B. Sc. Data Science & Analytics Syllabus AFFILIATED COLLEGES Program Code:*** 2024 - 2025 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC, Ranked 26th among Indian Universities by MHRD-NIRF, World Ranking: Times -801-1000,Shanghai -901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

BSc Data Science and Analytics											
	SCHEME OF EXAM	IINATIONS									
		Ins hrs/week		Exan	ninations						
Part	Course Title	(Theory)	Dur. Hrs.	CIA	End Sem Exam	Total	Credits				
	Semester-I			1							
Ι	Language-I	4	3	25	75	100	4				
II	English-I	4	3	25	25	50	3				
III	Core 1: Programming in C	5	3	25	75	100	4				
III	Core 2: Data structures	5	3	25	75	100	4				
III	Core Lab 1: Programming Lab – C	5	3	25	75	100	4				
III	Allied 1: Introduction to Linear algebra	5	3	25	75	100	4				
IV	Environmental Studies*	2	3	2	50	50	2				
	Total	30		150	450	600	25				
	Semester-II	Rea	10	Sec.							
Ι	Language–II	4	3	25	75	100	4				
II	English–II	4	3	25	25	50	3				
III	Core3: Program <mark>ming in C+</mark> +	5	3	25	75	100	4				
III	CoreLab2: Prog <mark>ramming L</mark> ab-C++	5	3	25	75	100	4				
III	CoreLab3: Micr <mark>osoft Excel L</mark> ab	3	3	20	30	50	2				
III	Allied2: Probability and Inferential Statistics	5	3	25	75	100	3				
IV	Value Education– Human Rights*	2	3	6-	50	50	2				
	Naan Muthalvan - Skill Course Effective English	2		25	25	50	2				
	Total	30		170	430	600	24				
	Semester-III	2020	1	1	5 1	1					
Ι	Language-III	4	3	25	75	100	4				
Π	English-III	4	3	25	25	50	3				
III	Core4:JAVA Programming	4	3	25	75	100	3				
III	Core5: Database Management Systems	4	3	25	75	100	3				
III	CoreLab4:JAVA Programming Lab	3	3	20	30	50	2				
III	Allied3: Optimization Techniques	4	3	20	30	50	2				
III	SkillbasedSubject1: Data Visualization	3	3	30	45	75	3				
IV	Tamil**/ Advanced Tamil*(OR)Non- major elective-I (Yoga for Human Excellence)*/ Women's Rights*	2	3	-	50	50	2				
	Naan Mudhalvan skill course	2	3	25	25	50	2				
	Total	30		195	430	625	24				
	Semester-IV										
Ι	Language-IV	4	3	25	75	100	4				
II	English-IV	4	3	25	25	50	3				

III	Core6: Python Programming	4	3	25	75	100	3
III	Core7: Data Warehousing and Data Mining	4	3	25	75	100	3
III	CoreLab5: Python Programming Lab	3	3	20	30	50	2
III	Allied4: Data Engineering	4	3	20	30	50	2
III	Skill based Subject2 Lab: Mini project using Python Programming / Advanced Excel	3	3	20	30	50	3
IV	Tamil**/Advanced Tamil* (OR) Non-major elective-II (General Awareness*)	2	3	-	50	50	2
	Naan Muthalvan – Skill Course Office Fundamentals	2		25	25	50	2
	Total	30		185	415	600	24
		mar Ba					
	Semester-V	1. 1.	1				
III	Core8: R Programming	6	3	25	75	100	4
III	Core9: Big Data Analytics	6	3	25	75	100	4
III	CoreLab6: R Programming Lab	5	3	20	30	50	4
III	Elective –I Business <mark>Data Analytics</mark> /Social Network Analysis/ Time Series Analysis	6	3	25	75	100	4
III	Skill Based Sub <mark>ject 3: Deep</mark> Learning	5	3	30	45	75	3
	Naan Mudhalv <mark>an skill cour</mark> se	2	3	25	25	50	2
1	Total	30		150	325	475	21
- 1	Semester-VI	1.1.1.1	7.0	7.8		123	
III	Core10: Linux and Shell Programming	6	3	25	75	100	4
III	Core11: Project WorkLab%%	6	-	40	60	100	4
III	CoreLab7: Linux and Shell Programming Lab	3	3	20	30	50	3
III	Elective–II: Web Application Security/ Software Agents /Recommender system	5	3	25	75	100	4
III	Elective-III: Ethical Hacking/ Open-source Software/ Internet of Things	5	3	25	75	100	4
III	Skill Based Subject4: Machine Learning	3	3	20	30	50	3
V	Extension Activities**	- Contraction	<u> </u>	50	-	50	2
	Naan Muthalvan	2	1	25	25	50	2
	Total	30		230	370	600	26
	Grand Total			1080	2420	3500	144
*No	Continuous Internal Assessment (CIA). Only University	Examinations.					
**N	o University Examinations. Only Continuous Internal As	sessment (CIA)	•				

Semester – I

Co	urse Code		Programming in C	L	Т	Р	С				
Co	re/elective/Suj	pportive	Core: 1	5	0	0	4				
	Pre – requi	site	• Basic knowledge in computers	Syll ver	abus sion	2023 Onw	-24 ard				
			Course Objectives								
To int constr	roduce the con ucts of C prog	ncepts of Pr	ocedure Oriented Programming and the v	arious	s prog	gramn	ning				
	Expected Course Outcomes										
1	Describe abo software and	o <mark>ut the</mark> about I <mark>hardware</mark> d	the fundamentals of computers, history and variation variation of the second seco	ous ty	pes of	f	K1				
2 Interpret the concepts of Variables, Constant, Operators and various types of Expressions											
3 Apply the concept of Decision-making statements and looping constructs for solving basic programs											
4	Use the conc	cepts of files	and pointers inside a C program	1			K3				
5	Develop pro	grams incor	porating all the C language constructs			4	K4				
6	Test the corr	ectness of th	e programs and identify logical and syntax errors			8	K5				
Q. 6	K1 – Re <mark>meml</mark>	ber K2 – Un	derstand K3 – apply K4- Analyze K5 – evalua	te K6	- Cre	ate					
			0			1	15				
UNI	ГΙ		Fundamentals of Computers		in l	1	12				
Fund	amentals of Co	omputers: In	troduction – History of Computers-Generations o	f Con	npute	rs-	1				
Class	sification of Co	omputers-Ba	sic Anatomy of a Computer System-Input Device	s-Pro	cesso	r-Out	put				
Devie	ces-Memory N	lanagement	- Types of Software- Overview of Operating Sys	tem- I	Progr	ammi	ng				
Lang	uages-Translat	tor Programs	-Problem Solving Techniques - Overview of C.	÷.	1		11				
UNIT			Overview of C	0	1	X 7	<u>11</u>				
- Dat - Ar Decre arithr Math	a types - Decla ithmetic, Relat ement operator netic operators ematical funct	aration of va tional, Logic rs - Arithmet s - Type con ions - Readi	riables - Assigning values to variables - Defining al, Assignment, Conditional, Bitwise, Special, ic Expressions - Evaluation of expression - prece version in expression – operator precedence & ass ng & Writing a character - Formatted input and o	Symb dence ociati utput.	Incre of vity -	- var Const ment	ants and				
UNIT	III		Decision Making and Branching				12				
Decis ladde Intro Char	Decision Making and Branching: Introduction – if, if else, nesting of ifelse statements- else if ladder – The switch statement, The? Operator – The go to Statement. Decision Making and Looping: Introduction- The while statement- the do statement – the for statement-jumps in loops. Arrays – Character Arrays and Strings										
UNIT IV Functions											
User- Retur Funct Varia	UNIT IVFunctions12User-Defined Functions: Introduction – Need and Elements of User-Defined Functions- Definition- Return Values and their types - Function Calls – Declarations – Category of Functions- Nesting of Functions - Recursion – Passing Arrays and Strings to Functions - The Scope, Visibility and Lifetime Variables- Multi file Programs- Structures and Unions.12										

UNIT V	POINTERS	13 Hours						
Pointe	rs: Introduction-Understanding Pointers-Accessing the address of a variable-Decla	ration and						
Initiali	ization of pointer Variable - Accessing a variable through its pointer-Chain of pointe	rs- Pointer						
Expres	Expressions – Pointer Increments and Scale factor- Pointers and Arrays- Pointers and Strings – Array of							
pointe	rs – Pointers as Function Arguments- Functions returning pointers – Pointers to F	unctions –						
Pointe	rs and Structures. File Management in C.							
	Total Lecture Hours	60 Hours						
	Text Book(S)							
1	E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill	,						
	Second Reprint 2008.							
	Reference Book(s):							
1	Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002. 2.							
	Henry Mullish& Hubert L.Cooper: The Sprit of C, Jaico, 1996.							
	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	e Designed by :							

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	L	L	L	L	L	L	L
CO2	M	L	L	L	L	L	L	L	L	L
CO3	S	M	L	L	L	L	L	L	L	L
CO4	S	M	L	L	L	L	L	L	L	L
CO5	S	M	M	L	L	L	L	L	L	L
CO6	S	S	S	L	L	L	L	L	L	L

Sigal Kowe

Co	urse Code		Programming Lab - C	L	Τ	Р	С			
Co	re/elective/Sup	pportive	Core Lab : 1	0	0	5	4			
	Pre – requis	site	• Basic knowledge in computers	Syll	labus		<u>I</u>			
-				ver	sion	202	3-24			
			Course Objectives	<u> </u>		On	vard			
To int	roduce the con	cepts of Pro	cedure Oriented Programming and the various pr	ogran	nming					
constr	ructs of C progr	ramming.	F	- 0	2	,				
		100	and the second sec							
	-	1 5	Expected Course Outcomes							
1	Apply the va	arious basic J	programming constructs like decision making sta	temen	its.		K3			
2	Looping stat	ements, func	ctions, structures, pointers and files				T 7 A			
2	Design progr	rams using t	he concept of files in C and be able to simulate o	peration of the peration of th	ons		K4			
3	Problems	ne efficient to	echniques in programming to solve various scien	tific			K5			
	K1 – Rememb	ber K2 – Un	derstand K3 – apply K4- Analyze K5 – evalua	ate Ke	6- Cre	ate				
		_								
EXE	RCISE 1 Im	plementatio	on of Control structures				6			
Devel	op vario <mark>us C P</mark>	Programs using	ng Control Structures	1.		B.	1			
Devel	Develop various C programs using Switch case.									
EXERCISE 2 Implementation of Loopings										
Devel	op various C p	orogram for t	he implementation of looping		-		10			
Devel	op various C p	or <mark>ogr</mark> am for t	he implementation of looping &Conrtol Structur	es	1000	3570	1			
EXE	RCISE 3 Im	plementatio	on of Functions	1	5	7 8	9			
Devel	op a C progran	n to illustrate	e recursive function.	43		1 3				
Devel	op a C progran	n to find the	palindrome in a given sentence	10	1					
Devel	op a C progran	n to manipul	ate strings using string functions.		Y					
Devel	op a C Program	n using Fund	ctions	1						
EXE	RCISE 4 Im	plementatio	on of Pointers	1 m			6			
Devel	op a C progran	n to swap tw	o integers using pointers.							
Devel	op a C progran	n using Arra	y of Pointers.							
EXE	RCISE 5 Im	plementatio	n of Structures				6			
Devel	op a C progran	n using the s	tructures.							
Devel	op a C progran	n using Arra	y of Structures.							
EXE	RCISE 6 Im	plementatio	n of Files				6			
Devel	op a C progran	n to calculat	e electricity bill using files							
EXE	RCISE 7 Im	plementatio	n of Security				6			
Devel	op a C progran	n to encrypt	and decrypt a string							
Devel	op a G progran	n to encrypt	and decrypt Files							
	Total Lecture Hours 45									

Text Book(S)								
1	E Balagurusamy: Computing Fundamentals & C Programming – Tata McGraw-Hill,							
	Second Reprint 2008.							
Reference Book(s)								
1	Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson, 2002. 2.							
	Henry Mullish& Hubert L.Cooper: The Sprit of C, Jaico, 1996.							
Course Designed by :								

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



Co	urse Code		Data Structures	L	Т	Р	C
Cor	e/elective/Su	pportive	Core: 2	5	0	0	4
	Pre – requis	site	Basic knowledge of Programming Constructs	Sylla vers	abus sion	2023 Onw	3-24 vard
			Course Objectives				
•]	Fo introduce th	ne concept of	f data structures and the types of data structures				<u> </u>
• ']	l'o demonstrate	e how variou	is data structures can be implemented and used in	vario	us ap	plicat	ions
1	Define the co	oncept of Da	ata structure and list the various classifications of	data			K1
1	structures.			Gutti			INI
2	Demonstrate	how arrays	, stacks, queues, linked lists, trees, heaps,				K2
	Graphs and I	Hash Tables	are represented in the main memory and various	operat	tions		
2	are performe	ed on those of	lata structures.	ad			K)
3	organization	s.	organizations like Sequential, Randon and Linko	30			K 2
4	Discover the	real time ap	pplications of the various data structures				K3
5	Design algor	r <mark>ithms fo</mark> r va	rious sorting and searching techniques				K4
]	K1 – Rememl	<mark>ber K2</mark> – Ur	nderstand K3 – apply K4- Analyze K5 – evalua	te K6	- Cre	ate	
LINIT		DUCTION		-		1	2
UI		DUCTION				Но	ours
Introdu	uction: Introdu	action of Alg	gorithms, Analyzing Algorithms. Arrays: Sparse N	Matric	es -	h.	á
Repres	sentation of A	rrays. Stacks	and Queues. Fundamentals - Evaluation of Expr	ession	Infix	to	1
Postfix	conversion -	Multiple St	acks and Queues				
UNIT	II LINKE	D LIST			_	1	2
Linked	l List: Singly I	Linked List	- Linked Stacks and Queues - Polynomial Addition	on - M	ore o	n Lin	ked
Lists - Garba	Sparse Matric	es - Doubly	Linked List and Dynamic - Storage Management	E			<u>r</u>
UNIT	III NON-L	INEAR DA	TA STRUCTURES	18		1	2
01,11					1	Но	ours
Trees:	Basic Termin	ology - Bina	ry Trees - Binary Tree Representations - Binary	Trees -	-Trav	ersal	-
More of	on Binary Tree	es - Threade	d Binary Trees - Binary Tree Representation of T	rees -	Coun	ting	
Binary	Graphs: Term	inology and	Representations - Traversals Connected Compo	nente	and		
Spann	ing Trees. Sho	ortest Paths a	nd Transitive Closure	nents	anu		
UNIT	IV EXTER	RNAL – SO	RTING			1	2
						Но	urs
Extern	al Sorting: Sto	orage Device	es -Sorting with Disks: K-Way Merging - Sorting	with '	Tapes	Sym	bol
Tables	: Static Tree T	Tables - Dyn	amic Tree Tables - Hash Tables: Hashing Function	ons - C	Overfl	ow	
Handli	ing.						
UNII	V INTER	NAL – SOF	KTING			1	.2
Interne	al Sorting: Inge	ertion Sort	Quick Sort - 2 Way Merge Sort - Hean Sort - She	11 Sor	t - So	rting	on
Severa	l Keys. Files: 1	Files, Querie	es and Sequential organizations - Index Technique	es -Fil	e - 50	rung	011
Organi	zations.	,	, <u>o</u>				
			Total H	ours		60 H	Iours

Text Book(s)							
1	Ellis Horowitz, Sartaj Shani, Data Structures, Galgotia Publication.						
Reference Book(s)							
1	Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, Computer Algorithms,						
	Galgotia Publication.						
	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	e Designed by :						

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

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Co	L	Т	Р	C						
			A112 1 1	_	0	0				
Co	re/elective/Suj	pportive	Allied : 1	5	U	U	4			
	Pre – requi	site	None	Syll	abus	2023	3_24			
				ver	sion	Onw	vard			
Toint	moduce the com	neutotional (Course Objectives	udu of	avata					
of line	ear equations, 1	matrix algeb	ra, and vector spaces		syste	eins				
			Expected Course Outcomes							
1	Explain the	concept/theo	bry in linear algebra, to develop dynamic and grap	hical	views		K2			
	to the related	d issues of th	e chosen topics as outlined in "course content," a	nd to						
formally prove theorems										
2 Recognize the basic applications of the chosen topics and their importance in the K										
2	modern science									
3	learned from the chosen topics to solve simple problems									
4	4 Report and communicate effectively with others and present mathematical results in a K									
	logical and coherent fashion									
5 Appraise the power and beauty of mathematics, and solve problems independently and k										
	collaborative	ely as part of	f a team							
	K1 – Remem	ber K2 – Ur	derstand K3 – apply K4- Analyze K5 – evalua	te K6	- Cre	ate	4			
TINIT	TI	-		5.2			-			
UNI	II duction Voc	torg and Mar	triage Length and Det Products Solving Lines	r Equ	otion		.5			
Equ	tions The Id	los of Elimin	utices – Length and Dot Floducts – Solving Linea	I Equa Actriv	Oper	o – LII	lear			
Inve	rse Matrices –	Elimination	= Eactorization: $A = I I I = Transposes and Permi$	itation	oper	ations	,			
LINI		Emmation	= ractorization. A = E0 = mansposes and remit	mation	15	1	5			
Vect	tor Spaces and	Subspaces -	- Spaces of Vectors – The Null space of A: Solvir	ng Ax	= 0 -	The				
Ranl	k and the Row	Reduced Fo	rm - The complete solution to Ax=b - Independence	nce, F	Basis,	and				
Dim	ensions				1					
- Di	mensions of th	e four Subsp	paces – Or <mark>thogonality – Or</mark> thogonality of the Four	r						
Subs	spaces – Projec	ctions – Leas	st Squares Approximations – Orthogonal Bases ar	nd Gra	.m – S	Schmi	dt.			
UNIT						1	.5			
Dete	rminants – The	e Properties of	of Determinants – Permutations and Cofactors – Cu	amer'	s Rul	e, Inv	erse,			
and	Volumes – Eige	en values and	d Eigenvectors – Introduction to Eigen values – D	iagona	alizin	g a M	atrix			
– Ap Defi	plications to L	Similar Ma	trices – The Singular Value Decomposition							
UNIT		Similar Ma	the singular value becomposition			1	5			
Sing	ular value Dec	composition	– Linear Transformations – The Idea of a Linear	Transf	forma	tion -	_			
The	Matrix of a Li	near Transfo	rmation – Change of Basis – Diagonalization and	the P	seudo	o inve	rse.			
UNI	ΓV					1	.5			
Com The I	plex Vectors a Fast Fourier Tr	and Complex ansform – A	Matrices – Complex Numbers – Hermitian and Upplications – Numerical Linear Algebra.	Jnitar	y Ma	rices	—			
			Total Lecture Hours		7	'5 Ho	urs			

	Text Book(s)	
1	Gilbert Strang(2016). Introduction to Linear Algebra, 5 th Edition. Wellesley –	
	Cambridge Press	
	Reference Books	
1	S.Lang (1997). Introduction to Linear Algebra. Second Edition. Springer.	
2	Gilbert Strang (2006). Linear Algebra and Its Applications. Fourth Edition. Cengage I	Learning.
3	David C. Lay, Steven R. Lay, and Judi J. McDonald (2014). Linear Algebra and	
	Its Applications. 5 th Edition. Pearson.	
	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	e Designed by :	

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

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Semester -II

Course (Code	Programming in C++	L	Т	Р	С		
Core/elec	ctive/Supportive	Core : 3	5	0	0	4		
				Ŭ	Ū	-		
		Basic knowledge of Procedure				<u> </u>		
Pre	– requisite	Oriented Programming concepts	Syll	abus	202	1-22		
	requisite	• Basic knowledge in C Programming	ver	sion	Onv	<u>vard</u>		
		Course Objectives						
To introduce	e he concepts of Ob	ject Oriented Programming Paradigm and the prog	ramn	ning c	onstr	ucts of		
C++								
		Eurostad Course Outcomes						
	cribe the procedural	and object oriented paradigm with concepts of str	aame			V 1		
r Des class	ses, functions, data	and objects	eams,	,		NI		
2 Den	nonstrate the various	s basic programming constructs like decision maki	ng			K2		
state	ements. L <mark>ooping s</mark> ta	tements and functions	-					
3 Exp	lain the object ori	ented concepts like overloading, inheritance, polyr	norpł	nism,		K3		
4 Exp	lain the various file	stream classes: file types, usage of templates and e	excen	tion		K3		
hand	dling mechanisms.	sucan classes, me types, usage of templates and t	леер	uon		KJ		
5 Con	npare the pros and c	ons o <mark>f proced</mark> ure oriente <mark>d langu</mark> age with the conce	pts of	f objed	ct	K5		
orie	nted language				BL	4		
6 Dev	elop programs incom	rporating the programming constructs of object ori	ented		$ ^2$	K5		
K1 -1	Remember K2 – U	nderstand K3 – apply K4. Apalyze K5 – evalua	te Kf	. Cre	ate	15		
						1		
UNIT I	A	Introduction to C++	1	-	175	12		
Introduction	to C++ - key conce	pts of Object-Oriented Programming –Advantages	s - O	oject (Drien	ted		
Languages -	- I/O in C++ - C++	Declarations. Control Structures : - Decision Maki	ng an	d Stat	emer	its : If		
else ,jump	, goto, break, contin	ue, Switch case statements - Loops in C++ : for, w	vhile,	do - f	uncti	ons in		
C++ - inline	functions – Function	on Overloading.	-	1		14		
UNIT II Classes and	Ohiosta Declaring	Classes and Objects	a sea la se		1.1.0.0	14 		
functions –	array of objects –fri	end functions – Overloading member functions – Hand functions – Overloading member functions – H	Bit fie	lds ar	d cla	anu Isses		
– Constructo	or and destructor wi	th static members.	510 110	ius ui				
UNIT III		Operator Overloading and Inheritance				16		
Operator Ov	verloading: Overload	ding unary, binary operators - Overloading Friend	funct	ions -	- type	;		
conversion -	- Inheritance: Types	of Inheritance – Single, Multilevel, Multiple, Hie	rarch	al, Hy	brid,			
Multi path in	nheritance – Virtual	base Classes – Abstract Classes.				10		
	a alamatian Daintar	Pointers and Polymorphism	ad als		a d D	18		
rointers – D classes – Ar	ravs – Characteristic	co Class , Object – this pointer – Pointers to derive	eu cia delete	isses a	uiu B ators	ase		
UNIT V		File and Exception Handling		open		15		
Files – File s	stream classes – file	modes – Sequential Read / Write operations – Bin	ary a	nd AS	CII F	Files		
– Random A	ccess Operation – T	Cemplates – Exception Handling - String – Declari	ng an	d Initi	alizir	ng string		
objects - Str	ing Attributes – Mis	scellaneous functions.						
		Total Lecture Hours				75		

	Text Book(s)							
1	Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson							
	Education, 2003.							
	Reference Books							
1	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998.							
2	Maria Litvin & Gray Litvin, C++ for you, Vikas publication, 2002.							
3	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002							
	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							
Course	Course Designed by :							
	8							

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Μ	Μ	L	L	L	L	L	L	L	L
CO2	Μ	Μ	Μ	L	L	L	L	L	L	L
CO3	S	M	Μ	L	L	L	L	L	L	L
CO4	S	S	Μ	L	L	L	L	L	L	L
CO5	S	S	Μ	L	L	L	L	L	L	L
CO6	S	S	S	L	L	L	L	L	L	L

Cou	rse Code		Programming Lab – C++	L	Т	Р	C	
Core	e/elective/Supp	ortive	Core Lab : 2	0	0	5	2	
-	Pre – requisit	te	 Basic knowledge of Procedure Oriented Programming concepts Basic knowledge in C Programming 	Syll ver	Syllabus version		3-24 ward	
			Course Objectives					
To intro of C++	oduce he conce	pts of Object	t Oriented Programming Paradigm and the progra	ımmir	ng cor	nstruc	:ts	
		de la						
	1	199	Expected Course Outcomes					
1 Apply the various basic programming constructs like decision making statements. Looping statements, functions, concepts like overloading, inheritance, polymorphism, virtual functions, constructors and destructors								
2	Illustrate the	concept of V	Virtual Classes, inline functions and friend function	ons			K4	
3	Compare the various file stream classes; file types, usage of templates and exception handling mechanisms.						K5	
4	4 Compare the pros and cons of procedure oriented language with the concepts of object oriented language							
K	1 – Rem <mark>embe</mark>	r K <mark>2 –</mark> Unde	erstand K <mark>3 – a</mark> pply K4- <mark>Analyze K5</mark> – e <mark>va</mark> luate	K6-	Creat	te	1	
		See 12	· proster frend - · /					
PROG	RAM - 1		and all		in.	ł.	5	
Write a initializ	C++ Program e the TOP of the POP () to dele	to create a cl ne STACK. V etc an eleme	ass to implement the data structure STACK. Wri Write a member function PUSH () to insert an ele	te a co ment	onstru and n	ictor t nemb	to er	
PROG	RAM -			é	1		5	
Write a variable multipli	C++ Program c. Write member cation, division	to create a cl er functions A n respectivel	ass ARITHMETIC which consists of a FLOAT a ADD (), SUB (), MUL (), DIV () to perform additional systems of the system of the sys	and an tion, s lues.	INT subtra	EGEI ction	R ,	
PROG	RAM - 3		ROUGATE TO ELEVATE				5	
Write a single d	C++ Program	to read an in tructors, des	teger number and find the sum of all the digits un tructors and inline member functions.	ntil it 1	reduce	es to a	a	
PROG	FRAM - 4						5	
Write a four Ar	C++ Program	to create a cl ors so that th	ass FLOAT that contains one float data member. ney operate on the object FLOAT.	Over	load a	all the	•	
PROG	PROGRAM - 5							
Write a C display st respective	C++ Program to ings. Overload the ly	o create a cla he operators +	ss STRING. Write a Member Function to initializ-+ and == to concatenate two Strings and to compare to	ze, ge two st	t and rings			

PRO	GRAM -6	5						
Write a	a C++ Program to create class, which consists of EMPLOYEE Detail like E_Number, E_N	lame,						
Depart	tment, Basic, Salary, Grade. Write a member function to get and display them. Derive a cla	iss PAY						
from the above class and write a member function to calculate DA, HRA and PF depending on he grade.								
PRO	GRAM -7	5						
Write a	a C++ Program to create a class SHAPE which consists of two VIRTUAL FUNCTIONS							
Calcul	ate_Area() and Calculate_Perimeter() to calculate area and perimeter of various figures. D	erive						
three c	classes SQUARE, RECTANGLE, TRIANGE from class Shape and Calculate Area and Per-	imeter of						
each cl	lass separately and display the result.							
PROC	GRAM -8	5						
Write a	a C++ Program to create two classes each class consists of two private variables, a integer	and a float						
variabl	le. Write member functions to get and display them. Write a FRIEND Function comm	on toboth						
classes	s, which takes the object of above two classes as arguments and the integer and float values	5						
		5						
INUC		3						
Write a	a C++ Program using Function Overloading to read two Matrices of different Data Types s	such						
as inte	gers and floating point numbers. Find out the sum of the above two matrices separately and	d						
display	y the sum of these arrays individually.							
PROG	GRAM -10	5						
Write a	a C++ Program to check whether the given string is a palindrome or not using Pointers.	1. A						
PROG	RAM -11	5						
	and the second and the second se							
Write a	a C++ Program to create a File and to display the contents of that file with line numbers.							
PROC	GRAM - 12	5						
Write a	a C++ Program to merge two files into a single file.	175 8						
	Total Lecture Hours	60 Hours						
		1						
	Text Book(s)							
1	Ashok N Kamthane, Object-Oriented Programming with Ansi And Turbo C++, Pearson Education, 2003.							
	Reference Books							
1	E. Balagurusamy, Object-Oriented Programming with C++, TMH, 1998.							
2	Maria Litvin & Gray Litvin, C++ for you, Vikas publication, 2002.							
3	John R Hubbard, Programming with C, 2nd Edition, TMH publication, 2002							
Cours	e Designed by :							

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

Course code		CoreLab3:	Microsoft Excel Lab	L	Τ	Р	С			
Core				-	-	2	2			
		Basic knowledge on	Computer	Sylla	bus					
Pre- requisit	te	Applications	Version							
Course Objectiv	es:									
The main objective	ves of thi	s course are to:								
• enrich stu	dents wit	h computer knowledge	to draw various diagrams	and sol	lving					
problems	in microl	biology using MS-Exce	el. Intelligence in Dielegigel	Caianaa	~					
 provide bit malza studio 	asic know	lion with the Die Dete	A polyaio	Science	:5.					
• make stuc	ients fam	mar with the Big-Data	Analysis.							
The listed topics	to be cov	arad under practical in	MS Excel provided the st	udants 1	10VA 1	rior				
exposure in the n	ackage	ered under practical in	Mis-Excer provided the st		lave p	101				
exposure in the p	uckage.	AL BLAN	a Histogram	1						
1. Graphical Re	presentat	tion	h Ogives							
	presente		c. Scatter diagram	diagram						
/		A CONTRACT	a. Line diagram	1.5	3					
2. Diagrams			b. Bar diagram							
			c. Pie diagram			- 6	d			
	100	12	a. Mean (Arithmetic, Ge	ometric	and l	Harmo	nic)			
3. Measures of L	ocation	Contraction N	b. Median							
	1	A and	c. Mode	1		1				
and have			a. Range (max –min)				5 F -			
4.14	101		b. Standard Deviation		10		¥ .			
4. Measures of L	Dispersio	n	c. Variance	m	8		¥			
			e. Skewness							
100			a. Karl Pearson's coeffic	ient	1	-				
5. Correlation			b. Spearman's Rank							
		138	c. Coefficient of determination							
6. Curve Fitting	15	- Dillion on	a. Linear Regression	all a						
		100cate	a. Normal(z)							
7 Parametric te	sts		b. t (Equal Variance)							
/ i ur unietric te	313		c. F							
			a Adding files and direc	tories						
8. (i) Implement	the follo	wing file	h. Retrieving files	101105						
manageme Hadoop	nt tasks i	n	c. Deleting files							
ii) Benchmark	and str	ess test								
an Apache	Hadoop	cluster								

Course co	de		Probability and Inferential Statistics	L	Т	С					
Core/Elec	tive/Supp	oortive	Allied 2	3	1	-	4				
Pre-requis	site		Basic level on mathematical computation	Syllal Versi	ous on	2023 2024	-				
Course Ol	bjectives:			•	•						
The main of	objectives	of this cou	rse are to:								
1. Under	rstand the	relationshi	p between two variables.								
2. Know	the conc	ept of assoc	tation of attributes and methods.								
3. Be fai	miliar wit	h the theore	etical probability and its concepts.								
E-mastad											
Expected On the suc	course C	multion o	f the course student will be able to:								
	Magazin		the degree of relationship between verichles		V1	V2	V 2				
1	Measure	and interpret	et the degree of relationship between variables.		K1,	K2,	K3 175				
2	Estimate	the average	relationship using regression.		K3,	K4,	K5 K5				
3	Interpret	the association	tion of attributes applying different methods.		K3,	K4,	<u>K5</u>				
4	Understand the concepts of probability and relate to real life situations KI										
5	Apply the theorems in practical problems with conditional probability K						4				
K1 - Reme	emb <mark>er; K</mark> a	2 - Undesta	nd; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – C	reate							
Unit:1			Basics of Probability	1		9 hoi	ırs				
Probability probability	v: Sample v.	Space-Con	cepts of events- Algebraic operations on events-Defin	nitions	of						
Unit:2			Properties of Probability	200	8	9 hoi	irs				
Generalize probability	d addition , Inverse	n <mark>and comp</mark> probability	ound Theorems of probability-independent events – C – Baye's Theorem.	Conditi	onal						
				5	1	ř.					
Unit:3	Rand funct	lom Variab ions	le and Probability Distribution	1	9	9 hou	ırs				
Random van probability continuous	Random variables –discrete and continuous random variables –distribution function-properties- probability mass function and probability density function –various statistical measures of continuous probability distribution										
Unit:4			Generating Functions			9 hoi	irs				
Moment ge	enerating	function. ci	imulant generating function. characteristic function a	nd thei	r pro	perti	es.				
8		, •			<u>r=</u> ,	L					
Unit:5		T	heorems on probability of random variable) hou	ırs				
Tchebyche theorem.	ev's inequ	ality, conve	ergence in probability, weak law of large numbers and	d centra	al lin	nit					

Unit:6		2 hours								
Expert l	ectures, Onli	ne seminars– Webinars								
		Total Lecture hours	47 hours							
Text Bo	ook(s)									
1	Fundamer chand & so	Fundamentals of Mathematical statistics by Guptha, S.C &Kapoor, V.K (Sulthan chand &sons)								
2	Introducti	Introduction to Mathematical statistics by Hogg.R.V and and Craig, A.G. (Amerin								
Referen	nce Books	Contraction of the local data								
1	Introducti Christian	on to probability and probability distributions by John Benjamin Akrong Hesse	ofosu and							
Related	l Online Con	ten <mark>ts [MOOC, SWAYAM, NPTEL, Website</mark> s etc.]								
1	https://ma	thcs.clarku.edu/~djoyce/ma217/moment.pdf								
2	https://wv	/w.itl.nist.gov/div898/handbook/eda/section3/eda36.htm								
3	https://wv statistics/t	https://www.toppr.com/guides/fundamentals-of-business-mathematics-and- statistics/theoretical-distribution/theoretical-distribution/								
	1000									



Semester - III

Co	urse Code		Java Programming	L	Т	Р	С		
Cor	e/Elective/Su	pportive	Core : 4	4	0	0	4		
	Pre - requis	site	Knowledge in Basics of Object Oriented Programming	Sylla vers	abus sion	2022 Onw	-23 ards		
Cour	se Objectives								
1.'	To introduce t	he concepts	of Object-Oriented Programming Paradigm and the	he prog	gram	ming			
C	constructs of	JAVA							
	Se Outcomes	story of IAN	/A and its evolution				K1		
1 2	Explain the n	story of JA	ramming language constructs object oriented cor	noonta	lika		KI K2		
2	explain the	inhoritonoo	nalumernhism Interfaces threads exception has	ndling	and		N 2		
	packages								
3	3 Illustrate the concepts of Applets files and the concept of stream classes K3								
4	Outline the benefits and applications of objects oriented programming concepts and K3								
	defend how	JAVA differ	rs from other programming languages	copts t	unu		110		
5	Judge the pr	os and cons	of other object oriented language with the concept	ts of J	AVA		K4		
]	K1 – Rememl	ber K2 – Un	derstand K3 – apply K4- Analyze K5 – evalua	te K6-	Cre	ate			
		2 B	CAUCE SHEET IN THE				1		
				1		A	á.		
Unit	I	. 17	Introduction	N.		1	8		
Jav	va Features – c	comparison of	of Java with C and C++ - Java and Internet $-$ Java	Envir	onme	ent –	2		
Java P	rogram structu	ire – Java To	okens – Implementing a Java Program – Java Virt	ual Ma	achin d	e –	1		
evpres	sions Decisi	on Making	Branching and Looping	ors and	u				
Unit		on waxing,	Classes and Arrays	100		1	8		
De	fining a class -	- Constructo	ors – Methods – overloading – static Members – N	Jesting	of N	 Ietho	$\frac{ds}{ds}$ –		
Overi	riding methods	s – Final Cla	sses – Abstract Class – Visibility control – Arrays	s - creations	ating	an ar	ray		
-Tw	o Dimensional	l arrays – Sti	ings – String Arrays – String Methods – String B	uffer C	Class	_	-		
Vecto	ors – Wrapper	Classes.	Contraction of the second	1					
Unit I	п	-2.5	Inheritance, Interfaces and Packages	×		1	7		
De	fining a subcl	ass – Subcla	ss constructor - Multilevel inheritance - Hierarc	hical l	Inher	itance	• –		
Defin	ing Interfaces	-Extending	Interfaces – Implementing Interfaces – Java APF	Packag	ges –	creati	ng		
a pac	kage – Access	ing and Usir	ng a package – Adding a class to a package – Hidi	ng Cla	asses				
Unit I	V		Multithreading Exception Handling			1	9		
Ext	tending the Th	read class –	Thread Life cycle – Thread Exception – Thread r	priority	/ —				
Synch	hronization – I	Runnable Int	erface – Exceptions – Throwing own Exceptions	– Con	cepts	of			
stream	ns – stream cla	asses – Byte	Stream Classes - Character stream Classes - Usi	ng Stre	eams	– Usi	ng		
file Class – Other Stream Classes.									
Unit		A 11	Applet Programming		11		8		
	terence betwee	en Applicatio	on and Applets – Applet Life cycle – creating an I	Execut	table	Apple	et –		
Desig	gning a web P	age – Addin	g Applet to HIML File – Passing Parameters to A	vpplets	\$	00			
			1 otai Lectur	re Hou	ILZ	90 11	MC		
	Hours								

	Text Book(s)
1	E. Balagurusamy, "Programming with Java – A primer", Second Edition, Tata McGraw Hill
	Publishing Company, Delhi, 2002.
	Reference Book(s)
1	Herbert Schildt, "The complete Reference – Java 2", Fifth Edition, Tata McGraw Hill
	Publishing Company, Delhi, 2002.
2	The Complete Reference Java 2 - Patrick Naughton & Hebert Schildt, 3rd Edition, TMH
3	Programming with Java – John R. Hubbard, 2nd Edition, TMH.
Rela	ted 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_
Cour	se Designed by :

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

*S-Strong<mark>; M-Medium</mark>; L-Low

Course Code		Database Management Systems	L	Т	Р	С		
Core/Elective/Su	pportive	Core : 5	3 0 0					
Pre - requis	site	None	Syll:	abus	2022	-23		
			vers	ion	Onw	ards		
		Course Objectives						
1. To introdu	1. To introduce database development life cycle and conceptual modelling							
2. To learn S	QL for data	definition, manipulation and querying a databas	e					
3. To learn re	elational data	abase design using conceptual mapping and norr	naliza	tion				
4. To learn the	ansaction co	oncepts and serializability of schedules	abasa					
5. 10 leani u		Expected Course Outcomes	abases	`				
1 Understand th	ne database o	levelopment life cycle and apply conceptual mo	delino			К2		
2 Apply SOL at	nd program	ning in SOL to create manipulate and query the	datah	250		K2		
3 Apply bell a	nceptual-to-r	elational mapping and normalization to design r	elation	nal		K3		
database	leoptuur to i	end normanization to design r	ciutioi	iui		110		
4 Determine the	e serializabil	ity of any non-serial schedule using concurrency	, techr	niques	2	К3		
K1 – Remem	ber K2 – Ur	derstand K3 – Apply K4- Analyze K5 – Eval	uate F	K6- C	reate	110		
				20 0				
Unit I	1	Conceptual Data Modeling			1	8		
Database env	ironment – D	atabase system development lifecycle –Require	ments	colle	ction -	_		
Database designEr	ntity-Relation	nship model – Enhanced-ER model – UML class	<mark>diag</mark> ra	ums.				
Unit II		Relational Model and SQL	12		1	5		
Relational mo	o <mark>del</mark> concept	s <mark>Integrity constraintsSQL Data manipulatio</mark>	<mark>n –</mark> SÇ	L Da	ta	1		
definition –ViewsS	S <mark>QL</mark> program	nming.						
Unit III	Relat	ional Database Design <mark>and Normalizati</mark> on	2.2		1	8		
ER and EER-	to-Relationa	l mapping –Update anomalies –Functional depe	ndenc	ies-In	ferenc	ce		
rules – Minimal cove	r – Properties	of relational decomposition –Normalization up	to BC	NF.		8		
Unit IV	1000	Transaction Management	1		1	.8		
Transaction cor	ncepts –prop	erties –Schedules –Serializability –Concurrency	Contr	rol –T	'wo-pł	nase		
locking techniques.	01.		4			0		
Unit V Monning FEP t	ODB school	t Relational and No-SQL Databases			L Subtu	ð		
and super types –use	er-defined ro	utines –Collection types –Object Query Langua	28 –01 ge.	515-	Subty	pes		
Unit VI	Init VI Contemporary Issues 3							
Expert lectures, on	line seminar	s – webinars						
Total Lecture Hours 90Hours						ours		
Text Book(s)		1911-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-						
1. Thomas M. Connol	lly, Carolyn	E. Begg, Database Systems – A Practical Approa	ich to	Desig	gn,			
Implementation and	d Manageme	ent, Sixth Edition, Global Edition, Pearson Educ	ation,	2015.				
2.Ramez Elmasri, Sha	amkant B. N	avathe, Fundamental of Database Systems, 7th I	dition	n, Pea	rson,			
2017.								

Reference Book(s)

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "DATABASE MODELING AND DESIGN -Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011.

2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012

3. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.

4. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems: The Complete Book", 2nd edition, Pearson.

5. S Sumathi, S Esakkirajan, "Fundamentals of Relational Database Management Systems ", (Studies in Computational Intelligence), Springer-Verlag, 2007.

6. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc)

1 https://www.tutorialspoint.com/oracle_sql/index.html

Course Designed by :

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

Co	ourse Code		Java Programming Lab	L T P				
Co	re/Elective/Su	pportive	Core Lab : 4	0 0	2	2		
Pre - requisite• Basic knowledge of Programming • Knowledge on Object Oriented Programming ConceptsSyllabus version20 O								
Cou	rse Objectives	5						
pr	To intro ogramming co	duce the con onstructs of J	cepts of Object Oriented Programming Paradigm a AVA	nd the				
1	Apply the y	prious basic	programming constructs of IAVA like decision ma	king		K3		
1	statements. I and destruct	Looping state	ements, overloading, inheritance, polymorphism, co	onstructor	ſS	KJ		
2	Illustrate the	e concepts of	threading and multi-threading			K4		
3	Design prog	rams using v	various file stream classes; file types, and frames			K4		
	K1 – Remem	<mark>ber K2 – U</mark> r	derstand K3 – apply K4- <mark>Analyze K5 – ev</mark> aluate	e K6- Cro	eate			
			are chart		-			
PRO	GRAM - 1	- G				3		
Write	a Java Applica	ations to extr	act a portion of a character string and print the extr	acted stri	ng.			
PRO	GRAM - 2			2	,	3		
Write	a Java Program	m to implem	ent the concept of multiple inheritance using Interfa	aces.				
PRO	GRAM - 3		A PARTY OF A			3		
Write	a Java Program	m to create a	n Exception called payout-of-bounds and throw the	exceptic	n			
PRO	GRAM - 4	· · · ·	at the formation of the second s	- ·		3		
Write	a Java Program	m to implem	ent the concept of multithreading with the use of ar	ıy				
three	multiplication	tables and as	sign three different priorities to them.	in la				
PRO	GRAM - 5			1		3		
Write	a Java Program	m to draw se	veral shapes in the created windows	(C.).	1			
PRC	OGRAM -6	52	And the second s	STUT		3		
Write	a Java Program	m to demons	trate the Multiple Selection List-box.	1.1				
PRC	OGRAM -7	1		. I		3		
Write	a Java Program	m to create a	frame with three text fields for name, age and qual	ification	and a	text		
field f	for multiple lin	e for address						
PRC	OGRAM -8	and the second	STATISTICS AND			3		
Write	a Java Program	m to create N	Ienu Bars and pull down menus.					
PRC	OGRAM -9	1000	AND CATE TO ELEVAN			3		
Write	a Java Program	m to create f	rames which respond to the mouse clicks.					
PRO	GRAM -10					3		
Write	a Java Program	m to draw cit	rcle, square, ellipse and rectangle at the mouse clicl	k positior	s.			
	6		Tota	al Hours	3	30		
					Ho	ours		

	Text Book(s)						
1	Programming with Java – A Primer - E. Balagurusamy, 3rd Edition, TMH.						
	Reference Book(s)						
2	The Complete Reference Java 2 - Patrick Naughton& Hebert Schildt, 3rd Edition, TMH						
Course Designed by : Dr. K.S.MOHANASATHIYA, Assistant Professor, School of Computer							
	Science, VET Institute of Arts and Science (Co-Education) College, Erode						

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



Course Code		Optimization Techniques	L	Т	Р	C		
	•		_	0	0			
Core/Elective/Su	pportive	Allied: 3	5	U	U	4		
Pre - requis	ite	Basic Knowledge in Optimization	Syl	labus	2022	-23		
Course Objecting			ver	sion	Onw	ards		
The objective of this course is to enable the student to								
1 Formul	late and solv	ve linear programming problems (I PP)						
2. Evalua	te Integer P	rogramming Problems. Transportation and Assig	nmen	t Proł	olems.			
3. Obtain	solution to	network problems using CPM and PERT technic	jues.					
4. Able to	o optimize th	he function subject to the constraints.	-					
5. Identify	y and solve	problems under game theory.						
Course Outcomes		State of the second						
1 Demonstrate	and Formu	ate and solve linear programming problems (LP	P)			K1		
2 Evaluate Inte	eger Transpo	ortation and Assignment Problems				K2		
3 Obtain soluti	on to netwo	rk problems using CPM and PERT techniques				K3		
4 Apply the str	rategies of g	ame theory and to make better decisions while				K4		
solving prob	solving pro <mark>blems</mark>							
5 Identify and	solve proble	ems under replacement models	A TZ			K5		
KI – Rememb	$\frac{1}{10000000000000000000000000000000000$	iderstand K5 – apply K4- Analyze K5 – evalu	ate K	0- Cr	eate			
Unit I		Introduction To Operation Research			1	5		
Introduction	n of Operati	ons Research - Linear programming- Mathemati	cal Fo	ormula	ation-	-		
Graphical Method to	o solve LPP	-Simplex Method.						
Unit II	1	Transportation and Assignment Problems	20		123	15		
Transportat	tion problem	ns: Introduction- Finding Initial Basic Feasible	e solu	tions-	mov	ing		
Towards optimality	(non- dege	<mark>nerate only) – Maximization in transportation</mark> p	robler	n- Un	balan	ced		
transportation proble	em.	Introduction Unservice Assignment without	М		- ati an			
Assignment problem	t problem: n – Unbalan	antroduction –Hungarian Assignment method	– Ma Proble	axiiiii	zation	111		
Unit III Project Scheduling Hours								
Project net	work -Diagr	am representation – Floats - Critical path metho	d (CP	M) _	- 2			
PERT- Cost conside	erations in P	ERT and CPM. (Simple Problems Only).	u (CI .					
Unit IV		Game Theory				15		
Game theor	ry: Concept	of Pure and Mixed strategies - solving 2 x 2 ma	trices	with	and			
without saddle point	t. Graphical	solution - mx2 and 2xn games- Solving games b	y Do	minan	ce			
Property.	and the second	Row-						

Replacement Theory

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

Total Lecture Hours 75 Hours

Text Book(s)

1. P. K. Gupta, Man Mohan, Kanti Swarup: "Operations Research", Sultan Chand, 2008.

Reference Book(s)

- 1. Sundaresan V, Ganapathy K.S, Ganesan K, Resource Management Technique- Lakshmi Publications, 2003.
- 2. J. K. Sharma: Operations Research Theory & Applications, Macmillan India Limited, Fifth edition.2013.

Course Designed by :

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

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



15

Cou	rse Code Data Visualization L T P		Р	C				
Core	/Elective/Su	pportive	Skill Based Subject 1	6	0	0	4	
	Pre - requis	ite	None	Syllabus2versionO		2022 Onw	2022-23 Onwards	
			Course Objectives					
• [To introduce	the concept	of Data Visualization					
• To explain the various techniques in Data Visualization								
			Expected Course Outcomes					
1	Understand t	he basics of	data visualization				K2	
2	Understand t visual compo	he importan onents	ce of data visualization and the design and u	use of many	r		K2	
3	Explain the p	process of da	ata visualization				K2	
4	Explain the bissues.	pasics of inte	eractive data visualization techniques visual	ization-base	ed		K2	
5	Understand t	he concept o	of various types of visualization				K2	
K	1 – Rememb	<mark>oer K2</mark> – Un	derstand K3 – apply K4- An <mark>alyze K5 –</mark> e	valuate K6	- C	reate		
			And Add					
Unit I	18-25		Introduction	1 miles		1	5	
visualiz	lata represent zation tools.	tation, data j	presenation, seven stages of data visualizatio	on,widgets,d	lata		6	
Unit II			Visualizing data methods	3.3		1	5	
Visualiz hierachi	zing data met es and recurs	hods- mappi sion- networ	ing, time series- connections and correlation ks naadgraphs, info graphics	is-scatter pl	ot n	naps- ti	rees,	
Unit II			Visualizing data process	. Alter	έ.,	1:	5	
Visualiz locating folder, a number	ting data pro- file for use synchronous of files.	cess- acquir with process image dow	ing data, where to find data, tools of acquir sing, loading text data, dealing with files an nloads, advanced web techniques, using a d	ring data fro d folders, li latabase, dea	om t isiti alin	the intended in the intended in the intended in the second s	ernet, s in a large	
Unit IV	7	1	Interactive data visualization			1	2	
Interac interac	tive data tivity- layout	visualization s-geomappin	n-drawing with data,scales-axes-updates ng- exporting frame work-T3 lstabio	s,transaction	1 8	and n	node-	
Unit V	100	a second second	Security data visualization			1	5	
Securit log vist system	y data visual ualization- in s- creating se	ization-port struction de curity visua	scan visualization-vulnerability assessment tection log visualization- attacking and defe lization system	and exploit ending visua	atio ıliza	on- fire ation	wall	
Unit V	I Conter	nporary Iss	ues			3	;	
			Total L	ecture Hou	rs	7	5	
						Ho	urs	

	Text Book(s)
1	Scott Murray,"interactive data visualization for the web ",0"Reilly media,inc,2013.

	Reference Book(s)
1	Ben fry,"visualizing data",O"Reilly media,inc,2007
2	Greg conti,"security data visualization:","graphical techniques for network analysis",No
	starch press inc,2007
Cours	e Designed by :

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



Semester -IV

Course Code		Introduction to Python Programming	L	Т	Р	С				
Core/Elective	Supportive	Core : 6	5	0	-	4				
Pre - rec	uisite	• Basic knowledge of Python Programming.	Syll	abus	202	2-23				
		• Knowledge in Object Oriented	ver	sion	Onv	wards				
		Programming Concepts.								
		Course Objectives	<u> </u>							
1. To know th	e basics of a	lgorithmic problem solving with read and write sim	ple Py	thon						
programs										
2. To develop	Python prog	grams with conditionals and loops.								
3. To define Python functions and call them.										
4. 10 use Fyt	ion data stru	ctures - lists, tuples, dictionaries and fix input/outpu	t with	mes	111					
	1	Expected Course Outcomes								
1 Develop	algorithmic s	olutions to simple computational problems				K1				
2 Read, wr	te, execute b	w hand simple Python programs. Structure simple P	vthon			K2				
programs	for solving	problems.	5							
3 Decompo	se a Python	program into functions.	2			K3				
4 Represen	t compound	data using Python lists, tuples, dictionaries. Read an	d writ	e data	ı	K3				
from/ <mark>to f</mark> i	es in Python	Programs								
5 Judge the	pros and con	ns of Python				K4				
K1 – Rem	mber K2 –	Understand K3 – apply K4- Analyze K5 – evalua	te K6	- Cre	ate	1				
	12 1 1									
Unit I		Algorithmic Problem Solving		- 3		16				
Algorithms,	uilding bloc	ks of algorithms (statements, state, control flow, f	functio	ons),	notat	tion				
(pseudo code, flo	w chart, prog	ramming language), algorithmic problem solving, s	imple	strate	egies	for				
developing algorithm	thms (iteration	on, recursion).	13	2 /						
Unit II		Data, Expressions, Statements	S		1	15				
Python interr	reter and in	teractive mode, values and types: int, float, boole	an, st	ring a	and	list:				
variables, expre	sions, stater	nents, tuple assignment, precedence of operators, c	comme	ents, 1	modı	ules				
and functions, fu	nction defin	ition and use, flow of execution, parameters and arg	ument	s.						
Unit III		Control Flow, Functions	-			14				
Conditionals:	Boolean va	alues and operators, conditional (if), alternative	(if-e	lse).	chai	ned				
conditional (if-e	if-else). Iter	ation: state, while, for, break, continue, pass. Fruitf	ul fun	ction	s: ret	turn				
values, paramete	rs, local and	global scope, function composition, recursion. Strin	ıgs: stı	ring s	lices	,				
immutability, str	ing function	s and methods, string module, Lists as arrays.								
Unit IV		Lists, Tuples, Dictionaries				13				
Lists: lis	operations,	list slices, list methods, list loop, mutability, aliasin	ig, clo	ning	ists,	list				
parameters. Tup	les: tuple as	signment, tuple as return value, Dictionaries: opera	tions :	and n	netho	ods,				
advanced list pro	cessing - lis	t comprehension.								
Unit V		Files, Modules, Packages				17				
Files and e	ception: tex	t files, reading and writing files, format operator, co	mman	id line	e					
arguments, errors and exceptions, handling exceptions, modules, packages.										
		Total Lect	ure H	ours		75				

Text Book(s)	
1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Up	dated
for Python 3, Shroff/O'Reilly Publishers, 2016.	

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

Reference Book(s)

- 1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013
- 2. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
- 3. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
- 4. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
- 5. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
- 6. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc)

1 http://greenteapress.com/wp/think-python/

Course Designed by :

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

Co	urse Code		Data Warehousing and Data Mining	L	Т	Р	С				
Cor	e/elective/Su	pportive	Core :7	4	0	0	3				
	Pre - requis	site	None	Sylla vers	abus sion	2023 Onv	3-24 vard				
			Course Objectives								
• Introduce the concepts of data ware house and data mining and explain the methodologies											
used for analysis of data											
Expected Course Outcomes											
1 Understand the functionality of the various data mining and data warehousing Component											
2	Describe dif	ferent metho	dologies used in data mining and data ware housi	ng.			K2				
3	Explain the	analyzing tec	chniques and Online Analytical Processing				K2				
4	Explain about	ut the associa	ation rule mining and classification				K2				
5	Compare dif	ferent appro	aches of data ware housing and data mining with	variou	IS		K4				
	Technologie	S									
]	K1 – Remem	b <mark>er K2 – U</mark> n	derstand K3 – apply K4- An <mark>alyze K5 – eval</mark> ua	te K6	- Cre	ate					
		82.10	A.C. PCA								
UNI	ΓI		Data Warehousing			1	8				
Data w	varehousi <mark>ng C</mark>	<mark>ompon</mark> ents –	Building a Data warehouse Mapping the Data	Warel	house	to a					
Multip	processor Arch	itecture – D	BMS Schemas for Decision Support – Data Extra	<mark>ction</mark> ,	Clean	nup, a	ınd				
Transf	ormatio <mark>n Too</mark>	ls – <mark>M</mark> etadata				5					
UNIT		-	Business Analysis			1	8				
Report	ting and Quer	y tools and A	Applications – Tool Categories – The Need for Ap	pplica	tions	- Co	gnos				
Impro	mptu – Online	Analytical	Processing (OLAP) – Need – Multidimensional J	Data N	Vlode	l – O. Teels	LAP				
the Int	ernet	imensional v	ersus Multirelational OLAP – Categories of Tool	s - 0	LAP	10015	and				
the int	ernet.	1000	Marrison and an add	- 1		375	1				
UNIT	III		Data Mining			1	7				
Introdu	uction – Data	– T <mark>ypes of D</mark>	Pata – Data Mining Functionalities – Interestingne	ess of l	Patter	ns –					
Classit	fication of Dat	ta Mining Sy	<mark>stems – Data Mining Ta</mark> sk Primitives – Integratio	on of a	Data	Mini	ing				
Systen	n with a Data	Warehouse –	- Issues –Data Preprocessing	1	1						
UNIT	IV	Ass	ociation Rule Mining and Classification	1		1	9				
Mining Associ Predic Classif Classif	Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction – Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.										
UNIT VClustering And Trends In Data Mining18											
ONIT v Clustering And Trends In Data Mining 18 Cluster Analysis – Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods – Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.											
			Total Lecture Hours			90	i				

	Text Book(s)								
1	Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and								
1	OLAP", TataMcGraw – Hill Edition, Thirteenth Reprint 2008.								
2	Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third								
2	Edition, Elsevier, 2012.								
Reference Book(s)									
1	Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining",								
L	Person Education, 2007.								
2	K.P. Soman, ShyamDiwakar and V. Aja, "Insight into Data Mining Theory and								
2	Practice", Eastern Economy Edition, Prentice Hall of India, 2006.								
2	G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy								
3	Edition, Prentice Hall of India, 2006.								
4	Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.								
	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								
Course Designed by :									

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

Course Coo	le	Python Programming - Lab	L	Т	Р	С				
Core/electiv	e/Supportive	Core Lab : 5	0	0	3	2				
Pre - r	equisite	Knowledge in basic Programming	Syll	abus	2023	-24				
		Course Objectives	ver	sion	Onw					
• To intr	duce the concer	ts of python programming constructs of C								
• TO IIII	duce the concep	its of python programming constructs of C++								
		Expected Course Outcomes								
1 Apply solving	he concept of D basic programs	ecision making statements, looping constructs, fur	nction	s for		К3				
2 Analyz	Analyze the concepts of Lists, tuples and error handling mechanisms									
3 Evalua	e a program inc	orporating all the python language constructs				K5				
K1 – Re	nember K2 – U	Inderstand K3 – apply K4- Analyze K5 – evalua	te K6	- Cre	eate					
PROGRAM - 1	100	and a local second				5				
Write a python	program that di	splays the following information: Your name, Full	addre	ss Mo	obile					
PROGRAM - 2	e nam <mark>e, Course</mark>	subjects.				5				
Write a python	program to find	the largest three integers using if-else and condition	onal o	perato	or.					
PROGRAM - 3	<u>F8</u>			<u>r</u>		5				
Write a python	program that as	ks the user to enter a series of positive numbers (T	he use	er sho	uld er	nter				
a negative num	ber to signal the	end of the series) and the program should display	the nu	ımbei	's in o	rder				
and their sum.	oor to signar are									
PROGRAM - 4	10	L TRA	575		0.0	5				
Write a python	program to find	the product of two matrices [A]mxp and [B]pxr			1	18				
PROGRAM - 5					ł.	5				
Write recursive	functions for G	CD of two integers.	-	1000	S	1				
PROGRAM - 6	Sec. 5		1		11	10				
Write recursive	functions for th	e factorial of positive integer.	12		7 1					
PROGRAM - 7				1		10				
Write recursive	functions for F	ibonacci Sequence up to given number n.		7						
PROGRAM - 8				-		10				
	-257		1							
Write recursive	functions to dis	play prime number from 2 to n.								
PROGRAM - 9		FOUCATE TO ELLEVAIL				10				
Write a python	program that w	rites a series of random numbers to a file from 1 to	n and	disp	lay.					
PROGRAM -10						10				
Write a progra	m to calculate	student grade			·					
PROGRAM -11						10				
Write a python program to make a simple calculator.										
PKUGKAM -12 10										
Write a python	program for Lir	ear Search and Binary Search.								
		Total Lecture Hours			-	90 Tour				
						10urs				

Text Book(s)							
1	Mark Summerfield. —Programming in Python 3: A Complete introduction to the Python						
	Language, Addison-Wesley Professional, 2009.						
2	Martin C. Brown, -PYTHON: The Complete Referencel, McGraw-Hill, 2001						
Reference Book(s)							
1	Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition,						
	Updated for Python 3, Shroff/O,,Reilly Publishers, 2016						
2	Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for						
	Python 3.2, Network Theory Ltd., 2011.						
Course	e Designed by :						

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



Course C	Code	Data Engineering	L	Т	Р	С				
Core / Electi Suppo	/ ve/ ortive	Allied 4	4	-		3				
Pre-requ	isite		Syllabus Version	5	202	2-23				
Course Ob	jectiv	es:								
The main of 1. Ider Dat 2. App 3. Ider	object ntify b a Eng ply dat ntify o	ives of this course are to: pasic concepts, terminology, theories, models and met ineering ta transformations such as aggregation and filtering f pportunities for application of data visualization in v	hods in th or visual arious do	ne field ization omains	l of					
Expected (Course	e Outcomes:	199							
On the succ	essful	completion of the course, student will be able:	(2 A		- T					
1	Acqui	equire knowledge on various phases of data engineering								
2	Identi	entify necessity of data pre-processing and apply the appropriate procedure								
3	Demo applic	onstrate data warehouse schema and process of data retriestations.	eval for re	al time	K2, 1	K3,K4				
K1 - Reme	mber;	K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evalu	uate; K6 –	Create	1					
UNIT:1	DAT	A ENGINEERING INTRODUCTION			8 H	ours				
KDD Prod Kinds of preprocess and Discret	cess – Applic sing ov etizatio	Kinds of data can be mined – Kind of patterns can be p cations targeted – Issues in data mining - Data Objects verview – Data Cleaning – Data Integration – Data Redu on	mined – 7 s and Attr ction – D	Techno ribute ' ata Tra	logies Fypes nsforn	used – - Data nation				
UNIT:2	DAT	A WAREHOUSING	< 9°	1	10 H	Iours				
Data ware Design an	house d Usag	– Basic Concepts – Modeling - Data cube and OLAP – I ge – Implementation - Data Generalization by Attribute	Data ware Oriented I	house nducti	on.					
UNIT:3	DA	FA MODELING			10 H	Iours				
Introducti Quality-P	on to c roduct	data modeling-Relational data models-NoSQL data mode ion data Pipelines	els-Data F	ipeline	es- Dat	a				
UNIT:4	DAT	TA PROCESSING			10 H	Iours				
ETL bas mechanisi basic quer	ics —] ms-ET :y-adva	Extraction of Data-Extraction Methods-Transportation L Tools-Loading and Transformation. Data Capture-D anced query-Schema modeling techniques-Analysis and	on of da Data warel Reporting	nta- T nouse j g-OLA	ranspo perforr P	rtation nance-				
UNIT:5	DATA	A VISUALIZATION			10	Hours				
Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.										
		Total Lecture hours								

Paul Crickard "Data Engineering with Python" work with massive datasets to	
design datamodels and automate data pipelines Using python,2020	
Jiawei Han, MichelineKamber, Jain Pei "Data Mining: Concepts and	
² Techniques", Third edition, Elsevier, Morgan Kaufmann Publishers, 2012.	
Reference Books	

IGlenn 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	М	S	S	M	S	M	М	L	М	М
CO2	S	S	S	S	L	M	L	M	L	М
CO3	S	S	M	M	L	M	S	Μ	Μ	М



Semester - V

Core/elective/Supportive Core :8 6 0 4 Pre - requisite None Syllabus 2023-24 Onward Course Objectives Onward Expected Course Outcomes Course Objectives Course Objectives 1 Understand the basics in R programming in terms of constructs, control statements, string functions K2 2 Understand the use of R for Big Data analytics K2 3 Apply R programming for Text processing K3 4 Appreciate and apply the R programming from a statistical perspective K3 K1 - Remember K2 - Understand K3 - apply K4- Analyze K5 - evaluate K6- Create 18 UNITI I Introduction to R 18 Creating matrices - Filtering - Victoriesed if-then else - Vector Element names. 18 UNIT II Matrices and operations - Avoiding Dimension Reduction - Higher Dimensional arrays - lists - Creating lists - General list operations - Accessing list components and values - applying functions to lista - recursive lists. 18 Creating Matrix Operations on Is frames - merging Data frames - Applying functions to bata Frames - Factors and Tables - Factors and levels - Common Functions used with factors - Working with tables - Other factors and table related functions - Control statements - Arithmetic and Boolean operators and values - Default Values for arguments - Returning Boole	Cou	urse Code		R Programming	L	Τ	Р	С
Pre - requisite None Syllabus 2023-24 Course Objectives • To expose the student sot the fundamental concepts of R Programming • To expose the student sot the fundamental concepts of R Programming • To expose the student sot the fundamental concepts of R Programming • To expose the student sot the fundamental concepts of R Programming • K2 • Understand the basics in R programming in terms of constructs, control statements, string functions • K2 • K3 2 Understand the use of R for Big Data analytics • K2 3 Apply R programming for Text processing • K3 4 Appreciate and apply the R programming from a statistical perspective • K3 Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – • Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names. • I8 UNIT II Matrices and operations • Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to Istar – recursive lists. • I8 Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Actors and Tables – Factors and Perlaut Values for arguments – Returning Boolean Values – Peructions – tools ar	Core/e	lective/Suppo	ortive	Core :8	6	0	0	4
Course Objectives • To expose the student sot the fundamental concepts of R Programming Expected Course Outcomes 1 Understand the basics in R programming in terms of constructs, control statements, string functions K2 2 Understand the use of R for Big Data analytics K2 3 Apply R programming for Text processing K3 4 Appreciate and apply the R programming from a statistical perspective K3 K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create K3 UNITI Introduction to R 18 Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victorised if-then else – Vector Element names. 18 UNIT II Matrices and operations 18 Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – crearisve lists. 18 Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Applying functions to list – recursive lists. 18 Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying	Pre – r	equisite		None	Syll vers	abus sion	202 Onv	3-24 ward
To expose the student sot the fundamental concepts of R Programming Expected Course Outcomes I Understand the basics in R programming in terms of constructs, control statements, string functions Understand the use of R for Big Data analytics Apply R programming for Text processing K3 Appreciate and apply the R programming from a statistical perspective K3 Appreciate and apply the R programming from a statistical perspective K3 K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create UNITI I Introduction to R Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victoriesed if-then else – Vector Element names. UNIT II Matrices and operations to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to Ists – recursive lists. UNIT II Data Frames (Course Objectives	1		I	E
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	Total I	Lecture Hour	S				90	
Hours							Ho	urs

	Text Book(s)
1	Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No
	Starch Press, 2011.
2	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley
	Data & Analytics Series, 2013.

	Reference Book(s)	
1	Mark Gardner, "Beginning R – The Statistical Programming Language", Wiley, 2013.	
2	Robert Knell, "Introductory R: A Beginner"s Guide to Data Visualisation, Statistical A	Analysis
	and programming in R", 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	e Designed by :	

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

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			Course Objective	S				
•	To expose t	the student s	t the fundamental concepts	of R Programming				
Expe	ected Course	Outcomes						
1	Understand t string function	he basics in	programming in terms of	constructs, control st	ateme	ents,]	K2
2	Understand t	he use of R	or Big Data analytics]	K2
3	Apply R programming for Text processing K							
4	Appreciate a	nd apply the	R programming from a state	istical perspective]	K3
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1	. R Expression	on <mark>s and D</mark> ata	Structures					
2	. Manipulati	on of vectors	and matrix					
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4	. Data Frame	es in R						
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6	. Working w	ath looping s	atements.					
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8	. 3D plots in	K		1000	33			-
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9			Text Book(s)	1000			4	1
1	Norman Mat	lo <mark>ff, "The A</mark> 2011	of R Programming: A Tou	ir of Statistical Softw	vare D	esign	", No	1
2	Jared P Land	der "R for F	ervone: Advanced Analyti	cs and Graphics" Ad	Idisor	-Wes	lev D	ata
-	& Analytics	Series, 2013	or yone. That anotal Third you	es una Graphies , rie	ansen			utu
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1	Mark Gardne	er, "Beginnin	g R – The Statistical Progra	mming Language", V	Wiley	, 2013	3.	
2	Robert Knell	, "Introducto	y R: A Beginner"s Guide t	o Data Visualisation,	Stati	stical	Anal	ysis
	and program	ming in R",	mazon Digital South Asia	Services Inc, 2013. H	Richa	ď		-
	Cotton(2013). Learning l	O"Reilly Media.	111111 C				
3	Garret Grole	mund (2014	Hands-on Programming w	ith R. O"Reilly Med	ia, Ind	.		
4	Roger D.Pen	g (2018). R	rogramming for Data Scier	nce. Lean Publishing.				
	Related Onl	ine Content	(MOOC, SWAYAM,NP	FEL, Websites etc)				
1	https://onlin	ecourses.sw	yam2.ac.in/aic20 sp06/pi	review				
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	Text Book(s)
1	Tom White "Hadoop: The Definitive Guide" Third Edit on, O"reily Media, 2012.
2	SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015. References.

3	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4	Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5	Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics
	with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media
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6	AnandRajaraman and Jefrey David Ulman, "Mining of Massive Datasets", Cambridge
	University Press, 2012.
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1	Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams
	with Advanced Analytics", John Wiley & sons, 2012.
2	Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
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4	Michael Mineli, Michele Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging
	Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
5	ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game",
	MC Press, 2012
6	Paul Zikopo <mark>ulos ,Dirk DeR</mark> oos , Krishnan Parasuraman , Thomas Deutsch , James Giles ,
	David Corigan, "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw
	Hill Publications, 2012
	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
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Cour	Course CodeDeep LearningLTP							
Core/	/elective/Suppo	ortive	Skill Based Subject 3	4	0	0	2	
Pre -	requisite		None	Syll vers	abus sion	202 On	2021-22 Onward	
			Course Objectives					
•	To introduce	students to t	he basic concepts and techniques of deep Learnin	ng.				
Expe	cted Course O	utcomes						
1	Understand t	he basic cor	cepts and techniques of Deep Learning.				K2	
2	To understan	d and apply	the Machine learning principles				K2	
3	To study the	deep learnir	g architectures				K2	
4	Explore and	create deep	earning applications with tensor flow				K3	
K1 –	Remember K2	2 – Underst	and K3 – apply K4- Analyze K5 – evaluate K6	- Cre	ate			
ΤΙΝΙΤΊ	T	1	Deging of Normal Natural			10		
	Joural Natwork	Limits of	Traditional Computing Machine Learning No	nuron	EE	18		
Neura	al Networks – T	vpes of Neu	rons – Softmax output layers	Suron	- 1.1.			
UNIT		<u>JP</u>	Variables & Operations			18		
Tenso	or flow – Variał	oles – Opera	tions – Placeholders – Sessions – Sharing Variab	les –	Graph	IS —		
Visua	lization			2				
UNII		- B	Basics of CNN	R.		19		
Conve Conve	olution Neural 1 olution Layer –	Network – F Application	eature Selection – Max Pooling – Filters and Fea	iture N	Maps -			
UNIT	IV I		Basics of RNN			17	1	
Recur Memo	rrent Neur <mark>al Ne</mark> ory augmented	twork – Mei Neural Netw	nory cells – sequence analysis – word2vec- LST orks – NTM—Application	M -		1ª		
UNIT	Γ		Reinforcement Learning			18		
Reint	forcement Lear	n <mark>ing – MD</mark> P	– Q Learning – Applications		(Trees	-		
Total	Lecture Hour	S		k	9.	90 Ho	urs	
		100	Text Book(s)	0.5	11	- 2		
1	Nikhil Budur NextGenerat	ma, Nichola ion Machine	<mark>s Locascio, "Fundamentals of De</mark> ep Learning: De Intellige <mark>nce Algorithms",</mark> O'ReillyMedia, 2017.	esignii	ng			
	1	2.7	Reference Book(s)	1				
1	Ian Goodfel computation	low, Yoshua and Machin	Bengio, Aaron Courville, "Deep Learning (Ada e Learning series", MITPress, 2017.	ptive				
	Related Onl	ine Content	s (MOOC, SWAYAM, NPTEL, Websites etc)					
1	https://onlin	ecourses.sv	vayam2.ac.in/aic20_sp06/preview					
2	https://onlin	ecourses.sv	ayam2.ac.in/arp19_ap79/preview					
Cour	se Designed by	7 :						

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

Semester - VI

Co	urse Code		Linux and Shell Programming	L	Т	Р	C	
Cor	e/elective/Suj	pportive	Core : 10	6	0	0	4	
	Pre - requis	site	Basic knowledge about Operating Systems	Syll ver	abus sion	5 2023-24 Onward		
			Course Objectives					
•	To introduce	the concept	s of Linux operating system					
•	To explain th	ne various co	instructs associated with Linux					
			Expected Course Outcomes					
1	Illustrate the	e various dire	ectory and fie commands in LINUX				K2	
2	Explain the	met <mark>hods of s</mark>	ecuring files in Linux				K2	
3	Explain the	various kern	el components of Linux				K2	
4	Apply the va	a <mark>rious comm</mark>	ands of Linux to perform several operations				K3	
5	Solve variou	is network ad	lministrative issues by writing Linux shell scripts				K3	
]	K1 – Remem	ber K2 – Un	iderstand K3 – apply K4- An <mark>alyz</mark> e K <mark>5 – evalu</mark> a	te K6	- Cre	ate		
							_	
UNI			Introduction to Linux	Creater	D	1	5	
comm	ands in Linux		ng System: Introduction - The LINUX Operating	Syster	ш - В	asic		
UNIT			Managing Files & Directories			<u>k</u> 1	8	
Mana	Managing Files and Directories: Introduction – Directory Commands in LINUX – File Commands in							
LINU	X. Creating fi	iles using the	e vi editor: Text editors – The vi editor. Managing	Doci	iment	s:		
Locat	ing files in LI	NUX – Stan	dard files – Redirection – Filters – Pipes.	, 2000				
UNIT	III		Shell script		in.	2	.0	
Secur	ing files in LI	N <mark>UX</mark> : File a	ccess permissions – viewing File access permission	ons –	Chan	ging l	File	
acces	s permissions.	Automating	Tasks using Shell Scripts: Introduction – Variab	les- L	ocal a	nd		
Globa	al Shell variab	les – Comm	and Substitution.	48		5 J		
UNIT	IV	10	Conditional & Looping Statements	÷.	1	1	.9	
Using	g Conditional I	Execution in	Shell Scripts: Conditional Execution – The case.	esac	Cons	struct		
Mana	ging repetitive	e tasks using	Shell Scripts: Using Iteration in Shell Scripts – T	The wh	nile co	onstru	ıct –	
until	construct – for	r construct –	break and continue commands – Simple Program	is usin	g She	ell		
Scrip	ts.	1						
UNII		1.0	Kernel & System Recovery			1	8	
Linux Custo	Kernel-Kern	tel Compone	ents- compiling a kernel- Customizing a kernel – s	system	ı start	up-		
Cusic	minzing the bo	ot process-s	Total Lecture Hours			00 H	ours	
Total Lecture Hours 90 Ho								
1	Operating St	vstem I INII I	X NIIT PHI 2006 Eastern Economy Edition					
	operating by		Reference Rook(S)					
1	Richard Pete	ersen. Linux.	The Complete Reference, Sixth Edition, Tata Ma	Graw	-			
-	Hill Publishi	ing Company	y Limited, New Delhi, Edition 2008.	. Cruw				
		~ 1 .						

Į	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	Course Designed by :						

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



Co	urse Code		Linux and Shell Programming Lab	Р	C			
Co	re/elective/Suj	pportive	Core Lab: 7 0 0	3	3			
	Pre - requis	site	Basic knowledge Linux commands Syllabus version	202 On	 23-24 ward			
			Course Objectives	Tion	waru			
To int progra	roduce he conc mming constr	cepts of Linu ruction in Lin	ax operating system commands execution and various nux shell script.					
			Expected Course Outcomes					
1	To create the	e directory, ł	now to change and remove the directory.		K1			
2	To evaluate Commands	the concept	of shell scripting programs by using an AWK and SED		K2			
3	3 To demonstrate the basic knowledge of Linux commands and file handling utilities by							
	using Linux	shell enviror	nment.					
	K1 – Rememl	<mark>ber K2 – U</mark> r	derstand K3 – apply K4- Analyze K5 – evaluate K6- Cre	ate				
		1	i marc inchange					
EXE	CISE I	that diaplays	list of all the files in the auront directory to which the user l	(5			
read. v	write and exect	ute permission	ist of all the mes in the current directory to which the user i	las				
EXE	RCISE 2			(6			
Write	an awk script	to find the n	umber of characters, words and lines in a file?	ι.	1			
EXE	RCISE 3	-		A.	9			
Write and di	a Shell script t splays all the l	that accepts a	a filename, starting and ending line numbers as arguments the given line numbers?	T	1			
EXE	RCISE 4				9			
Write	a shell script t	o sort numbe	er in ascending order.	lane.	1			
EXE	RCISE 5	Sec. 5		1	2			
Write numbe	a shell script (ers.	small calcul	ator) that adds, subtracts, multiplies and divides the two give	n				
EXE	RCISE 6				9			
Write	a shell script t	o determine	whether a given number is a prime number or not.					
EXEI	RCISE 7			1	2			
Write	a shell script t	o print the fi	rst n Fibonacci numbers.					
EXEI	RCISE 8				9			
Write	a shell script t	o find the G	CD of two given numbers.					
EXEI	RCISE 9				9			
Write	a shell script t	o check whe	ther given string is palindrome or not.					
EXE	RCISE 10				9			
Write	a shell script t	o find the fa	ctorial of given integer.					
			Total Lecture Hours	9)0			

T	ext Book(s)

1 Operating System LINUX, NIIT, PHI, 2006, Eastern Economy Edition.

Reference Book(S)

Richard Petersen, Linux: The Complete Reference, Sixth Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, Edition 2008.

Course Designed by :

1

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



Course Code	Project Work Lab	L	Р	C		
Core/elective/Supporti	ve Core - 11	0 0				
Pre - requisite	Students should have the strong knowledge in any one of the programming languages in this	Syll vers	abus ion	2023-24 Onward		
	course.					
	Course Objectives					
The main objectives of the	is course are to:					
• To understand and	l select the task based on their core skills.					
• To get the knowle	dge about analytical skill for solving the selected task	•				
• To get confidence	for implementing the task and solving the real time p	roblen	ıs.			

- Express technical and behavioral ideas and thought in oral settings.
- Prepare and conduct oral presentations

Expected Course Outcomes

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

1	Formulate a real world problem and develop its requirements develop a design solution	K3
	for a set of requirements	
2	Test and validate the conformance of the developed prototype against the original	K5
	requirements of the problem	b. All
3	Work as a responsible member and possibly a leader of a team in developing software	K3
	Solutions	18
4	Express technical ideas, strategies and methodologies in written form. Self-learn new	K1-
2.15	tools, algorithms and techniques that contribute to the software solution of	K4
10	the	12
	project	1
5	Generate alternative solutions, compare them and select the optimum one	K6
	K1 – Remember K2 – Understand K3 – apply K4- Analyze K5 – evaluate K6- Create	9

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 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	Μ	L	L	L	L	L
CO2	S	S	S	S	Μ	L	L	L	L	L
CO3	S	S	S	S	Μ	Μ	Μ	L	L	L
CO4	S	S	S	S	Μ	Μ	Μ	L	L	L
CO5	S	S	S	S	Μ	Μ	Μ	L	L	L

Course Code			Machine Learning	Т	Р	C			
Core/elective/Supportive		oportive	Skill based subject :4	3	0	0	2		
Pre - requisite			None Syllabus version				2023-24 Onward		
Course Objectives									
• To explain about the basics of machine learning									
Expected Course Outcomes									
1	1 Understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.								
2	Understanding of the strengths and weaknesses of many popular machine learning approaches.						K2		
3	Explain about the concepts of computational learning theory and dimensionality Reduction						K2		
4	4 Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.						К3		
	K1 – Rememb	o <mark>er K2 – U</mark> n	derstand K3 – apply K4- Analyze K5 – evalua	te K6	- Cre	ate			
	_	0.5	AC C						
UNIT	TI State Sta		Introduction to Learning			1	2		
Algor	rithmic models	of lea <mark>rning,</mark>	Learning classifiers, functions, relations, gramma	irs, pro	obabi	listic			
mode	ls, value <mark>functio</mark> vinimum descriv	ons, behavio	rs and programs for experience. Bayesian, maxin	num se	ome p	oster	ior,		
UNIT II Learning Models							2		
Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.									
UNI	Г III	12.20	Computational Learning	Æ	÷.,	1	2		
Comp Occar Analy	outational Learn m learning, acc ysis, feature selo	ning theory, curacy and c ection and vi	mistake bound analysis, sample complexity anal confidence boosting, Dimensionality reduction: isualization.	lysis, Princi	VC d pal c	imens ompo	sion, nent		
UNI	ГІ	¹⁵ 86	Unsupervised Learning	-		1	2		
Unsuj distril know	pervised Learn butional cluster ledge.	ing: Cluste ing, Reinfor	ring, mixture models, k-means clustering, hie reement learning; Learning from heterogeneous,	erarch distri	ical d	cluste , data	ring, and		

UNII	V Learning Applications	12					
Selected applications in data mining, automated knowledge acquisition, pattern recognition, program							
synthesis, text and language processing, internet-based information systems, human computer							
interac	interaction, semantic web, and bioinformatics and computational biology.						
	Total Lecture Hours 60						
	Hou	rs					
	Text Book(s)						
1	Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.						
	ReferenceBook(s)						
1	Russel, S. And Norving, P. (2003). Artificial Intelligence: A Modern Approach. 2 nd Editio	n,					
	New York: Prentice-Hall.						
2	Baldi, P., Frasconi, P., Smyth, P. (2002). Bioinformatics: A Machine Learning						
	Approach. Cambridge, MA: MIT Press.						
3	Baldi, P., Frasconi, P., Smyth, P. (2003). Modeling the Internet and the Web – Probabilistic						
4	Di la CM Na ING I Gradienti Viene Vi						
4	Bishop, C.M. Neural Networks for pattern recognition. New York: Oxford University press (1995).						
5	Hastie, T., Tibshirani, R., and Friedman, J. (2001). The elements of Statistical Learning –						
	Data mining, Inference, and Prediction, Berlin: Springer-Verlag.						
6	Cohen, P.R. (1995) Empirical Methods in Artificial Intelligence. Cambridge, MA: MIT Press.						
7	Cowell, R.G., Dawid, A.P., Lauritzen, S.L., and Spiegelhalter. D.J. (1999). Graphical						
	Models and Expert Systems. Berlin: Springer.						
	Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc)	1					
1	https://onlinecourses.swayam2.ac.in/aic20_sp06/preview	1					
2	https:// <mark>onlinecour</mark> ses.swayam2.ac.in/arp19_ap79/preview						
Cours	Designed by :	18					
		1.1					

1000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	Μ	L	L	L	L	L	L	L	L	L
CO2	Μ	L	L	L	L	L	L	L	L	L
CO3	S	Μ	L	L	L	L	L	L	L	L
CO4	S	S	Μ	L	L	L	L	L	L	L
*S-Strong; M-Medium; L-Low										

