntials of Business Analytics			12	hours				
Categorizat Business A Analytics.	tion of analyti Analy	ecision Making- Business Analytics Definition Analytical methods and models: Descriptive -F cs in practice: Financial, Human Resource, Mark tics for government and Nonprofits, sports and	Predictive - keting, Hea	Prescriptivalth care, Su	e–E ipp	Big data- ly chain				
Unit: 3	Busi	ness Analytics for Managers			12	hours				
	•	cs model: Overview of Business-driven envir es of Reporting and Analytical process-case stu		technical	ус	riented				
Unit: 4 Financial Analytics 12 hours										
Financial	Analy	eaning-Importance of Financial Analytics use tics: Balance Sheet, Income Statement, Cas : Liquidity, Leverage, Profitability.								
Unit:5 Analysts: Role and Responsibilities										

Information and Knowledge-Methodology-Data-Required Competencies for the Analyst- Data Scientist vs. Data Engineer vs. Business Analyst, Career in Business Analytics, , Applications for data science. Data Scientists Roles and Responsibility

	Total Lecture hours 60 hours
	Text Book(s)
1	An Introduction to Business Analytics, Ger Koole, Lulu.com, 2019
2	Business Analytics for Managers - GEAT H.N.LAURSEN JESPER THORLUND, P.No: 1-16- UnitIII, P.No:93-136-Unit V
3	Fundamentals of Business Analytics -R N Prasad,. Seema Achavya, Wiley India PVT Ltd, New Delhi, P.No: 87-100, P.No:115-125

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	L	L	M	L
CO2	S	S	S	M	S	M	L	L	M	L
CO3	S	S	S	S	M	M	L	L	L	L
CO4	S	S	S	S	M	M	L	L	L	L
CO5	S	S	S	M	M	M	L	L	M	L

^{*}S-Strong; M-Medium; L-Low



Course code	TITLE OF THE COURSE	Т	P	С						
Elective II	Recommender Systems	5	-		3					
Pre-requisite	Pre-requisite None Syllabus Version 2022-									
Course Objectives:										

The main objectives of this course are to:

- 1. Understand about different types of recommender systems.
- 2. Understand the evaluation methods for recommender systems
- 3. Understand about some of the recent developments in this field

Expected Course Outcomes:

On the successful completion of the course, student will be able:

1	Understand the basics of Recommender systems	K2
2	Understand about the different types of recommender systems	K2, K3
3	Analyze ways to evaluate Recommender Systems and provide explanations	K3, K4
4	Understand a few applications of Recommender Systems	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6— Create

Unit:1 Collaborative recommendation

12 hours

Introduction to basic concepts behind recommender systems-Recent developments

Collaborative recommendation: User-based and item-based nearest neighbour recommendations — Ratings- Further model-based and preprocessing based approaches- Recent practical approaches and systems

Unit:2 Content-based and Knowledge-based recommendation

12 hours

Content-based recommendation: Content representation and content similarity-Similarity-based retrieval.

Knowledge based recommendation: Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders.

Unit:3 Hybrid recommendation and explanations

12 hours

Hybrid recommendation : Opportunities for hybridisation-monolithic, parallelized and piplined hybridization designs

Explanations in recommender systems: Explanations in constraint-based, case-based and collaborative filtering recommenders

Unit:4 Evaluating Recommender System and case study

12 hours

General properties of evaluation research- Popular evaluation designs-Evaluation on historical datasets – Alternate evaluation designs Case study- Personalised game recommendation on the mobile internet

Unit:5		Re	cent dev	elopment	S						12 hours		
	Online consumer decision making: Context, primacy/recency and further effects - Personality and social psychology												
	Recommender systems and the next generation Web: Trust-aware recommender systems-Folksonomies-Ontological filtering-Extracting semantics from the web												
			Total Lecture hours										
									Text Bo	ook(s)			
1			Jannach and Zanker, Recommender Systems: An Introduction, Cambridge University Press, 2012.										
2		_	garwal, F olications		nder Sys	tems: Th	e Textboo	ok, Sprin	iger				
		Re	ference I	Books									
1				kach L., Springer(-		or B.P., R	ecomme	nder Syst	ems			
2													
Related	d On	line	Content	s [MOO	C. SWA	YAM, N	PTEL, W	/ebsites	etc.1				
1							ations/red			ns			
L			<u> </u>		\$ 1.		561	1	<u> </u>				
	PC		PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
CO1	S	S S S M L L L							L				

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CO2

CO3

CO4

^{*}Strong-S, Medium-M, Low-L;

Course o	urse code TITLE OF THE COURSE L T									
Elective	e III	HR Analytics	5	-	-	3				
Pre-		None		Syllabus		022-23				
requisi				Version		U22-23				
Course C										
		ectives of this course are to:								
		the fundamentals of HR analytics								
2. Under	stand	the process of recruitment analysis								
Expected	l Cou	rse Outcomes:								
-		sful completion of the course, student will be able:								
1		derstand of the role and importance of HR analytics.			K 1	, K2				
2	!			ret HR						
2	Explain the strategies to track, store, retrieve, analyse and interpret HR data to support decision making.									
3		oly appropriate software to record, maintain, retrieve	e and ana	lyse	K2	*				
	hun	nan resources information.			K3	3,K4				
4	Apply quantitative and qualitative analysis to understand trends and K2, K3									
	indicators in human resource data.									
_		ωħΦIDa	1.		T					
5 Demonstrate how to connect HR results to business results. K4,K										
K1 - Ren	nemb	er; K2 - Understand; <mark>K3</mark> - Apply; K4 - Analyze; K	5 - Evalu	ate; K6 – C	reat	e				
						hours				
Unit:1	t:1 Introduction to HR Analytics									
Evolution	n of	HR Analytics, HR information systems and data	Sources	HR Meti	ric	and HR				
		olution of HR Analytics; HR Metrics and HR Analytics								
		MS/HRIS and data sources	,,							
Unit:2		ersity Analysis			12	hours				
		ersity and inclusion, measuring diversity and inc	lusion.	Testing the						
		ckforce segmentation and search for critical job role		6		1				
Unit:3		ruitment and Selection Analytics			12	hours				
	_	liability and validity of selection models, finding or	it selection	on bias, Pre	dict	ing the				
Unit:4		and turnover. formance Analysis			11	2 hours				
		ployee performance, training requirements, evaluat	ina train	ing and day						
		lection and promotion decisions	mg uam	ing and dev	/E10	pinient,				
Unit:5		nitoring impact of Interventions:			12	hours				
		act interventions, Evaluating stress levels and value-	change.	Formulatin						
based pr	actice	es and responsible investment. Evaluation mediat	_		_					
interaction	n ana									
	T.		tal Lect	ure hours	60	hours				
	Text	Book(s)								
1	Edv	vards Martin R, Edwards Kirsten (2016), "Predictiv	e HR An	alytics: Ma	iste	ring the				
	HR	HR Metric", Kogan Page Publishers, ISBN-0749473924								

2	Fitz-e	Fitz-enz Jac (2010), "The new HR analytics: predicting the economic value of your									
	compa	company's human capital investments", AMACOM, ISBN-13: 978-0-8144-1643-3									
3	Fitz-e	Fitz-enz Jac, Mattox II John (2014), "Predictive Analytics for Human Resources",									
	Wiley	Wiley, ISBN- 1118940709									
	PO1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10									
CO1	S	S	S	M	L	L	L	L	L	L	
CO2	S	S	M	M	L	L	L	L	L	L	
CO3	S	M	M	M	L	M	L	L	M	L	
CO4	M	M M M L L L L M L									
CO5	M	M	M	M	L	L	L	L	M	L	

^{*}S-Strong; M-Medium; L-Low



Course	code	TITLE OF THE COURSE	L	T	P	C				
Electiv	e III	Data Mining	5	-	-	3				
Pre-req	uisite			Syllabus Version	2022-23					
Course O	bjectiv	es:								
The main	object	ives of this course are to:								
		e fundamentals of data mining and significance			_					
	2. Apply appropriate data mining technique on the large dataset for knowledge discovery.									
	3. Understand the application of data mining on complex data objects.									
		e Outcomes:								
		d completion of the course, student will be able		.1 1	K2					
1 Understand data mining primitives and data pre-processing methods. 2 Apply prediction and association rule mining for real life mining										
$\begin{vmatrix} 2 \end{vmatrix}$	Apply prediction and association rule mining for real life mining applications.									
3	110	appropriate Classification techniques for vari imensional data using modern tools.	ous proble	ems with	К3					
4	Apply appropriate Clustering techniques for various problems with high dimensional data using modern tools.									
5	Synthesize various mining techniques and work in teams to develop									
project on complex data objects.										
K1 - Ren	nember	; K2 - Understand; K3 - Apply; K4 - Analyze	; K5 - Eva	luate; K6 – C	reat	e				
Unit:1	DATA	A MINING FUNDAMENTALS			12	hours				
		cycle - KDD Process - Kinds of data can be r								
		used –Kinds of Applications targeted – Issues	in data mi	ning - Data (Obje	cts and				
		- Data Pre-processing overview.				hours				
Unit:2	Unit:2 ASSOCIATION AND CORRELATION									
_	-	t Patterns - Associations and Correlations -	_							
		g various Kinds of Association Rules – Correla	ation Anal	ysis – Const	raint	Based				
Associati										
Unit:3	CLAS	SIFICATION			12	hours				
		asic Concepts – Decision Tree Induction – Bay								
		tion — Support Vector Machine - Lazy Learne	ers – Othei	classificatio	n m	ethods				
		ion and Selection.			10	1				
Unit:4		STERING AND OUTLER ANALYSIS				hours				
		Partitioning Methods - Hierarchical MethodEvaluation of Clustering - Outlier Analysis -								
Unit:5	MINI	NG COMPLEX DATA								
		Sequence Mining – Mining graphs and netwo		-	12	hours				
Spatial M	Iining –	- Text Mining – Multimedia Mining – Data M								
			Total Le	cture hours	60	hours				
Text Boo										
1		Han, Micheline Kamber, Jain Pei "Data Medition, Elsevier, Morgan Kaufmann Publishe		ncepts and	Гесh	miques",				

2	Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OL McGraw—Hill Edition, Tenth Reprint 2007.	AP", Tata
	Reference Books	
1	K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory	and
	Practice", Easter Economy Edition, Prentice Hall of India, 2006.	
2	Hand.D, Mannila H, Smyth.P, "Principles of Data Mining", MIT press, USA	.,2001.
3	Dunham M, "Data Mining: Introductory and Advanced Topics", Prentice Ha	ll, New
	Delhi, 2002	
Related	Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105174/	
2	https://www.coursera.org/specializations/data-mining	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	S	S	M	M	S	M	L	L	L	L
CO2	S	S	S	M	S	S	L	L	L	L
CO3	S	M	S	M	S	S	L	L	L	L
CO4	M	M	M	M	S	S	L	L	L	L
CO5	S	M	S	M	S	S	L	L	L	L

^{*}S-Strong; M-Medium; L-Low



Cou	rse Code	TITLE OF THE COURSE	L	Т	P	С				
Ele	ctive III	Big data and Cloud Computing	5	0	0	3				
Pre -	requisite	None	Syllabu version		20	022-23				
		Course Objectives	1		1					
 To provide an overview of an exciting growing field of big data analytics. To introduce the tools required to manage and analyze big data like Hadoop, Map Reduce and other Hadoop Ecosystems. Introduction to cloud computing, cloud architecture, cloud service models, Service Oriented Architectures, security in cloud computing, disaster management in clouds. Expected Course Outcomes 										
1	Identify the processing	e components of Hadoop Distributed File Syst	em for big	g data	K1	, K2				
2		ig Data Solutions using Hadoop Eco System			K1	, K4				
3		e architecture and infrastructure of cloud comp S, IaaS, Maas, public cloud, private cloud, hyb	_	_	K1	, K3				
4	Provide the appropriate cloud computing solutions and recommendations according to the applications used									
5		generate new ideas and innovations in cloud of	computing	7	K1	, K2				
	K1 – Reme	mber K2 – Under <mark>stand K3 – apply K4- A</mark> na	lyze K5 -	- evalua	te K6-	Create				
		The state of the s								
UNI	TI	Introduction to Big Data			H	12 Iours				
enviror enviror large d	nment- Clas nments- Para lata – Gene	igital data — Characteristics of data — Challe ssification of analytics- Data science — ' allel Vs Distributed Environment-Big data app eral techniques for handling large data — Co orage and processing with Frameworks — Case	Ferminolo dications, ase study	ogies us Problen	sed in ns when	big data n handling				
UNIT	ΓII INTR	ODUCTION TO HADOOP ECO SYSTEM			E	12 Iours				
Introduction to Hadoop Eco system- Hadoop core components- Hadoop distributions- HDFS-Common Hadoop Shell commands- Processing data with Hadoop- Name Node- Secondary Name Node, and Data Node - Hadoop Map Reduce paradigm- Map and Reduce tasks, Job, Task trackers - Cluster Setup - SSH & Hadoop Configuration - HDFS Administering -Monitoring & Maintenance.										
UNIT	UNIT III HADOOP ECOSYSTEM COMPONENTS									
Latin, Metas	User Definatore, HiveQ	to PIG, Execution Modes of Pig, Comparison ed Functions, Data Processing operators, Hive L, Tables, Querying Data and User Defined Zookeeper - Building applications with Zooke	e : Hive S Functions	hell, Hi s. Base:	ve Serv HBase	rices, Hive Concepts,				

Unit IV Introduction to Cloud Computing

12 Hours

Defining the Cloud, The Emergence of Cloud Computing, Cloud-Based Services, Grid Computing or Cloud Computing, Components of Cloud Computing, Virtualization, Cloud Computing Deployment Models (Types): Public, Private, Hybrid, Benefits of Using a Cloud Model, Legal Issues in Using Cloud Models, Characteristics of Cloud Computing, Evolution of Cloud Computing, Challenges for the Cloud computing, Grid Computing, Distributed Computing in Grid and Cloud.

UNIT V Cloud Service Models

12 Hours

Communication-as-a-Service (CaaS): Advantages of CaaS, Fully Integrated, Enterprise-Class Unified Communications, Infrastructure-as-a-Service (IaaS): Modern On-Demand Computing, Amazon's Elastic Cloud, Amazon EC2 Service Characteristics, Monitoring-as-a-Service (MaaS), Protection Against Internal and External Threats, Platform-as-a-Service (PaaS): The Traditional On-Premises Model, The New Cloud Model, Key Characteristics of PaaS, Software-as-a-Service (SaaS): SaaS Implementation Issues, Key Characteristics of SaaS, Benefits of the SaaS Model, Jericho Cloud Cube Model.

	Total Lecture hours 60 hours						
	Text Book(s)						
1	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics" Wiley, First Edition, 2015						
2	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing,						
	Visualizing and Presenting Data", Wiley publishers, 2015						
3	David S. Linthicum., "Cloud Computing and SOA Convergence in your Enterprise, a step						
	by step guide" 2009						
4	John W. Rittinghouse, James F. Ransome., "Cloud Computing: Implementation						
	Management and Security, 2009						
5	Dirk Deroos et al., Hadoop for Dummies, Dreamtech Press, 2014						
	Reference Books						
1	Tom White, "HADOOP: The definitive Guide", O Reilly 2012						
2	Borko Furht, Handbook of Cloud Computing, Armando Escalante (Editors), Springer, 2010						
3	Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles						
	and paradigms, 2011						
Rel	ated Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]						
1 h	ttps://onlinecourses.nptel.ac.in/noc20_cs92/preview						
2 h	ttps://onlinecourses.nptel.ac.in/noc20_cs20/preview						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	L	M	L	L	M	L
CO2	S	S	S	M	M	S	M	L	M	L
CO3	M	S	M	M	L	S	L	L	L	L
CO4	M	S	M	M	M	M	L	L	L	L
CO5	M	S	M	M	L	M	L	L	L	L

^{*}S-Strong; M-Medium; L-Low