

Department of Computer Science & Engineering (Data Science)

Academic Year 2024-25



5th and 6th Semester Scheme & Syllabus BATCH: 2022-26 CREDITS: 160

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NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

• To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

• To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.

• To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities

QUALITY POLICY

To provide educational services of the highest quality both curricular and co- curricular to enable students integrate skills and serve the industry and society equally well at global level.

VALUES

- Academic Freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

PROGRAM OUTCOMES (POs)

PO1 Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex Computer Science and Data Science engineering problems.

PO2 Problem Analysis: Identify, formulate, review research literature and analyze complex Computer Science and Data Science engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3 Design / Development of Solutions: Design solutions for complex Computer Science and Data Science engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4 Conduct Investigations of Complex Problems: Use researchbased knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex Computer Science and Data Science engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice in Computer Science and Data Science Engineering.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in Computer Science and Data Science engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and Team Work: Function effectively as an individual and as a member or leader to diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex Computer Science and Data Science engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective report and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

DSU1	Apply Computer Science and Data Science principles,
1301	and use knowledge in various domains to identify research
	gaps and hence provide solution to new ideas and innovations.
PSO2	Collaborate proficiently with experts from diverse fields and actively engage in continuous professional growth in the domain of computing.

NEW HORIZON COLLEGE OF ENGINEERING B. E. in Computer Science and Engineering (Data Science) Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

V Ser	nester												
S.	S. Course and Course		Course Title	BoS	D	Cre istri	edit buti	on	Overall Crodits	Contact	Marks		
NU.	L L	Joue			L	Т	Р	S	creuits	nours	CIE	Marks SEE 50 50 50 50 50 50 50 50 50 50 50 50 50 50	Total
1	HSMS	22CDS51	Software Engineering and Project Management	DS	3	0	0	0	3	3	50	50	100
2	PCC	22CDS52	Design and Analysis of Algorithms	DS	3	0	0	0	3	3	50	50	100
3	PCCL	22CDL52	Design and Analysis of Algorithms Lab	DS	0	0	1	0	1	2	50	50	100
4	PCC	22CDS53	Fundamentals of Data Science	DS	3	0	0	0	3	3	50	50	100
5	PCCL	22CDL53	Fundamentals of Data Science Lab	DS	0	0	1	0	1	2	50	50	100
6	PEC	22CDS54X	Professional Elective Course-I	DS	3	0	0	0	3	3	50	50	100
7	AEC	22RMK55	Research Methodology and IPR	DS	1	1	0	0	2	3	50	50	100
8	AEC	22SDK56	Critical and Creative Thinking Skills	DS	0	0	1	0	1	2	50		50
9	UHV	22ESK57	Environmental Studies	Any Dept.	1	0	0	0	1	1	50	50	100
10	PROJ	22CDS58	Mini Project -II	DS	0	0	1	0	1	0	50	50	100
		22NSS50	National Service Scheme (NSS)	NSS coordinator									
11	NCMC	22PED50	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	0	0	0	2	50		50
		22YOG50	Yoga	Yoga Teacher									
			Total						19	24	550	450	1000

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work **L**: Lecture, **T**: Tutorial, **P**: Practical **S**: **SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation

Professional Elective Course-I										
22CDS541	Data Engineering	22CDS544	Automata Theory and Computability							
22CDS542	Principles of Cloud Computing	22CDS545	Advanced Java							
22CDS543	Business Analytics									

22XXX51 (HSMS) - This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management. **For IT allied Branches:** Software Product Management

For Core Branches: Engineering Economics and Management / Industrial Management and Entrepreneurship

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

(i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)

(ii) A group of 2-4 if mini project work is single discipline (applicable to all Core Branches)

(iii) A group of 2 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

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

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition:	03-Credits courses are to be designed for 40 hours in Teaching-
1-hour Lecture (L) per week=1Credit	Learning Session
2-hoursTutorial(T) per week=1Credit	02- Credits courses are to be designed for 25 hours of Teaching-
2-hours Practical / Drawing (P) per week=1Credit	Learning Session
2-hous Self Study for Skill Development (SDA) per week =	01-Credit courses are to be designed for 15 hours of Teaching-Learning
1 Credit	Sessions

NEW HORIZON COLLEGE OF ENGINEERING B. E. in Computer Science and Engineering (Data Science) Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

VI Se	emester												
S.	S. Course and Course		Course Title	BoS	Credit Distribution				Overall	Contact	Marks		
NO.		Loue			L	Т	Р	S	creatts	Hours	rs <u>CIE SEE T</u> 50 50 50	Total	
1	PCC	22CDS61	Artificial Intelligence & Machine Learning	DS	3	0	0	0	3	3	50	50	100
2	PCCL	22CDL61	Artificial Intelligence & Machine Learning Lab	DS	0	0	1	0	1	2	50	50	100
3	PCC	22CDS62	Computer Networks	DS	3	0	0	0	3	3	50	50	100
4	PCCL	22CDL62	Computer Networks Lab	DS	0	0	1	0	1	2	50	50	100
5	PCC	22CDS63	Essentials of Cyber Security	DS	2	1	0	0	3	4	50	50	100
6	PEC	22CDS64X	Professional Elective Course-II	DS	3	0	0	0	3	3	50	50	100
7	PROJ	22CDS65	Project Phase - I	DS	0	0	2	0	2	0	50	50	100
8	AEC	22SDK66	Problem Solving Skills	DS	0	0	1	0	1	2	50		50
9	AEC	22CDS67X	Ability Enhancement Course – V	DS	0	0	1	0	1	2	50	50	50
10	OEC	23NHOP6XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	100
		22NSS60	National Service Scheme NSS (NSS) coordinator										
11	NCMC	22PED60	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	0	0	0	2	50		50
		22Y0G60	Yoga	Yoga Teacher									
			Total						21	26	550	450	1000
E	PCC: Profe nhancemen Pract	essional Core Co nt Course, PEC : ical S: SDA : Self	ourse, PCCL : Professional Core Professional Elective Course, C Study for Skill Development, C	Course laborat DEC: Open Elec IE: Continuous	tory, tive (NCM Cours rnal F	C: No e, PR Evalu	n-Ci OJ: atio	redit Manc Project wo n. SEE :Sen	latory Cour ork , L: Lect nester End	rse, AE ure, T : Evalua	C : Abil Tutori ation.	ity al, P :

Professional Elective Course-II											
22CDS641	Scalable Data Science	22CDS644	Advanced DBMS								
22CDS642	Predictive Analytics	22CDS645	Software Testing and Automation								
22CDS643	Optimization Techniques										

Ability Enhancement Course – V											
22CDS671	Fundamentals of Mobile Application Development	22CDS673	Applied Data Science with Julia								
22CDS672	Scala Programming	22CDS674	Advanced Python Programming								

Industrial Open Elective Courses-I:

Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Project Phase-I: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition:	03-Credits courses are to be designed for 40 hours in Teaching-
1-hour Lecture (L) per week=1Credit	Learning Session
2-hoursTutorial(T) per week=1Credit	02- Credits courses are to be designed for 25 hours of Teaching-
2-hours Practical / Drawing (P) per week=1Credit	Learning Session
2-hous Self Study for Skill Development (SDA) per	01-Credit courses are to be designed for 15 hours of Teaching-Learning
week = 1 Credit	Sessions

V Semester

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

			so	FTWA	RE ENG	INEERI	NG AND	PROJE	CT MA	NAGEME	NT			
Course Code	22CDS	51							CIE M	larks		50		
L:T:P:S	3:0:0:0								SEE N	Marks		50		
Hrs / Week	3								Tota	l Marks		100)	
Credits	03								Exan	1 Hours		03		
Course outcomes:														
At the end of the co	urse, the	studer	nt will	be able	e to:									
22CDS51.1	Underst	Understand the Software Engineering basics and Software Process Models.												
22CDS51.2	Identify	dentify the core Requirements and Design principles applicable in the Projects.												
22CDS51.3	Demons	strate	Codin	g and T	esting p	orinciple	es applio	cable in	the Pro	jects.				
22CDS51.4	Analyze	e the m	netrics	in pro	cess and	l projec	t domai	ns, focu	sing on	software	measurer	nent and s	software	quality
22CDS51.5	Examin	e the r	isk m	anagem	ent tec	hniques	to effec	tively a	ddress	project ris	sks.			
22CDS51.6	Interpr	et proj	ect sc	hedulin	ıg, track	ing tecl	nniques	and cos	t mana	gement pr	actices.			
Mapping of Course	e Outcom	es to l	Progr	am Ou	tcomes	and Pr	ogram	Specific	: Outco	mes:				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
22CDS51.1	1	1	1	-	-	-	-	2	-	-	-	2	2	2
22CDS51.2	1	1	1	-	-	-	-	-	-	-	-	2	2	2
22CDS51.3	2	2	2	-	-	-	-	2	-	-	-	2	2	2
22CDS51.4	2	2	2	-	-	-	-	2	-	2	-	2	2	2
22CDS51.5	-	-	-	-	-	-	-	2	-	2	-	2	2	2
22CDS51.6	2	2	2	-	-	-	-	-	-	2	-	2	2	2
MODULE-1					Introd	uction					22CDS	51.1	81	Hours
ethics, Software Dev Incremental model,	velopmen Spiral mo	ering, it Life odel, V	Defin Cycle Z-Mod	(SDLC), el, Agile	e Develc	of SDL opment,	C, Activi Princip	ties in e les of Ag	ach pha gile, Scr	ase, Softw rum frame	ai perspec are Proce work, Ext	ss Models reme Pro	ware eng , Waterfa grammin	ll model, g (XP).
Case Study	A small software development company specializing in mobile application development, Over the past year, faced challenges with project delays, scope creep, and customer satisfaction due to inefficient project management practices. The company is considering adopting a structured software process model to streamline their development processes and improve project outcomes. Recommend the most suitable software process model based on the company's current challenges and future													
Text Book	Text Bo	ok 1: (Chapte	er 1, 2, 3	3.1-3.3.									
MODULE-2			Requ	ireme	nts Eng	ineerin	g & Des	sign			22CDS	51.2	8	Hours
Requirements Engin functional Requiren Patterns, Introducti	neering P nents, Sys on to des	rocess stem M ign pa	s, Elici Iodels tterns	tation t s, Conte s, Creati	echniqu xt mode onal, St	ies, Req els, Beha ructura	uiremer avioural l, and Be	nts analy models ehaviou	ysis, Re , Use Ca ral patt	quiremen ase Model erns.	ts validati ing., Archi	ion, Funct itectural I	ional and Design, De	Non- esign
Text Book	Text Bo	ok 2:	Chapt	er 5.1-5	5.3,6.1-6	ó.5								
MODULE-3			Softw	are Imj	plemen	tation	and Tes	sting			22CDS	51.3	8	Hours
Software Coding - P code Testing ,Unit t testing , White box t	Programm esting an testing, te	ning pr d Cod est Cas	rincipl e Insp e Desi	es and ection gn.	coding ,Testing	guidelir g concep	nes ,met ots and f	hod of in testing j	ncreme process	ntally dev , Design c	veloping c of Test cas	ode , man se and Te:	aging the st plan , I	evolving 3lack-box
Case Study	Examir behavio	ie the our.	matr	ix mult	tiplicati	on prog	gram to	identif	y key	functional	lities, inp	uts, outp	uts, and	expected
Text Book	Text Bo	ok 1: (Chapte	er 7,8										
MODULE-4			Pr	oject M	lanage	ment &	Metric	S			22CDS	51.4	8	Hours
Project Managemer	nt Basics,	the M	anage	ement S	pectrur	n, Peop	le, Proce	ess, Pro	duct, Pi	roject, Pro	oject Plan	ning, and	Work Br	eakdown
Structure (WBS), M	letrics in ftware pr	the P	roces	s and F	Project	Domain	s, Softw	vare Me	asurem	ient, Metr	rics for So	oftware Q	uality, In	tegrating
Text Book	Tevt Ro	ok 2.2	4 7 4 1	-24.5	25 1-25	4								
I CAL DOUR	LICAL DU	JI 2.2	ר בי בו	<u> </u>	-0.1-40	. 1								

MODULE-5	
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Risk Management, Risk identification, Risk analysis, Risk mitigation strategies, Communication Management, Stakeholder communication, Information distribution, Performance reporting.

Project Scheduling and Tracking, Gantt charts, Critical Path Method (CPM), PERT charts, Cost Management, Budgeting, Cost estimation techniques, Earned value management, Quality Management, Quality planning, Quality assurance, Quality control, Project Closure, Post-project evaluation.

Text Book Text Book 2 – Chapter 27.1-27.5 ,28.1-28.4

CIE Assessment Pattern (50 Marks – Theory) –											
		N	larks Distributio	n							
R	BT Levels	Test (s)	MCQ's								
		25	15	10							
L1	Remember	5	-	5							
L2	Understand	5	-	5							
L3	Apply	5	7.5	-							
L4	Analyze	5	7.5	-							
L5	Evaluate	5	-	-							
L6	Create	-	-	-							

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

TEXT BOOK(S):

1. Roger S Pressman and Bruce Maxim: Software Engineering-A Practitioner's Approach, Mc-GrawHill, 9th editions, 2020, ISBN: 9781260548006, 1260548007

2.Ian Somerville: Software Engineering, Pearson Education, Tenthedition, 2017, ISBN: 9789332582699, 9332582696

Reference Books:

 Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009, ISBN:9788126523115, 8126523115
 Hans VanVliet: Software Engineering: Principles and Practices, Wiley India, 2018, ISBN: 8126527374, 978-8126527373

3. Richard Fairley: Software Engineering Concepts, McGraw-Hill, 2018, ISBN: 9780074631218, 978-0074631218

Course Code 22CDS52 CIF Marks 50 LTFPS 3:0:0:0 SEE Marks 50 Credits 93 Total Marks 100 Credits 93 Caurse outcomes: 93 03 At the end of the course, the student will be able to: 22CDS52.1 Analyze the algorithmic efficiencies using asymptotic notations for various problems. 22CDS52.2 Demonstrate divide-and-conquer design strategies for solving intricate problems. 22CDS52.4 22CDS52.4 Interpret the P, NP, and NP-complete complexity classes to scrutinize the constraints and boundaries of an algorithm's performance. 22CDS52.5 Apply appropriate algorithm design technique for a given problem. Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes: 22CDS52.1 3 3 - - - 1 3 3 22CDS52.2 3 3 3 - - - 1 1 3 3 22CDS52.1 3 3 3 - - - 1 1 3 3 3 3 3 3 <td< th=""><th></th><th></th><th></th><th></th><th></th><th>DESI</th><th>GN AN</th><th>D ANA</th><th>LYSIS (</th><th>OF ALG</th><th>ORITH</th><th>IMS</th><th></th><th></th><th></th><th></th></td<>						DESI	GN AN	D ANA	LYSIS (OF ALG	ORITH	IMS					
LiT:PES Biolea SEE Marks B0 Merg / Week 3 Total Marks 100 Credits 03 Exam Hours 93 Course outcomesis At the end of the course, the student will be able to: 22CD552.1 Analyze the algorithmic efficiencies using asymptotic notations for various problems. 22CD552.1 Analyze greedy and dynamic programming strategies for solving intricate problems. 22CD552.4 Analyze greedy and dynamic programming strategies for solving intricate problems. 22CD552.4 Apply baptrate algorithm design technique for a given problem. 22CD552.6 Apply appropriate algorithm design technique for a given problem. Magping of Course outcomes to Program Outcomes to Program Specific Outcomes: PO1 PO1 PO2 PO3 PO4 PO5 PO10 PO11 PO12 PS01 PS02 22CD552.2 3 3 3 - - - - 1 3 3 22CD552.2 3 3 3 - - - 1 3 3 3 3 3 3 3 3 3 <td< th=""><th>Course Code</th><th>22CDS</th><th colspan="10">22CDS52</th><th></th><th>50</th><th colspan="3">50</th></td<>	Course Code	22CDS	22CDS52											50	50		
Procedits Joo Course outcomes: At the end of the course, the student will be able to: 22CD552.1 Analyze the algorithmic efficiencies using asymptotic notations for various problems. 22CD552.2 Deemonstrate divide-and-conquer design strategies to evaluate an algorithm's effectiveness in devising a solution. 22CD552.3 Analyze greedy and dynamic programming strategies for solving intricate problems. 22CD552.4 Interpret the P, NP, and NP-complete complexity classes to scrutinize the constraints and boundaries of an algorithm sperformance. 22CD552.4 Apply appropriate algorithm design technique for a given problem. 22CD552.5 Apply appropriate algorithm design technique for a given problem. Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes: 22CD552.1 3 3 - - - 1 3 3 22CD552.1 3 3 3 - - - 1 3 3 22CD552.2 3 3 3 - - - 1 3 3 22CD552.2 3 3 3 - - - 1 3 3 22CD552.5 3 3	L:T:P:S	3:0:0:0)								SEE	Marks		50			
Credits Joans/2010 Exam Hours Joans/2010 Course outcomes: At the end of the course, the student will be able to: 2200552.1 Analyze the algorithmic efficiencies using asymptotic notations for various problems. 2200552.2 Demonstrate divide-and-conquer design strategies to evaluate an algorithm's effectiveness in devising, a solution. 2200552.4 Interpret the P, NP, and NP-complete complexity classes to scrutinize the constraints and boundaries of an algorithm's performance. 2200552.4 Apply bachtracking and branch & bound methods for crafting solutions to real-time problems. 2200552.6 Apply appropriate algorithm design technique for a given problem. Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes: 2200552.1 3 3 - - - 1 3 3 2200552.3 3 3 - - - - 1 3 3 2200552.5 3 3 3 - - - - 1 3 3 2200552.5 3 3 3 - - - 1 3 3 3 3 3	Hrs / Week	3									Tota	l Marks		10	0		
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MODULE-1ALGORITHM FUNDAMENTALS AND BRUTE FORCE TECHNIQUES22CDS52.18 HoursIntroduction: Fundamentals of Algorithms Problem Solving: Important Problem Types; Analysis Framework: Worst-Case, Best-Case, and Average-Case Efficiencies; Asymptotic notations and Basic efficiency classes: Big-Oh notation (0), Omega notation (Ω), Theta notation (Θ), Mathematical analysis for Recursive and Non recursive algorithms. Brute Force Approach: Selection Sort and Bubble Sort; Sequential Search and Brute-Force String MatchingSolve practice problems and exercises to reinforce concepts such as asymptotic notations and mathematical analysis of algorithms.Brute Force Approach: Selection Sort and Bubble Sort; Sequential Search and Brute-Force String MatchingSolve practice problems and exercises to reinforce concepts such as asymptotic notations and mathematical analysis of algorithms.Text BookText Book 1: 1.1.1.2, 2.1 to 2.4, Text Book 2: 1.3MODULE-2ADVANCED SORTING AND SEARCHING TECHNIQUES22CDS52.2Porcease and Conquer: Insertion sort, Depth-First Search and Breadth-First Search, Topological Sorting Transform and Conquer: Balanced Search Trees, Heaps and Heap Sort. Case StudyExplore applications of depth-first search and breadth-first search in graph traversal algorithms, such as finding shortest paths or network analysis. Text BookPtext Book 1: 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.3, 6.4MODULE-3OPTIMIZATION TECHNQUES22CDS52.38 HoursDynamic Programming: Warshall's and Floyd's Algorithms: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-Paths Problem, The Knapsack Problem and Memory Functions. Greedy Approach: Prim's Algorithm, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum s	22CDS52.6		3	3	-	-	-	-	-	-	-	-	-	1	3	3	
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MODULE-2ADVANCED SORTING AND SEARCHING TECHNIQUES22CDS52.28 HoursDivide and Conquer: Merge sort, Quick sort, Binary SearchDecrease and Conquer: Insertion sort, Depth-First Search and Breadth-First Search, Topological SortingTransform and Conquer: Balanced Search Trees, Heaps and Heap Sort.Case StudyExplore applications of depth-first search and breadth-first search in graph traversal algorithms, such as finding shortest paths or network analysis.Text BookText Book 1: 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.3, 6.4MODULE-3OPTIMIZATION TECHNIQUESDynamic Programming: Warshall's and Floyd's Algorithms: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-PathsProblem, The Knapsack Problem and Memory Functions.Greedy Approach: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks.Text BookText Book 1: 8.2, 8.4, 9.1, 9.2, 9.3MODULE-4ALGORITHMIC COMPLEXITY AND NP PROBLEMSLimitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, and Searching a sorted array to gain insights into their efficiency and performance.Text BookText Book 1: 11.1, 11.2, 11.3	Text Book				Text	Book 1	: 1.1,1.2	2, 2.1 to	o 2.4 , T	'ext Boo	ok 2: 1.	3					
Divide and Conquer: Merge sort, Quick sort, Binary Search Decrease and Conquer: Insertion sort, Depth-First Search and Breadth-First Search, Topological Sorting Transform and Conquer: Balanced Search Trees, Heaps and Heap Sort. Case Study Explore applications of depth-first search and breadth-first search in graph traversal algorithms, such as finding shortest paths or network analysis. Text Book Text Book 1: 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.3, 6.4 MODULE-3 OPTIMIZATION TECHNIQUES 22CDS52.3 8 Hours Problem, The Knapsack Problem and Memory Functions. Greedy Approach: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm For the All-Pairs Shortest-Paths Case Study Explore applications of Prim's, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks. a finding minimum spanning trees or shortest paths in transportation or communication networks. Text Book Text Book 1: 8.2, 8.4, 9.1, 9.2, 9.3 8 Hours MODULE-4 ALGORITHMIC COMPLEXITY AND NP PROBLEMS 22CDS52.4 8 Hours Imitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Sorting algorithms, Problems. 8 1 Self-study Study decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performa	MODULE-2	AI	DVAN	CED SC	ORTIN	IG AN) SEAR	CHING	TECHI	NIQUES	S		22CDS	52.2	8	Hours	
Transform and Conquer: Balanced Search Trees, Heaps and Heap Sort. Case Study Explore applications of depth-first search and breadth-first search in graph traversal algorithms, such as finding shortest paths or network analysis. Text Book Text Book 1: 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.3, 6.4 MODULE-3 OPTIMIZATION TECHNIQUES Dynamic Programming: Warshall's and Floyd's Algorithms: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-Paths Problem, The Knapsack Problem and Memory Functions. Greedy Approach: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm Case Study Explore applications of Prim's, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks. Text Book Text Book 1: 8.2, 8.4, 9.1, 9.2, 9.3 MODULE-4 ALGORITHMIC COMPLEXITY AND NP PROBLEMS 22CDS52.4 8 Hours Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Sorting algorithms, Problems. Problems, NP-Complete Problems. Self-study Study decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance. Fext Book 1: 11.1, 11.2, 11.3	Divide and Conqu Decrease and Con	1er: Merge nquer: Inse	e sort, (ertion	Quick s sort, D	ort, B epth-	inary S First S	Search earch a	nd Brea	adth-Fi	rst Sea	rch, To	pologica	l Sorting				
Case StudyExplore applications of depth-infst search and breadth-infst search in graph traversal algorithms, such as finding shortest paths or network analysis.Text BookText Book 1: 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.3, 6.4MODULE-3OPTIMIZATION TECHNIQUES22CDS52.38 HoursDynamic Programming: Warshall's and Floyd's Algorithms: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-Paths Problem, The Knapsack Problem and Memory Functions. Greedy Approach: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's AlgorithmCase StudyExplore applications of Prim's, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks.8Text BookText Book 1: 8.2, 8.4, 9.1, 9.2, 9.388 </td <td>Transform and Co</td> <td>onquer: Ba</td> <td>alance</td> <td>d Sear</td> <td>ch Tro</td> <td>ees, He</td> <td>aps and</td> <td>1 Heap</td> <td>Sort.</td> <td> 1 1</td> <td></td> <td>C</td> <td></td> <td></td> <td></td> <td></td>	Transform and Co	onquer: Ba	alance	d Sear	ch Tro	ees, He	aps and	1 Heap	Sort.	1 1		C					
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Dynamic Programming: Warshall's and Floyd's Algorithms: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-Paths Problem, The Knapsack Problem and Memory Functions. Greedy Approach: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's AlgorithmCase StudyExplore applications of Prim's, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks.Text BookText Book 1: 8.2, 8.4, 9.1, 9.2, 9.3MODULE-4ALGORITHMIC COMPLEXITY AND NP PROBLEMS22CDS52.4Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Searching a Sorted Array; P, NP, and NP-complete Problems: P and NP Problems, NP-Complete Problems.Self-studyStudy decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance.Text BookText Book 1: 11.1, 11.2, 11.3	MODULE-3	01	PTIMI	ZATIO	N TE	CHNIO	UES	1, 012, 0	510, 010				22CDS	52.3	8	Hours	
Greedy Approach: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's AlgorithmCase StudyExplore applications of Prim's, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks.Text BookText Book 1: 8.2, 8.4, 9.1, 9.2, 9.3MODULE-4ALGORITHMIC COMPLEXITY AND NP PROBLEMS22CDS52.4Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Searching a Sorted Array; P, NP, and NP-complete Problems: P and NP Problems, NP-Complete Problems.Self-studyStudy decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance.Text BookText Book 1: 11.1, 11.2, 11.3	Dynamic Program Problem, The Knap	mic Programming: Warshall's and Floyd's Algorithms: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest-Palem, The Knapsack Problem and Memory Functions.										est-Paths					
Case StudyExplore applications of Prim's, Kruskal's, and Dijkstra's algorithms in network optimization, such as finding minimum spanning trees or shortest paths in transportation or communication networks.Text BookText Book 1: 8.2, 8.4, 9.1, 9.2, 9.3MODULE-4ALGORITHMIC COMPLEXITY AND NP PROBLEMS22CDS52.4Limitations of Algorithm Power:Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Searching a Sorted Array; P, NP, and NP-complete Problems: P and NP Problems, NP-Complete Problems.Self-studyStudy decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance.Text BookText Book 1: 11.1, 11.2, 11.3	Greedy Approach	: Prim's Al	lgorith	ım, Kru	skal'	s Algor	ithm, D	ijkstra'	s Algor	ithm							
Text BookText Book 1: 8.2, 8.4, 9.1, 9.2, 9.3MODULE-4ALGORITHMIC COMPLEXITY AND NP PROBLEMS22CDS52.48 HoursLimitations of Algorithm Power:Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Searching a Sorted Array; P, NP, and NP-complete Problems: P and NP Problems, NP-Complete Problems.Self-studyStudy decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance.Text BookText Book 1: 11.1, 11.2, 11.3	Case Study	Ex mi	xplore a inimur	applica m span	tions ning	s of Prin trees o	n's, Kru r shorte	skal's, a est path	and Dij 1s in tra	kstra's ansport	algorit ation c	hms in ne or commu	etwork op unication	otimizati network	on, such a s.	as finding	
MODULE-4ALGORITHMIC COMPLEXITY AND NP PROBLEMS22CDS52.48 HoursLimitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Searching a Sorted Array; P, NP, and NP-complete Problems: P and NP Problems, NP-Complete Problems.22CDS52.48 HoursSelf-studyStudy decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance.Fext Book 1: 11.1, 11.2, 11.3	Text Book	Те	ext Boc	ok 1: 8.	2, 8.4	<u>, 9.1, 9.</u>	2, 9.3										
Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees: Decision Trees for Sorting Algorithms, Decision Trees for Searching a Sorted Array; P, NP, and NP-complete Problems: P and NP Problems, NP-Complete Problems. Self-study Study decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance. Text Book Text Book 1: 11.1, 11.2, 11.3	MODULE-4	AI	LGORI	THMI	C CON	1PLEX	ITY AN	D NP P	ROBLI	EMS			22CDS	552.4	8	Hours	
Self-studyStudy decision trees for sorting algorithms and searching a sorted array to gain insights into their efficiency and performance.Text BookText Book 1: 11.1, 11.2, 11.3	Limitations of Alg for Searching a Sor	gorithm P rted Array;	ower: ; <i>P, NP,</i>	Lower , and N	r-Bou P-cor	nd Arg nplete	uments Probler	s, Decis ns: <i>P</i> ai	ion Tre nd <i>NP</i> F	ees: Dee Problen	cision ' ns, NP-	Frees for Complete	Sorting A Problem	Algorithr 1s.	ns, Decis	ion Trees	
Text Book Text Book 1: 11.1, 11.2, 11.3	Self-study	St	udy de ficienc	ecision y and 1	trees	for sor	ting alg	gorithn	ns and s	searchi	ng a so	rted arra	y to gain	insights	into thei	r	
	Text Book	Те	ext Boc	ok 1: 12	l.1, 1	1.2, 11.	3										

MOD	ULE-5	ADVANCED P	ROBLEM-SOLVING TE	CHNIQUES		22CDS52.5,	8 Hours
						22CDS52.6	
Copii	ng with the Limit	ations of Algori	thm Power: Backtrac	king: n-Queer	ns Problem, H	Iamiltonian Circuit Problem	n, Subset-Sum
Probl	em. Branch-and-Bo	und: Assignmen	t Problem, Knapsack Pr	oblem, Trave	ling Salesman	Problem.	
Case	Study	Investigate re	al-world examples of	the subset-su	m problem u	sed in resource allocation	tasks, such as
		budget planni	ng or inventory manage	ement.	-		
Text	Book	Text Book 1: 1	2.1, 12.2				
CIE A	ssessment Patter	n (50 Marks - T	heory)				
			Marks Distribution				
	RBT Levels	Test (s)	Qualitative Assessment (s)	MCQ's			
		25	15	10			
L1	Remember	5	-	5			
L2	Understand	5	-	5			
L3	Apply	5	7.5	-			
L4	Analyze	5	7.5	-			
L5	Evaluate	5	-	-			
L6	Create	-	-	-			

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

- 1. Anany Levitin , "Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012, ISBN-13, 978-9332585485.
- 2. Thomas H Cormen, Charles E Leiserson, Ronald R Rivest & Clifford Stein, "Introduction to Algorithms", fourth edition, 2022, MIT Press, ISBN:9780262367509.

Reference Books:

- 1. Anuradha A. Puntambekar, "Analysis and Design of Algorithms", 2020, Technical Publications, ISBN: 9789333223867.
- 2. Design and Analysis of Algorithms, S. Sridhar, 2014, Oxford University Press, ISBN: 9780198093695.

Web links and Video Lectures (e-Resources):

- <u>https://www.javatpoint.com/daa-rabin-karp-algorithm</u>
- https://www.javatpoint.com/daa-knuth-morris-pratt-algorithm
- <u>https://www.javatpoint.com/greedy-algorithms</u>
- https://www.javatpoint.com/dynamic-programming
- https://www.javatpoint.com/backtracking-introduction

- Group implementation of merge sort, quick sort, and binary search.
 - Solve decision tree problems for sorting and searching.

				D	ESIGN A	ND AN	ALYSIS	OF ALG	ORITH	MS LAB				
Course Code	2	2CDL52	2						CIE M	larks		50		
L:T:P:S	0:0:1:0 SEE Marks											50		
Hrs / Week	3								Total	Marks		100		
Credits	0	1							Exam	Hours		03		
Course outcom	es:													
At the end of th	e cour	se, the s	studen	t will be	e able to):								
22CDL52.1	Analyze sorting and searching algorithms with graph traversal.													
22CDL52.2	Demonstrate graph algorithms Floyd Warshall's, Prim's, Kruskal's, and Dijkstr related problems												ns for var	rious graph-
22CDL52.3	In	npleme	nt con	nbinato	rial opti	mizatio	n proble	ems for l	oacktra	cking.				
22CDL52.4	A) Sa	pply dy alesmar	namic 1 prob	progra lem	mming	by imple	ementin	g solutio	ons for t	the 0/1 Kr	iapsack pi	oblem an	d the Tra	iveling
Mapping of Cou	rse Ou	itcome	s to P	rogram	Outcor	nes and	l Progra	am Spe	cific Ou	tcomes:				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
22CDL52.1	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDL52.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDL52.3	3	3	3	3	3	-	-	-	-	-	-	2	3	3
22CDL52.4	3	3	3	3	3	-	-	-	-	-	-	2	3	3
Fyn No /														
Pgm. No.						List of I	Program	ns				Hour	'S	COs
						Prer	requisit	e Progr	ams					
	Imple	ement a	nd ana	alyze so	rting an	d sortin	ıg algori	thms.				3		NA
							PAR	T-A						
1	Given • Comp	a list o Seleo Bubl are the	f integ ction S ble Son perfo	gers per Sort algo rt algori rmance • Nur	form the orithm. ithm. of both mber of	e sorting algorith compar	g of elen nms in te risons m	nents in erms of: ade by e	ascend each alg	orithm.	using :	3	2:	2CDL52.1
2	<u>C'</u>	11. 1	<u> </u>	• Nui	mber of	swaps p	berform	ed by ea	ch algo	rithm.		<u> </u>		
2	eleme	a list ents in a Merg Anal com	of inte iscend ge Sor yze t pariso	egers re ling ord t algorit he perf ons mad	epresen er using thm. formanc e and th	ting shi g: the of the time t	pment I ne algor zaken to	rithm ir sort the	gers pe n terms e list.	of the	number o	or 3	2.	2CDL52.1
3	Consi Quick IDs.	der a re Sort al	ecord gorith	with tup Im to so	ole cont ort these	aining e record	mploye s in asce	e ID, nai ending o	ne, and rder ba	age, impl sed on the	lement th e employe	e 3	2	2CDL52.1
4	IDS. Implement the following graph traversal techniques using decrease and conquer 3 approach: a. Breadth First Search method. 2 b. Depth First Search method. 2												2	2CDL52.1
5	Imple pairs the in	ement th of vertion plement	he floy ices us nted a	d_wars sing the lgorithr	shall() f Floyd-V n in rela	function Warshal ation to	to com ll algorit the num	pute the thm, An iber of v	e shorte alyze th ertices	est paths h e time co and edges	oetween a mplexity o	ll 3 of	2	2CDL52.2
6	Devel using efficie	op a fui Prim's ently, su	nction s algo ich as	prim_n prithm, adjacen	nst(grap Ensure Icy lists	oh) that e the a or matr	comput algorithi ices.	es the M m hanc	linimun lles gra	n Cost Spa aph repro	nning Tre esentation	e 3 Is	2	2CDL52.2
							PAR	T-B						
7	Imple given	ement a connec	nd ana ted ur	alyze Kr ndirecte	uskal`s d graph	algorith	m and f	ind mini	mum c	ost spanni	ng tree of	a 3	22	2CDL52.2

	8	Implement source.	and analyze	Dijkstra's	algorithm to	find the shortest path from a given	3	22CDL52.2				
	9	Implement solution by	N-Queens p comparing r	oroblem us esults with	ing backtrack known solutio	king, Verify the correctness of the cons for different values of N.	3	22CDL52.3				
	10 Implement sum of subset problem using backtracking. 3 22CDL52.3 11 Implement 0 /1 Knoncools problem 2 22CDL52.4											
	11	3	22CDL52.4									
	12	Implement	travelling sal	esman pro	blem using dy	namic programming.	3	22CDL52.4				
					PART	'-C						
				Beyon	d Syllabus Vi	rtual Lab Content						
•	https://o	ds2-iiith.vla	bs.ac.in/List	<u>%20of%20</u>	experiments.h	<u>itml</u>						
•	https://d	ls2-iiith.vlat	os.ac.in/exp/	red-black-	ree/index.htm	<u>nl</u>						
			(To be do	one during	g Lab but not	to be included for CIE or SEE)						
CIE A	ssessment	Pattern (50	Marks – La	b)								
	DDTIou	alc	Test (s)	Weekly A	Assessment							
	$\frac{20}{30}$											
L1												
L2	Understa	ınd	-		-							
L3	Apply		10		10							
L4	Analyze		5		10							
L5	Evaluate		5		10							
L6	Create		-		-							
SEE /	Assessment	Pattern (50) Marks – La	b)								
	DDTLow		Exam M	Iarks								
	KDI Leve	215	Distributi	on (50)								
L1	Remembe	er	-									
L2	Understa	nd	-									
L3	Apply		20)								
L4	Analyze		20)								
L5	Evaluate		10)								
L6	Create		-]							
Sugg	ested Learn	ing Resour	ces:									
Refe	rence Books	5:										
1	l. Anany Le	vitin, "Intro	duction to th	e Design &	Analysis of A	gorithms", Second Edition, 2017, Pear	rson Educa	tion, ISBN: 978-				

 Analy Levian, Infroduction to the Design & Analysis of Algorithms, Second Edition, 2017, Fearson E 9332585485.
 Design and Analysis of Algorithms, S. Sridhar, 2014, Oxford University Press, ISBN: 9780198093695

					FUND	DAMEN	TALS	OF DA	TA SCI	ENCE					
Course Code	22CD	S 53							CIE	Marks		5	50		
L:T:P:S	3:0:0:	:0							SEE	Marks		5	50		
Hrs / Week	3								Tota	al Marks		1	00		
Credits	03								Exa	m Hours		0	3		
Course outcomes:															
At the end of the course,	the stu	udent	will	be able	e to:										
22CDS53.1	Under	rstand	d the j	probał	oility, S	tatistic	s and I	Linear	algebra	a concep	ts essent	ial for da	ata scien	ce.	
22CDS53.2	Apply	oply sampling and dimensionality reduction techniques to enhance data analysis and modeling													
22CDS53.3	Analy	nalyze linear regression and multiple linear regression for model building and prediction.													
22CDS53.4	Demo	emonstrate Classification & Clustering algorithms with respect to theoretical foundations, practical													
	applications across diverse datasets.														
22CDS53.5	Evaluate the performance metrics associated with various models.														
22CDS53.6	Understand the optimization techniques used to enhance computational efficiency in data-driven decision-making processes.														
Mapping of Course Outc	omes	to Pr	ograi	n Out	comes	and P	rograr	n Spec	ific Ou	tcomes					
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2	
22CDS53.1	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS53.2	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS53.3	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS53.4	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS53.5	3	3	3	3	-	-	1	-	-	-	-	2	3	3	
22CDS53.6	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
MODULE-1			FOU	NDAT	IONS ()F DAT	ASCIE	ENCE			22CD	S53.1		8 Hours	
distribution, Confidence i	nterva	l for p	opula	ation n	nean a	nd prop	portion	n, Hypo	othesis	Testing	and the p	ower of	Hypoth	esis Testing.	
Case Study			Tovt	Book	$\frac{1}{1}$		$\frac{1}{5161}$	Tovt	Book 2	\cdot 1 1 1 2	1 2	pany.			
MODIILE-2			Тел	DOUR	PRFP	ROCF	SING	, ICAU	DOOK 2	. 1.1,1.2,	22CD	\$53.2		8 Hours	
Types of Data Sampling	Theor	v Sa	mplin	g Tec	nique	s Corr	elation	ı Feat	ure Se	lection I	Dimensio	nality R	eduction	n Techniques	
Projections, Eigen Value I	Decom	positi	on, Pi	rincipa	l Com	ponent	Analys	sis (PC	A).		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	financy i	cuuctio	reeninquesi	
Self-study	Exper	imen	t with	n Pytho	on libra	aries lik	ke sciki	it-learr	n and p	andas th	at offer f	unctiona	alities for	r data	
	analys	sis an	d dim	ension	nality r	eductio	on tech	iniques	S.						
Text Book	Text E	Book 1	1: 4.1,	4.3,4.4	4.5,8.	1,10.7,	Text B	ook 2:	3.4,3.5		2200	050.0		0.11.	
MODULE-3				LIN	EAKK	EGRES	SIUN				22CD 22CD	S53.5		8 Hours	
Simple Linear Regression	- Steps	in bu	ilding	g a regi	ession	model	, Mode	l diagn	ostics,	Multiple	Linear R	egressic	n Devel	oping Multiple	
Linear Regression, Co line	earity,	Resid	ual A	nalysis	s, Deteo	cting In	fluenc	ers.		_		-			
Self-study	In a so	cenari	io wh	ere yo	u are b	uilding	g a moo	lel to p	redict	student l	oan repa	yment,	what po	tential	
Text Book	Text E	Book (1:9.1	. 9.2. 9	7.9.8.9	.9.9.10	.10.1.	Text Bo	rata and r	1.1.11.2.	12.1. Tex	kt Book 2	2: 8.3.1.8	3.3.2	
MODULE-4	MODULE-4 CLASSIFICATION 22CDS53.4 8 Hours														
	22CDS53.5														
Classification Algorithms Hyper parameter tuning.	orithms: Logistic Regression, Regularization techniques, Naïve Bayes, K- Nearest Neighbor, Ensemble methods,														
Text Book	Text E	Book (1: 14.	1 to 14	:.6										
MODULE-5			CLUS	STERI	NG ANI	D OPTI	MIZA	ΓΙΟΝ		220	CDS53.5	, 22CDS	53.6	8 Hours	
Clustering techniques- H	ierarcl	hical	Clust	ering,	Single	– link,	Comp	olete li	nkage,	and Clu	stering a	algorithr	ns-K me	ans, DB Scan,	
Jaccard Coefficient, Elbow	v techn	ique.	Optir	nizatic	n, Opt	imizati	on tecl	nnique	s for D	ata Scien	ce.				
Text Book	Text E	Book 2	1: 14.	1 to 14	:.6										
CIE Assessment Pattern	(50 M	larks	– Th	eory) ·	-										

		Ма	arks Distributi	on					
]	RBT Levels	Test (s)	Qualitative Assessment (s)	MCQ's					
		25	15	10					
L1	Remember	5	-	5					
L2	Understand	5	-	5					
L3	Apply	5	7.5	-					
L4	Analyze	5	7.5	-					
L5	Evaluate	5	-	-					
L6	Create	-	-	-					
SEE	Assessment P	attern (50	Marks - Theo	rv)					
]	RBT Levels	Exam M Distribut	Marks ion (50)						
L1	Remember	10)						
L2	Understand	10)						
L3	Apply	10)						
L4	Analyze	10)						
L5	Evaluate	10)						
L6	Create								
 Suggested Learning Resources: Text Books: U Dinesh Kumar, "Business Analytics : The Science of Data Driven decision making", First Edition, Wiley Publishers, 2017, ISBN-13, 978-8126568772. Jiawei Han , Micheline Kamber , Jian Pei Professor, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann Series, 2011, ISBN-13, 978-9380931913. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning using Python", First Edition, Wiley Publishers, 2019, ISBN-13 978-8126579907. Gilbert Strang, "Introduction to Linear Algebra, Fifth Edition", Wellesley-Cambridge Press and SIAM, 2016, ISBN : 978-09802327-7-6. Reference Books: Bruce M King, Edward W Minium , "Statistical Reasoning in the Behavioral Sciences", 5th Edition, Wiley Publishers, 2018,ISBN-1119379733. Douglas C. Montgomery, George C. Runger, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley Publishers, 2016, ISBN-13, 978-8126562947 McKinney W. "Python for data analysis: Data wrangling with Pandas, NumPy, and IPython." O'Reilly Media, Inc., 2012, ISBN-13, 978-9352136414. EMC Education Services , "Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, Inc, ISBN:9781119183686. Web links and Video Lectures (e-Resources): https://machinelearningmastery.com/. 									
	 <u>https://tov</u> https://www.initialized.com 	wardsdatas vw.masters	science.com/dat sindatascience.c	<u>a-science</u>	<u>nome</u>				
	<u>https://on</u>	linecourse	s.nptel.ac.in/no	<u></u> 20_cs46/j	preview				
٨	tivity-Bacad I	oorning (C	Suggested Activ	itios in Cl	ass) / Practical Rased Jearning				

- ased Learning (Suggested Activities in Class)/ Practical Based learning
 Demonstrate the need of statistics and probability for data science to students.
- Demonstration of jupyter notebook for hands-on experience with datasets.
- Construct flowcharts to represent the supervised and unsupervised learning techniques

• Contents related activities (Activity-based discussions)

≻ For active participation of students, instruct the students to understand real-world datasets and various optimization techniques.

 \succ Organizing Group wise discussions on issues

≻ Seminars

					FUN	DAMEN	NTALS (OF DAT.	A SCIEN	NCE LAB		1		
Course Code	22	CDL53	3						CIE I	Marks		50		
L:T:P:S	0:0):1:0							SEE	Marks		50		
Hrs / Week	3								Tota	l Marks		100		
Credits	1								Exar	n Hours		03		
Course outcom At the end of t	ies: he cour	rse, the	e stude	ent will	be able	to:								
22CDL53.1	Un	dersta	nd ba	sic oper	rations	of Num	Py, Panc	las, and	Matplo	tlib.				
22CDL53.2	Im	pleme	nt Reg	gressior	n model									
22CDL53.3	De ap	Demonstrate Classification & Clustering algorithms with respect to theoretical foun applications across diverse datasets.												
22CDL53.4	Eva	Evaluate the performance metrics associated with various models.												
Mapping of Co	urse O	utcom	es to	Progra	m Outo	omes a	nd Pro	gram S	pecific	Outcome	S:			
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
22CDL53.1	3	3	3	2	2	-	-	-	-	-	-	3	3	3
22CDL53.2	2	2	2	2	2	-	-	-	-	-	-	3	3	3
22CDL53.3	2	2	2	2	2	-	-	-	-	-	-	3	3	3
22CDL53.4	2	2	2	2	2	-	-	-	-	-	-	3	3	3
Exp. No. / Pgm. No.						List of I	Prograi	ms				Hours		COs
						Dı	oroqui	cita Dra	arame					
			•	Mathor	natice_ E	Prohahil	ity stat	istics on	d calcu	luc				
			•		oriente	d progr	ity, stat	istics all	aos liko	iava C Pr	rthon	3		NΔ
				Structu	red Oue	ry I and		OI) for	datahas	s java, C, I y se gueries	liion	5		11/1
			<u> </u>	Structu	icu que	ry nang	<u>uage (5</u> P	ART-A	uatabas	se queries				
1	Using	y Numl	Pv libr	arv wri	te a pyt	hon pro	ogram to	o demor	istrate			3		
	0	,	i.aran	ge, lins	bace, log	gspace l	Function	1				_		
		i	i.Arra	y index	ing								220	ר ביז וחי
		ii	i.Sliciı	ng Arra	ys								220	DF22'1
		iv	v.Joini	ng Arra	ys									
		1	v.Split	ting and	d Search	ning Arr	ays							
2	Using	g pand	as in	python	demoi	istrate	the foll	owing	operatio	ons for th	e sample	3		
	datas	et give	en,											
	$\frac{1}{2}$	lexing	or Dat	a frame	; tinα									
	2)010 3)Ad	ding ai	nd ren	noving	attrihut	es							220	CDL53.1
	4)Ioir	ning da	ata fra	mes	attribut	65								
	5)Filt	tering	the da	ta										
	6) Ha	ndling	g missi	ing valu	es.									
3	Write	e a Pytl	hon Pi	rogram	to impo	rt any (CSV file t	to Panda	as Data	Frame and	l perform	3		
	the fo	ollowir	ıg:											
	i. Visualize the first and last 10 records													
	ii.	Get	t the s	hape, in	idex and	l colum	n detail	s ,	,	1			224	
	111.	Sel	ect/D	elete th	e recore	ls(rows	5)/colun	nns base	ed on co	onditions.			220	DL53.1
	IV.	Pe Do	roqui	red stat	g and so istical c	neratio	peration	15. 16 given	columr	16				
	v.	V	i Find	the con	int and	uniquer	ns on u iess of t	he given	n catego	ns. Drical valu	95			
		vi	i. Ren	ame sin	gle/mi	ltiple co	olumns.	8	. catego					
4	Using	g panda	as and	Matple	otlib der	nonstra	ite the fo	ollowing	g operat	tions for th	ne sample	3		
	datas	et give	en, i) I	Bar cha	rt and F	listogra	m ii) Co	mparin	g Distri	ibution iii]	Box plot		220	DL53.21
	and n	nentio	n quai	rtiles.						-				

5	 Develop a program to implement Simple Linear Regression model and evaluate the model by evaluate the performance by Mean Squared Error (MSE), Mean Absolute Error (MAE). Develop a program to implement Multiple Linear Regression model and evaluate the model by verifying the performance by R-squared (Coefficient of Determination) 	3	22CDL53.2
6	Develop a program to implement Logistic Regression and indicate the class label for the test dataset. (Computing coefficients (weights) using gradient descent).	3	22CDL53.2
	PART-B		
7	Develop a program to implement Naive Bayes classifier model and analyze the model using confusion matrix	3	22CDL53.3 22CDL53.4
8	 Develop a function or class decision_tree(X_train, y_train) that implements a Decision Tree classifier. Use the trained Decision Tree model to predict class labels for a test dataset (X_test). Compute a confusion matrix to evaluate the model's performance. 	3	22CDL53.3 22CDL53.4
9	Develop a program to implement Random Forest classifier model and analyze the model using Receiver Operating Characteristic (ROC) Curve and Area Under the Curve (AUC).	3	22CDL53.3 22CDL53.4
10	Develop a program to implement KNN classifier model and analyse the model using Classification Report.	3	22CDL53.3 22CDL53.4
11	Develop a program to implement K Means clustering model for the given value of K, where K is number of clusters.	3	22CDL53.3 22CDL53.4
12	Develop a program to implement Hierarchical clustering model for the given value of N, where N is number of clusters.	3	22CDL53.3 22CDL53.4
	PART-C		
	Beyond Syllabus Virtual Lab Content		
	(To be done during Lab but not to be included for CIE or SEE)		

- <u>https://cloudlabs.ai/virtual-labs</u>
- <u>https://www.iiitmk.ac.in/DAVirtalLab/</u>

CIE Assessment Pattern (50 Marks - Lab)

	DDT Lovele	Test (s)	Weekly Assessment				
	KD1 Levels	20	30				
L1	Remember	-	-				
L2	Understand	-	-				
L3	Apply	10	10				
L4	Analyze	5	10				
L5	Evaluate	5	10				
L6	Create	-	-				

Suggested Learning Resources:

Reference Books:

- 1. U Dinesh Kumar, "Business Analytics : The Science of Data Driven decision making", First Edition, Wiley Publishers, 2017, ISBN-13, 978-8126568772.
- 2 N Jiawei Han, Micheline Kamber , Jian Pei Professor, "Data Mining: Concepts and Techniques", Third Edition, Morgan Kaufmann Series, 2011, ISBN-13, **978-9380931913.**

DATA ENGINEERING															
Course Code	22CDS	541						CIE Ma	arks		5	0			
L:T:P:S	3:0:0:0)						SEE M	arks		5	0			
Hrs / Week	3							Total	Marks		1	00			
Credits	03 Exam Hours 03														
Course outco	mes:														
At the end of	the cour	se, the	studen	t will be	e able to	:									
22CDS541.1	Unders	stand. o	core dat	a engin	eering o	concept	s and to	echnologi	es in Data	Enginee	ring.				
22CDS541.2	Demonstrate the data modeling techniques and database design principles to create optimized database schemas for various applications.														
22CDS541.3	Apply I	ETL pr	ocesses	to ensu	ıre data	integri	ty and	quality in	data war	ehousing	environ	ments.			
22CDS541.4	Examir	ne data	workfl	ows usi	ng mod	ern orc	hestrat	ion tools,	ensuring	data inte	gration	and quali	ity acr	oss soi	irces.
22CDS541.5	Unders such as	stand t s GDPR	he data , CCPA.	govern	ance fu	ndame	ntals st	ewardshi	p, owners	hip, and	adheren	ice to reg	ulator	y comp	oliance
22CDS541.6	Analyz data m	e the c anager	oncepts nent.	s of data	securit	y, focus	sing on	encryptic	on techniq	ues, mor	nitoring a	and ethic	al cons	siderat	ions in
Mapping of C	ourse 0	utcon	nes to I	Program	m Outc	omes	and Pr	ogram S	pecific O	utcome	S:				
	P01	P02	P03	PO4	P05	P06	P07	P08	P09	P010	P011	P01	2	PSO1	PSO2
22CDS541.1	2	2	2	2	-	-	-	-	-	-	-	2		3	3
22CDS541.2	2	2	2	2	2	-	-	-	-	-	-	2		3	3
22CDS541.3	2	2	2	2	2	-	-	-	-	-	-	2		3	3
22CDS541.4	2	2	2	2	2	-	-	-	-	-	-	2		3	3
22CDS541.5	2	2	2	2	2	-	-	-	-	-	-	2		3	3
22CDS541.6	2	2	2	2	2	-	-	2	-	-	-	2		3	3
MODULE-1		INTR	ODUCT	ION TO) DATA	ENGI	NEERII	NG	2	22CDS54	41.1		8 H	lours	
Overview of D	Data Eng	ineerir	ng, Role	e of a D	ata Eng	gineer,	Data E	ngineerin	g vs. Dat	a Science	e, Data l	Lifecycle	Manag	gemen	t, Data
Architecture a	nd Infras	structu	re, Intro	oductio	n to Big	Data, C	haracte	eristics of	Big Data,	Tools an	d Techn	ologies ir	n Data	Engine	ering.
Text Book	Text Bo	ook 1: (Chapter	· 1											
Self Study	Explor	e the	latest t	rends	and adv	vancem	ents sl	haping th	e field o	f data e	ngineeri	ing, inclu	ding	techno	logical
	innova	tions, i	ndustry	/ practi	ces, and	evolvi	ng roles	and resp	onsibiliti	es.					
MODULE-2]	DATA	MODE	LING A	ND DA'	TABAS	E DESI	GN		22CD	5541.2		8	B Hour	ſS
Data Modeling	g Concept	ts, Dim	ensiona	al Mode	ling, SQ	L and L	NoSQL	Databases	s, Relatior	nal Datab	ase Mar	agement	Syste	ms (RI)BMS),
Document Sto	res, Key-	Value	Stores,	Colum	1-Family	y Store	s, Grapl	h Databas	ses, Norm	alization	and De	normaliz	ation,	Indexi	ng and
Query Optimiz	ation.														
Text Book	Text Bo	ook 2: (Chapter	· 4,7											
Case Study	Design	a dime	ensiona	l model	for an o	online r	etail co	mpany ai	ming to o	ptimize i	ts busin	ess opera	tions a	and cus	stomer
	experie	ence. D	iscuss t	he norn	nalizatio	on and o	lemora	lization st	rategies,	indexing	techniqu	ies, and d	latabas	se tech	nology
	choices	s, cons	idering	scalabi	lity and	perfor	mance	requirem	ents. Eval	uate the	potentia	ll use of g	graph o	databa	ses for
	analyzi	ing cus	tomer-j	product	relatio	nsnips.	DOCEC	CEC		2200	2741 2) II	
MODULE-3							RUCES	3E3			541.3	ת (ו ד	<u> </u>	S HOUL	<u>.'S</u>
Data Warehou	sing Con	icepts, lloongi	ULAP V	S. ULIF Trancfo	', Data V rmatior	wareno	use Arc	cnitecture	e, eil (ex	tract, Tra	ansform,	Load Pi	rocess	es, EII	1 001S
and recinique	es, Data C	leansi	iig allu	11411510	Inatioi	I, Data I	Lakes.								
Text Book Text Book 3: Chapter 2,3															
MODULE-4	MODULE-4 DATA INTEGRATION AND WORKFLOW 22CDS541.4 8 Hours MANAGEMENT 22CDS541.4 1000000000000000000000000000000000000								*S						
Data Integrati Quality Manag	ion Tech ement D	niques ata Pr	s, APIs, ofiling.]	Webho Data Ou	oks, Da Iality Di	ta Coni mensio	nectors	, Workflo	w Orches	tration,	Apache	Airflow,	Luigi,	Prefec	t, Data
Text Book Text Book 2: Chapter 11															
MODULE-5 DATA GOVERNANCE AND COMPLIANCE 22CDS541.5. 22CDS541.6 8 Hours															
Data Governar	nce Fund	ament	als, prin	nciples of	of Data	Govern	ance. D	ata Stewa	rdship ar	nd Owner	ship. Re	gulatorv	Comp	liance	GDPR.
CCPA, and Oth	er Data I	Privacy	v Regula	tions. I	ndustrv	-specif	ic Com	oliance Re	quiremer	nts (e.g., l	HIPAA fo	or Health	care).	Data S	ecurity
and Encryption	n, Encryp	otion T	echniqu	ies and	Best Pra	actices,	Secure	Data Trar	ismission	and Stor	age, Aud	iting and	Monit	oring,	Ethical
Considerations	S		· ·			, 									
Text Book	Text Bo	ook 3: (Chapter	· 1											

CIE	Assessment Patt	ern (50 Mai	rks – Theo	ry) -
		Marks I	Distributio	<u>, j</u>
	RBT Levels	Test (s)	NPTE	L
		25	25	
L1	Remember	5	5	
L2	Understand	5	5	
L3	Apply	5	5	
L4	Analyze	5	10	
L5	Evaluate	5		
L6	Create	-	-	
SEE	Assessment Pat	ern (50 Ma	rks – Theo	ory)
	RRT Lovols	Exam M	larks	
	KD1 Levels	Distributi	on (50)	
L1	Remember	10		
L2	Understand	10		
L3	Apply	10		
L4	Analyze	10		
L5	Evaluate	10		
L6	Create			

Suggested Learning Resources:

Text Books:

- 1. Joe Reis , Matt Housley , Fundamentals of Data Engineering: Plan and Build Robust Data Systems (Grayscale Indian Edition) 27 June 2022, ISBN-13, 978-9355421548.
- 2. Hector Garcia-Molina Jeffrey D. Ullman Jennifer Widom, DATABASE SYSTEMS ,The Complete Book Second Edition ,2019, ISBN-13, **978-0131873254**.
- 3. Mayank Malhotra, Ultimate Data Engineering with Databricks: Develop Scalable Data Pipelines Using Data Engineering's Core Tenets Such as Delta Tables, Ingestion, Transformation, Security, and Scalability Import, 14 February 2024, ISBN-13, **978-8196994785**.

Reference Books:

1. Roberto Zagni, Data Engineering with dbt: A practical guide to building a cloud-based, pragmatic, and dependable data platform with SQL,Second Edition,2023, ISBN-13978-1803246284.

Web links and Video Lectures (e-Resources):

- https://www.datacamp.com/category/data-engineering
- https://www.udemy.com/topic/data-engineering/

- > Contents related activities (Activity-based discussions)
- > Organizing Group wise discussions on issues

PRINCIPLES OF CLOUD COMPUTING Course Code 22CDS542 **CIE Marks** 50 L:T:P:S 3:0:0:0 **SEE Marks** 50 Hrs / Week 100 3 **Total Marks** Credits 03 **Exam Hours** 03 **Course outcomes:** At the end of the course, the student will be able to: 22CDS542.1 Understand the foundational principles of cloud computing and centralized computing systems. 22CDS542.2 Demonstrate the Cloud infrastructure of Google Cloud ad Amazon Cloud. 22CDS542.3 Identify private and hybrid cloud for organizations to execute customized applications. 22CDS542.4 Analvze authentication. confidentiality, and privacy issues in Cloud computing environment. 22CDS542.5 Analvze financial and technological cloud the implications for selecting computing platforms 22CDS542.6 Categorize the security issues and emerging technologies of Cloud computing. Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes: P03 **PO4** P05 P06 P07 **P08** P09 P01 P02 P010 P011 P012 **PSO1 PSO2** 22CDS542.1 2 2 2 -------2 3 3 -22CDS542.2 2 2 2 2 3 3 -_ _ ----22CDS542.3 2 2 2 --2 3 3 ----_ -22CDS542.4 2 2 2 2 3 3 --------22CDS542.5 2 2 2 2 3 3 ---_ ---2 2 22CDS542.6 2 2 3 3 **MODULE-1 Introduction of Cloud Computing** 22CDS542.1, **8 Hours** 22CDS542.2 Introduction and Fundamentals of Centralized and distributed Computing, Historical evolution of cloud computing, Introduction to Cloud Computing, Cloud Architecture, characteristics of cloud computing, Cloud issues and challenges. Overview of cloud computing concepts relevant to data science, Benefits of using cloud services for data science projects. Text Book Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16 **MODULE-2** Cloud Infrastructure and Service models 22CDS542.1. 8 Hours 22CDS542.2 Cloud Service models, Cloud Deployment Models, Data Pipelines in the Cloud, Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualizations- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs. Virtualization in Data Science **Development Pipelines.** Text Book Text Book 1: 2.2, 2.3, 2.4 to 2.15 **MODULE-3 Cloud Computing Tools and Services** 22CDS542.3, 8 Hours 22CDS542.4 Cloud Storage Solutions, Cloud based data storage solutions, Data lakes and data warehouses in the cloud, Cloud providers, Networking in Cloud Computing, Serverless Computing, Cloud Development and Deployment, Cloud platform & Management: Computation, Storage - Case studies. Software as a Service (SaaS) - Web services - Web 2.0 - Web OS - Case studies - Anything as a service (XaaS). Text Book Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10 **MODULE-4 Cloud Applications and Programming** 22CDS542.3, 8 Hours 22CDS542.4 Cloud Applications Moving Applications the Cloud Microsoft Cloud Services Google to Cloud Applications - Amazon Cloud Services, Cloud Programming and Software Environments - Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine – Emerging Cloud software Environment, Cloud-based Data Processing Frameworks Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7 Text Book

MODULE-5

Emerging Trends and Security in Cloud Computing

22CDS542.5, 22CDS542,6

8 Hours

Edge Computing, Edge Computing Platforms and Tools, Serverless Architectures and Functions, Security in Edge Computing, Hybrid and Multi-cloud Strategies - Cloud Access: authentication, authorization and accounting - Cloud Provenance and metadata - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards, Compliance and Governance in Cloud-based Data Science.

Text Book Text Book 2: 12.1 to 12.10

CIE Assessment Pattern (50 Marks - Theory)

		Marks Distribution				
	RBT Levels	Test (s)	NPTEL			
		25	25			
L1	Remember	5	5			
L2	Understand	5	5			
L3	Apply	5	5			
L4	Analyze	5	10			
L5	Evaluate	5				
L6	Create	-	-			

SEE Assessment Pattern (50 Marks - Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	

Suggested Learning Resources:

Text Books:

- 1) Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier 2012. ISBN-13, 978-0123858801.
- 2) A.Srinivasan and J.Suresh, "Cloud Computing A Practical Approach for Learning and Implementation", Pearson India Publications 2014,ISBN-9788131776513

Reference Books:

- 1. Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010, ISBN: 978-0-470-90356-8.
- 2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009, ISBN-9780596802769.
- 3. Rajkumar Buyya, James Broberg, Andrzej, *"Cloud Computing: Principles and Paradigms"*, Wiley India Publications 2011, ISBN-13- 978-8126541256.

Web links and Video Lectures (e-Resources):

- WEB REFERENCES:
- NPTEL & MOOC courses titled Cloud computing https://nptel.ac.in/courses/106105167/

- Cloud Service Provider Visit
- Industry Collaboration Projects, Hackathon, or Innovation Challenge
- Internships or Summer Programs
- Analyze case studies of successful cloud implementations in various industries.
- Video demonstration of latest trends in cloud computing
- Contents related activities (Activity-based discussions)
 - > For active participation of students, instruct the students to prepare Flowcharts and Handouts
 - > Organizing Group wise discussions on issues
 - Seminars

BUSINESS ANALYTICS														
Course Code	22CD	\$543							CI	E Marks		50		
L:T:P:S	3:0:0:	0							SE	E Marks		50	50	
Hrs / Week	3								То	tal Marks		100)	
Credits	03	03 Exam Hours 03												
Course outco	mes:													
At the end of	the cou	rse, the	stude	nt will b	e able to	:								
22CDS543.1	Under HR, op	stand f eratior	undam 1s)	ental bu	isiness a	nalytics	concep	ts and te	echniqu	es across v	various fui	nctions (n	narketing,	finance,
22CDS543.2	Apply	analyti	cs met	hodolog	y to pre	pare obj	ectives,	identify	data re	equiremen	ts, collect	and prepa	re data	
22CDS543.3	Demoi distrib	nstrate oution t	profic echniq	tiency i ues	n organ	izing a	nd stru	cturing	data, i	ncluding 1	abulation	, orderin	g, and fr	equency
22CDS543.4	Under foreca	stand 🗎 sting.	basic t	time sei	ries tecl	nniques	like de	compos	ition a	nd ARIMA	models	for effect	tive analy	rsis and
22CDS543.5	Exami approa	ne adva aches.	anced	time ser	ies mod	els inclu	iding ST	'L, ARCH	I, and G	ARCH, gai	ning profi	ciency in	diverse ai	nalytical
22CDS543.6	Apply financ	advand e. and F	ced Exe ESG and	cel funct alvsis, in	tions an	d quant	itative t ency	echniqu	es in fi	nancial mo	deling for	r risk mar	nagement,	project
Mapping of C	Course (Dutcon	nes to	Progra	m Outc	omes a	nd Pro	gram S	pecific	Outcome	s:			
	P01	P02	P03	P04	P05	P06	P07	POR	P09	P010	P011	P012	PS01	PSO2
22CDS543.1	2	2	2	2	-	-	-	-	-	2	-	2	3	3
22CDS543.2	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS543.3	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS543.4	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS543.5	2	2	2	2	2	-	-	-	-	-	-	2	3	3
22CDS543.6	2	2	2	2	2	-	-	-	-	2	-	2	3	3
MODULE-1			JTROE		N TO B	USINES	S ANAL	YTICS	1		22CDS5	43.1	81	lours
Concept of an Analytics, orga in Business & S	alytics, inizatior Society	Types and so	of Ana ource o	llytics, A f data, in	Applicati nportan	ion field ce of dat	ls - Mar a quality	rketing 7, dealing	Analyti g with r	cs, Financo nissing or i	e Analytic ncomplet	s, HR Ana e data, Rol	alytics, Oj le of Data S	peration Scientist
Text Book	Text B	ook 1:	Chapte	r 1				1						
Case Study	A glob	al e-cor	nmerc	e compa	ny want	s to opti	mize its	marketi	ng stra	tegies to in	crease cus	stomer acc	quisition, i	mprove
	custor	ner ret	ention,	and en	hance of	verall sa	lies peri	ormanc	e. They	decide to	leverage	marketing	g analytics	to gain
	action		signts i 1 Ida	rom the	ir data.	stomor	aamon	-a bacad	on bob	avior dom	ographics	and nur	hacing na	ttorne
		2	$\begin{array}{ccc} 1. & 10e \\ 2. & Eva \\ & me \end{array}$	aluate th	ne effect	iveness	of marl	keting ca	ampaig	ns across	different o	channels	(e.g., emai	il, social
MODULE-2			A	NALYT	TICS ME	THOD(DLOGY		marke		22CD9	543.2	8	Hours
Introduction to	o Analvt	ics Met	hodolo	gy, prer	paring ol	piective	s & iden	tifving d	ata reg	uirements	Data Coll	ection. Un	derstandi	ng data.
Data preparati	ion – Da	ta Clear	nsing. I	Vormaliz	zation. D	ata prei	paration	. Data B	lending	. Data Mod	lelling. Ev	aluation &	feedback	
Text Book	Text B	ook 2:	Chapte	r 2 .2.1-	2.6			,	2	,,	- 8, -			
MODULE-3				EX	PLORIN	G DAT	A				22CDS	\$543.3	8	Hours
Storing and S Distribution, C	tructuri umulati	ng Dat ve Frec	a, Org quency	anizatio Distribı	n of Da ution, Pe	ta, Tabı rcentile	ulation, s, Meası	Orderin ures and	g Data evalua	, Frequen ting variat	cy Distrib ion in Dat	oution, Gro a Values.	ouped Fr	equency
Text Book	Text B	ook 3:	Chapte	r 3,3.1-3	3.12									
MODULE-4			TIN	AE SERI	IES AND) FORE	CASTIN	G		220	DS543.4,	22CDS5	43.5 8	Hours
Introduction t Average (ARIM and Generalize	Introduction to Time Series Analysis, Time Series Decomposition, Exponential Smoothing, Autoregressive Integrated Moving Average (ARIMA) Models, Seasonal Decomposition of Time Series (STL), Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized ARCH (GARCH) Models State Space Models													
Text Book	Text B	ook 2:	Chapte	r 7										
MODULE-5				FINAN	ICIAL M	IODELL	ING				22CDS	5543.6	8	Hours
Advanced Exce Financial Mode	el Funct eling, Fi	ions fo nancial	r Finaı Model	ncial Mo ing for F	deling, 1 Risk Mar	Project 1 lagemer	Finance It, Envir	Models, onmenta	, Finano al, Socia	cial Modeli al, and Gov	ng using ernance (l	Python ar ESG) Finai	nd R, Quan ncial Mode	ntitative eling.
Text Book	Text B	ook 3:	Chapte	r 9&10		Text Book 3: Chapter 9&10								

Case Study A multinational financial institution wants to enhance its risk management framework by developing advanced financial models to assess and mitigate various types of risks across its investment portfolio. The institution decides to leverage quantitative financial modeling techniques to improve decision-making and regulatory compliance. Gather historical financial data, market data, and economic indicators relevant to the institution's investment portfolio.

Cleanse and preprocess data to ensure accuracy and consistency for modeling purposes.

CIE Assessment Pattern (50 Marks - Theory) -

		Marks Distribution					
	RBT Levels	Test (s)	NPTEL				
		25	25				
L1	Remember	5	5				
L2	Understand	5	5				
L3	Apply	5	5				
L4	Analyze	5	10				
L5	Evaluate	5	-				
L6	Create	-	-				
SEE A	Assessment Patt	tern (50 Marks – Theory					
		Exam Marks					

	DDT Lovale	LAIII Mai Ko
	NDI Leveis	Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	

Suggested Learning Resources:

Text Books:

- 1. Foster Provost and Tom Fawcett, Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, O'Reilly Media, ISBN-13, **978-1449361327**.
- 2. Arun Sukumar, Lucian TIPI, Jayne Revill, Applied Business Analytics.1st Edition, 2016, ISBN-9788740313635.

Reference Books:

1. Thomas H. Davenport and Jeanne G. Harris, Competing on Analytics: The New Science of Winning, 2017, ISBN-13, 978-1422103326.

Web links and Video Lectures (e-Resources):

- <u>https://www.udemy.com/courses/business/analytics-and-intelligence</u>.
- <u>https://www.coursera.org/specializations/business-analytics</u>

- Contents related activities (Activity-based discussions)
- ➤ Organizing Group wise discussions on issues
- ≻ Seminars

Course Code 22CDS544 IEE Marks 50 LiP:PS 30:0:00 SER Marks 50 Centrse outcomes: At the end of the course, the student will be able to: 22CDS544.1 Demonstrate finite automata properties, Chomsky classification, and language-set relations. Z2CDS544.1 Demonstrate finite automata properties, Chomsky classification, and language-set relations. Z2CDS544.2 Analyze routext-free languages through derivation trees and resolving ambiguity in context-free grammars. Z2CDS544.4 Understanding pushdown automata and their relationship with context-free languages, including parsing dechniques. Z2CDS544.5 Analyze context-free languages through derivation trees and resolving ambiguity in context-free grammars. Z2CDS544.5 Analyze Turing machine theory, linear bounded automata, and relationship with type 0 grammars. Z2CDS544.1 3 3 - - - 1 3 3 Z2CDS544.3 3 3 - - - 1 3 3 Z2CDS544.3 3 3 3 - - - 1 3 3 Z2CDS544.4 3 3 3 -	AUTOMATA THEORY AND COMPUTABILITY														
L:T:P:S 3:0:0:0 SEE Marks 50 Trey Weck 3 Total Marks 100 Credits 03 Exam Hours 03 Course outcomes: At the end of the course, the student will be able to: 22CDS544.1 Demonstrate finite automata properties, Chomsky classification, and language-set relations. Z2CDS544.2 Analyze context.Free languages through derivation trees and resolving ambiguity in context-free grammars. Context.Free languages, including parsing techniques. Z2CDS544.4 Understanding pushdown automata and their relationship with context-free languages, including parsing techniques. Context.Free languages, including parsing techniques. Z2CDS544.5 Analyze Turing machine theory, linear bounded automata, and relationship with type 0 grammars. Z2CDS544.5 Analyze Turing machine theory. Incar bounded automata, and relations to understand their computational properties Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes: 1 3 3 Z2CDS544.1 3 3 3 - - 1 1 3 3 Z2CDS544.2 3 3 3 - - - 1 3 3 3 3 3 3 3 3	Course Code		22CDS544	ŀ						CI	E Marks		50		
Hrs / Week B Iou Marks 100 Course outcomes: At the end of the course, the student will be able to: Exam Hours 03 22CD5544.1 Demonstrate finite automata properties, Chomsky classification, and language-set relations. 22CD5544.2 Analyze regular sets and grammars using regular expressions, finite automata, and pumping lemma techniques. 22CD5544.3 Analyze context-free languages through derivation trees and resolving ambiguity in context-free grammars. 22CD5544.5 Analyze Turing machine theory, linear bounded automata, and relationship with type 0 grammars. 22CD5544.5 Analyze Turing machine theory, linear bounded automata, and relationship with type 0 grammars. 22CD5544.6 Explore the analysis and construction of computable functions to understand their computational properties Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes: 1 3 3 22CD5544.1 3 3 3 - - - 1 3 3 22CD5544.5 3 3 3 - - - 1 3 3 22CD5544.5 3 3 3 - - - 1 3 3 22CD5544.5 3	L:T:P:S		3:0:0:0							SE	E Marks		50		
Credits D3 Exam Hours D3 Course outcomes: At the end of the course, the student will be able to: 22005344.1 Demonstrate finite automata properties, Chomsky classification, and language-set relations. 220D5344.2 Analyze regular ests and grammars using regular expressions, finite automata, and pumping lemma techniques. 22005344.3 Analyze for the standing pushdown automata and their relationship with context-free languages, including parsing techniques. 220D5344.3 Understanding pushdown automata and their relationship with context-free languages, including parsing techniques. 220D5344.5 Analyze Turing machine theory, linear bounded automata, and relationship with type 0 grammars. 220D5344.5 Analyze Turing machine theory. linear bounded automata, and relationship with type 0 grammars. 220D5344.6 Fxphore the analysis and construction of computable functions to understand their computational properties 220D5344.2 3 3 - - - 1 3 3 220D5344.4 3 3 3 - - - 1 3 3 220D5344.4 3 3 3 - - - 1 3 3 220D5	Hrs / Week		3							То	tal Mark	S	100)	
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Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:PO1PO2PO3PO4PO5PO6PO7PO8PO9PO10PO11PO12PS01PS0222CDS544.133313322CDS544.2333313322CDS544.4333313322CDS544.533313322CDS544.633313322CDS544.6333113322CDS544.6333113322CDS544.6333113322CDS544.6333113322CDS544.6333113322CDS544.1& Definition and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets: Operations on Languages; Languages and Automata.FORMAL LANCUAGESEXAMOARS22CDS544.28 Hours	22CDS544.6		Explore th properties	ie ana	alysis a	and cor	nstructi	on of o	comput	able fu	inctions	to unders	stand the	eir comp	utational
PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PS01 PS02 22CDS544.1 3 3 - - - - - 1 3 3 22CDS544.3 3 3 3 - - - - 1 1 3 3 22CDS544.4 3 3 3 - - - - 1 1 3 3 22CDS544.5 3 3 3 - - - - 1 1 3 3 22CDS544.6 3 3 - - - - 1 3 3 22CDS544.6 3 3 - - - - 1 3 3 22CDS544.1 AUTOMATA AND FORMAL LANGUAGES 22CDS544.1 8 Hours Recursively faumerable Sets: Operations on Languages: Languages and Automata. FetMd	Mapping of Course Or	itcoi	nes to Pro	gram	Outco	mes an	d Prog	ram Sp	ecific (Dutcom	nes:				
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22CDS544.3 3 3 3 3 - - - - - 1 3 3 22CDS544.4 3 3 3 - - - - 1 3 3 22CDS544.5 3 3 3 - - - - 1 3 3 22CDS544.6 3 3 - - - - 1 3 3 22CDS544.6 3 3 - - - - 1 3 3 22CDS544.6 3 3 - - - - - 1 3 3 22CDS544.6 3 3 - - - - - 1 3 3 3 - - - - - - 1 3 3 3 3 - - - - - - 1 3 3 3 3 - - 1 3 3 3 <t< td=""><td>22CDS544.2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>3</td><td>3</td></t<>	22CDS544.2	3	3	3	3	-	-	-	-	-	-	-	1	3	3
22CDS544.4 3 3 3 3 - - - - 1 3 3 22CDS544.5 3 3 3 - - - - 1 3 3 22CDS544.6 3 3 - - - - 1 3 3 MODULE-1 AUTOMATA AND FORMAL LANGUAGES 22CDS544.1 8 Hours THEORY OF AUTOMATA: Definition, Description of a Finite Automator, Transition Systems; Properties of Transition Functions; Acceptability of a String by a Finite Automaton; Nondeterministic Finite State Machines; The Equivalence of DFA and NDFA; Mealy and Moore Models; Minimization of Finite Automata. FORMAL LANGUAGES: Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata. SetEvidy: Study academic papers or research articles on minimization techniques for finite automata. Text Book Textbook 1: 3.1 to 3.9, 4.1 to 4.6 MODULE-2 REGULAR SETS AND REGULAR GRAMMARS 22CDS544.2 8 Hours Closure Properties of Regular Sets. Quivalence of Two Negular Expressions; Fuming Lemma for Regular Expressions: Transition Systems to understand how they efficiently match patterns in text dat	22CDS544.3	3	3	3	3	-	-	-	-	-	-	-	1	3	3
22CDS544.5 3 3 3 - - - - 1 3 3 22CDS544.6 3 3 - - - - - - 1 3 3 22CDS544.6 3 3 - - - - - - 1 3 3 MODULE-1 AUTOMATA AND FORMAL LANGUAGES 22CDS544.1 8 Hours THEORY OF AUTOMATA: Definition, Description of a Finite Automaton; Transition Systems; Properties of Transition Functions; Acceptability of a String by a Finite Automata; Nondeterministic Finite State Machines; The Equivalence of DFA and NDFA; Mealy and Moore Models; Minimization of Finite Automata. FORMAL LANGUAGES: Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata. Self-study: Study academic papers or research articles on minimization techniques for finite automata. Text Book Textbook 1: 3.1 to 3.9, 4.1 to 4.6 MODULE-2 REGULAR GRAMMARS: Regular Expressions; Conversion of Nondeterministic Systems to Deterministic Systems to Deterministic Systems of Regular Sets. Regular Expression; Convariance of Nondeterministic Systems to Deterministic Systems to Deterministic Systems of Regular Sets. <td>22CDS544.4</td> <td>3</td> <td>3</td> <td>3</td> <td>3</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>1</td> <td>3</td> <td>3</td>	22CDS544.4	3	3	3	3	-	-	-	-	-	-	-	1	3	3
22CDS544.6 3 3 - - - - - 1 3 3 MODULE-1 AUTOMATA AND FORMAL LANGUAGES 22CDS544.1 8 Hours THEORY OF AUTOMATA: Definition, Description of a Finite Automaton; Transition Systems; Properties of Transition Functions; Acceptability of a String by a Finite Automaton; Nondeterministic Finite State Machines; The Equivalence of DFA and NDFA; Mealy and Moore Models; Minimization of Finite Automata. FORMAL LANGUAGES: Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata. Self-study: Study academic papers or research articles on minimization techniques for finite automata. Text Book MODULE-2 REGULAR SETS AND GRAMMARS: Regular Expressions; Finite Automata and Regular Expressions: Transition System Containing A-moves, NDFAs with A-moves and Regular Expressions; Conversion of Nondeterministic Systems to Deterministic Systems, Algebraic Method Using Arden's Theorem, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Finite Automata, Equivalence of Two Regular Expressions; Pumping Lemma for Regular Sets; Application of Pumping Lemma; Closure Properties of Regular Sets. 8 Hours Case Study Analyze the implementation of reegilar expression engines in programming languages or search engines to understand how they efficiently match patterns in text data. 8 Hours Context-Free LANGUAGES(CFL): CFL and Derivation Trees; Ambiguity in Context-free	22CDS544.5	3	3	3	3	-	-	-	-	-	-	-	1	3	3
MODULE-1AUTOMATA AND FORMAL LANGUAGES22CDS544.18 HoursTHEORY OF AUTOMATA: Definition, Description of a Finite Automaton; Transition Systems; Properties of Transition Functions; Acceptability of a String by a Finite Automaton; Nondeterministic Finite State Machines; The Equivalence of DFA and NDFA; Mealy and Moore Models; Minimization of Finite Automata.FORMAL LANGUAGES Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata.Self-Study:Study academic papers or research articles on minimization techniques for finite automata.Text BookTextbook 1: 3.1 to 3.9, 4.1 to 4.6MODULE-2REGULAR SETS AND GRAMMARS22CDS544.28 HoursREGULAR SETS AND REGULAR GRAMMARS: Regular Expressions; Finite Automata and Regular Expressions: Transition System on NEAs with A-moves and Regular Expressions, Conversion of Nondeterministic Systems to Deterministic Systems, Algebraic Method Using Arden's Theorem, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Finite Automata, Equivalence of Two Regular Expressions; Pumping Lemma for Regular Sets; Application of Pumping Lemma; Closure Properties of Regular Sets.8 HoursCase StudyAnalyze the implementation of regular expression engines in programming languages or search engines to understand how they efficiently match patterns in text data.8 HoursText BookTextbook 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6MODULE-3CONTEXT-FREE LANGUAGES & PUSHDOWN AUTOMATA22CDS544.3 22CDS544.48 HoursContext-free Grammars, Normal Forms for Context-free Grammars, Normal Forms for Context-free Grammars, Supplication of	22CDS544.6	3	3	-	-	-	-	-	-	-	-	-	1	3	3
MODULE-1AUTOMATA AND FORMAL LANGUAGES22CDS544.18 HoursTHEORY OF AUTOMATA: Definition, Description of a Finite Automaton; Transition Systems; Properties of Transition Functions; Acceptability of a String by a Finite Automaton; Nondeterministic Finite State Machines; The Equivalence of DFA and NDFA; Mealy and Moore Models; Minimization of Finite Automata.FORMAL LANGUAGES: Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata.Self-study:Study academic papers or research articles on minimization techniques for finite automata.Text BookTextbook 1: 3.1 to 3.9, 4.1 to 4.6MODULE-2REGULAR SETS AND GRAMMARSREGULAR SETS AND REGULAR GRAMMARS: Regular Expressions; Finite Automata and Regular Expressions: Transition System Construction of Finite Automata Equivalenct of a Regular Expression, Conversion of Nondeterministic Systems to Deterministic Systems, Algebraic Method Using Arden's Theorem, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Finite Automata, Equivalence of Two Regular Expressions; Pumping Lemma for Regular Sets; Application of Pumping Lemma; Closure Properties of Regular Sets.Case StudyAnalyze the implementation of regular expression engines in programming languages or search engines to understand how they efficiently match patterns in text data.Text BookTextbook 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6MODULE-3CONTEXT-FREE LANGUAGES(CFL); CFL and Derivation Trees; Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars.PUSHDOWN AUTOMATA(PDA):Basic Definitions, Acceptance by PDA, Pushdow															
THEORY OF AUTOMATA: Definition, Description of a Finite Automaton; Transition Systems; Properties of Transition Functions; Acceptability of a String by a Finite Automaton; Nondeterministic Finite State Machines; The Equivalence of DFA and NDFA; Mealy and Moore Models; Minimization of Finite Automata. FORMAL LANCUAGES: Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata. Self-study: Study academic papers or research articles on minimization techniques for finite automata. Text Book Textbook 1: 3.1 to 3.9, 4.1 to 4.6 MODULE-2 REGULAR SETS AND GRAMMARS: Regular Expressions; Finite Automata and Regular Expressions: Transition System Containing A-moves, NDFAs with A-moves and Regular Expressions, Conversion of Nondeterministic Systems to Deterministic Systems, Algebraic Method Using Arden's Theorem, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Regular Sets. Closure Properties of Regular Sets. Case Study Analyze the implementation of regular expression engines in programming languages or search engines to understand how they efficiently match patterns in text data. Text Book Textbook 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 MODULE-3 CONTEXT-FREE LANGUAGES(CFL): CFL and Derivation Trees; Ambiguity in Context-free Grammars, Simplification of Context-free Grammars. PUSHDOWN AUTOMATA(PDA): Ba	MODULE-1		AUTOMA	A AN	D FOR	MAL LA	ANGUA	GES				2200	544.1	8	Hours
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and moore Models; Minimization of Finite Automata. FORMAL LANGUAGES: Definitions and Examples; Chomsky Classification of Languages; Languages and Their Relation; Recursive and Recursively Enumerable Sets; Operations on Languages; Languages and Automata. Self-study: Study academic papers or research articles on minimization techniques for finite automata. Text Book Textbook 1: 3.1 to 3.9, 4.1 to 4.6 MODULE-2 REGULAR SETS AND GRAMMARS 22CDS544.2 8 Hours REGULAR SETS AND REGULAR GRAMMARS: Regular Expressions; Finite Automata and Regular Expressions: Transition System Containing A-moves, NDFAs with A-moves and Regular Expressions; Conversion of Nondeterministic Systems to Deterministic Systems, Algebraic Method Using Arden's Theorem, Construction of Finite Automata Equivalent to a Regular Expression, Equivalence of Two Finite Automata, Equivalence of Two Regular Expressions; Pumping Lemma for Regular Sets; Application of Pumping Lemma; Closure Properties of Regular Sets. Case Study Analyze the implementation of regular expression engines in programming languages or search engines to understand how they efficiently match patterns in text data. Text Book Textbook 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 MODULE-3 CONTEXT-FREE LANGUAGES & PUSHDOWN AUTOMATA 22CDS544.3 CONTEXT-FREE LANGUAGES (CFL): CFL and Derivation Trees; Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars. PUSHDOWN AUTOMATA(PDA): Basic Definitions, Acceptance by PDA, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata. Case Study: Explore applications of pushdown automata in syntax analysis stages of compilers and interpreters, where they are used to recognize and parse context-free grammars. Text Book Textbook 1: 6.1, to 6.4, 7.1 to 7.4 MODULE-4 TURING MACHINES & LINEAR BOUNDED AUTOMATA 22CDS544.5 8 Hours	Acceptability of a Strin	ig by	a Finite A	itoma	iton; No	ondeter	ministi	c Finite	State I	Machine	es; The E	quivalenc	e of DFA	and NDF	A; Mealy
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Case Study:Explore applications of pushdown automata in syntax analysis stages of compilers and interpreters, where they are used to recognize and parse context-free grammars.Text BookTextbook 1: 6.1 to 6.4, 7.1 to 7.4MODULE-4TURING MACHINES & LINEAR BOUNDED AUTOMATA22CDS544.58 Hours	and Pushdown Automa	ita.													
Text BookTextbook 1: 6.1 to 6.4, 7.1 to 7.4MODULE-4TURING MACHINES & LINEAR BOUNDED AUTOMATA22CDS544.58 Hours	Case Study:		Explore ap where the	plicat y are ι	ions of used to	pushdo recogni	own aut ize and	omata i parse c	n synta ontext-	ix analy free gra	vsis stage: ammars.	s of comp	ilers and	interpret	ters,
MODULE-4 TURING MACHINES & LINEAR BOUNDED AUTOMATA 22CDS544.5 8 Hours	Text Book		Textbook 1	1:6.1	to 6.4, 7	7.1 to 7.	4			U					
	MODULE-4		TURING M	IACHI	NES &	LINEAI	R BOUN	NDED A	UTOM	АТА		22CI	DS544.5	8	B Hours

TURING MACHINES AND LINEAR BOUNDED AUTOMATA: Turing Machine Model; Representation of Turing Machines; Language Acceptability by Turing Machines; Design of Turing Machines; Description of Turing Machines; Techniques for TM Construction; Variants of Turing Machines; The Model of Linear Bounded Automaton; Turing Machines and Type 0 Grammars; Linear Bounded Automata and Languages.

Self-study	Solve practice problems and exercises to reinforce concepts such	as designing Turing machine	s and their				
	elationship with type 0 grammars.						
Text Book	Textbook 1: 9.1 to 9.10						
MODULE-5	COMPUTABILITY THEORY ESSENTIALS 22CDS544.6 8 Hours						

COMPUTABILITY: Introduction and Basic Concepts; Primitive Recursive Functions; Recursive Functions; Partial Recursive Functions and Turing Machines: Computability, A Turing Model for Computation, Turing-computable Functions, Construction of the Turing Machine that Can Compute the Zero Function Z, Construction of the Turing Machine for Computing the Projection U_i^m, Construction of the Turing Machine that Can Perform Composition, Recursion, Minimization.

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Case Study	Investigate real-world examples of computable functions used in algorithmic decision-making or
	problem-solving tasks, and analyze their efficiency and limitations.
Text Book	Textbook 1: 11.1, 11.2, 11.3, 11.4

CIE Assessment Pattern (50 Marks – Theory)

	Marks Distribution								
	RBT Levels	BT Levels Test (s)							
		25	25						
L1	Remember	5	5						
L2	Understand	5	5						
L3	Apply	5	5						
L4	Analyze	5	10						
L5	Evaluate	5	-						
L6	Create	-	-						

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	

Suggested Learning Resources:

Text Books:

- 1. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PhI, 2012, ISBN-13, 978-8120329683. **Reference Books:**
- 1. Michael Sipser : Introduction to the Theory of Computation, 3rd edition, Cengage learning, 2013, ISBN-13, 978-8131525296.
- 1. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012, ISBN-13, 978-8131788226.
- 2. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw Hill Publishing Company Limited, 2013, ISBN-13, 978-0072322002.

Web links and Video Lectures (e-Resources):

- 1. <u>https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/</u>
- 2. <u>https://brilliant.org/courses/computer</u>
- 3. <u>https://www.youtube.com/playlist?list=PLEbnTDJUr_IcPtUXFy2b1sGRPsLFMghhS</u>
- 4. https://www.youtube.com/playlist?list=PLF7D3B75EDA17FE4D

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

• Grammar Construction Challenge:

- Provide students with a set of language specifications or constraints.
- Challenge them to construct context-free grammars that generate the specified languages.
- Have students present their grammars to the class and discuss their design choices.
- Turing Machine Simulation:

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• Use online Turing machine simulators or develop a simple Turing machine simulator.

• Assign students various language recognition tasks and ask them to implement Turing machines to recognize these languages.

Students can test and debug their Turing machine implementations using the simulator.

							ADV	ANCED	JAVA						
Cour	se Code	22CD	S545							CIE	Marks		50		
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Hrs /	/ Week	3								Tota	al Marks		100)	
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22CD	S545.1	Analy	ze the e	event	-based cla	isses a	nd interfa	ces for c	reating	GUI app	lications	in Java.			
22CD	0\$545.2	Demo	onstrate	JDB	C connect	ivity t	o access d	atabase	through	ı Java Pı	rograms				
22CD	S545.3	Apply	v servlet	t tech	inologies t	o builo	d server-s	ide appl	ications						
22CD	S545.4	Develop JSP based server-side solutions.													
22CD	S545.5	Implement web-based software components and frame works to solve real world problems.													
22CD	S545.6	Interp	oret the	impo	ortance of	Spring	g frame w	orks in e	enterpris	se softw	vare soluti	ons.			
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		P01	P02	PO	3 PO4	POS	5 PO6	P07	P08	P09	P010	P011	P012	PSO1	PSO2
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22CD	S545.2	2	2	3	3	2	-	-	-	1	1	-	2	3	3
22CD	S545.3	2	2	3		2	-	-	-	1	1	-	2	3	3
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22CD)S545.5	2	2	3	3	2	-	-	-	1	1	-	2	3	3
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Even	t Classes, E	Event S	ources,	Even	t Listener	, Adap	ter Classe	s.							
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		1		up	date the t	ext fie	ld content	. Impler	nent this	s functio	onality usi	ing event	handling c	concepts.	
MOD	DULE-2					KING	WITH JD	BC	T . 1			22CDS	<u>545.2</u>	<u> </u>	Hours
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		Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	10		
L4	Analyze	10		
L5	Evaluate	10		
16	Create			

Suggested Learning Resources:

Text Books:

- 1. HerbertSchildt, "JAVAtheCompleteReference", 11thEdition, TataMcGrawHill, 2020(print). ISBN-13: 978-. 0072263855.
- 2. JimKeogh, "J2EE-TheComplete Reference", McGrawHill, 2017, ISBN-13, 978-0070529120
- **3.** Rod Johnson, "Professional Java Development with the Spring Framework", Wrox , July 2018(Re-print), ISBN-13, **978-0764543852**.

Reference Books:

- 1. Stephanie Bodoff et al, "The J2EE Tutorial", 3rd Edition, Pearson Education, 2015 (Reprint), ISBN-13:978-8176111652.
- 2. Uttam K Roy, "Advanced JAVA programming", Oxford University press, 2018 ISBN-13- 978-0199455508

Web links and Video Lectures (e-Resources):

- <u>https://onlinecourses.nptel.ac.in/noc22_cs47/preview</u>
- <u>https://www.udemy.com/course/how-to-connect-java-jdbc-to-mysql/</u>
- <u>https://www.javatpoint.com/html-tutorial</u>
- <u>https://www.geeksforgeeks.org/life-cycle-of-a-servlet/?ref=ml_lbp</u>
- https://www.youtube.com/results?search_query=java+jdbc+connection
- <u>https://spring.io/projects/spring-framework</u>

- ≻ Create Dynamic web projects by using JDBC drivers.
- Contents related activities (Activity-based discussions)
- ➤ Organizing Group wise discussions on issues
- ≻ Seminars
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| 22RMK55.2 | Demonstr | Demonstrate the various processing techniques of research | | | | | | | | | | |
| 22RMK55.3 | Choose ap | Choose appropriate methods to formulate research objectives | | | | | | | | | | |
| 22RMK55.4 | Develop a | dvanced o | critical t | hinking | skills an | id enhanc | e writing | g skills | | | | |
| 22RMK55.5 | Understar | id the stat | tutory p | rovision | s of diff | erent forn | ns of IPR | Rs in simp | le forms | | | |
| 22RMK55.6 | Identify th | ie signific | ance of j | practice | and pro | ocedure of | patents | | | | | |
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MODULE-4
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MOD	ULE-5	BASICS OF PA	TENTS			22RMK55.5, 22RMK55.6	6 Hours
Paten	ts and its Basics	s – Patentable an	l Non-Patental	ole Inventio	ns–Patent Ap	plication Process (National and Inter	national level)
– Sear	ching a Patent	Drafting and Fili	ng a Patent –1	Sypes of Pat	ent Applicati	ons-Patent Documents- Specificatio	n and Claims-
Assign	iment Licensir	ng Infringement	-Different Lav	ers of Inte	rnational Pa	tent System-Some Examples of Pa	atent – forms
requir	ement for nate	nt application wit	h charges			tene bystem some Enamples of the	
Casa	tudu	Analyza diffor	nt domains of	filed nation	ta		
Case 3	study	Allalyze ulliele		meu paten	LS		
Text E	Book	Text Book 2: Ch	1 and 2				
CIE As	ssessment Patt	ern (50 Marks -	Theory)			7	
			Marks Di	stribution	1		
	RBT Levels	Test (s	Qualit	tative	MCQ's		
		25	Assessm	ient (s)	10	-	
11	Romomhor	5	1	5	5	-	
12	Understand				5	-	
13		1 5	7	5	5	-	
1.4	Analyze	5	7.	5 5	_	-	
L5	Evaluate	5		5	-	-	
L6	Create	-	-		-		
SEE A	ssessment Pat	tern (50 Marks	· Theory)	-			
	RBT Levels	Exa	m Marks				
L1	Remember	Distri	10				
L2	Understand		10				
L3	Apply		10				
L4	Analyze		10				
L5	Evaluate		10				
L6	Create						
Sugge	ested Learning	g Resources:					
Text	t Books:						
	Kothari, C.R.,Re	search Methodo	ogy: Methods	and Techni	ques, New Ag	ge International, 2018, ISBN-13: 978	3-8122436235
2)	Kamakrishna (.nintakunta, A T	ext book of in	tellectual P	roperty righ	ts, Blue Hill Publication, ASIN: B09	I 6Y DB5N,
Pofor	2022 Pance Books						
1)	Garg BL Kara	dia R Agarwal	F and Agarwal	IIK An Int	roduction to	Research Methodology RBSA Publis	hers 2015
1)	ISBN-13:978-81	176111652	. unu rigui wui	, 0.10, 111 111	liouuction to	Research Methodology, Robit Fabilis	1015. 2015,
2)	Ranjith Kumar,	Research method	ology, Saga pu	blications,4	th edition, 201	14, ISBN-13- 978-9351501336	
3)	Sinha, S.C. and	Dhiman, A.K., Ro	esearch Metho	dology, Ess	Ess Publicat	ions. 2 volumes, 2012. ISBN : 81-70	000-324-5, 81-
	7000-334-2						
4)	Asha Vijay Dura	lfe, Dhanashree K	. Toradmalle , l	Intellectual	Property Rigł	nts, Dreamtech Press,2020, ISBN:939	0395917
Web	links and Vide	o Lectures (e-F	esources):				
	• http	s://www.youtul	e.com/watch	v=GSeeyJV?	DOJU		
	• http	s://www.youtul	e.com/watch	v=nv7MO	0HMM2k		
	• http	s://www.youtul	e.com/watch	v=BG2821	J⊗-yŲ		
Activ	ity-Based Lea	rning (Suggeste	d Activities in	n Class)/ P	ractical Bas	ed learning	
•	Video Sessio	ons					
•	• Organizing (Group Wise Discu	ssions				
•	Seminars						

			CR	ITICAL A	ND CREA	TIVE TH	INKING S	KILLS				
Course Code		22SDK5	56						CIE Ma	rks	50	
L:T:P:S		0:0:1:0							SEE Ma	rks	-	
Hrs / Week		2							Total M	larks	50	
Credits		1							Exam H	lours	01	
Course outcom	es:											
Upon successful	completio	on of this	course, th	ne student	t will be a	ble to:						
22SDK56.1	Demons	trate prof	ficiency ir	n solving c	quantitati	ve aptituc	le probler	ns using f	fundamen	tal concep	ts	
22SDK56.2	Apply ac	dvanced q	uantitativ	ve technic	ques to ad	dress and	l solve cor	nplex rea	l-world p	roblems.		
22SDK56.3	Develop	and enha	ance logic	al reasoni	ing skills e	essential f	or proble	m-solving	g in vario	us competi	tive exam	inations.
22SDK56.4	Cultivat	e critical a	and creati	ve thinkiı	ng skills n	ecessary	for analyt	ical reasc	oning and	problem-s	olving.	
Mapping of Cou	irse Outc	omes to H	Program	Outcome	es and Pro	ogram Sp	ecific Ou	tcomes:				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22SDK56.1	3	3	-	-	2	-	-	-	-	-	-	2
22SDK56.2	3	3	-	-	2	-	-	-	-	-	2	
22SDK56.3	3	3	-	-	2	-	-	-	-	-	-	2
22SDK56.4	3	3	-	-	2	-	-	-	-	-	-	2
			1			1	1			1	1	1
MODULE 1			CRITICA	AL THINK	KING THR	OUGH			22SDK56	.1	611	
MODULE-1			QUANT	ITATIVE	ANALYSI	S		:	22SDK56	.2	оп	ours
Number syste	ems: LCM	and HCI	F of num	bers, Squ	laring an	d Cubing	g Techniq	ues, Mu	ltiplicatio	on Tricks,	Divisibili	ty rules,
Digit sum meth	10d, Spee	d Math, S	Simplific	ations, A	pproxim	ations.						
Percentages:	Convers	ion of F	raction	to Perce	ntage Ta	ahle Pei	centage	Change	Net ne	rcentage	change/l	Effective
percentage ch	ange. Su	ccessive	Percent	age. Cor	ncent of	more/le	ss perce	ntage. F	Percentag	ve of ner	centage.	Product
constancy. Inci	reased/d	ecreased	bv P%.	Percenta	ge Chang	ges in Nu	merator	and Den	ominato	r. Success	sive Perce	ntage.
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Averages: Ba	uding co	ept, Cons ncent Re	ecutive l	numbers	ont Avera	age Snee	d concen	ers, Equa	ation Co	ncept, Tri	ue/Faise	concept,
menuumg/ Exci	uunig co	ncept, Re			ερι, Avera	age Spee	u concep	L.			1	
MODULE-2			NUMER	ICAL TEC	CHNIQUE	S FOR PR	OBLEM		22SDK56	.1	6 H	ours
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Dishonest shop	okeeper,	d concep More/les	ss loss co	ncept.	tage, Los	s Perce	ntage, Pi	OIII/LOS	s Percer	itage, Uv	erall Pro	III, LOSS,
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Ratio and Pro	portion:	Concep	t Explan	ation, Du	iplicate R	latio, Tri	plicate R	atio, Dire	ect Propo	ortion, Inc	direct Pro	portion,
Double rule of	three or	· compoi	ind prop	ortion, F	Ratio in i	nvestme	nt, Ratio	in parti	hership,	Ratio in a	iverages,	Ratio in
profit and loss,	, Ratio in	interest	rates.									
Time and Wor	rk: Unit v	vork, Coi	mbined v	vork, Ind	lividual e	fficiency	, Group e	fficienci	es, Time	taken by	an indivio	dual or a
group, Work de	one by an	individu	ual or a g	roup, Tot	tal work	done, Ch	ain Rule	Concept,	Pipes an	d Cistern	s, 4 Rules	of Pipes
and Cistern.												
									22SDK56	.1		
MODULE-3			ADVAN	CED QUA	NTITATI	VE TECH	NIQUES	:	22SDK56	.2	6 HC	DURS
Algebra: Simpl	le Arithm	etic Opera	ations, Li	near equa	ation is or	ne, Two a	nd three	variables	, Method	s of solvin	g linear e	quations,
Series and Proc	ressions	• Arithme	tic Seque	nces Geor	metric Se	ununns.	Harmonic	Sequence	es Fihona	cci Numbe	ars	
Commenter C			cc	-l			1 -	sequence			r	
Geometry: Con Perimeter and A	cepts of A trea of Tri	angles, Di angle, Rec	rierent po ctangle, ai	nd circles.	ке triangl	ies, rectai	ngle, squa	re, right-	angle tria	angie, Pytł	lagorean '	i neorem,
												39

MODULE-4ANALYTICAL REASONING AND CREATIVE PROBLEM SOLVING22SDK56.3 22SDK56.46 Hours								
Number Series - Missing numbers, Incomplete series - Odd-even series, primes, Fibonacci series, Arithmetic progression, Geometric progression, Harmonic progression, Squares and cubes, Operations on digits, Exponential series, Increasing multiplication, Hybrid series.								
Alphabetical Series- Missing alpha letters marked with corresponding numbers and words/letters, compl	abets, incomplete letter series - series of words, numbers sequence, positions of letters, ranking ete the series.	series of letters, arrangemen of the word in dictionary; Mix	nt of words/letters, and Series - Missing					
Analogies: Alphabet Classification, Word Classification, Number Classification.								
Analogies: Alphabet Classification,	, Word Classification, Number Classification.							
Analogies: Alphabet Classification, Coding and Decoding: Coding bas ordering sequences; Word sequence	, Word Classification, Number Classification. sed on order, Letter to Letter Mapping, Letter to sing, Match the word to code, Symbol Coding.	number mapping, Letter to	digit mapping, Re-					

Directions: Eight Directions, Distance, Displacement, Starting and ending points, Referential directions, Directions of shadows, Axis based problems, Actual and conditional directions.

Seating Arrangements: Linear arrangement, Square Arrangement, Rectangular Arrangement, Circular arrangement, Vertical arrangement, Seating arrangement in a photograph, Tabular arrangement, Hexagonal Seating Arrangement, Complex arrangement, Miscellaneous arrangements.

Blood Relations: Relations defined, Generation Verticals, Family Tree, Single Person Blood Relations, Mixed/Chain Blood Relations, Symbol based Blood Relation.

CIE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Marks Distribution
		Tests
		50
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

				EN	VIRON	MENTAL	STUDIES					
Course Code	22ESK57						CIE M	larks		50		
L:T:P:S	1:0:0:0						SEE N	Marks		50		
Hrs / Week	1						Tota	l Marks		100)	
Credits	01						Exan	1 Hours		02		
Course outcome	s:											
At the end of the	e course, the	student	will be	able to:								
22ESK57.1	Understand 1	the conc	epts of	Environ	ment, e	cosystem	and biodi	versity.				
22ESK57.2	Explain the s	trategie	s for ma	anageme	ent of na	atural res	ources to	achieve sı	ıstainab	ility		
22ESK57.3	Analyze the o	control 1	neasure	es of Env	vironme	ental pollu	ition and g	global Env	vironme	ntal issues.		
22ESK57.4	Apply the kn	owledge	e of Env	ironmer I human	it Impa bealth	ct Assessr	nent, Tecł	nnology, E	nvironn	nental acts	and laws i	n
Mapping of Cou	rse Outcom	es to P	rogran	n Outco	mes ai	nd Progr	am Speci	fic Outco	mes:			
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P0100	P011	P012
22ESK57.1	-	-	-	-	-	3	3	-	-	-		-
22ESK57.2	-	3 3 3										3
22ESK57.3	-	3 3 3 - 3 - 3										3
22ESK57.4	-	-	-	-	1	3	3	3	-	3	-	3
MODULE 1	INTRODU(BIODIVER	TRODUCTION TO ENVIRONMENT, ECOSYSTEM AND 22ESK57.1 3hrs										
Environment: De	finition, Com	ponents	of Env	ironmer	t; Ecos	vstem: Tv	pes & Stri	icture of H	Ecosvste	m, Energy	flow in the	e ecosystem;
Biodiversity: Typ	es, Hot-spots	, Threat	s and C	onserva	tion of	biodiversi	ty.		5	, 0,		<i>.</i>
Self-study / Case	Study /	Data Ar	nalysis	on Envi	ronme	nt, Ecosy:	stem And	Biodiver	sity			
Applications	5 /		2						2			
Text Book		Text Bo	ok 1: Cł	n.1,38	ı 4							
MODULE 2	NATURAL	RESOU	JRCES						2	2ESK57.2		3hrs
Advanced Energy	y resources (Hydrog	en, Sola	ar, OTEO	C, Tidal	and Win	d), merits	and dem	nerits, W	/ater resou	ırces – clo	oud seeding,
Mineral resource	s, Forest reso	ources. S	Strategi	es of ma	nageme	ent, conce	pt of susta	inability.				
Self-study / Case	Data Ana	lysis or	n Natur	al Resou	irces							
Study /												
Applications			_									
Text Book	Text Boo	k 1: Ch.	2									
MODULE 3	ENVIRON	MENTA	L POLI	<u>UTION</u>			D 11		2	2ESK57.3	11	<u>3hrs</u>
Definition, Cause	s, effects and	contro	l measu	res of A	ir Pollu	tion, Wate	er Pollutio	on, soil Po	llution a	and Noise p	ollution. S	Solid wastes
and its managem	ent. Role of s	ociety, ľ	NGO and	1 Govt. a	gencies	in prever	ition of po	ollution				
Self-study /	Data Analy	sis on E	environ	ment po	ollution	1						
Lase Study /												
Text Book	Text Book	1. Ch 5	6 Tovt 1	Sook 2.	Ch 5							
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Environmental la	ws and acts	Interna	tional a	reemer	its and	nrotocols		i iiiiig and	l ciinate	change. No		est policy,
Self-study / Case	Data Anal	vsis on	Global (environ	mental	issues						
Study /	Duta miai	y 515 011	GIODUI		mentui	155465						
Applications												
Text Book	Text Book	1: Ch. 6	, Text B	ook 2: C	h. 6							
												21
MODULE 5	HUMAN ASSESSMI	POPU ENT	LATIO	N AN	ID E	NVIKONN	IENT]	IMPACT	22	е зк 57.4		3hrs
Population grow	th & explosi	on, Pop	ulation	pyramic	ls. Nega	ative imp	act of agr	iculture a	nd urba	nization, F	Role of Te	chnology in
protecting enviro	nment and h	uman h	ealth. E	nvironm	nent Im	pact Asses	sment.					
Self-study / Case	Data Anal	vsis on	human	populat	tion	-						
Study /		,		. F								
Applications /												
Applications												

Text B	ook	Text Book	: 1: Ch. 7			
CIE As	sessment F	Pattern (50	Marks – Th	eory) –		
				Marks Distribu	ıtion	7
	RBT Lev	els	Test (s)	Qualitative Assessment (s	s) MCQ's	
			25	15	10	
L1	Remem	ber	5	-	5	
L2	Underst	and	10	7.5	5	
L3	Apply		10	7.5	-	
L4	Analyze			-	-	7
L5	Evaluate	е		-	-	7
L6	Create			-	-	7
SEE A	ssessment l	Pattern (50) Marks - Tł	ieory)		
	RBT Leve	els	Exam Distribu	Marks tion (50)		
L1	Rememb	er	1	.5		
L2	Understa	nd	1	.5		
L3	Apply		2	0		
L4	Analyze		-	-		
L5	Evaluate		-	-		

Text Books:

Create

L6

- Environmental studies by Benny Joseph, Tata McGraw Hill Education Private Limited, 2009, ISBN: 9870070648135.
 "Environmental Studies: Basic Concepts" by Ahluwalia, V. K. The Energy and Resources Institute (TERI) Publication,
- 2nd edition, 2016. ISBN: 817993571X, 9788179935712.

Reference Books:

- 1. Handbook of Environmental Engineering by Rao Surampalli, Tian C. Zhang, Satinder Kaur Brar, Krishnamoorthy Hegde, Rama Pulicharla, Mausam Verma; McGraw Hill Professional, 2018. ISBN: 125986023X, 9781259860232
- 2. Environmental Science and Engineering by P. Venugopala, Prentice Hall of India Pvt. Ltd, New Delhi, 2012 Edition. ISBN: 978-81-203-2893-8.
- 3. Elements of Environmental Science and Engineering by P. Meenakshi, Prentice Hall of India Pvt. Ltd, 2005 Edition. ISBN: 8120327748, 9788120327740

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/120/108/120108004/
- https://archive.nptel.ac.in/courses/103/107/103107215/

- Visit to any company to study the initiative taken for environmental impact.
- Case study based learning on engineering approaches for pollution prevention.
- Video/ model / charts based learning
- Activities/awareness program for preventing environmental pollution

						MINI P	ROJECT	Г - II						
Course Code	22CDS	58							CI	E Marks		50)	
L:T:P:S	0:0:1:0								SE	E Marks		50)	
Hrs / Week	k 2 Total Marks							10	100					
Credits	01								Ex	am Houi	'S	03	3	
Course outcome	es:													
At the end of t	he course, th	ne stude	nt will	be able	e to:									
22CDS58.1	Apply	the knov	vledge	ofapp	ropriat	e doma	ins of th	e Solve	real wo	rld probl	ems			
22CDS58.2	Design	module	es for s	olving t	he prob	olems ic	lentified	1						
22CDS58.3	Impler	nent mo	dules	with a s	uitable	softwaı	re frame	ework						
22CDS58.4	Analyz	e real w	orld p	roblem	s throug	gh surv	ey of exi	isting p	roblems					
Mapping of Cou	irse Outcoi	nes to	Progr	am Ou	tcomes	and P	rogran	n Speci	fic Out	comes:				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2
22CDS581	3	3	3	2	3	1	2	1	1	1	3	2	3	3

The student shall be capable of identifying a problem related to the field of Computer Science and carry out a mini project on the problem defined. Each student is expected to do the mini project individually. The work progress towards the project will be reviewed by a panel of experts during the course of the semester. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

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Scope of the Mini project areas, but are not limited to :

1) Data Structure driven applications

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- 2) Web based Applications
- 3) Data Science Applications
- 4) Java Based Projects
- 5) IoT applications

CIE Assessment Pattern (50 Marks – Lab)

22CDS58.2

22CDS58.3

22CDS58.4

DDT Lovale	Test (s)	Weekly Assessment
KD1 Levels	20	30
Remember	-	-
Understand	5	10
Apply	5	10
Analyze	5	5
Evaluate	5	5
Create	-	-
	RBT Levels Remember Understand Apply Analyze Evaluate Create	RBT LevelsTest (s)20RememberUnderstand5Apply5Analyze5Evaluate5Create

SEE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	10

NATIONAL SERVICE SCHEME (NSS)												
Course Code	22NSS3	0, 22NS	S40, 22NSS	50, 22NS	S60		CIE Ma	rks	r)	50		
Ι.Τ.Ρ.ς	0.0.0.0						SFF Ma	rks	1)			
Hrs / Week	2 Total Marks 50 x 4										x 4 = 200	
Credits	$\frac{2}{1000}$											
Course outcomes	:											
At the end of the course, the student will be able to:												
22NSSX0.1	Understa	and the i	mportance	of his / he	er respons	ibilities	towards s	ociety.				
22NSSX0.2	Analyse	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.										
22NSSX0.3	Evaluate	the exis	sting system	n and to pr	opose pra	actical sc	olutions fo	r the sa	me for s	ustainable o	developme	ent.
	Impleme	ent gove	rnment or s	elf-driven	projects e	effective	ly in the f	ield.				
22NSSX0.4	Develop	capacity	v to meet en	nergencies	and natu	ral disas	ters & pra	ictice na	tional in	tegration a	nd social h	armony
	in genera	al.										
Mapping of Cour	se Outco	mes to	Program (Outcomes	S:							
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22NSSX0.1	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.4	-	-	-	-	-	3	3	-	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
3 RD 22NSS30	 Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing Waste management-Public, Private and Govt organization, 5R's. Setting of the information imparting club for women leading to contribution in social and economic issues. 	22NSS30.1, 22NSS30.2, 22NSS30.3, 22NSS30.4	30 HRS
4 ^{тн} 22NSS40	 Water conservation techniques – Role of different stakeholders– Implementation. Preparing an actionable business proposal for enhancing the village income and approach forimplementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 	22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4	30 HRS
5 ^{тн} 22NSS50	 Developing Sustainable Water management system for rural areas and implementationapproaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. Spreading public awareness under rural outreach programs. (minimum 5 programs). 	22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4	30 HRS
6 ^{тн} 22NSS60	 10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure. 	22NSS60.1, 22NSS60.2, 22NSS60.3, 22NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks - Activity based) -

CIE component for every semester	Marks
Presentation - 1	10
Selection of topic, PHASE - 1	
Commencement of activity and its progress -	10
PHASE - 2	
Case study-based Assessment Individual	10
performance	
Sector wise study and its consolidation	10

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Reference Books:

- 1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
- 2. Government of Karnataka, NSS cell, activities reports and its manual.
- 3. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

- 1. Students should have a service-oriented mindset and social concern.
- 2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
- 3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
 - Lecture session by NSS Officer
 - Students Presentation on Topics
 - Presentation 1, Selection of topic, PHASE 1
 - Commencement of activity and its progress PHASE 2
 - Execution of Activity
 - Case study-based Assessment, Individual performance
 - Sector/ Team wise study and its consolidation
 - \circ Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation	Evaluation as per the rubrics of scheme and syllabus by NSS officer

		vocational education.				authority	
5	7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
£	8.	Contribution to any national level initiative of Government of India.For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
	9.	Spreading public awareness under rural outreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
-	10.	Organize National integration and social harmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

 11.	Govt. school	May be	Villages/ City	Place	Report	Evaluation	
	Rejuvenation	individual	Areas /Grama	selection/proper	should be	as per the	
	andhelping them	or team	panchayat/ public	consultation/	submitted	rubrics of	
	to achieve good		associations/	Continuous	by	scheme	
	infrastructure.		Government	monitoring /	individual	and	
			Schemes officers/	Information board	to the	syllabus	
			campus		concerned	by NSS	
			-		evaluation	officer	
					authority		

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)												
Course Code	22PED30, 22PED40, 22PED50, 22PED60 CIE Marks							50				
							(each s	emester	()			
L:T:P:S	0:0:0:0						SEE Ma	rks				
Hrs / Week	2						Total M	larks		50 x	4= 200	
Credits	00						Exam H	lours		02		
Course outco	mes:	a student	urill bo ok	la ta								
			will be at		1 1 111	(D) ·	1.0.1		1	1		
22PEDX0.1 Understand the fundamental concepts and skills of Physical Education, Heal						on, Healt	h, Nutriti	on and Fit	ness			
22PEDX0.2	Create cons healthy life	sciousness style	among th	ie student	s on Healt	h, Fitnes	ss and We	llness in	developi	ng and ma	intaining	a
22PEDX0.3	Perform in	the select	ed sports	or athletic	s of stude	nt's cho	ice and pa	rticipate	in the co	mpetition	at	
22050204	regional/st	ate / natio	onal / inte	rnational	levels.	inction	ndadmin	istration	of an ort	and com		
ZZPEDX0.4	Understand	i the roles	and resp		s of organ	ization a	na aamin	istration	l of sports	s and game	25	
Mapping of C	Course Outco	omes to P	rogram	Outcome	S:							2010
2205080.4	P01	POZ	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22PEDX0.1	-	-	-	-	-	2	-	3	3	-	-	2
22PEDA0.2	-	-	-	-	-	2	-	3	3	-	-	2
22FEDX0.3	-	-	-	-	-	2	-	3	3	-	-	2
ZZFEDA0.4	-	-	-	-	-	Z	-	3	3	-	-	Z
Semester				CONTE	VТ					' <u>0</u> s	HOURS	
Jemester	Module 1:	Orientati	on	CONTE	11					.03		5115
	A. Lifestyle.										- UD2	
	B. Fitness									ED30.1.		
	C. Food & Nutrition								22PI	ED30.2	5 HKS	
	D. Health & Wellness											
	E. Pre-Fitness test.											
	Module 2: General Fitness & Components of Fitness											
0.00	A. Warming up (Free Hand exercises)											
3 ^{KD}	B. Strength – Push-up / Pull-ups									22PED30.2,		IDC
ZZPED30	C. Speed – 30 MIT Dash D. Agility – Shuttle Rup									ED30.3	15 HRS	
	D. Ag	unty – Shu wibility	Cit and De	ach								
	E. Fit	rdiovascu	lar Fndur	ach ance – Hai	rvard ster	Test						
	Module 3: Recreational Activities											
	A. Postural deformities.									22PED30.3, 22PED30.4 10 H		
	B. Stress management.											
	C. Aerobics.											
	D. Tr	aditional (Games.									
Module 1: Ethics and Moral Values					22PE	ED40.1,	E D	DC				
	A. EL B. Ma	nics in spe oral Value	s in Sport	s and Gam	es				22PI	ED40.2	эп	KS
	Module 2:	Snecific (ames (A	nvone to	he selec	ted hv t	he stude	nt)				
	A Vollevh	all – Attacl	z Block S	ervice Un	ner Hand	Pass and	Lower h	and Pass				
4 TH	B. Throwb	all – Servi	ce. Receiv	e. Spin att	ack. Net D	rop & It	mp throv	v.				
22PED40	C. Kabadd	i – Hand to	ouch. Toe	Touch. Th	igh Hold.	Ankle ho	old and Bo	onus.	2201	2040.2	20.1	IDC
	D. Kho-Kh	o – Giving	Kho, Sing	le Chain, P	ole dive, l	Pole turr	ning, 3-6 l	Jp.	2291	2D40.3	201	185
	E. Table T	ennis – Se	rvice (Fo	re Hand &	Back Har	nd), Rece	eive (Fore	Hand &	&			
	Back Ha	ind), Smas	h.									
	F. Athletic	s (Track /	Field Eve	nts) – Any	event as	per avai	lability of	Ground.				
	Module 3:	Role of O	rganizati	ion and a	dministr	ation			22PI	ED40.4	5 H	IRS
5 TH	Fitness C	omponen	ts: Mean	ing and	Importan	ce, Fit	India Mo	vement,	22PF	ED50.1,	Total 3	0 Hrs/
22PED50	50 Definition of fitness, Components of fitness, Benefits of fitness, Types								22PE	D50.2,	Seme	ester

Practical Components: Speed, Strength, Endurance, Flexibility, and Agility 227ED50.4 2 Hrs/week Athletics: 1. Track-Sprints: 222ED50.4 2 Hrs/week Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. Acceleration with proper running techniques. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball Recovery (Perry O'Brien Technique) Handball A. Fundamental Skills 1. Catching, Throwing and Ball control, 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbiling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Stotics: Overhead shot, Defensive clearshot, thatacking clearshot, Dropshot, N
Athletics: 1. Track-Sprints: 2. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball: A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Kules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shuts. Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 6 ⁵⁷⁴ Atthetics: 1. Track -110 Mtrs and 400Mtrs: 7 9. Rules and their interpretation and duties of officials. 6 ⁵⁷⁴ Atthetics: 1. Track -110 Mtrs and 400Mtrs: • Hurudling Technique: Lead leg Technique, Trail
1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws: Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service (Long-high service. 3. Shot: Soverhead shot, Defensive skills, Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 6 ^{ruii} Athletics: 22P
 Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. Acceleration with proper running techniques. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball OR Ball Badminton Catching, Throwing and Ball control, Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. Orbibling: High and low. Attack and counter attack, simple counter attack, counter attack from two wings and center. Blocking, Goal Keeping and Defensive skills. Game practice with application of Rules and Regulations. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills Basic Knowledge: Various parts of the Racket and Grip. Service, Short service, Long service, Long-high service. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. Game practice with application of Rules and Regulations. Bules and their interpretation and duties of officials. 6^{run} Athletics: Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling. Over the Hurdles, In Between Hurdles, Last Hurdles to
use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. • Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 6 ⁷¹⁴ Athletics: 4. Game practice with application of Rules and Regulations.
 Acceleration with proper running techniques. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug, Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball I. A. Fundamental Skills Catching, Throwing and Ball control, Goal Throws: jumpshot, Centershot, Diveshot, Reverseshot. Dribbiling: High and low. Attack and counter attack, simple counter attack, counter attack from two wings and center. Blocking, Goal Keeping and Defensive skills. Game practice with application of Rules and Regulations. Rules and their interpretations and duties of officials Ball badminton: Basic Knowledge: Various parts of the Racket and Grip. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. Game practice with application of Rules and Regulations. Rules and their interpretation and duties of officials. 6^r^H Athletics: Track -110 Mtrs and 400Mtrs: Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles, in Between Hurdles, Last Hurdles to
 Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball: A. Fundamental Skills Catching, Throwing and Ball control, Coal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. Dribbling: High and low. A. Attack and counter attack, simple counter attack, counter attack from two wings and center. Blocking, Goal Keeping and Defensive skills. Game practice with application of Rules and Regulations. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills Basic Knowledge: Various parts of the Racket and Grip. Service: Short service, Long service, Long-high service. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, NetShot, Smash. Game practice with application of Rules and Regulations. Rules and their interpretation and duties of officials. Brack forwledge: Various parts of the Racket and Grip. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, NetShot, Smash. Game practice with application of Rules and Regulations. Rules and their interpretation and duties of officials. Prack-110 Mtrs and 400Mtrs: Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles Crouch start (its variations)use of Start
Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball: A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and Iow. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, NetShot, Smash. 4. Game practice with application of Rules and Regulations. 8. Rules and their interpretation and duties of officials. 6 TH Athletics: 1. Track-110 Mtrs and 400Mtrs: 9. Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles, Last Hurdles, Last Hurdles to 6. Crouch start (its variations)use of Starting Block.
 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball: A. Fundamental Skills Catching, Throwing and Ball control, Coal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. Doribbling: High and low. Attack and counter attack, simple counter attack, counter attack from two wings and center. Bocking, Goal Keeping and Defensive skills. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills Basic Knowledge: Various parts of the Racket and Grip. Service: Short service, Long service, Long-high service. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 6⁷¹⁴ Athletics: Track -110 Mtrs and 400Mtrs: Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles Crouch start (its variations)use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to
Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball: A. Fundamental Skills 1. Catching, Throwing and Ball control, Coal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 6 TH Athletics: 1. Track -110 Mtrs and 400Mtrs: 8. Rules and their interpretations and source, Trail leg Technique, Side Hurdling, Over the Hurdles 1. Track -110 Mtrs and 400Mtrs: 9. Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles 2. Crouch start (its variations)use of Starting Block. 9. Approach to First Hurdles, In Between Hu
 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) Handball OR Ball Badminton Handball: A. Fundamental Skills
Handball OR Ball Badminton Handball: A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 6 TH 22PED60 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations)use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to
Handball: A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials 8 Ball badminton: A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 8. Rules and their interpretation of Rules and Regulations. B. Shots: Overhead shot, Defensive clearshot, Dropshot, Netshot, Smash. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles 6. Crouch start (its variations)use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to 5.
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 Crouch start (its variations)use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to
Approach to First Hurdles, In Between Hurdles, Last Hurdles to
Finishing.
2. Jumps- Hign Jump: Approach Run, Take-off, Bar Clearance (Straddle) and
Langing.
Turn, Release and Recovery (Rotation in the circle).
Football OR Hockey 22PED60.2, 22PED60.3, 22P
Football: 22PED60.4 2 Hrs/week
A. Fundamental Skills
1. KICKING: KICKING the ball with inside of the foot, KICKING the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the
ball with Outer Instep of the foot and Lofted Kick.
2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot.
3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball
with Inner and Outer Instep of the foot.
4. Heading: In standing, running and jumping condition.
5. Throw-in: Standing throw-in and Running throw-in.

6. Feinting: With the lower limb and upper part of the body.	
7. Tackling: Simple Tackling, Slide Tackling.	
8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting.	
9. Game practice with application of Rules and Regulations.	
A. Rules and their interpretation and duties of officials.	
Hockey:	
A. Fundamental Skills	
1. Passing: Short pass, Longpass, pushpass, hit	
2. Trapping.	
3. Dribbling and Dozing	
4. Penalty stroke practice.	
5. Penalty corner practice.	
6. Tackling: Simple Tackling, Slide Tackling.	
7. Goal Keeping, Ball clearance- kicking, and deflecting.	
8. Game practice with application of Rules and Regulations.	
B. Rules and their interpretation and duties of officials	

CIE Assessment Pattern (50 Marks - Practical) -

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	50

Suggested Learning Resources:

Reference Books:

- 1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
- 2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
- 3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
- 4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
- 5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
- 6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
- 7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
- 8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
- 9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
- 10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
- 11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
- 12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
- 13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
- 14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

					YOG	A								
Course Code	22Y0G30, 22Y0G40, 22Y0G50, 22Y0G60 CIE Marks								50					
L:T:P:S	0:0:0:0	0:0:0:0 SEE Marks								-	-			
Hrs / Week	2	2 Total Marks								5	50 x 4	= 200		
Credits	00						Exam H	lours		()2			
Course outcon At the end of th	nes: le course, the	e student v	will be abl	e to:										
22Y0GX0.1	Underst	anding the	e origin, h	istory, aim	n and obje	ctives of	Yoga							
22Y0GX0.2	Become	Become familiar with an authentic foundation of Yogic practices												
22YOGX0.3	Practice	different	Yogic met	hods such	as Suryar	namaska	ira, Prana	yama an	d some	of the Sh	at Kr	iyas		
22Y0GX0.4	Use the	teachings	of Patanja	ali in daily	life.									
Mapping of Co	ourse Outco	omes to F	Program	Outcome	s:									
	P01	P02	P03	P04	P05	P06	P07	P08	POS	PO 1	10	P011	P012	
22YOGX0.1	-	-	-	-	-	3	-	-	-	-		-	1	
22YOGX0.2	-	-	-	-	-	3	-	-	-	-		-	1	
22Y0GX0.3	-	-	-	-	-	3	-	-	-	-		-	1	
22Y0GX0.4	-	-	-	-	-	3	-	-	-	-		-	1	
Semester / Course Code				CONT	TENT					COs	5	H	HOURS	
3 rd 22YOG30	 history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health Rules and regulations: Rules to be followed during yogic practices by practitioner Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices. Suryanamaskara: Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar. Suryanamaskar 12 count, 2rounds Different types of Asanas: Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana Prone line: Bhujangasana, Shalabhasana 									l 32 Hrs/ mester rs/week				
4 ^{тн} 22YOG40	4.Supineline: Utthitadvipadasana, Ardhahalasana, HalasanaSuryanamaskara: Suryanamaskar 12 count,4roundsBrief introduction and importance of: Kapalabhati: Revision of Kapalabhati -40strokes/min3roundsDifferent types of Asanas:1.Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana22Y0G40.1, 22Y0G40.2, 22Y0G40.3, 22Y0G40.3, 22Y0G40.4Total 32 Hrs Semester 2 Hrs/week2.Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3.Prone line: Dhanurasana 22Y0G40.4Total 32 Hrs Semester 2 Hrs/week4.Supine line: Karna Peedasana, Sarvangasana, Chakraasana Pranayama: Chandra Bhedana, Nadishodhana, Surya BhedanaPatanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya BhedanaPatanjali's Ashtanga Yoga: Asana, Pranayama								l 32 Hrs/ mester rs/week					

5 ^{тн} 22Y0G50	 Kapalabhati: Revision of Kapalabhati - 60strokes/min3rounds Brief introduction and importance of: Different types of Asanas: Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana Patanjali's Ashtanga Yoga: Pratyahara, Dharana Pranayama: Ujjayi, Sheetali, Sheektari 	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week
б ^{тн} 22Y0G60	 Kapalabhati: Revision of Kapalabhati – 80 strokes/min3rounds Brief introduction and importance of: Different types of Asanas: Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana Supine line: Setubandhasana, Shavasanaa (Relaxation posture) Balancing: Sheershasana Patanjali's AshtangaYoga: Dhyana (Meditation), Samadhi Pranayama: Bhastrika, Bhramari, Ujjai Shat Kriyas: Jalaneti and sutraneti, Sheetkarma Kapalabhati 	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks - Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	50

Suggested Learning Resources:

Reference Books:

- 4. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
- 5. Tiwari, O P: Asana Why and How
- 6. Ajitkumar: Yoga Pravesha (Kannada)
- 7. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
- 8. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
- 9. Nagendra H R: The art and science of Pranayama
- 10. Tiruka: Shatkriyegalu (Kannada)
- 11. Iyengar B K S: Yoga Pradipika (Kannada)
- 12. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

<u>https://youtu.be/KB-TYlgd1wE</u>

• https://youtu.be/aa-TG0Wg1Ls

VI Semester

	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING													
Course Code	е		22CD	S61				(CIE Marks	5		50		
L:T:P:S			3:0:0:	:0				S	SEE Mark	S		50		
Hrs / Week			3					1	Fotal Mar	·ks		100		
Credits			03					E	Exam Hou	irs		03		
At the end of	o mes: of the c	ourse,	the stud	lent will ł	be able to):								
22CDS61.1			Apply Value	search te d function	echnique n	s and co	ncept lea	rning	for findin	g optima	l solutions	and infer	ring Boo	lean-
22CDS61.2			Analy: Better	ze the her and Fast	uristic al ter Decis	gorithms ions	s and lea	rning	algorithm	s over a	range of av	vailable op	tions to o	obtain
22CDS61.3			Emplo	oy Decisio	on tree le	arning a	nd Bayes	sian Le	earning to	make us	seful predi	ctions		
22CDS61.4			Derive	e the prol	babilistic	framew	ork usin	g learr	ning techr	iques to	predict tai	rget variab	oles	
22CDS61.5			Comp	ute new d	data poin	its using	memory	-base	d learning	5				
22CDS61.6Examine the new query instance using instance-based learning														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	PO3	P04 P05 P06 P07 P08 P09 P010 P011 P012 PS01										
22CDS61.1	3	2	2	2	-	-	-	-	-	-	-	2	2	2
22CDS61.2	3	3	3	3	-	-	-	-	-	-	-	2	2	2
22CDS61.3	3	2	2	2	-	-	-	-	-	-	-	2	2	2
22CD301.4	3	2	2	2	-	-	-	-	-	-	-	2	2	2
22CDS61.6	3	3	3	3	-	-	-	-	-	_	-	2	2	
		U	U	0			I						. –	
MOD	ULE-1		Introduction to AI 22CDS61.1 8 How 22CDS61 2									Hours		
What is artif	ficial in	telliger	ice, We	ll-Posed	Learning	g Probler	ns, Desig	gning a	a Learnin	g System	, Choosing	g the train	ing expe	erience,
Choosing the	e targe	t functi	on, Cho	osing a r	epresent	tation fo	r the tar	get fu	nction, Ch	loosing a	function	approxima	ation algo	orithm,
Perspectives	and is	sues in	Machin	e Learnir	ıg, probl	em space	es and se	arch, l	Heuristic	search te	chniques			
Applications	S		8 Puz	zle probl	em									
Text Book			Textb	ook 1: Ch	apter 1,	2 and 3								
MODULE-2			Conce	ept Lear	nıng						22CI 22CI	DS61.1 DS61.2	8	8 Hours
Knowledge 1 task, Concep Algorithm	represe ot learn	entatior ling as	i issues search,	, Predica Find-S a	te logic, lgorithm	Represen , Candid	ntation k ate Elim	nowle inatio	edge usin n Algoritl	g rules. (1m, Indu	Concept Le ctive bias	earning: Co of Candida	oncept le ate Elim	earning ination
Applications	S		•	A can	didate e	liminatio	on appro	oach to	o rule lea	rning in	version sp	bace		
Text Book			Textb	ook 1: Cł	hapter 4	, 5 and 6	& Texb	ook2:	Chapter	2 (2.1-2.	5, 2.7)			
MODULE-3			Decis	ion Tree	e Learni	ng in M	achine l	Learn	ing		22CI 22CI	DS61.3 DS61.4	8	8 Hours
Decision Tre	ee Leai	rning: I	ntrodu	ction, De	cision tr	ee repre	sentatio	on, Ap	propriate	e probler	ns, ID3 alg	gorithm. A	rtificial	Neural
Network: In Perceptrons	troduc s, Back	tion, N propag	N repre gation a	esentatio Ilgorithm	n, Appro 1.	opriate p	oroblem	S,						
Case Study			•	Decisi	ion Tree	Algorith	ım in He	ealthca	are Appli	cations				
Text Book			Texho	ok2. Cha	anter 3 (31-34)	Chapte	r 4 (4	1-45)					
MODULE-4			Bayes	sian Lea	rning	012 011)	, on ap to	(1.05		22CI 22CI	OS61.3	8	8 Hours
Bayesian Le predicting, N	arning MDL pı	: Intro rinciple	duction e, Bates	, Bayes ti optimal	heorem, classifie	Bayes tl r, Gibbs	heorem algorith	and co m, Na	oncept lea vie Bayes	arning, M s classifie	IL and LS er, BBN, El	error hyp M Algorith	othesis, nm	ML for
Applications • Bayesian learning of network structures from interventional experimental data														

Text B	Text Book Texbook2: Chapter 6											
MODU	JLE-5	Instanc	e- based Learning			22CDS61.6	8 Hours					
Instan	ce-Base Learning:	Introduct	ion, k-Nearest Neigh	ıbour Learni	ng, Locally weigh	ted regression, Radial basi	s function,					
Case-I	Based reasoning. Re	einforcem	ent Learning: Introd	uction, The l	earning task, Q-Le	earning.						
Self-st	udy / Case Study /	•	Personal Well-Being	g Analysis tł	rough the Integr	ation of Instance-Based Le	earning with					
Applic	cations		Interpretable AI Teo	chniques								
Text Book Text book 1: Chapter 8 (8.1-8.5), Chapter 13 (13.1 – 13.3)												
CIE As	CIE Assessment Pattern (50 Marks – Theory)											
Marks Distribution												
	RBT Levels	Test	Qualitative	MCO's								
		(s) Assessment (s)										
		25										
	Remember	5										
	Understand	5										
	Apply	5	3 7.5 5									
	Analyze	5	7.5	5	-							
	Create				-							
CEE A	Cicate	(EO Montr	a Theory)									
SEE A	ssessment Pattern	(50 Mark Evom	S - Theory									
	RBT Levels	Distrihi	ition (50)									
L1	Remember	Distribu	10									
L2	Understand		10									
L3	Apply		10									
L4	Analyze		10									
L5	Evaluate		10									
L6	Create											
Sugge	sted Learning Res	ources:										
Textb	Fextbooks:											
1. T	om M Mitchell, "Ma	chine Ler	ning",1st Edition, Mo	Graw Hill Ec	lucation, 2017, ISI	3N-13, 978-1259096952.						
2. E	laine Rich, Kevin K	and S B N	air, "Artificial Intellig	gence", 3rd E	dition, McGraw H	lill Education, 2017, ISBN-13	5, 978-					
0 Deferre	070087705.											
terere	Reference Books:											

- 1. Saroj Kaushik, Artificial Intelligence, Cengage learning, ISBN-13, **978-813151099**.
- 2. Stuart Rusell, Peter Norving , Artificial Intelligence: A Modern Approach, Pearson Education 2nd Edition, ISBN-13, 978-8120323827.
- 3. AurÈlienGÈron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, Shroff/O'Reilly Media, 2017, ISBN-13, 978-9355421982.
- 4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics, ISBN-13, **978-0387848570**.

Web links and Video Lectures (e-Resources):

- 1. <u>https://nptel.ac.in/courses/106102220</u>
- 2. <u>https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners</u>
- 3. <u>https://www.toptal.com/machine-learning/machine-learning-theory-an-introductory-primer</u>
- 4. <u>https://pythonprogramming.net/machine-learning-tutorial-python-introduction/</u>
- 5. <u>https://machinelearningmastery.com/start-here/</u>
- 6. <u>https://www.tutorialspoint.com/mahout/mahout_machine_learning.htm</u>

- > Using Teachable Machine with Google
- > NPTEL Videos

				ARTIFIC	CIAL INT	ELLIGE	NCE & N	IACHIN	E LEAR	NING LAE	}				
Course Code	e 22	2CDL61	L						CI	E Marks		5	0		
L:T:P:S	0:	0:1:0							SE	E Marks		5	0		
Hrs / Week	3								То	tal Mark	S	1	00		
Credits	0	1							Ex	am Hour	S	0	3		
Course outc	omes:														
At the end o	of the c	course, t	he stuc	lent will	be able	to:									
22CDL61.1	A	nalyze s	earch a	algorithn	ns and le	earning a	algorithr	ns for a	training	data set					
22CDL61.2	A	pply He	uristic	search te	echnique	es and va	arious le	arning t	echniqu	es for effi	cient comp	uting			
22CDL61.3	Ev	valuate	the var	ious arti	ificial int	elligenco	e and ma	achine le	earning	algorithm	S				
22CDL61.4	Use machine learning models for solving classification and prediction problems														
Mapping of	Cours	se Outc	omes	to Prog	ram Ou	tcomes	and Pr	ogram	Specifi	c Outcom	es:				
	P01 P02 P03 P04 P05 P06 P07 P08 P09 P010 P011												PSO	1 PSO2	
22CDL61.1	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$												3	3	
22CDL61.2	3	3	3	3	3	-	-	-	1	-	-	2	3	3	
22CDL61.3	3	3	3	3	3	-	-	-	1	-	-	2	3	3	
22CDL61.4	3 3 3 3 3 1											2	3	3	
Exp. No. /	List of Programs												urs	COs	
i gili. No.	Droroquisito Drograma														
						Prerec	luisite F	rogram	IS			-			
	 Introduction to Buthon programming 														
	Introduction to Python programming Use of numpy libraries														
	Use of numpy libraries Use of nandas libraries											3	3		
	Use of pandas libraries Use of visualization tool bit														
	Use of visualization tool Kit														
	ΡΔΡΤ-Δ														
1	. I					c c 1	.1 .1						3	22CDL61	
	Imple	ement t	he A* S	earch alg	gorithm	for findi	ng the sl	nortest p	bath in a	weighted	l graph.			22CDL62	
2	Imple	ement A	40* (A	O-star) S	Search a	lgorithn	n for fin	ding the	e shorte	st path in	n a weighte	ed 3	3	22CDL61	
	grapł	1.												22CDL62	
3	For a	given s	et of tr	aining d	ata exan	nples sto	ored in a	.CSV file	e, implei	ment and	demonstra	te 3	3	22CDL61	
	the C	andida	te-Elim	ination a	algorithi	n to out	put a de	escriptio	on of the	e set of al	I hypothese	es		22CDL62	
1	Write	stent w	ram to	domone	example	es. workin	g of tho	docision	troo ba	cod ID2 al	gorithm II	10	2		
т	anar	nronria	i ani to ate data	set for	huilding	the dec	ision tre	e and ar	nly this	seu 105 al knowled	ge to classi	fv .		22CDL61	
	a nev	v sampl	e e	000101	bunung	the dee		e una ap	pij till		50 00 010001	. y		22CDL62	
5	Deve	lop an A	rtificia	l Neural	Networ	k by imp	lementi	ng the b	ackprop	agation a	lgorithm ar	d 3	3	22CDL61	
	test t	he same	e using	appropr	riate data	a sets.		-		-	-			22CDL62	
6	Write	e a prog	ram to	implem	ent the I	Naïve Ba	yesian o	lassifier	for a sa	imple trai	ning data s	et 3	3	22CDL61	
	store	d as a .(CSV file	Compu	te the ac	curacy o	of the cla	ssifier, c	onsider	ing few te	st data sets			22CDL62	
	-			<u> </u>			PART-	<u>B</u>							
7	Demo	onstrate	e the	Bias-Vai	riance '	Trade-of	tt in a	machii	ne lear	ning mo	del, provid	ie 3	5	22CDL63	
0	Dom	inzation		isignts.	ulo Mini	ing usin	a tha FE	Crowth	Algori	thm IItili	zo a suitab		2	22CDL64	
U	datas	susu att set to id.	лосос entify f	requent	item set	s and on	5 uie FP nerate a	ssociati	ו תקחד י 1 n rules	unn. Uull	Le a suitad			22CDL03	
9	Implement the non-parametric Locally Weighted Regression algorithm in order to fit dat											a	3	22CDL63	
-	points. Select appropriate data set for your experiment and draw graphs.												22CDL64		
10	Deve	lop a C	onvolu	tional N	eural Ne	etwork ((CNN) a	nd test	it using	appropri	ate dataset	s. 3	3		
	Imple	ement	key co	mponen	ts such	as con	volutior	al laye	rs, pool	ling layer	s, and ful	y		22CDL63	
	conn	ected la	yers. E	valuate t	the CNN'	s perfor	mance o	n tasks s	such as	image clas	sification			22CDL64	
11	Imple	ement 🤇	learni (ng algor	ithm.							3	3	22CDL63	
														22CDL64	

	12	Develop	a simple C	habot using rule-ba	sed responses.	3	22CDL63						
							22CDL64						
					PART-C								
				Beyond Sy	/llabus Virtual Lab Content								
			(То	be done during La	b but not to be included for CIE or SEE)								
•	Parallel and distributed processing - I: Interactive activation and competition models (<u>https://cse22-</u> iiithe behavior (activation in the behavior is the behaviore												
	iiith.vlabs.ac.in/exp/parallel-distributed-processing-i/theory.html)												
•	Competitive learning neural networks for pattern clustering												
	(https://cse22-iiith.vlabs.ac.in/exp/pattern-clustering/)												
•	Solution to travelling salesman problem using self organizing maps												
	(https://cse22-iiith.vlabs.ac.in/exp/self-organizing-maps/)												
CIE A	CIE Assessment Pattern (50 Marks – Lab)												
	Test Weekly												
	RBT Levels(s)Assessment												
	_		20	30									
L1	Rem	ember	-	-									
L2	Unde	erstand	-	-									
L3	Appl	у	10	10									
L4	Anal	yze	5	10									
L5	Evalu	uate	5	10									
L6	Crea	te	-	-									
SEE A	lssessn	nent Patte	ern (50 Ma	arks – Lab)									
			Exam M	Marks									
	RBT Le	evels	Distrib	ution									
			(50)]									
L1	Reme	ember	-										
L2	Unde	rstand	-										
L3	Apply	/	20)									
L4	Analy	ze	20)									
L5	Evalu	ate	1()									
L6	Creat	e	-										
Sugg	ested I	Learning	Resource	S:									
Refe	rence I	Books:											
1	Tam		all Maahi	I I	Edition 2012 McCrow Hill Education JCDN 12 070	4050000	050						

- 1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education, ISBN-13, **978-1259096952**.
- 2. Pattern Recognition and Machine Learning, Bishop, Christopher, Springer nature publications, ISBN-13, **978-1493938438.**
- 3. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O'Reilly Media, March 2017. ISBN-13, **978-9355421982**.

	COMPUTER NETWORKS													
Course Code		22CD	S62					CI	E Marks	5		50		
L:T:P:S		3:0:0:	0					SE	E Mark	s		50		
Hrs / Week		3						Тс	otal Mar	ks		100)	
Credits		03						Ex	am Hou	ırs		03		
Course outco	mes:													
At the end of	the cou	rse, the	studer	it will be	able to:									
22CDS62.1	Unders	stand th	ne conc	ept of lag	yering ir	1 netwoi	rks							
22CDS62.2	Predic	t the fu	nctions	of proto	ocols of e	each laye	er of TCI	P/IP pro	otocol su	ite.				
22CDS62.3	Illustra	ate the l	End-to-	End flov	v of info	rmation								
22CDS62.4	Analyz	e the fu	inction	s of netw	vork laye	er and tł	ne vario	us routii	ng proto	cols				
22CDS62.5	Exami	ne the f	unctior	ns and pr	otocols	of the T	ranspor	t layer						
22CDS62.6	DS62.6 Implement network applications and end to end Data Communication													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22CDS62.1	3	3	2	1	-	-	-	-	-	-	-	3	2	2
22CDS62.2	3	2	2	3	-	-	-	-	-	-	-	2	2	2
22CDS62.3	2	2	2	2	-	-	-	-	-	-	-	3	2	2
22CDS62.4	3	2	2	3	-	-	-	-	-	-	-	2	2	2
22CDS62.5	3	3	3	3	-	-	-	-	-	-	-	3	2	2
22CDS62.6	3	3	1	2	-	-	-	-	-	-	-	2	2	2
MODULE-1Introduction to Data Communication concepts22CDS62.18 Hours														
Introduction t	to netwo	orks: Ne	etwork	hardwa	re, Netw	ork soft	ware, R	eferenc	e model	s, Physica	l layer co	nnectivity	(wired/	wireless
communicatio	on) with	device	standa	rds. Data	a Comm	unicatio	n - Netw	vorks – I	Network	c Types –	Protocol I	ayering –	TCP/IP	Protocol
suite –OSI Mo	del – Int	roducti	on to S	ockets -	Applicat	tion								
Text Book	Textbo	ok 1: C	h.1.2 to	0 1.4, Ch.	2.2 to 2.	3			<u> </u>					
MODULE-2			C	Data	Link lay	yer				1 . 1. 1	22CDS62	.2	8	Hours
The Data link	layer: De	esign iss	sues of	DLL, Err u The sh	or detec	tion and	l correct	ion, Elei	mentary	data link	protocols	, Sliding w	rindow pi	otocols.
The meaturn a	iccess co	introl St	ibiayei	: The ch	anneran	location	problem	n, Mulup	pie acces		15.			
Text Book	Textbo	ok 1: C	h.3.1 to	3.4, Ch.	4.1, 4.2									
MODULE-3				Netw	ork Lay	yer					22CDS62	.3	8	Hours
The Network	Layer: N	letwork	k Layer	Design I	ssues, R	outing A	Algorithi	ns, Flow	v and Co	ngestion (Control Al	gorithms,	QoS.	
Text Book	Textbo	ok 1: C	h 6.1 to	6.4 and	6.5.1 to	6.5.7								
MODULE-4			T	ranspo	rtation	Layer					22CDS62	.4	8	Hours
The Transpor	t Layer: '	Гhe Tra	nsport	Service,	Elemen	ts of trai	nsport p	rotocols	s, Conges	stion cont	rol, The in	ternet tra	nsport pi	otocols.
-			-						-					
Text Book	Text Book Text Book 1: 5 1 5 2 5 3 5 4 5 5 5 6 Text Book 2: 10 1 10 3 10 5 10 7													
MODULE-5	T ONCE)).		ation L	aver		., 10.0, 1	2010) 201	22CDS	62.5, 22	CDS62.6	8	Hours
Application La	ayer: Pri	nciples	of Net	work Ar	plicatio	ns, The	Web an	d HTTP	, Electro	nic Mail i	n the Inte	rnet, DNS	—The Ir	iternet's
Directory Serv	vice.	•		1	-	-								
Text Book	Textbook 2: Ch 2.1 to 2.4													

CIE Assessment Pattern (50 Marks - Theory) -

		M	arks Distributi	on
R	BT Levels	Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	7.5	5
L4	Analyze	5	7.5	5
L5	Evaluate	5		-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks - Theory)

R	BT Levels	Exam Marks Distribution (50)
		()
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	

Suggested Learning Resources:

Text Books:

- 1. Tanenbaum, Andrew S., et al. Computer Networks, Global Edition. United Kingdom, Pearson Education, 2021, ISBN-9781292374017.
- 2. Kurose, James F. Computer Networking: A Top-Down Approach Featuring the Internet, 3/e. India, Pearson Education, 2005, ISBN 0133594149

Reference Books:

- 1. Forouzan, Behrouz A. Data Communications and Networking: With TCP/IP Protocol Suite. United States, McGraw-Hill, 2021, ISBN-13, 978-1260597820.
- 2. Peterson, Larry L. and Davie, Bruce S.. Computer Networks: A Systems Approach. Netherlands, Elsevier Science, 2011, ISBN-13: 978-0-12-370548-8

Web links and Video Lectures (e-Resources):

- 1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
- 2. http://www.digimat.in/nptel/courses/video/106105081/L25.html

Activity-Based Learning (Suggested Activities in Class)

- Case Studies
- Simulation of Personal area network, Home area network, achieve QoS etc

Note: - Note: For the Simulation experiments modify the topology and parameters set for the experiment and take multiple rounds of reading and analyze the results available in log files and also plot graphs and reports using any open source software/python programming.

					CO	MPUTE	R NETW	ORKS L	AB						
Course Code		220	CDL62					CIE M	arks		50	50			
L:T:P:S		0:0	:1:0					SEE M	larks		50				
Hrs / Week		3						Total	Marks		100				
Credits		03						Exam	Hours		03				
Course outcome	es:		.		-1-1										
At the end of the	e cour	se, the 7 the L	inux cor	t will be nmands	to cantu	re ning a	and prot	ocols for	networ	k design					
22CDL62.2	Analy	ze the	networ	k lavers	to data l	ink lave	r	00015 101	networ	k design					
22CDL62.3	Imple	ement	socket r	program	ming for	TCP/IP	for file t	ransferr	ing						
22CDL62.4	Exam	ine th	e effecti	veness o	f policie	s for var	ious scei	narios	8						
Mapping of Cou	rse Oi	utcom	es to Pi	ogram	Outcom	es and F	rogram	Specifi	c Outco	mes:					
	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO											PO12	PS01	PS02	
22CDI 62 1	3	3	2	1	1	-				-	-	3	2	2	
2200102.1	3	2	2	3	1	_	_	_		_	_	2	2	2	
22CDL62.2	2	2	2	2	2	_	_	_		_	_	3	2	2	
22CDL62.4	3	2	2	3	2	_	_	_	_	_	_	2	2	2	
	0	-	-	0	-							-	-		
Pgm, No.	Pgm, No. List of Programs Hours COs														
Prerequisite Programs										110410					
		•	Basics HTTP	of progi program	raming Iming						3		NA		
							PART-	4			I				
1	E t a	Examin tracero analyz	ne the c oute. Caj er.	comman oture pir	ds like t 1g and ti	tcpdump racerout	, netsta e PDUs ι	t, ifconfi using a r	g, nsloc network	kup and protocol	3		22CDL62.1		
2	V s	Write socket	a HTTP s.	web clie	ent prog	ram to o	downloa	d a web	page u	sing TCP	3		22CDL	62.1	
3	C f i a	Create unctio s to un at the I	a simp malities iderstan DLL.	ole prog such as f d how da	ram to Framing, ata pack	simulat error de ets are p	e basic tection, a repared,	Data Li and flow transmi	ink Lay control. tted, and	er (DLL) The goal d verified	3		22CDL	62.2	
4	I s r	Develo sliding necha	p a simj windo nism.	ole data w proto	link laye ocol, an	r that pe d loss	erforms t recover	the flow y using	control the G	using the o-Back-N	3		22CDL	62.3	
5	5 Implement the data link layer framing methods such as character, 3 character stuffing and bit stuffing											22CDL	62.2		
6	Examine static routes and dynamic routing protocols (such as RIP, OSPF)36on routers, and analyze their performance and behaviour in a simulated network environment.22CDL62.2											62.2			
							PART-	В				·			
7	Design and implement network topologies (star, ring, mesh) us 7									h) using	3	22CDL62.2			

8	Implement a specific application layer protocol (e.g., HTTP, FTP) using socket programming, simulate client-server communication, and analyze protocol messages exchanged between endpoints.	3	22CDL62.2
9	Evaluate the performance of TCP/IP in terms of reliability, throughput, and latency using network simulation tools, and compare its behaviour under various network conditions to understand its impact on application performance.	3	22CDL62.3
10	Implement TCP socket programming to enable file transfer between a client and server. Develop functionalities for file upload, download, and error handling, while analyzing the reliability and efficiency of TCP in file transfer scenarios.	3	22CDL62.3
11	Implement Quality of Service (QoS) policies on a network router to prioritize traffic based on specific criteria such as packet classification, traffic shaping, and bandwidth allocation.	3	22CDL62.4
12	Evaluate the effectiveness of QoS policies in ensuring optimal performance for different types of network traffic (e.g., VoIP, video streaming) under varying traffic loads and congestion scenarios.	3	22CDL62.4

PART-C Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

- 1. http://vlabs.iitkgp.ac.in/ant/1/
- 2. http://vlabs.iitkgp.ernet.in/ant/2/

CIE A	ssessment Pattern (50) Marks – La	ւb)
	DDT Lovele	Test (s)	Weekly Assessment
	RB1 Levels	20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	

Suggested Learning Resources:

- 1. Forouzan, Behrouz A. Data Communications and Networking: With TCP/IP Protocol Suite. United States, McGraw-Hill, 2021, ISBN-13, 978-1260597820.
- Peterson, Larry L. and Davie, Bruce S.. Computer Networks: A Systems Approach. Netherlands, Elsevier Science, 2011, ISBN-13: 978-0-12-370548-8

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/105/106105183/
- <u>https://www.youtube.com/watch?v=VwN91x5i25g</u>
- <u>https://www.nptelvideos.com/course.php?id=393</u>

					ESS	ENTIA	LS OF C	YBER S	ECURIT	Y				
Course Code	220	CDS63	;						CIE	Marks		50		
L:T:P:S	2:1:	:0:0							SEE	Marks		50		
Hrs / Week	3								Tota	l Marks		10	0	
Credits	03								Exai	n Hours		03		
Course outcomes:														
At the end of the cour	se, the s	studer	nt will	be able	e to:									
22CDS63.1	Ana	lyse t	he con	cept of	cyber s	security	, includ	ling its 1	elated is	ssues and	challenge	es		
22CDS63.2	Ideı	ntify t	he typ	es of cy	bercrin	nes, del	ineate l	legal rei	nedies, a	and outlin	e reportii	ng procec	lures	
22CDS63.3	Ana inte	lyze t gratir	he into ng this	errelati knowl	ionship edge to	betwee evaluat	en priva te and e	acy and enhance	security reportir	concerns	in the re ures	alm of o	nline soci	al media
22CDS63.4	Eva app	luate lying	the co RBI gu	ncepts	of E-C	ommer mulate	ce and strateg	digital ies aim	payment ed at pre	t modes v	vithin the avment fi	e context rauds.	of cyber	security
22CDS63.5	Res	tructu	ire fun	damen	tal secu	ırity pri	inciples	pertair	ning to co	omputers	and mobi	ile device	S	
22CDS63.6	Ass	sess elementary tools and technologies for defending personal devices against cyber threats												
Mapping of Course Or	utcome	s to P	rogra	m Outo	comes	and Pro	ogram	Specifi	c Outcor	nes:				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
22CDS63.1	3	2	2	-	-	-	-	-	-	-	-	2	2	2
22CDS63.2	3	2	2	-	-	-	-	-	-	-	-	2	2	2
22CDS63.3	3	3	2	-	-	-	-	-	-	-	-	2	2	2
22CDS63.4	3	3	2	-	-	-	-	-	2	-	-	2	2	2
22CDS63.5	3	3	3	-	-	-	-	-	-	-	-	2	2	2
22CDS63.6	3	3	3	-	-	-	-	-	-	-	-	2	2	2
MODULE-1		Introduction to Cyber security 22CDS63.1 8 Hours												
Defining Cyberspace	and Ove	erviev	v of C	omput	er and	Web-te	echnolo	ngv Arc	hitectur	e of cybe	erspace (Communi	cation ar	nd web
technology, Internet, W Regulation of cyberspa	/orld wi ice, Con	ide we cept o	eb, Adv f cybe	r secur	internet ity, Issu	t, Intern les and	iet infra challen	structu ges of c	re for da yber sec	ita transfe urity.	er and gov	ernance,	Internet	society,
Self-study / Case Study Applications	7 / 1. Ir Digi	nterne ital Mo	et Socie edia Et	ety Stat thics Co	ement ode) Ru	regardi les 202	ng the l 1.	Indian I	nformati	on Techn	ology (Int	termedia	ry Guideli	ines and
	2.0	1. C 2. E	sation: Can you yberci Descrik	s dealir u provi rime an oe the r	ig with de an o id cybei oles an	Cyber c verview c securi d respo	rime ai v of the ty issue nsibilit	id Cybe key org es? ies of or	r securit anizatio ganizati	y in India, ns in India ons like C	, Case stu a dedicate ERT-In (I	dies. ed to add: ndian Co	ressing mputer	
		E 3. C v	Emerge Could y vith th	ency Re vou pro e invol	esponse vide a c vement	Team) ase stu of Indi	in hand dy whe an cybe	dling cy re a not er securi	ber incid able cyb ity	lents. ercrime ii	ncident w	as succes	sfully res	olved
		0	organiz	zations	?									
Text Book	Tex	t Bool	<1: Cha	apter-1										
MODULE-2		~		Cybe	er Crim	e and C	<u>yber la</u>	aw			22CD	<u>\$63.2</u>	8	Hours
Classification of cyber and children, financia Cybercriminals modus	crimes, l frauds -operan	Comi s, soci ndi , R	non cy al eng eporti	yber cr gineerir ng of cy	imes- c ng attao /ber cri	yber cr cks, ma mes, Re	ime tar lware a emedial	geting of and ran and mi	compute somwar tigation	rs and mo e attacks, measures	zero da <u>:</u> 5, Legal pe	y and ze	e against ro click a e of cyber	women attacks, c crime,
IT Act 2000 and its an Case studies.	nendme	nts, C	yber c	rime a	nd offer	nces, Oı	rganisa	tions de	ealing wi	th Cyber	crime and	d Cyber s	ecurity in	1 India,
Self-study / Case Study Applications	7 / 1. C 2. C	1. Checklist for reporting cyber crime at Cyber crime Police Station. 2. Checklist for reporting cyber crime online.												
1F	3. R	eport	ing ph	ishing	emails.									
	4. D	emon	stratio	on of en	nail phi	shing a	ttack ar	nd preve	entive m	easures				
Text Book	Тех	kt Boo	k1: Ch	apter-2	2									
MODULE-3		Social Media Overview and Security 22CDS63.3 8 Hours												
Introduction to Social r	network	ks. Typ	oes of S	Social n	nedia, S	ocial me	edia pla	tforms,	Social m	iedia mon	itoring, H	ashtag, V	iral conte	nt, Socia
media marketing, Socia	al media	priva	cy, Ch	allenge	s, oppo	rtunitie	s and p	itfalls ir	n online s	social netv	vork, Secu	urity issu	es relatec	l to social

media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

Self-Study / Lises Study / Lises Study / Lises Study / Lises Study I. hasic checkinst, privacy and security settings for popular Social media platforms. Splications 2. Reporting and refressal mechanism for violations and misuse of Social media platforms. 3. Best practices for the use of Social media, Case studies 2200563.4 B Hours. Definition of E- Commerce and Digital Payments 2200563.4 B Hours. Definition of E- Commerce, Main components of E-Commerce security. ECommerce threats, E-Commerce security best practices, Introduction to digital payments. Components of digital payment and stake holders, Modes of digital payments. B Hours. Self-Study / Case Study / 1. Configuring security settings in Mobile Wallets and UPIs. Checklist for secure net banking. 2. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Stutement Act2007 Ret Book Text Book Text Book Lichapter-7 WODULE-5 Digital Devices Security. Tools and Technologies for Cyber 22CD563.5 8 Hours. Gal Point device and Mobile phone security. Password policy, Security path management, Data backup, Downloading and management of third party software. Device security policy. Security path management, Data backup, Downloading and management of host firewall and Anti-virus. Wi-Fi security. 3 Setting and configuring transactions in the Mobile phone. 2 Setting and configuring transaconfiguring transacond backup. Setting and configur	C - 1 C		1 D: 1 1	list mains a l											
Splitations 2. Reporting and redressin methalisms of social methal platforms. Splitations 2. Reporting and redressin methalisms. Splitations Text Book Text Book Text Book: Chapter-9 Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security. Econmerce threats, E-Commerce security, best practices, Introduction to digital payments. Components of digital payment and stake holders, Modes of digital payments. Supplementary Service Data (USDD), Aadhar enabled payments, Digital Payments and customer protection in unauthorized banking. Vapplications 2. RB guidelines on digital payment sand customer protection in unauthorized banking. transactions. Relevant provisions of Payment Settlement Act;2007 22CDS63.5 8 Hours Self-study / Case Study / 1. Configuring security, Tools and Technologies for Cyber 22CDS63.6 8 Hours Self-study / Case Study / 1. Setting, configuring and managing three password policy. Security patch management, Data backup, Downloading and management of the social and Anti-virus. Wanagement of host freevall and Anti-virus. Wi-11 security. 2 2 2 Administrator and Standard User). 3 3 3 3 3 2 Administrator and Standard User). 3 3 3 3 3 5 1 1 1 Setting, configuring and managing three password policy in the com	Self-st	udy / Case Study /	1. Basic check	list, privacy and secu	rity settings for p	opular Social	l media platforms.								
Best Practices of use of social metal, case studies Text Book Text Book1: Chapter-9 MODULE-4 E-Commerce and Digital Payments Z2CDS63.4 8 Hours Definition of E. Commerce, and normonents of E-Commerce security, best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments. Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. Self-study / Case Study / 1. Configuring security settings in Mobile Wallets and UPIs. Checklist for secure net banking. Z. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act, 2007 22CDS63.5 8 Hours Set Book Text Book1: Chapter-7 22CDS63.6 8 Hours MODULE-5 Digital Devices Security, Tools and Technologies for Cyber 22CDS63.5 8 Hours Set Book Text Book1: Chapter-7 22CDS63.6 8 Hours Gif Audit Case Study / Case Study / Case Study 1 Setting and configuring and managing three password policy in the computer (BIOS, 2 Set Book Text Book1: Chapter-8 2 8 Hours Effectudy Case Study / 1 1 Setting and configuring two factor authentications in the Mobile phone. Text Book Text Rook1: Chapter-8 1 1 <th< td=""><td>Аррис</td><td>ations</td><td>2. Reporting a</td><td>na rearessal mechan</td><td>al modia. Case stu</td><td>s and misuse</td><td>of Social media platforms.</td><td></td></th<>	Аррис	ations	2. Reporting a	na rearessal mechan	al modia. Case stu	s and misuse	of Social media platforms.								
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L5 Evaluate 10 L6 Create - Suggested Learning Resources: -	L4 	Analyze		.0											
L6 Create - Suggested Learning Resources:	L5	Evaluate		.0											
Suggested Learning Resources:	L6	Create		-											
	Sugge	sted Learning Reso	ources:												
Text Books:	Tovt	Books:													

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011), ISBN-13, 978-8126521791.

2. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010, ISBN-13

978-8172730888.

3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001), ISBN-13, **978-1516821020**

Reference Books:

- 1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011), ISBN-13, **978-8126521791**
- 2. Michael E. Whitman, Herbert J. Mattord, (2018). Principles of Information Security, 6th edition, Cengage Learning, N. Delhi, ISBN-13, 978-1337102063

3. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd , ISBN-13, 978-0470502495.

Web links and Video Lectures (e-Resources):

- <u>https://www.youtube.com/watch?v=lpa8uy4DyMo</u>
- <u>https://onlinecourses.nptel.ac.in/noc23_cs127/preview</u>
- https://www.coursera.org/professional-certificates/google-cybersecurity?

- Capture the flag challenges
- Threat hunting exercises
- Secure Coding Challenges

	SCALABLE DATA SCIENCE														
Course Code	22CD9	641							CIE Mai	rks		50			
L:T:P:S	3:0:0:	0							SEE Ma	rks		50	50		
Hrs / Week	3								Total M	larks		100			
Credits	03								Exam H	ours		03			
Course outcom	nes:														
At the end of	the cours	se, the s	studen	t will be	able to:										
22CDS641.1	Demoi	nstrate	the co	re conce	pts in da	ata scien	ce such	as prob	ability, l	inear alge	bra, and o	optimizati	on.		
22CDS641.2	Apply	basic p	rincipl	es of has	sh functi	ons and	sketche	es to app	roximat	te data op	erations e	ffectively			
22CDS641.3	Illustra	ate app	roxima	ate near	neighbo	ors searc	h techn	iques, ir	ncluding	extension	ns and rai	ndomized	numerica	al linear	
	algebra methods, to efficiently process large datasets														
22CDS641.4	Demonstrate the ability to implement map-reduce programming examples, such as page rank, k-means, and matrix														
22000(41 5	multiplication, to analyze and process big data efficiently.														
22CDS641.5	Evaluate the Hadoop ecosystem and related paradigms, including Map-reduce, Scala, and Spark, to design and ontimize computational solutions for large-scale data processing tasks														
22CDS641.6	2CDS641.6 Implement hasic functional programming concents in parallel data processing tasks														
Manning of C	nurse O	utcom	es to I	Program	n Outco	mes ar	nd Prog	ram Sn	ecific (lutcomes	<u>.</u>				
Mapping of C	P01	PO2	P03	PO4	P05	PO6	P07	P08	P09	PO10	P011	P012	PSO1	PSO2	
22CDS641.1	2	2	2	2	-	-	-	-	-	-	-	2	2	2	
22CDS641.2	2	2	2	2	-	-	-	-	-	-	-	2	2	2	
22CDS641.3	2	2	2	2	-	-	-	-	-	-	-	2	2	2	
22CDS641.4	2	2	2	2	-	-	-	-	-	-	-	2	2	2	
22CDS641.5	2	2	2	2	-	-	-	-	-	-	-	2	2	2	
22CDS641.6	2	2	2	2	-	-	-	-	-	-	-	2	2	2	
MODULE-1		1	1	IN	rodu	CTION					22CD64 1	l.1	8 H	ours	
Introduction, Probability: Concentration inequalities, Linear algebra: PCA, SVD, Optimization: Basics, Convex, GD, Machine															
Learning: Supervised, generalization, feature learning, clustering.															
Text Book Text Book 1: Chapter 1															
Self Study	Provid	le an ex	ample	of how	concent	ration in	equaliti	es can b	e applie	d in analy	zing algo	rithms or	data.		
MODULE-2		M	EMOR	Y-EFFIC	CIENT D	ATA ST	RUCTU	JRES			22CDS6	41.2	8 H	lours	
Hash functions	s, univer	sal / p	erfect	hash fa	milies, l	Bloom fi	lters, Sl	ketches	for dist	inct coun	t. Count S	Sketch, Co	ount-Min	Sketch ,	
Approximate n	ear neig	hbors s	earch:	Introdu	ction, ko	l-trees, I	LSH fam	ilies, Mi	nHash fo	or Jaccard	, SimHash	for L2			
Text Book	Text B	ook 2:	Chapte	-2.1, r 2	2.6										
Self Study	Prepai	re a rep	ort on	the way	v hash fu	inctions	and ske	etching t	echniqu	ies contril	oute to eff	ficient dat	a process	ing and	
	storag	e in cor	nputer	science	•					-1					
MODULE-3			PROX	MATE	NEAR N	EIGHBO	JRS SEA	ARCH			22CDS6	41.3	. 81	lours	
Extensions e.g.	multi-p	robe, b	-bit ha	ishing, L	ata dep	endent	variants	Rando	mized N	umerical	Linear Al	gebra Rai	ndom pro	jection,	
Randomized N	umerical	Linear	Algeb	ra CUR I	Jecomp	osition, s	Sparse F	(P, Subs	pace RP,	, Kitchen S	SINK				
Text Book	Text B	ook 3:	Chapte	r 3,3.1-3	3.12										
MODULE-4		MA	AP-RE	DUCE A	ND REL	ATED I	PARAD	GMS			22CDS64	41.4,	8 H	lours	
		1	1. 1					1	(22CDS64	41.5	1		
Map-reduce an	d relate	a para	aigms I	Map red	luce - Pi	ogramn Ion rodi	ning exa	mples -	(page r	ank, k-me	eans, and	matrix m	ultiplicat	ion) Big	
Tart Pool	Tout D	colt 2.	i, пацо Chanto	n 7	ystem, N	lap-reu	ice and	related	paradigi	ills, scala,	эрагк.				
	Text D				DADAI		TA DDC	CECCIN	JC		220056	116	QI	Joure	
MUDULE-5 IN I KUDUL I IUN I U PAKALLEL DA I A PKULESSING ZZLDS641.6 8 Hours															
and Data Frames on AnacheSnarkSOL															
Text Book Text Book 3: Chapter 9&10															
CIE Assessment Pattern (50 Marks – Theory) –															
	Marks Distribution														
		Test													
RBT Level	S	(s)	NP	TEL											
		25		25											
L1 Remem	ber	5		5											

			_					
	Understand	5	5					
L3	Apply	5	5					
L4	Analyze	5	10					
L	Evaluate	5	-					
L	6 Create	-	-					
SEE Assessment Pattern (50 Marks – Theory)								
		Exam I	Marks					
	RBT Levels	Distrib	oution					
		(5	0)					
L	Remember	1	0					
L	2 Understand	1	0					
L	Apply	1	0					
L4	Analyze	1	0					
L	Evaluate	1	0					
Le	6 Create		-					

Text Books:

- 1. J. Leskovec, A. Rajaraman and JD Ullman. Mining of Massive Datasets. Cambridge University Press, 2nd Ed.2014, ISBN-13, **978-1316638491.**
- 2. Woodruff, David P. ""Sketching as a tool for numerical linear algebra."" Foundations and Trends® in Theoretical Computer Science 10.1–2 (2014): 1-157., ISBN-13- **978-1680830040**.
- 3. Muthukrishnan, S. (2005). Data streams: Algorithms and applications. Foundations and Trends® in Theoretical Computer Science, 1(2), 117-236, ISBN-13, **978-1933019147**.

Reference Books:

- **1.** Essential PySpark for Scalable Data Analytics Paperback Import, 29 October 2021, ISBN-13, **978-180056887**.
- 2. Mahoney, Michael W. ""Randomized algorithms for matrices and data."" Foundations and Trends® in Machine Learning 3.2 (2011): 123-224, 978-1-60198-506-4

Web links and Video Lectures (e-Resources):

- <u>https://www.classcentral.com/course/swayam-scalable-data-science-14279</u>.
- <u>https://www.ibm.com/training/badge/fundamentals-of-scalable-data-science</u>

- > Contents related activities (Activity-based discussions)
- > Organizing Group wise discussions on issues
- ≻ Seminars

PREDICTIVE ANALYTICS															
Course Code	22CD	S642							CIE Ma	arks		50			
L:T:P:S	3:0:0	:0							SEE M	arks		50	50		
Hrs / Week	3								Total	Marks		100)		
Credits	03								Exam	Hours		03	-		
Course outcomes	:														
At the end of the	course	, the stı	udent v	vill be a	ble to:										
22CDS642.1	Unde: netwo	rstand orks.	predict	tive moo	leling te	echniqu	es like s	upervise	ed, unsu	pervised	learning,	decision	trees, and	neural	
22CDS642.2	Interp	pret dat	ta prep	aration,	, includi	ng clear	ning, hai	ndling n	nissing v	alues, and	d creating	g features.			
22CDS642.3	Apply PCA and clustering algorithms for dimensionality reduction and pattern recognition.														
22CDS642.4	Imple	Implement and assess predictive models, focusing on key metrics and interpretation.													
22CDS642.5	Evalu	ate pre	dictive	models	s using p	bercent	correct		ation an	d rank-oi	dered me	ethods.	T 11.		
22CDS642.6	Analy minin	rse the o ng.	challen	ges in p	redictiv	ve analy	tics, incl	uding d	ata und	erstandin	g and inte	egrating B	l and dat	a	
Mapping of Cour	se Out	tcomes	s to Pr	ogram	Outcor	nes and	d Progr	am Spe	ecific O	utcomes					
	P01	P02	PO3	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2	
22CDS642.1	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS642.2	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS642.3	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS642.4	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS642.5	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
22CDS642.6	3	3	3	3	-	-	-	-	-	-	-	2	3	3	
MUDULE-1 Overview of Predictive Analytics 22CDS642.1 8 Hours															
Predictive Analytics: Supervised vs. Unsupervised Learning, Parametric vs. Non-Parametric Models; Business Intelligence,															
in Using Predictive	Predictive Analytics vs. Business Intelligence, Predictive Analytics vs. Statistics; Predictive Analytics vs. Data Mining; Challenges in Using Predictive Analytics, Data Understanding														
Self-study			Study non-pa	key diff arametr	erences ic mode	and ap	plicatio	ns of su	pervise	d vs. unsu	ipervised	learning,	paramet	ric vs.	
Text Book			Text B	ook 1: (Ch1, Ch3	3									
MODULE-2	Data	Prepa	ration	I	,						22CD	S642.2	8	Hours	
Data Preparation:	Variab	le Clear	ning, In	correct	Values,	Consist	ency in	Data Fo	rmats, ()utliers, M	Iultidime	nsional O	utliers, M	issing	
Values, Fixing Mis	sing D	ata; Fe	ature (Creation	: Simpl	e Varial	ble Trar	nsforma	tions, F	ixing Ske	w, Binnin	ig Contini	uous Vari	ables,	
Numeric Variable	Scaling	, Nomir	nal Vari	able Tra	ansform	nation, O	rdinal V	/ariable	Transfo	rmations	Date and	l Time Vai	riable Fea	tures,	
ZIP Code Features	, Multic	limensi	ional F	eatures,	Sampli	ng.									
Case Study	Detec	ting ar	nd mar	naging o	outliers	in sens	or data	collect	ed from	a netwo	ork of en	vironmen	tal moni	toring	
	devic	es, ensı	uring d	ata inte	grity an	d reliab	ility for	accurat	e analys	is					
Text Book	Text I	Book 1:	Ch4												
MODULE-3	Desc	riptive	e Mode	eling							22CD 22CD	S642.3, S642.4	8	Hours	
Descriptive Model	ing: Dat	ta Pren	aration	Issues	with De	scriptiv	e Model	ing: App	lving P(CA to New	Data, PC/	A for Data	Interpret	ation.	
Additional Conside	eration	s befor	e Using	PCA. T	he Effec	ct of Var	iable Ma	agnitude	e on PCA	A Models:	Selecting	the Num	ber of Clu	isters.	
The Kohonen SOM	Algori	thm, Vi	sualizi	ng Koho	nen Ma	ips, Simi	larities	with K-	Means.	,	2	,		,	
Case Study	0		Apply	Princip	al Comj	ponent A	Analysis	(PCA)	to finan	cial data	for dime	nsionality	reductio	n and	
Text Book			under:	stand m	<u>arket tr</u> `h6	ends.									
Text DUUK Text DUUK 1: UIO MODILE A Drodictive Modeling 22006(42 fr/l/2000)															
Predictive Model	ng. Th	o Docic	tion Tr		lscano	<u>5</u> Buildin		ion Tro	as Doci	sion Tree	Splitting	Metrice	Decision	Tree	
Knobs and Ontio	ing, Ill	weight	ing P	ee Laiit	Priore	Rewei	g Decisi ghting	Record	s Mise	lassificati	on Cost	s Intorni	eting Io	oistic	
Regression Mode	ls Nei	iral Ne	nng Nu tworb	s Build	ling Rl	, newel	e Neur	n Neu	ral Net	work Tr	aining T	he Flevih	ility of N	eural	
Networks Neura	l Netw	ork Se	ttings	Neural	Netwo	ork Pru	ning In	ternret	ing Net	iral Netw	orks Ne	ural Net	work De	cision	
Boundaries.			83,	uiui				pi et							

Self-	Self-study / Case Study / Case Study: Apply decision trees for customer segmentation in retail and logistic regression for										
Appl	ications		predicting customer churn in telecommunications,								
Text	Book		Text Book 1: Ch8	8							
MOI	OULE-5		Assessing Pred	lictive Models	22CDS642.6	8 Hours					
Asse	ssing Predictiv	e Models:	Batch Approach t	proach to Model Assessment, Percent Correct Classification, Rank-Ordered Approa							
to Model Assessment; Assessing Regression Models; Model Ensembles: Motivation for Ensembles, Bagging, Bor											
Improvements to Bagging and Boosting.											
Case	Study		Apply k-NN for	r movie recommendations and evalua	te model performance in	practical					
			applications.								
Text	Book		Text Book 1: Ch9), Ch10							
CIE /	Assessment Pat	tern (50 l	Marks - Theory)								
		Marks	Distribution								
	RBT Levels	Test (s)	NPTEL								
		25	25								
L1	Remember	5	5								
L2	Understand	5	5								
L3	Apply	5	5								
L4	Analyze	5	10								
L5	Evaluate	5	-								
L6	Create	-	-								
SEE	Assessment Pa	ttern (50	Marks – Theory)	_							
	DDT Lovale		Exam Marks								
	KD1 Levels	D	istribution (50)								
L1	Remember		10								
L2	Understand		10								
L3	Apply		10								
L4	Analyze		10								
L5	Evaluate		10								
L6	Create										

Text Books:

1. Dean Abbott "Applied Predictive Analytics, Principles and Techniques for the Professional Data Analyst", Wiley, ISBN: 978-1-118-72796-6, 2014.

Reference Books:

1. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett (2020). ISBN-13

978-1449361327.

- 2. "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel (2020), ISBN-13, 978-1119145677.
- 3. "Advanced Analytics with Spark: Patterns for Learning from Data at Scale" by Sandy Ryza, Uri Laserson, Sean Owen, Josh Wills (2019), ISBN-13, **978-1491912768.**

Web links and Video Lectures (e-Resources):

- 3. <u>https://www.coursera.org/learn/predictive-analytics</u>
- 4. <u>https://www.youtube.com/watch?v=PaFPbb66DxQ</u>
- 5. <u>https://www.udemy.com/course/data-science-analytics-ai-for-business-the-real-world</u>
- 6. <u>https://onlinecourses.swayam2.ac.in/imb24_mg71/preview</u>

- Use k-means clustering on a dataset and visualize the clusters, then compare with Kohonen SOM.
- Implement PCA on a dataset to reduce dimensionality and visualize the principal components.
- Implement a decision tree classifier on a dataset, adjusting various parameters and observing the effects.
- Implement k-NN and Naïve Bayes classifiers on a dataset and evaluate their performance.

			01	PTIMIZA	TION T	ECHNIC	QUES FO	R COM	PUTING	SCIENCE	S			
Course Code	22CI	DS643					-		CI	E Marks		50		
L:T:P:S	3:0:0):0							SE	E Marks		50		
Hrs / Week	3								To	tal Mark	s	100		
Credits	03								Ex	am Hour	S	03		
At the end of th	e s: e cours	e, the s	tuden	t will be a	able to:									
22CDS643.1	Unde	erstand	differ	ent types	s of opti	mizatio	n techni	aues in o	enginee	ring prob	lems			
22CDS643.2	Anal	yze line	ear pro	ogrammi	ng meth	nods and	l classica	al optim	ization	echnique	S			
22CDS643.3	Appl	Apply unconstrained optimization techniques in single variable problems												
22CDS643.4	Analyze nonlinear programming model to solve constrained optimization techniques													
22CDS643.5	Impl	Implement Modern methods of optimization to solve decision problems												
22CDS643.6	22CDS643.6 Develop various applications using tools to solve different optimization problems													
Mapping of Cou	ırse Oı	itcom	es to I	Program	o Outco	mes an	d Prog	ram Sp	ecific O	utcomes	:			
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
22CDS643.1	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS643.2	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS643.3	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS643.4	3	3	3	2	-	-	-	-	-	-	-	2	3	3
22CDS643.5	3	3	3	2	-	-	-	-	-	-	-	2	3	3
MODULE-1 Introduction to Optimization 22CDS643.1 8 Hours														
Engineering application of optimization, Statement of an optimization problem, Optimal Problem formulation, Classification of optimization problem, Optimization techniques, Solution of optimization problems using MATLAB, Optimum design concepts, Definition of global and local optima – Optimality criteria.														
Text Book			Т	'ext Book	: 1: Chaj	pter 1.1	to 1.7							
MODULE-2	Class	sical Op	otimiza	tion Tec	hniques	s and Lin	iear pro	grammi	ng		22CD	\$643.2	8	3 Hours
Introduction, Sir Equality constrai Review of Linea optimality analys	ngle van ints, Mu ar progr sis, App	riable Ilti vari rammin licatior	optimi able o ng me n of LP	zation, M ptimizati thods fo P models	Multi va ion with r optim s in desi	ariable o n inequa num des ign and n	optimiza lity cons ign, Dua manufac	ition wi straints, ality in sturing.	th no c Convex linear p	onstraint: programi programm	s, Multi v ning prob iing, Deco	ariable o blem. Line ompositio	ptimizati ar progra n princip	ion with amming: ole, Post
Text Book	Т	ext Boc	ok 1: C	hapter 2.	1 to 2.6	, 4.1 to 4	1.6							
MODULE-3	Algo	rithm f	or Unc	onstrain	ed Opti	mizatior	1				22CD	S643.3	8	3 Hours
Classification of unconstrained minimization methods, Rate of convergence, Random Jumping method, Random Walk method, Random Walk method with direction exploitation, Grid search method, Univariate search methods, Gradient of a function, Cauchy's steepest descent method, Newton's method, Conjugate gradient method, Marquardt method, Quasi -Newton method, Davidon - Fletcher-Powell method														
Text Book	Text	Book 1	: Chap	oter 6.1 to	o 6.4 <u>,</u> 6.	8 to 6.14	<u> </u>							
MODULE-4	Algo	rithm f	or Con	strained	Optimi	zation					22CD	S643.4	8	3 Hours
Optimization algorithm of the second	orithms x metho 1's grad	s for sol od, Sequ ient pre	lving c uential ojectic	onstraine linear pi on metho	ed optin rogram d, Gene	nization ming, Ba ralized r	problen sic appr educed	ns, Chara oach foi gradien	acteristi feasibl t metho	cs of a cor e direction d, Sequen	nstrained ns, Zouter tial quadi	problem, l ndijk's me ratic progi	Random s thod of fe ramming	search easible
Text Book	Text	Book 1	: Chap	oter 7.1 to	o 7.10					1		a	–	
MODULE-5	Mode	ern me	thods	of Optim	ization						22CD	\$643.5	8	3 Hours
	22CDS643.6													

Introduction, Genetic Algorithms, Genetic operators, Simulated Annealing, Ant colony optimization, Ant search behavior, Path retracing, Neural-Network based Optimization, Fuzzy optimization techniques, Fuzzy set theory, Computational procedure, Use of MATLAB to solve optimization problems.

Case study

A case study on the application of a genetic algorithm for optimization Text Book 1: Chapter 13.1 to 13.7 Text Book

CIE Assessment Pattern (50 Marks - Theory)

		Marks I	Distribution		
г	DT Lovala	Test	NDTEI		
r	CB1 Levels	(s)	NPIEL		
		25	25		
L1	Remember	5	5		
L2	Understand	5	5		
L3	Apply	5	5		
L4	Analyze	5	10		
L5	Evaluate	5	-		
L6	Create	-	-		

SEE Assessment Pattern (50 Marks - Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	

Suggested Learning Resources:

Text Books:

1. Singiresu S. Rao, 'Engineering Optimization, Theory and Practice' New Age International Publishers, 4th Edition, 2012, ISBN-13, 978-8122427233.

Reference Books:

1. 1. Deb K., 'Optimization for Engineering Design Algorithms and Examples', PHI 2000, ISBN-13, 978-8120346789.

2. Arora J., 'Introduction to Optimization Design' – Elsevier Academic Press, New Delhi ,2004, ISBN: 9780128008065.

3. Saravanan R., 'Manufacturing Optimization through Intelligent Techniques', Taylor & Francis (CRC Press), 2006, ISBN 9781138106093.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=WYyWIpa50P0
- https://www.youtube.com/watch?v=d7_4u0QXDFs
- https://en.wikipedia.org > wiki > Constrained optimization
- https://en.wikipedia.org > wiki > Genetic algorithm
- https://www.researchgate.net > figure > Fuzzy-optimization

- Contents related activities (Activity-based discussions)
 - Organizing Group wise discussions on related topics for solving tutorials \geq
 - \geq Seminars

						A	DVAN	CED D	BMS						
Course Code	22	CDSe	644						CI	E Marks	s	50	50		
L:T:P:S	3:0	0:0:0							SE	E Mark	S	50			
Hrs / Week	3								Тс	otal Mar	rks	100)		
Credits	03								Ex	am Hou	urs	03			
Course outcomes: At the end of the cours	se, the	stude	ent w	ill be a	ble to:	:									
22CDS644.1	Un	derst	and t	the fur	ndame	ntals c	of Stora	age an	d Inde	xing, inc	luding D	isks and	Files.		
22CDS644.2	Ap	ply T	ree-S	tructu	red in	dexing	g princ	iples f	or vari	ous ope	rations.				
22CDS644.3	Exa	amin	e and	Imple	ement	Hash-	Based	Indexi	ng in v	various s	cenario.				
22CDS644.4	An	alyze	quei	ries us	ing ext	ternal	sortin	g algor	ithms.						
22CDS644.5	Eva	valuate queries involving relational operators.													
22CDS644.6	Exa	Examine the stages of physical database design and optimization.													
Mapping of Course Ou	tcome	es to l	Prog	ram O	utcon	nes an	d Prog	gram S	Specifi	ic Outco	mes:				
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	
22CDS644.1	3	3	3	-	-	-	-	-	-	-	-	1	2	3	
22CDS644.2	3	3	3	-	-	-	-	-	-	-	-	1	2	3	
22CDS644.3	3	3	3	-	-	-	-	-	-	-	-	1	2	3	
22CDS644.4	3	3	3	2	-	-	-	-	-	-	-	1	2	3	
22CDS644.5	3	3	3	2	-	-	-	-	-	-	-	1	2	3	
22CDS644.6	3	3	3	2	-	-	-	-	-	-	-	1	2	3	
MODULE-1	D	IGITA	AL D	ATA S'	TORA	GE AN	D MA	NAGEN	MENT		22C	DS644.1	- j	8 Hours	
Disks and Files: Mem formats. Self-study:	ory hie	erarc	hy; R	AID, I	Disk sp	bace m	nanage	ment;	Buffer	r manag	ger; Files	of recon	rds; Pag	e formats and Record	
Sen-study.			Com	pare t	heir ac	dvanta	iges an	d disa	dvanta	i as seq ages in te	erms of s	torage e	fficiency	and access speed.	
Text Book			Text	Book	1: 8.2	to 8.5,	9.1 to	9.7.							
MODULE-2	EX	PLOI	RING	INDE	XING:	TREE	S TO H	IASHII	NG		22 22	CDS644. CDS644	.2, .3	8 Hours	
Tree Structured Index	king: I	ndexe	ed se	quenti	al acce	ess me	thod;	B+ tree	es, Sea	rch, Inse	ert, Delet	e, Duplic	ates, B+	trees in practice.	
Hash-Based Indexing:	Static	hashi	ing; E	Extend	ible ha	ashing	, Linea	r hash	ing, co	mpariso	ons of Ext	tendible	and Lin	ear hashing.	
Case Study:]	Inves maint	tigate tainir	e real ng B+ t	-world rees, s	d cha such as	llenges rebal	s face ancing	d by and o	databa ptimizin	se admi ng tree st	inistrato ructure.	rs whe	n implementing and	
Text Book	r	Гext I	Book	1:10	.2 to 1	0.8,11	.1 to 1	1.4							
MODULE-3	E	NHAN	NCIN	G DAT	'ABAS	ES: OF	PERAT	'ORS 1	O PLA	NNING	22	CDS644	.4	8 Hours	
Ouery Evaluation: Th	ie syste	em ca	atalo	g; Intr	oducti	on to	operat	tor eva	aluatio	n; Algor	rithms fo	or relatio	nal ope	ration Introduction to	
query optimization; Alt	ernativ	ve pla	ns: A	motiv	atinge	examp	le: Tvp	ical or	otimize	er; Exter	nal Sort	ing: DBN	4S sort o	lata; A simple two-way	
merge sort; External me	erge so	ort.				ľ	-, ,,			,		8		, r r s	
Case Study:	Ex] pri	Explore how the system catalog is utilized by the DBMS to enforce data integrity constraints, such as primary keys, foreign keys, and unique constraints, in a large-scale database system.													
Text Book	Te	xt Bo	ok 1:	12.1 t	o 12.6	, 13.1,	13.2,13	3.3							
MOD	ULE-4	PHYS	ICAL DATABASE	DESI	IGN AND CRASH RECOVERY	22CDS644.5	8 Hours								
--------	--------------------	--------------	-----------------------	--------	-----------------------------------	------------------------	---------------------------------------								
Intro	duction to Physi	ical Databa	se Design: Databa	se W	Vorkloads, Physical Design and '	Funing Decisions, Ne	ed for Database Tuning;								
Guid	elines for Index	Selection, C	lustering and Ind	lexin	g, Co-clustering Two Relations	, Indexes on Multiple	e-Attribute Search Keys,								
Index	kes that Enable Ir	ndex-Only P	lans. Introduction	to A	ARIES; Recovering from a System	Crash; Media Recov	ery.								
							-								
Self-s	study:	Explo	re different types	of se	election conditions used in SQL o	jueries, including sim	iple comparisons, logical								
		opera	tors, and pattern r	matc	ching with wildcard characters.										
Text	Book	Text E	Book 1: 16.1 - 16.6	, 20.1	1 - 20.3		-								
MOD	ULE-5	OPTI	MIZING INDEXING	G AN	ND DATABASE PERFORMANCE	22CDS644.6	8 Hours								
Phys	ical Database D	esign and	Tuning: Introdu	ction	n; Guidelines for index selection	; examples; Clusterin	g and indexing; Indexes								
that e	enable index-only	v plans; Too	ls to assist in index	x sele	ection; Overview of database tur	ing; Choices in tuning	g the conceptual schema;								
Choi	ces in tuning que	ries and vie	ws; Impact of cond	curre	ency.	6,	, , , , , , , , , , , , , , , , , , ,								
	8 1		, F												
Case	Study	Explo	re how clustering	and i	indexing techniques are applied	in a healthcare infor	mation system to								
		impro	ove the efficiency o	of que	erying patient records and medi	cal data.									
Text	Book	Text E	Book 2 : 20.1 to 20	.10											
CIE A	ssessment Patt	ern (50 Ma	irks – Theory)												
		Marks	Distribution												
	RBT Levels	Test (s)	NPTEL												
	T.	25	25												
L1	Remember	5	5												
L2	Understand	5	5												
L3	Apply	5	5												
L4	Analyze	5	10												
L5	Evaluate	5	-												
L6	Create	-	-												
SEE /	Assessment Patt	ern (50 Ma	arks – Theory)												
	RRT Levels		Exam Marks												
	RDT Eevels	D	istribution (50)												
L1	Remember		10												
L2	Understand		10												
L3	Apply		10												
L4	Analyze		10												
L5	Evaluate		10												
L6	Create														
Sugg	ested Learning	Resources													

Text Books:

- 1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003, ISBN-13, 978-0072465631.
- 2. Elmasri and Navathe: Fundamentals of Database Systems, 5thEdition, Pearson Education, 2007, paper back-2018, ASIN : B076K8CM55

Reference Books:

1. Connolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002, ISBN 0 321 21025 5

Web links and Video Lectures (e-Resources):

- 1. https://www.coursera.org/learn/database-clients
- 2. <u>https://www.udemy.com/courses/search/?src=ukw&q=advanced+databases</u>
- 3. <u>https://www.amigoscode.com/courses/advanced-databases</u>

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

- Query Optimization Challenge: Optimize SQL queries considering indexing strategies.
- NoSQL Database Exploration: Have students explore NoSQL databases like MongoDB or Cassandra.

SOFTWARE TESTING & AUTOMATION															
Course Code	22CD5	S645							CIE	Marks		50	50		
L:T:P:S	3:0:0:	0							SEE	Marks		50			
Hrs / Week	3								Tota	al Marks		10	0		
Credits	03								Exa	m Hours		03			
Course outcom	ies:														
At the end of t	he cour	se, the s	studen	t will be	able to:										
22CDS645.1	Under	stand t	he fund	damenta	al concep	pts in so	ftware t	esting.							
22CDS645.2	Analyz	ze the ii	mporta	ance of S	Structura	al and Re	egressio	n testing	z .						
22CDS645.3	Exami	camine the various types of Non Functional Testing and related software metrics.													
22CDS645.4	Interp	iterpret the Defect Management Process.													
22CDS645.5	Analyz	Analyze the Test Automation process and related tools.													
22CDS645.6	Apply the testing tools related to web automation and mobile automation.														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	P01 P02 P03 P04 P05 P06 P07 P08 P09 P010 P011 P012 PS01 PS02														
22CDS645.1	-	- $ -$												3	
22CDS645.2	-	-	-	-	-	-	-	-	-	-	-	-	2	3	
22CDS645.3	3	3	3	3	-	1	-	-	-	-	-	3	2	3	
22CDS645.4	-	-	-	-	-	1	-	3	3	2	2	3	2	3	
22CDS645.5	3	3	3	3	2	1	-	-	-	2	-	-	2	3	
22CDS645.6	3	3	3	3	2	-	-	-	-	-	2	3	2	3	
MODULE-1	_	_	-	FU		ENTALS			1		22CD64	45.1	81	Hours	
Software Verifi	MUDULE-1 FUNDAMENTALS ZZCD645.1 8 Hours Software Verification and Validation Validation Validation Software Verification Software Verification														
Tosting Tayon	omu of	Dugo D	afact A	nd Eail	uro Anal	u vanua		octing T	ochnia	loc Plack	Doy Whi	to Dov (rou Pov'	Tosting	
Testing - Taxon		Dugs, D				ysis, i y		esting, i	echniqu			10 DOX - 0		i esting	
Test Adequacy	and Cov	verage.	Function	onal les	sting Fui	nctional	testing,	Bounda	ry valu	e Testing,	Equivalei	ice class t	testing, D	ecision	
table based test	ing, Eva			e testing	,Assess	ea exerc	ise: Spe	city and	design	test cases.					
Text Book	Text B	00K Z:	Chapte	er 8,9	<u> </u>	1 (1	0	. 1 1	1 1		1 1	1	
Self Study	Specif	y and d	esign t	est cases	s for a sli	mple sof	tware a	pplicatio	on. Cons	ider boun	dary valu	es, equiva	lence clas	sses, and	
MODULE 2	decisio	on table	es in yc	our test (ign. L TECT	INC				22000	6452	0	Hours	
Doth tosting D	ata and	Contro		Tosting	CTURA	h Pacad	Tosting	Evolu	ation of	the tection	and our	04J.2	graccion	Tosting	
Paul testing - D	ata allu	Contro	JI FIOW	Analwa	g – Grapi	II Daseu	Testing	- Evalua			g allu Sul	al Dagad 7	giession Cochaicus	Testing:	
Need for Regres	SSION, I	esting-	ппрас	Analys	is – Regi	ression	l'est Sele	ection 1	ecnniqu	es – Code	and Mod	el Based I	echnique	es – Test	
Case Optimizati	on Tech	iniques	Classe ta		02040	100									
Text BOOK	Text B	00K Z:	Chapte	er 8,8.1	8.3,8.4,5	9.1-98			1 1	C 1	1.			1	
Self Study	Provid	ie exam	iples of	r situatio	ons whe	re path t	esting is	s particu	ilarly us	seful comp	ared to o	ther testin	ig metho	as.	
MODULE-3			I	NONFU	NCTION	NAL TES	TING				22005	645.3, 645.4	8	Hours	
GIII Testing - F)omain	Rased '	Fosting	T _ Porfe	rmance	Testing	- Stree	c Tectin	σ <u>–</u> Ι ο 2	d Testing	- Accent	ance Test	$in\sigma = \Delta ln$	ha Reta	
Camma Testing	– Softw	$are \Delta c$	contan	co Plan	Motrice	· Imnort	$\frac{1}{2}$	Motrics i	in Testi	ng - Effect	iveness of	f Testing .	- Defect I)onsity_	
Defect Leakage	Ratio -	Residu	al Defe	ee Flan. oct Densi	ity – Tes	t Team l	Efficienc	w – Test	Case Fi	ficiency_V	Verious Te	est Renor	ts	Jensity	
Text Book	Tovt B	ook 1.	Chante	r 15 15	$\frac{1}{1}$	Tovt Ro	$rac{1}{2}$. <u>y = 1030</u> 1.0		incicity - v		l st Repor	1.3.		
MODILIE-4	TEXUD	UUK 1.	cnapte	AUTO	MATIO	N TEST	INC	T. J			22005	645 5	8	Hours	
Automation tes	ting: Ba	sice Si	mifica	nce Con	nnonent	S Droce	ss of To	et Auton	nation	Stratogias	Automat	od tasts	Fyamples	oftest	
automation, Tes	st Auton	nation	mainte	nance, Con	Automat	ion test	framew	orks-typ	es, tool	Strategies, S.	Automat	eu lesis, l	Lixamples	ontest	
Text Book	Text B	ook 1:	Chapte	er 13,13.	1-13.11										
MODULE-5			W	EB & M	OBILE	AUTOM	IATION				22CDS	645.6	8	Hours	
Selenium Aut	omation	ı Frame	ework,	Seleniu	m IDE, S	elenium	Web D	river, Da	ita drive	en, Keywo	rd driven	, Hybrid. S	Selenium	basics,	
waits, Web Co	mponei	nt conc	ept, Ju	nit4 bas	sics, Sele	enium in	Java, P	age Obje	ect Con	cept, Data	transfer	Object Co	ncept. Da	atabase	
Testing using	Seleniur	n, Cros	s Brow	vser Test	ting. Mol	bile Auto	omation	: Mobile	applica	tion fram	ework, AF	PPIUM bas	sics.		
Text Book	Text B	ook 3:	Chapte	er 2,3											
Case Study	Write	and tes	t a pro	gram to	provide	e total nu	ımber o	f objects	presen	t on a goo	gle web p	age using	seleniun	1.	
-			-							-	•				

CIE A	ssessment Patt	ern (50) Marks –	Theory) –
		M	arks	
		Distr	ibution	
	RBT Levels	Test (s)	NPTEL	
		25	25	
L1	Remember	5	-	
L2	Understand	5	5	
L3	Apply	5	5	
L4	Analyze	5	10	
L5	Evaluate	5	5	
L6	Create	-	•	
SEE A	Assessment Pat	tern (50	0 Marks -	- Theory)
		Exam	Marks	
]	RBT Levels	Distri	bution	
	-	(5	50)	
L1	Remember	ĺ	10	
L2	Understand	ĺ	10	
L3	Apply	10		
L4	Analyze		10	
L5	Evaluate	1	10	
L6	Create			

Text Books:

- 1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, 2009, ISBN: 9780070139909.
- 2. Paul C. Jorgensen, Software Testing Fourth Edition, CRC Press, 2013, ISBN-13, 978-1466560680.
- **3.** Selenium with Java A Beginner's Guide: Web Browser Automation for Testing using Selenium with Java Paperback 14 February 2022, ISBN-13 ,**978-9391392680**.
- 4. Boris Beizer, "Software Testing Techniques", 2nd Edition, Dream tech press, 2003, ISBN-13, 978-1850328803

Reference Books:

- 1. Edward Kit, "Software Testing in the Real World Improving the Process", Pearson Education, 2004, ISBN: 978-1-4666-8662-5.
- 2. William E. Perry, "Effective methods for software testing", 2ndEdition, John Wiley, 2000, ISBN-13: 978-0471354185.

Web links and Video Lectures (e-Resources):

- Automation Testing Tutorial", https://artoftesting.com/automation-testing
- Tools QA, Selenium Tutorial, <u>https://www.toolsqa.com/selenium-tutorial/</u>
- "Appium Tutorials", <u>https://appium.io/tutorial.html</u>

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

- Contents related activities (Activity-based discussions)
- ➤ Organizing Group wise discussions on issues
- ≻ Seminars

						PROJ	ЕСТ РН	ASE-1						
Course	22CDS6	55								C	IE Marks			50
Code														
L:T:P:S	0:0:3:0									S	EE Marks	5		50
Hrs / Week	3									Т	otal Mar	ks		100
Credits	03									E	xam Hou	rs		03
Course outco	mes:													
At the end of the course, the student will be able to:														
22CDS65.1 Identify an issue and derive problem related to society, environment, economics, energy and technology														
22CDS65.2	2CDS65.2 Formulate and Analyze the problem and determine the scope of the solution chosen													
22CDS65.3	2CDS65.3 Determine, dissect, and estimate the parameters, required in the solution and Evaluate the solution by													
considering the standard data / Objective function and by using appropriate performance metrics.														
22CDS65.4	DS65.4 Compile the report and take part in present / publishing the finding in a reputed conference / publications													
Mapping of	Course O	urse Outcomes to Program Outcomes and Program Specific Outcomes:												
	P01	PO2	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2
22CDS65.1	3	2	-	3	2	2	3	3	3	3	2	3	3	3
22CDS65.2	3	3	2	3	3	3	3	3	3	3	3	3	3	3
22CDS65.3	3	2	3	3	3	3	3	3	3	3	3	3	3	3
22CDS65.4	1	2	3	3	1	2	1	3	3	3	2	3	3	3
Project: Carri	ed out at t	he Insti	tution	or at an l	ndustry	<i>.</i>								
Project work	shall pre	ferably	be bat	ch wise,	the str	ength o	f each b	atch sh	all have	minimun	n of two	and max	kimum of	four
students,For	Project Ph	ase –I a	nd Pro	ject Pha	se –II, th	ne CIE sh	all be 50	0 and 10	0 respec	ctively.				
Project activi	ties to be c	ommur	licated	to the g	uide on	regular	basis.						.1 1	C . 1
The CIE mark	s of Phas	e-1 sha	ll be ba	ased on	the eva	luation	based of	n the re	views by	y a comm	ittee con	sisting of	the Head	of the
concerned De	partment	and the	e panel	membe	rs of the	e Depart	ment, of	ne of wh	iom shal	I be the p	roject gu	ide.		
Minimum rec	uirement	of CIE r	narks f	or Proje	ct work	shall be	50% Of	the max	imum m	iarks.	1:-:1.1.6.		4	
Students fall	ng to secu	re a mi	nimun	1 0I 50%	or the	CIE mar	KS IN Pr	oject wo	ork shal	I not be e	ligible for	r the Proj	ect exam	nation
conducted by	and usto	r Sity an	a they	shall be	conside	a com o sto	neu III t	nat/tho	se cours	ers. поw	ever, they	/ can appe	atho prov	versity
examinations	marka in	the Cou		whon of	forod du	semeste	r anu ba	t comos	tor chall	any. Stud	ents arter	satisfyin	g the pres	cribeu
Improvemen	of CIE m	ule Cou	ll se/s		el eu ut	n nig Sui oioct wh	oro tho	student	bas alro	appear it	n see. rod tho m	inimum r	oquirod r	narke
For a pass in	DI CIL III	11 K5 5116		minatio		Jont sha		stuuent	mum of	ANO% of the	neu une m	um mark	e proscrib	alks
the Universit	a Froject/	tion	лееха	mmatio	li, a stut	ient sna	II Secure			4070 01 0		uiii iiiai k	s prescrit	eu 101
the University Examination.														
CIE - Continuous Internal Evaluation (50 Marks)														
			Te	ests (50										

Bloom's Category	Marks)
Remember	-
Understand	05
Apply	15
Analyze	10
Evaluate	-
Create	20

SEE - Semester End Examination (50 Marks)

Bloom's Category	Tests
	(50 Marks)
Remember	-
Understand	-
Apply	20
Analyze	-
Evaluate	-
Create	30

PROBLEM SOLVING SKILLS														
Course Code	2	2SDK6	6			CIE Ma	rks		50					
L:T:P:S	0	:0:1:0							SEE Ma	nrks		-		
Hrs / Week	3								Total N	larks		50		
Credits	1								Exam H	lours		1		
Course outcom At the end of th	es: ne cour	se, the s	student	will be a	able to:									
22SDK66.1	Ir	nfer the	comple	x proble	ems usir	ng the co	ncepts	of data s	tructur	es and C p	rogramr	ning		
22SDK66.2	А	pply ob	ject-ori	ented pr	ogramr	ning cor	icepts in	C++and	l Java to	o solve rea	l time pi	roblem st	atements	
22SDK66.3	S	olve rea	l-world	probler	n using	python	and C#							
22SDK66.4	D	evelop	the skill	s of han	dling da	ata base	queries	and pro	cedures	5				
Mapping of Co	urse O)utcom	es to P	rogram	Outco	mes an	d Prog	ram Sp	ecific O	utcomes	:			
P01 P02 P03 P04 P05 P06 P07 P08 P09 P010 P011 P012 PS01 PS02												PSO2		
22SDK66.1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
22SDK66.2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
22SDK66.3	3	3	3	2	2	-	-	-	-	-	-	2	2	2
22SDK66.4	3	3	3	2	2	-	-	-	-	-	-	2	2	2
MODULE-1	Р	ROBLE	M SOL	VING O	N DATA	A STRU	CTURES	S AND C	2		22SDK6	6.I	6	Hours
Data Structures	s using	g C: Stac	k and q	ueues, li	st, grap	h, tree, s	sorting a	nd sear	ching, H	lash functi	ons			
Advanced C pro	ogram	ming: F	ointers	, Recurs	sion, Fui	ictions,	Structur	e, Unior	i, C Prep	processor			•	
MODULE-2	P P	ROBLE ROGRA	M SOL	VING O G USIN	N OBJE G CPP	CT ORI	ENTED			22	2SDK66	5.2	6 H	ours
Object Oriented	Progra	amming	: Inheri	tance, P	olymorp	ohism, E	xception	ı handli	ng, File	Handling,	Predefi	ned funct	ion, Void	function,
Name spaces, In	put and	d output	t strean	is.			•		0	C.				
MODULE-3	Р	ROBLE	M SOL	VING O	N JAVA	AND X	ML			22	2SDK66	. 2	6 H	ours
Object oriente	d pro	gramm	ning us	ing Jav	a: Inhe	ritance,	Polymo	rphism,	Abstra	ct class a	nd Inter	face, Col	lections, I	Exception
handling, Stream	ns, Fun	ctional	Interfac	e.										
XML: DTD, Sche	ema, Se	erver Pa	th, DOM	, XSLT, I	Name Sj	pace, AJ	AX. DVTUO	NI		21		2	6 11	01170
MUDULE-4	P	itorat	M SUL	hing U	SING C	# AND	rammi	N ng Ev	contior	Landli	DA Da		<u>оп</u> Framo I	vorks
Django, Collec	tions.	, iterat	.015, 0	DJECT C	niente	u riog	1 a111111	ng, Ext	Leption	i Hallull	ng, rat	.Kages,	Frame v	V01K5-
C#: Object ori	ented	Progra	ammin	g, Dele	gate, Co	ollectio	ns and	generi	c, Nam	e space.				
MODULE-5	S	CENAR	IO BAS	ED PRO)BLEM:	S ON DI	BMS			22	2SDK66	5.4	6 Ho	ours
ER Model, SQL-	DDL, I	DML, T(CL, DCL	, Joins, s	subquer	ry, PL/S	QL-Inde	ex, Sequ	ence, p	rocedures	s and fu	nctions,	normaliza	ation, B
tree, B+ tree, Fo	orms.													
CIE Assessment	t Patte	ern (50	Marks ·	- Theor	y)									
RBT Levels Test (s)														
L1 Remer	L1 Remember 5													
L2 Under	L2 Understand 10													
L3 Apply			20											
L4 Analyz	ze		15											
L5 Evalua	ite													
L6 Create			-											

Reference Books:

- 1. Martin C Brown, "Python-The Complete Reference", Mc Graw Hill, 4th edition, 2020
- 2. Reema Tharega, "Data Structures using C", Oxford University Press, 2020
- 3. Ullakirch-Prinz, "A complete guide to program in C++", Jonas and Bartlett Learning, 2022
- 4. Kathy Sierra, "Headfirst Java", O'reilly Media, 2021
- 5. Andrew Stellman, "Headfirst C#", O'reilly Media, 2021

Web links and Video Lectures (e-Resources):

- 1. <u>https://www.learncpp.com/</u>
- 2. <u>https://www.programiz.com/dsa</u>
- 3. <u>https://code.visualstudio.com/Docs/languages/csharp</u>
- 4. <u>https://www.udemy.com/course/the-complete-java-course-from-basics-to-</u>
 - advanced/?couponCode=ST16MT70224
- 5. <u>https://www.codecademy.com/learn/paths/c</u>

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

- Analysis of industry relevant use cases
- Problem solving on scenario-based questions
- Placement portal practice sessions

					MOBILE	E APPLI	CATIO	N DEVE	ELOPME	INT						
Course Code		22CDS6	71						CIE M	larks		50				
L:T:P:S		0:0:1:0							SEE N	/ larks		50				
Hrs / Week		2							Total	Marks		100				
Credits		1							Exam	n Hours		03				
Course outcome	es: At	the end	of the c	course, t	he stud	ent will	be able	e to:								
22CDS671.1		Develop	single	screen	mobile a	applicat	tions by	y setting	g up Anc	droid dev	elopment	environm	ent			
22CDS671.2		Use Inte	ents & S	Services	concep	ts in de	velopin	ıg mobi	le applio	cations.						
22CDS671.3		Implem	ent mo	bile app	olication	is using	files.									
22CDS671.4		Demons	trate n	nethods	of stori	ng and	retriev	ing data	a using I	Database						
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:											es:					
	P01 P02 P03 P04 P05 P06 P07 P08 P09 P010 P011 3 3 3 3 3 3 3 3 1 <td>PSO1</td> <td>PSO2</td>												PSO1	PSO2		
22CDS671.1	3	3	3	3	3	-	-	-	-	-	-	2	3	3		
22CDS671.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3		
22CDS671.3	3 3 3 3 3 3									-	2	3	3			
22CD5671.4	3	3	3	3	3	-	-	-	-	-	-	Z	3	3		
Pgm. No.	List of Programs											Hours		COs		
	Prerequisite Programs															
	Basics of Programming													NA		
							DAD7	г <u>а</u>								
				, ,,			PARI	I-A	1.5.1							
1	Deve	elop an A Iculator	Android having	d applic	ation us	ing But ality like	ton, Te Additi	xtView ion Sub	and Edi	tText for Multinli	designing	2	22CI	DS661.1		
	and	Division		busie n	inctione	inty int	e maant	ion, out	, ci accioi	i, Multipli	eation					
2	Deve	elop an A	Androi	d applic	ation th	at displ	ays info	ormatio	n about	a small b	usiness.	2 22CDS		DS661.1		
	Your	design	must II	nclude:												
	凹 Du 回 Ph	oto of h	usines	2												
		ntact in	format	s ion and												
	2 De	scriptio	n of Bu	isiness												
3	Deve	elop an A	Androi	d applic	ation to	design	a Visiti	ng card	. The vis	siting car	d should	2	2201	0\$661.1		
5	have	a comp	any log	go at the	e top rig	ht corn	er. The	compar	ny name	e should b	e C · l	-	2201	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
	disp	layed in	capital	l letters	, aligned	l to the	center.	Inform	ation lik	ke Name o Wohaita a	of the					
	to be	display	esignat ved.	uon, Ph	one nun	iber, A	luress,	Eman, a	and the	website a	luuress is					
4	Deve	elop an A	Androi	d applic	ation Th	ne Easy	Unit Co	onverte	r using I	Radio But	tons	2	22CI	DS661.1		
	Dove	olon an /	Indroid	dapplic	ation Cu	irrongu	Convo	rtor uci	ng Spipr	ors						
5	Deve		anuron	a applie		intency	Conver	ter usn	ig Spiin	1015		2	22CI	DS661.1		
6	Develop an Android application using Explicit intent to display the login page. On											2 22CDS661.1		DS661.1		
	giving the wrong credentials it should display the toast message and if credentials are correct it should display. Welcome and the username															
	PART-B															
7	Deve	elop an A	Androi	d applic	ation us	ing Imp	olicit in	tent to o	display t	the Galler	y and Call	2	2201	0\$661.2		
/	butte	ons. On	clickin	g these	outtons,	, it shou	ld goto	the res	pective	pages		2	2201	5001.2		
8	Deve	elop an A	Androi	d applic	ation To	ourist sp and Wo	pot with	h three	activitie	es : Welco	me page,	2	22CI	DS661.2		
	Disp	iay attira	ictions	or tour	scspota	anu we	upage	Ji tile tt	ui ist sp	σι						

9	Develop an Android application to play music in background	2	22CDS661.2
10	Develop an Android application Hospital Database App using Android. The app should store Hospital ID, Hospital name and location of hospital in a file	2	22CDS661.3
11	Develop an Android application The Expense Manager using Android. The application should store all the expenses in a file	2	22CDS661.3
12	Develop an Android application Student Database App using Android. The app should store USN, Student name and Semester of student in SQLite database	2	22CDS661.4

PART-C Beyond Syllabus Virtual Lab Content

- (To be done during Lab but not to be included for CIE or SEE)1) Develop an Android application Health Monitoring App using Android. The app should store Name, Age,
- blood pressure, blood group and glucose level of patient in SQLite database
- 2) Develop an Android application to display Map of your college locality
- 3) Develop an Android application to alert SMS to one given phone number

CIE Assessment Pattern (50 Marks - Lab)

	DDT Lovale	Test (s)	Weekly Assessment
	KD1 Levels	20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

- 1) Reto Meier; Professional Android 4 Application Development; Wiley India Pvt.ltd; 1st Edition; 2012; ISBN-13: 9788126525898.
- 2) Phillips, Stewart, Hardy and Marsicano; Android Programming, 2nd edition Big Nerd Ranch Guide; 2015; ISBN-13 978-0134171494.

Reference Books:

- 1) Mark Murphy; Beginning Android 3; Apress Springer India Pvt Ltd. ;1st Edition; 2011;ISBN-13: 978- 1- 4302-3297-1
- 2) Eric Hellman; Android Programming Pushing the limits by Hellman; Wiley; 2013; ISBN 13: 978- 1118717370
- 3) <u>www.developer.android</u>

SCALA PROGRAMMING Course Code 22CDS672 CIE Marks 50																	
Course Code	22CD	S 672				50											
L:T:P:S	0:0:1	:0							SEE Ma	rks		50					
Hrs / Week	2								Total M	arks		100					
Credits	1								Exam H	ours		03					
Course outcon	nes:							1									
At the end of th	e cours	se, the s	tudent	will be a	able to:												
22CDS662.1	Demo	onstrate	e the ba	asic synt	ax, data	i types, c	onditio	nal state	ments a	nd Arrays							
22CDS662.2	Imple	ement p	orimary	v operati	ons sucl	h as filte	ring, gro	ouping, a	ggregat	ion, and jo	ining t	o extract m	eaningful ii	ısights			
	from	data.															
22CDS662.3	Apply	7 Librar	ries to v	visualize	and int	erpret da	ata distr	ributions	s, trends	, and patt	erns.	ns.					
22CDS662.4	Imple	ement N	Machin	e learnin	ıg algori	thms su	ch as Liı	near Reg	ression	and Clust	ering u	sing Spark	MLlib.				
Mapping of Co	ourse (rse Outcomes to Program Outcomes and Program Specific Outcomes:															
	P01	P02	P03	P04	P01	1 P012	PS01	PSO2									
22CDS662.1	1 1 1 1										2	2	2				
22CDS662.2	2 2 2 2 2								2	2	2						
22CDS662.3	2 2 2 2 2							- 2		2							
22CDS662.4	DS662.4 2 2 2 2 2								-	2	2	2					
Pgm. No.					Lis	st of Pro	grams					Hours	rs COs				
						Prer	equisite	e Demo									
	•	Pro	gramm	ing knov	wledge (C/C++/J	AVA/PY	(THON)				2	2 NA				
							PART-	A									
1	Write	e a Scala	a progr	am to de	eclare va	riables o	of differ	ent data	types (i	nteger, do	uble,			662 1			
	string	g, boole	an) and	d print tl	heir valı	les.						2	22003	002.1			
2	Write	e a Scala	a progr	am that	checks	if a giver	n numbe	er is posi	itive, ne	gative, or	zero,	2	22005	662.1			
	and p	orints a	n appro	opriate n	nessage.							<i>L</i>	22005	002.1			
3	Write	e a Scal	la prog	gram to	create a	an array	and a	list of i	ntegers,	then prin	nt all	2	22CDS	662.1			
	eleme	ents in l	both co	ollections	S.							-	11000	00211			
4	Write	e a Scal	a prog	ram tha	t define	s two fu	inctions	, one to	add tw	o integers	and						
	anoth	ner to m	nultiply	two inte	egers. Us	se these	functior	ns to prir	nt the su	m and pro	oduct	2	22CDS	662 .2			
	oftw	o given	numbe	ers.													
5	Write Datal	e a Scala Frame ι	a progr ising A	am to lo pache Sp	ad a CSV oark. Pei	/ file con rform th	taining e follow	retail sa ing oper	les data ations:	into a							
	•	Sho Filte Gro eacl	w the f er the r up the n categ	irst 10 ro ecords v data by t ory.	ows of th vhere sa the 'Cate	he DataF Iles are g egory' co	Frame. greater t lumn ar	han \$10 1d calcul	00. ate the t	total sales	for	2 22CDS662 .2					

	• Join this DataFrame with another DataFrame containing product details on a common column and display the result.		
6	 Write a Scala program to visualize data using Breeze and Vegas libraries. Perform the following tasks: Create a list of integers representing some data points. Plot a histogram of these data points using Breeze. Use Vegas to create a bar plot showing the distribution of these data points. 	2	22CDS662 .3
	PART-B		
7	 Write a Scala program to calculate descriptive statistics for a dataset containing temperature readings, Visualize using appropriate libraries. Your program should: Compute the mean, median, variance, and standard deviation of the temperature readings. Print out the computed values. 	2	22CDS662 .3
8	Write a Scala program to train a linear regression model using Spark MLlib to predict house prices based on various features (e.g., size, location). Your program should: • Load the dataset from a file. • Split the data into training and test sets. • Train a linear regression model on the training data. • Evaluate the model on the test data and print out the coefficients and intercept of the model.	2	22CDS662.4
9	 Write a Scala program to perform K-Means clustering on a dataset of customer attributes using Spark MLlib. Your program should: Load the dataset from a file. Train a K-Means model with a specified number of clusters. Print out the coordinates of the cluster centers. Assign each data point to a cluster and display the results. 	2	22CDS662.4
10	Write a Scala program to classify movie reviews as positive or negative using Spark MLlib. Your program should: • Load a dataset of movie reviews and their corresponding labels. • Tokenize the text data and transform it into feature vectors. • Train a logistic regression model on the training data. • Evaluate the model and display the prediction results.	2	22CDS662.4
11.	 Write a Scala program to perform time series forecasting on stock price data using the Prophet library. Your program should: Load and prepare the stock price data. Fit a Prophet model to the data. Make future predictions for the next 12 months. Print out the forecasted stock prices. 	2	22CDS662 .4
12	Write a Scala program to clean a dataset of customer information using Apache Spark. Your program should:	2	22CDS662 .4

	 Load the dataset from a file. Handle missing values by filling them with specified default values. Filter out records with outlier values in the 'age' column. Perform a transformation to create a new column 'income_scaled' where the income is divided by 1000. Display the cleaned and transformed DataFrame. 										
	PART-C										
	Beyond Syllabus Virtual Lab Content										
		(To be d	lone during Lab but not t	o be included for CIE or SEE)							
			1. https://www.scal	a-exercises.org/							
		1. De	monstrate Functional Pr	ogramming with Monads.							
			2. Demonstrate Actor	Model with Akka.							
CIE As	ssessment Pattern (5	0 Marks – La	b)								
	RBT Levels	Test (s)	Weekly Assessment								
		20	30								
L1	Remember	-	-								
L2	Understand	-	-								
L3	Apply	10	10								
L4	Analyze	5	10								
L5	Evaluate	5	10								
L6	Create	-	-								
SEE As	ssessment Pattern (50 Marks – La	b)								
	RRT Lovols	Exam M	larks								
	NDT LEVEIS	Distribut	ion (50)								
L1	Remember	-									
L2	Understand	-									
L3	Apply	20)								
L4	L4 Analyze 20										
L5	Evaluate	10)								
L6	Create	-									
Sugge	ested Learning Reso	urces:									

Text Books:

 Martin Odersky, Lex Spoon, Bill Venners, "Programming in Scala", 3rd Edition Paperback – 31 May 2016, ISBN-13,978-0981531687.

2. Sandy Ryza, Uri Laserson, Sean Owen, and Josh Wills," Advanced Analytics with Spark: Patterns for Learning from Data at Scale", O'Reilly Media, 2nd Edition (July 2017), ISBN: 9781491972908.

Reference Books:

1. Pascal Bugnion,"Scala for Data Science", Packt Publishing, 1st Edition (October 2016), ISBN-13 :9781785281372

					APP	LIED D	ATA SC	IENCE W	/ITH JULI	A					
Course Code	2	22CDS6	573						CIE N	Marks		50			
L:T:P:S	(0:0:1:0							SEE	Marks		50			
Hrs / Week	2	2							Tota	l Marks		100			
Credits	(01							Exar	n Hours		03			
At the end of th	ne cou	urse, the	e stud	ent will	be able	to:									
22CDS663.1	I	Apply Ju	ılia co	nstructs	s to solv	e compl	ex prob	lems in l	inear alge	ebra					
22CDS663.2	I	Analyze	the D	ata Scie	nce con	cepts us	ing stat	istical pa	ackages						
22CDS663.3	I	Evaluat	e vario	ous tech	niques	for Data	science	operati	ons						
22CDS663.4	5	Solve th	e quei	ries usir	ng graph	ıs and vi	sualiza	tions							
Mapping of Co	urse	Outco	mes t	o Prog	ram Ou	tcomes	and P	rogram	Specific	Outcome	S:				
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	
22CDS663.1	3	3	3	3	3	-	-	-	-	-	-	2	3	3	
22CDS663.2	3	3	3	3	3	-	-	-	-	-	-	2	3	3	
22CDS663.3	3	3	3	3	3	-	-	-	-	-	-	2	3	3	
22CDS663.4	3	3	3	3	3	-	-	-	-	-	-	2	3	3	
Pgm. No.	Pgm. No. List of Programs											Hours		COs	
Prerequisite Programs															
	 Basic programs on python Basics of visualization 									2		NA			
					1.7.1			RT-A		.1	.1				
1	Dem follo	onstratwing taCorCal	e Mat sks wi npute culate	and pri and dis	nd Linea 3 matrix nt the tr play the	r Algebr AAA: ranspose e determ	e of AAA	ia with a A. f AAA.	program	that perfo	rms the	2	22CDS663.1 22CDS663.2		
2	 Write a Julia program that generates 100 random numbers from a standard normal distribution. Perform the following statistical operations: Calculate the mean and standard deviation of the generated data. Perform a one-sample t-test to test if the mean of the data is significantly different from 0 (null hypothesis). 									ormal Intly	2	2 22CDS663.1 22CDS663.2			
3	Demonstrate feature reduction using Principal Component Analysis (PCA). Generate sample dataset with 100 observations and 3 features. Perform PCA to reduce th features to 2 principal components and display the transformed dataset.								enerate a duce the	2	22C 22C	DS663.1 DS663.2			
4	Write a Julia program that performs K-means clustering on a randomly generate dataset with 100 observations and 2 features. Use K=3K = 3K=3 clusters and displa the following results: Assignments of each data point to a cluster.									enerated d display	2	22C 22C	22CDS663.1 22CDS663.2		
5	Writ mod follo	e a Julia el. Use wing ta	a prog the far isks:	ram tha nous Iri	t demor is datase	nstrates et (availa	classific able in I	cation us RDataset	sing a mac (s) and pe	hine learni rform the	ng	2	22C 22C	22CDS663.1 22CDS663.2	

	Load the Iris dataset and select the features (sepal length, sepal width, petal length, petal width) and target variable (species).		
	 Split the dataset into training (70%) and testing (30%) sets. Train a Random Forest classifier on the training data. Predict the classes for the testing data and display the predicted classes. 		
6	Write a Julia program to illustrate Classification operations.	2	22CDS663.1 22CDS663.2
	PART-B		
7	Write a Julia program that demonstrates linear regression operations using the following steps:	2	
	 Generate sample data with independent variable XXX and dependent variable yyy. Fit a linear regression model to predict yyy based on XXX. Print the coefficients of the regression model and the R² score. Predict values for new data points and calculate the mean squared error (MSE). 		22CDS663.3 22CDS663.4
8	Write a Julia program that utilizes the Plots package with a GR backend to plot various types of graphs, including:	2	
	 Line plot Scatter plot Histogram Box plot Bar plot 		22CDS663.3 22CDS663.4
9	 Write a Julia program that performs numerical optimization for portfolio investment using the following steps: Define the objective function to maximize portfolio return or minimize risk (e.g., using Sharpe ratio or variance). Set constraints on portfolio weights (e.g., sum of weights equals 1). Implement a numerical optimization algorithm (e.g., gradient descent, Newton's method) to find optimal portfolio weights. Display the optimized portfolio weights and expected return/risk metrics. 	2	22CDS663.3 22CDS663.4
10	 Write a Julia program that implements a neural network for classifying the MNIST dataset: Load the MNIST dataset (available in Flux or other packages). Preprocess the data (normalize, reshape). Build a neural network model (e.g., feedforward neural network, convolutional neural network) using Flux.jl. Train the model on the training data and evaluate its performance on the test data. Print the classification accuracy and visualize some predictions. 	2	22CDS663.3 22CDS663.4
11	Write a Julia program that demonstrates interfacing with Python, R, and C:	2	22CDS663.3 22CDS663.4

		 Call tasl Invention hyp 	Call a Python function/module (e.g., using PyCall.jl) that performs a specific task (e.g., data preprocessing, machine learning). Invoke an R function (e.g., using RCall.jl) to perform statistical analysis (e.g., hypothesis testing, regression).									
	 3D plots (e.g., surface plot, scatter plot with 3D points). Interactive plots (e.g., using plotlyjs backend). Customizing plot aesthetics (e.g., color schemes, markers). 											
	PART-C											
	Bevond Syllabus Virtual Lab Content											
			(To be do	ne during L	ab but not t	o be included for CIE or SE	(E)					
			(1000000				-,					
•	https:/	/iulia.mit.ed	u/									
•	https:/	/juliahub.co	m/									
CIE As	sessmen	t Pattern (50) 0 Marks – La	b)								
	DDTL	`	Test (s)	Weekly A	ssessment							
	KBI L	evels	20	3	0]						
L1	Reme	mber	-		-]						
L2	Under	rstand	-		-							
L3	Apply		10	1	.0							
L4	Analy	ze	5	1	.0							
L5	Evalua	ate	5	1	.0							
L6	Create	e	-		-							
SEE As	sessmer	nt Pattern (5	0 Marks – La	ıb)								
Exam Marks												
RBT Levels Distribution (50)												
L1	Remen	nber	-									
L2	Unders	stand	-									
L3	L3 Apply 20											
L4	4 Analyze 20											
L5	Evalua	te	10	0								

Reference Books:

Create

L6

- 1. <u>https://juliaacademy.com/p/julia-for-data-science</u>
- 2. <u>https://github.com/pszufe/MIT 18.S097 Introduction-to-Julia-for-Data-Science</u>.

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- 3. McNicholas, Paul D., Tait, Peter. Data Science with Julia. United Kingdom: CRC Press, 2019, ISBN-13,978-1138499997.
- 4. Voulgaris, Zacharias. Julia for Data Science. United States: Technics Publications, 2016, ISBN-13

978-1634621304

ADVANCED PYTHON PROGRAMMING															
Course Code	22	22CDS674 CIE Marks									50				
L:T:P:S	0:0	0:0:1:0 SEE Marks									50				
Hrs / Week	2								Tot	al Marks	5	10	0		
Credits	01								Exa	m Hours	5	03			
Course outcomes	:	o tho a	tudant	will be	abla ta										
	cours	$\frac{1}{1}$	ludent	will be				1.		1	0.0.00				
22CDS664.1	Ap	Jpry auvanceu python language constructs to use data structures and OOPS concepts													
22CDS664.2	Ana	halyze the language constructs for graphical opeartions													
22CDS664.3	Eva	valuate various techniques for interconnection to network and databases													
22CDS664.4 Solve the queries using advanced packages for python computing															
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2	
22CDS664.1	3	3	3	3	3	-	-	-	1	1	-	2	3	3	
22CDS664.2	3	3	3	3	3	-	-	-	1	1	-	2	3	3	
22CDS664.3	3	3	3	3	3	-	-	-	1	1	-	2	3	3	
22CDS664.4	3	3	3	3	3	-	-	-	1	1	-	2	3	3	
Pgm. No.						List of	Progra	ms				Hour		COs	
						LISCOI	TTUgra	1115				noui	3		
						Prer	equisit	e Demo)						
		Basic programs on python								2		NΔ			
		Basics of visualization								2		INA			
1							IANI	Π				2			
-	Writ	e a Pyt	hon pr	ogram	that per	forms th	ne follov	ving tas	ks:			_			
										. 1	c				
		• Ma	inipula	te a stri	ng to re T	everse it	s charac	cters an	d count	the occur	rence of a	a			
		• Cr	ooto o l	ist of in	5. togors a	nd nerf	orm sor	ting and	d slicing	operatio	nc		220	DS664.1	
		De	fine a t	unle of	mixed o	litu peri lata tyn	es and u	innack i	ts eleme	operation onts into y	variahles		220	DS664 2	
		• Im	nleme	nt a set	to remo	ve dunl	icates fr	om a lis	st of inte	gers and	nerform			2000112	
		set	opera	tions (u	nion, in	itersecti	on).			J 0 4114	r01111				
		• Us	e a dict	tionary	to store	student	t grades	and cal	culate t	he averag	ge grade.				
										_					
2	117	o o Dert	hon	0.0000	hat da-	nonstar	tog the f	allowin	<u>a</u> .						
۷ ک	vvrit	e a Pyt	non pr	ogram	inat der	nonstra	les the f	onowin	g:			2			
		• IIc	o contr	ol flow	statom	ante (if-a	مادم امم	ne) to it	orato th	rough a l	ist and				
		e US ne	rform of	conditio	nal one	rations	.130,100	p3) to it		i ougii a i	ist and				
		• Im	pleme	nt list co	ompreh	ensions	to gene	rate a li	st of sau	ared nun	nbers from	n	220	DS664.1	
		1 to 10.													
		Define a basic function to calculate factorial and use recursion.													
		• Cr	eate a l	ambda	functio	n to com	pute th	e square	e of a nu	mber.					
2	1A7-ait		hor	o ano re	-hot	former	lo hor -1	lingan	orrespect	ong har J	ling				
3	vvrit	e a Pyt	non pr	ogram	mat per	IOTIIS ÎI	ie nand	ing and	excepti	ions nand	nng:	2			
	.	• Ro	ad date	a from a	text file	e count	the nun	nher of I	lines an	d nrint e	ach line		220	DS664.1	
		• Wi	rite dat	a to a n	ew text	file and	handle	excenti	ons for f	file openi	ng and		220	DS664.2	
		wr	iting o	peratio	ns.										

	 Use try-except blocks to handle specific exceptions (e.g., FileNotFoundError, IOError). Implement file operations (open, read, write, close) using context managers (with statement). 		
4	 Write a Python program that demonstrates OOP concepts: Define a class representing a Car with attributes (make, model, year) and methods (accelerate, brake). Create instances of the Car class and invoke its methods to simulate driving actions. Implement inheritance by creating a subclass (ElectricCar) that inherits from the Car class and has additional methods (charge_battery). Use encapsulation to restrict access to certain attributes and methods of the Car class. 	2	22CDS664.1 22CDS664.2
5	Python Turtle Graphics – Drawing Shapes, Filling shapes	2	22CDS664.1 22CDS664.2
6	Games programing using Pygame	2	22CDS664.1 22CDS664.2
	PART-B		
7	Network programming – Client Server Application	2	22CDS664.3 22CDS664.4
8	Web Services in Python using webframeworks	2	22CDS664.3 22CDS664.4
9	Working with Relational Database	2	22CDS664.3 22CDS664.4
10	Web Development with Flask	2	22CDS664.3 22CDS664.4
11	Threading in python	2	22CDS664.3 22CDS664.4
12	Concurrent image processing	2	22CDS664.3 22CDS664.4
	PART-C	•	

Beyond Syllabus Virtual Lab Content (To be done during Lab but not to be included for CIE or SEE)

• <u>https://python-iitk.vlabs.ac.in/</u>

<u>https://codingjr.online/home/virtual labs</u>

CIE Assessment Pattern (50 Marks – Lab)									
	DDT Lovolc	Test (s)	Weekly Assessment						
	NDI Levels	20	30						
L1	Remember	-	-						
L2	Understand	-	-						
L3	Apply	10	10						
L4	Analyze	5	10						
L5	Evaluate	5	10						
L6	Create	-	-						

SEE A	EE Assessment Pattern (50 Marks – Lab)					
RBT Levels		Exam Marks				
		Distribution (50)				
L1	Remember	-				
L2	Understand	-				
L3	Apply	20				
L4	Analyze	20				
L5	Evaluate	10				
L6	Create	-				

- **Reference Books:**
 - 1. Hunt, John. Advanced Guide to Python 3 Programming. Germany: Springer International Publishing, 2023, ISSN 2197-1781.
 - Lanaro, Gabriele., Nguyen, Quan., Kasampalis, Sakis. Advanced Python Programming: Build High Performance, Concurrent, and Multi-threaded Apps with Python Using Proven Design Patterns. India: Packt Publishing, 2019, ISBN-13978-1838551216
 - **3.** Nguyen, Quan. Advanced Python Programming: Accelerate Your Python Programs Using Proven Techniques and Design Patterns. Germany: Packt Publishing, ISBN-13,**978-1801814010**

			NA	ΓΙΟΝΑL	SERVIC	E SCHE	ME (NS	S)				
Course Code	22NSS3	0, 22NS	S40, 22NSS	50, 22NS	S60		CIE Ma (each S	rks emeste	r)	50	50	
L:T:P:S	0:0:0:0						SEE Marks					
Hrs / Week	2	2								50 2	50 x 4 = 200	
Credits	00	00								02		
Course outcomes: At the end of the course, the student will be able to:												
22NSSX0.1	Underst	Understand the importance of his / her responsibilities towards society.										
22NSSX0.2	Analyse	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.										
22NSSX0.3	Evaluate Impleme	e the exis ent gove	sting system rnment or s	n and to pr elf-driven	opose pra	octical so effective	olutions fo ly in the f	or the sam ield.	me for s	ustainable o	levelopme	nt.
22NSSX0.4	Develop in gener	capacity al.	v to meet en	nergencies	and natu	ral disas	ters & pra	actice na	tional ir	itegration a	nd social h	armony
Mapping of Co	irse Outco	mes to	Program (Outcome	s:							
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22NSSX0.1	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSSX0.4	-	-	-	-	-	3	3	-	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
3 rd 22NSS30	 Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing Waste management-Public, Private and Govt organization, 5R's. Setting of the information imparting club for women leading to contribution in social and economic issues. 	22NSS30.1, 22NSS30.2, 22NSS30.3, 22NSS30.4	30 HRS
4 ^{тн} 22NSS40	 Water conservation techniques - Role of different stakeholders- Implementation. Preparing an actionable business proposal for enhancing the village income and approach forimplementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 	22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4	30 HRS
5 ^{тн} 22NSS50	 Developing Sustainable Water management system for rural areas and implementationapproaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. Spreading public awareness under rural outreach programs. (minimum 5 programs). 	22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4	30 HRS
6 ^{тн} 22NSS60	 21. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 22. Govt. school Rejuvenation and helping them to achieve good infrastructure. 	22NSS60.1, 22NSS60.2, 22NSS60.3, 22NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks - Activity based) -

CIE component for every semester	Marks
Presentation - 1	10
Selection of topic, PHASE - 1	
Commencement of activity and its progress -	10
PHASE - 2	
Case study-based Assessment Individual	10
performance	
Sector wise study and its consolidation	10

deo based seminar for 10 minutes by each10udent at the end of semester with eport.10
otal marks for the course in each semester 50

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
 - Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Reference Books:

- 1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
- 2. Government of Karnataka, NSS cell, activities reports and its manual.
- 3. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

- 1. Students should have a service-oriented mindset and social concern.
- 2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
- 3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
 - o Lecture session by NSS Officer
 - Students Presentation on Topics
 - Presentation 1, Selection of topic, PHASE 1
 - Commencement of activity and its progress PHASE 2
 - Execution of Activity
 - Case study-based Assessment, Individual performance
 - Sector/ Team wise study and its consolidation
 - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Торіс	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/Continu ous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

7.	Developing SustainableWater management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India.For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas/Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)													
Course Code	22PED3	80, 22PED	40, 22PE	D50, 22P	ED60		CIE Marks			50			
	0.0.0.0						(each semester)						
L:I:P:S	0:0:0:0						SEE Ma	Irks Iorks		 E0 v	4-200		
Credits	00						Exam F	1011KS		02	4-200		
Course outco	mes:						LAUIIII	10415		02			
At the end of	the course, th	ne student	will be ab	ole to:									
22PEDX0.1	Understand	d the funda	amental c	oncepts an	d skills of	f Physica	l Educati	on, Healt	h, Nutriti	on and Fit	ness		
22PEDX0.2	Create cons healthy life	sciousness style	s among tł	ne student:	s on Healt	th, Fitnes	ss and We	ellness in	developi	ng and ma	intaining	а	
22PEDX0.3	Perform in regional/st	the select ate / natio	ed sports onal / inte	or athletic rnational	s of stude levels.	nt's choi	ce and pa	articipate	in the co	mpetition	at		
22PEDX0.4	Understand	d the roles	and resp	onsibilities	s of organ	ization a	nd admir	nistration	of sports	s and game	es		
Mapping of C	Course Outco	omes to P	rogram	Outcome	S:								
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	
22PEDX0.1	-	-	-	-	-	2	-	3	3	-	-	2	
22PEDX0.2	-	-	-	-	-	2	-	3	3	-	-	2	
22PEDX0.3	-	-	-	-	-	2	-	3	3	-	-	2	
22PEDX0.4	-	-	-	-	-	2	-	3	3	-	-	2	
Semester	Madala 1	0		CONTE	NT				(COs	HOU	JRS	
	F. Lifestyle, G. Fitness H. Food & Nutrition I. Health & Wellness									22PED30.1, 22PED30.2		5 HRS	
J. Pre-Fitness test. Module 2: General Fitness & Components of Fitness G. Warming up (Free Hand exercises) H. Strength – Push-up / Pull-ups 22PED30 I. Speed – 30 Mtr Dash J. Agility – Shuttle Run K. Flexibility – Sit and Reach				22PF 22PI	ED30.2, ED30.3	0.2, 0.3 15 HRS							
	Module 3: Recreational Activities E. Postural deformities. F. Stress management. G. Aerobics. H. Traditional Games								22PF 22PF	ED30.3, ED30.4	10 H	HRS	
	Module 1: Ethics and Moral Values22PED40.1,C. Ethics in Sports22PED40.2D. Moral Values in Sports and Games						5 H	IRS					
4THG. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. H. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. I. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. J. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. K. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.22PED40.3					20 F	łRS							
	Module 3:	Role of O	rganizat	ion and a	dministr	ation			22PI	ED40.4	5 H	íRS	
5 th	Fitness C	omponen	ts: Mean	ing and	Importan	ce, Fit	India Mo	ovement,	22PF	ED50.1,	Total 3	0 Hrs/	

22PED50	Definition of fitness, Components of fitness, Benefits of fitness, Types of	22PED50.2,	Semester
	fitness and Fitness tips.	22PED50.3,	211 / 1
	Athlatics	22PED50.4	2 Hrs/week
	4. Track -Sprints:		
	 Starting Techniques: Standing start and Crouch start (its variations) 		
	use of Starting Block.		
	 Acceleration with proper running techniques. 		
	• Finishing technique: Run Through, Forward Lunging and Shoulder		
	Shrug.		
	5. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang		
	Style/Hitch Kick)and Landing		
	6. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique)		
	Handball OR Ball Badminton		
	Handball: B Fundamental Skills		
	7. Catching, Throwing and Ball control,		
	 B. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. Dribbling: High and low. 		
	10. Attack and counter attack, simple counter attack, counter attack from		
	11. Blocking, Goal Keeping and Defensive skills.		
	12. Game practice with application of Rules and Regulations.		
	C. Rules and their interpretations and duties of officials		
	Ball badminton:		
	B. Fundamental Skills		
	5. Basic Knowledge: various parts of the Racket and Grip. 6. Service: Short service. Long service. Long-high service.		
	7. Shots: Overhead shot, Defensive clearshot, Attacking clearshot,		
	Dropshot, Netshot, Smash.		
	8. Game practice with application of Rules and Regulations.		
C TH	B. Rules and their interpretation and duties of officials.		
22PED60	4 Track -110 Mtrs and 400Mtrs		
	Hurdling Technique: Lead leg Technique Trail leg Technique Side		
	Hurdling. Over the Hurdles		
	 Crouch start (its variations) use of Starting Block. 		
	• Approach to First Hurdles, In Between Hurdles, Last Hurdles to		
	Finishing.		
	5. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and		
	Landing.		Total 30 Hrs/
	Turn, Release and Recovery (Rotation in the circle).	22PED60.1, 22PED60.2,	Semester
	Football OR Hockey	22PED60.3,	2 Hrs/week
	Football:	22PED60.4	
	A. Fundamental Skills		
	Insten of the foot. Kicking the ball with Inner Insten of the foot. Kicking the		
	ball with Outer Instep of the foot and Lofted Kick.		
	10. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole		
	of the foot.		
	11. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the		
	ball with Inner and Outer Instep of the foot.		
	12. Heading: In standing, running and jumping condition.		

	13.	Throw-in: Standing throw-in and Running throw-in.	
	14.	Feinting: With the lower limb and upper part of the body.	
	15.	Tackling: Simple Tackling, Slide Tackling.	
	16. and	Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing deflecting.	
	17.	Game practice with application of Rules and Regulations.	
	B. Rul	es and their interpretation and duties of officials.	
1	Hockey	7:	
	A. Fun	damental Skills	
	1. P	assing: Short pass, Longpass, pushpass, hit	
	2. T	rapping.	
	3. Dril	bbling and Dozing	
	9. Pen	alty stroke practice.	
	10.	Penalty corner practice.	
	11.	Tackling: Simple Tackling, Slide Tackling.	
	12.	Goal Keeping, Ball clearance- kicking, and deflecting.	
	13.	Game practice with application of Rules and Regulations.	
	B. Rul	es and their interpretation and duties of officials	

CIE Assessment Pattern (50 Marks - Practical) -

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	50

Suggested Learning Resources: Reference Reaks:

Reference Books:

- 12. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
- 13. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
- 14. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
- 15. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
- 16. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
- 17. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
- 18. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
- 19. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
- 20. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
- 21. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
- 22. Rachana Jain, Teach Yourself Basketball, Sports Publication.
- 15. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
- 16. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
- 17. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

					YOG	A							
Course Code	22Y0G3	30, 22YOC	G40, 22YC)G50, 22Y	0G60		CIE Ma	rks		5	50		
L:T:P:S	0:0:0:0						SEE Ma	ırks		-	-		
Hrs / Week	2						Total M	larks		50 x 4 = 200			
Credits	00						Exam H	lours		0	2		
Course outcom At the end of th	nes: le course, the	e student v	will be abl	e to:									
22YOGX0.1	Underst	anding the	e origin, h	istory, aim	and obje	ctives of	Yoga						
22Y0GX0.2	Become	familiar v	vith an au	thentic for	indation c	of Yogic	practices						
22YOGX0.3	Practice	different	Yogic met	hods such	as Suryaı	namaska	ira, Prana	yama an	d some	of the Sh	at Kri	iyas	
22YOGX0.4	Use the	teachings	of Patanja	ıli in daily	life.								
Mapping of Co	ourse Outco	omes to F	rogram	Outcome	s:								
	P01	P02	P03	P04	P05	P06	P07	P08	POS) PO1	.0	P011	P012
22YOGX0.1	-	-	-	-	-	3	-	-	-	-		-	1
22YOGX0.2	-	-	-	-	-	3	-	-	-	-		-	1
22Y0GX0.3	-	-	-	-	-	3	-	-	-	-		-	1
22YOGX0.4	-	-	-	-	-	3	-	-	-	-		-	1
Semester / Course Code				CONT	TENT					COs	;	Н	OURS
3 rd 22YOG30	history ar yoga, imp Brief intr common r Rules an practition Misconce and non-y Suryanan 3. Surya Surya 4. Surya Different t 5. Sittin 6. Stanc 7. Prone 8. Supir	 Introduction of roga: Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health Rules and regulations: Rules to be followed during yogic practices by practitioner Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices. Suryanamaskara: Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar. Suryanamaskar 12 count, 2rounds Different types of Asanas: Sitting: Padmasana, Vajrasana, Sukhasana Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana Total 32 Hrs/week 							l 32 Hrs/ mester rs/week				
4 ^{тн} 22YOG40	7.Prone line: Bhujangasana, Shalabhasana 8.Supineline: Utthitadvipadasana, Ardhahalasana, Halasana8.Supineline: Utthitadvipadasana, Ardhahalasana, HalasanaSuryanamaskara: Suryanamaskar 12 count,4rounds8.Suryanamaskara: Suryanamaskar 12 count,4roundsBrief introduction and importance of: Kapalabhati: Revision of Kapalabhati -40strokes/min3roundsSuryanamaskara: Suryanamaskara: Suryanamasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana22YOG40.1, 22YOG40.2, 22YOG40.2, 22YOG40.3, 22YOG40.4Total 32 Hrs, Semester 2 Hrs/week6.Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 8.Supine line: Karna Peedasana, Sarvangasana, Chakraasana Patanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya BhedanaTotal 32 Hrs, 22YOG40.4Total 32 Hrs, Semester 2 Hrs/week						l 32 Hrs/ mester rs/week						

5 ^{тн} 22Y0G50	 Kapalabhati: Revision of Kapalabhati - 60strokes/min3rounds Brief introduction and importance of: Different types of Asanas: 5. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 6. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 7. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 8. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana Patanjali's Ashtanga Yoga: Pratyahara, Dharana Pranayama: Ujjayi, Sheetali, Sheektari 	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week
б ^{тн} 22Y0G60	 Kapalabhati: Revision of Kapalabhati – 80 strokes/min3rounds Brief introduction and importance of: Different types of Asanas: Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana Supine line: Setubandhasana, Shavasanaa (Relaxation posture) Balancing: Sheershasana Patanjali's AshtangaYoga: Dhyana (Meditation), Samadhi Pranayama: Bhastrika, Bhramari, Ujjai Shat Kriyas: Jalaneti and sutraneti, Sheetkarma Kapalabhati 	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks - Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	50

Suggested Learning Resources:

Reference Books:

- 4. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
- 5. Tiwari, O P: Asana Why and How
- 6. Ajitkumar: Yoga Pravesha (Kannada)
- 7. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
- 8. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
- 9. Nagendra H R: The art and science of Pranayama
- 10. Tiruka: Shatkriyegalu (Kannada)
- 11. Iyengar B K S: Yoga Pradipika (Kannada)
- 12. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

<u>https://youtu.be/KB-TYlgd1wE</u>

• <u>https://youtu.be/aa-TG0Wg1Ls</u>

APPENDIX A

List of Assessment Patterns

SLNO	Assessments
1	Continuous Internal Evaluation
2	Assignments
3	Online/Offline Quizzes
4	Mini Projects/ Projects
5	Group Discussions
6	Case studies
7	Practical Activities/Problem Solving Exercises
8	Practical Orientation on design thinking, Creative & Innovation
9	Participatory & Industry-Integrated Activities
10	Class Presentations

APPENDIX B

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes

COURSE OUTCOME PROGGRAM OUTCOME PROGRAM EDUCATIONAL OBJECTIVES DEPARTMENTAL MISSION DEPARTMENTAL VISION

APPENDIX C

The Graduate Attributes of NBA

Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct investigations of complex problems	The problems that cannot be solved by straight forward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.
Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

APPENDIX D

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.





www.newhorizonindia.edu

Ring Road, Bellandur Post, Near Marathahalli, Bengaluru, Karnataka 560103, India.

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