Study & Evaluation Scheme

of

Bachelor of Technology
in
Computer Science & Engineering

[Applicable for Batch 2021-25]

[As per CBCS guidelines given by UGC]

Approved in BOS	Approved in BOF	Approved in Academic Council
09-08-2021	18-08-2021	14-11-2021 Vide agenda No. 6.5.1

Quantum University, Roorkee
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Website: www.quantumuniversity.edu.in

Study & Evaluation Scheme

Study Summary

Name of the Faculty	Faculty of Computer Science and Engineering
Name of the School	Quantum School of Technology
Name of the Department	Department of Computer Science and Engineering
Program Name	Bachelor of Technology in Computer Science & Engineering
Duration	4 Years
Medium	English

Evaluation Scheme

Type of Papers	Internal Evaluation (%)	End Semester Evaluation (%)	Total (%)
Theory	40	60	100
Practical/ Dissertations/Project Report/ Viva-Voce	40	60	100
Internal Evaluation Components (Theory Papers)			
Mid Sem Exam	60 Marks		
Assignment-I	30 Marks		
Assignment-II	30 Marks		
Attendance	30 Marks		
Internal Evaluation Components (Practical Papers)			
Quiz One	30 Marks		
Quiz Two	30 Marks		
Quiz Three	30 Marks		
Lab Records/ Mini Project	30 Marks		
Attendance	30 Marks		
End Semester Evaluation (Practical Papers)			
ESE Quiz	40 Marks		
Practical Performance	20 Marks		
Lab Record	20 Marks		
Viva- Voce	20 Marks		

Structure of Question Paper (ESE Theory Paper)

The question paper will consist of 5 questions, one from each unit. Student has to Attempt all questions. All questions carry 20 marks each. Parts a) and b) of question Q1 to Q5 will be compulsory and each part carries 2 marks. Parts c), d) and e) of Q1 to Q5 Carry 8 marks each and the student may attempt any 2 parts.

Important Note:

1. *The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to attainment of Programme Outcomes (POs). A question paper must assess the following aspects of learning as planned for a specific course i.e Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy). The standard of question paper will be based on mapped BL level complexity of the unit of the syllabus, which is the basis of CO attainment model adopted in the university.*

2. Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.

3. There shall be continuous evaluation of the student and there will be a provision of real time reporting on QUMS. All the assignments will evaluated through module available on ERP for time and access management of the class.

Program Structure – Bachelor of Technology in Computer Science & Engineering

Introduction

Bachelor of Technology in Computer Science & Engineering is an academic programme that integrates the field of Computer Engineering and Computer Science. It is one of the most sought after courses amongst engineering students. The course contains a plethora of topics but emphasises the basics of computer programming and networking. The topics covered in the course are computation, algorithms, programming languages, program design, computer software, computer hardware, and others.
Computer science engineers are involved in many aspects of computing, from the design of individual microprocessors, personal computers, and supercomputers to circuit designing and writing software that powers them.
Many technical institutes in India and abroad offer UG (Undergraduate) and PG (Postgraduate) level courses in Computer Science Engineering. Students can do BTech and MTech in Computer Science Engineering from these institutes. Students pursuing these courses get to learn about the design, implementation, and management of information systems of computer hardware and software.

Career Scope of Computer Science Engineering
Bachelor of Technology in Computer Science & Engineering is one of the engineering specialisations. However, candidates pursuing this programme have the option of further choosing amongst various other specialisations like telecommunication, web designing, computer hardware and software implementation and maintenance, etc.
These professionals can work as a data scientist, computer programmer, systems analyst, hardware engineer, software developer, system engineer, IT consultant, system designer, networking engineer, web developer, database administrator, mobility tester, programmer, e-commerce specialist, and software tester.

Computer Science Engineering: Eligibility Criteria

Find below the basic eligibility requirement to pursue a Computer Science Engineering programme at the UG and PG level:

- **Eligibility requirements for Bachelor of Technology in Computer Science & Engineering:** Aspirants should have passed the Class 12 exam from a recognized board with Physics, Chemistry, and Mathematics as core subjects. Besides this candidates should also have secured minimum aggregate marks of 60% in the above subjects combined.
- **Eligibility requirements for Masters of Technology in Computer Science & Engineering**: Aspirants must have completed a BTech degree in the same specialization with a passing percentage

Curriculum (21-25) Version 2021

Quantum School of Technology

Department of Computer Science and Engineering
Bachelor of Technology in Computer Science & Engineering – **PC: 01-3-01**

BREAKUP OF COURSES

Sr. No	CATEGORY	CREDITS
1	Foundation Core (FC)	40
2	Program Core (PC)	78
3	Program Electives (PE)	15
4	Open Electives (OE)	9
5	Project	14
6	Internship	5
7	Value Added Programs (VAP)	8
8	General Proficiency	7
9	Disaster Management*	2*
TOTAL NO. OF CREDITS		176
TOTAL NO. OF CREDITS (Honors)		188

*Non-CGPA Audit Course

DOMAIN-WISE BREAKUP OF CATEGORY

Domain	Foundation core	Program Core	Program Elective	Sub total	%age
Sciences	14	-	-	14	7.95
Humanities	5	-	-	5	2.84
Engineering	21	97	15	133	75.56
Open elective				9	5.11
VAP				8	4.54
GP				7	3.97
Disaster Management*				2*	0.0
Grand Total	**40**	**97#**	**15**	**176**	**100**

#Credits of projects and internships included *Non-CGPA Audit Course

SEMESTER-WISE BREAKUP OF CREDITS

Sr. No	CATEGORY	SEM 1	SEM 2	SEM 3	SEM 4	SEM 5	SEM 6	SEM 7	SEM 8	TOTAL
1	Foundation Core	19/20	21/20	-	-	-	-	-	-	40
2	Program Core	-	-	21	17	15	14	11	-	78
3	Program Electives	-	-	(+3H)	(+3H)	(+3H)	3 (+3H)	6	6	15 (+12H)
4	Open Electives	-	-	-	3	3	3	-	-	9
5	Projects	-	-	2	2	2	2	2	4	14
6	Internships	-	-	1	-	2	-	2	-	5
7	VAPs	1	1	1	1	2	2	-	-	8
8	GP	1	1	1	1	1	1	1	-	7
9	Disaster Management*									2*
	TOTAL	**21/22**	**23/22**	**26**	**24**	**25**	**25**	**22**	**10**	**176**

H- Honors program *Non-CGPA Audit Course

Minimum Credit Requirements:

B. Tech. : 176 Credits
With Honors : 176 +12 = 188 credits

SEMESTER 1

Common

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3102	FC	Mathematics I	3	2	0	4	1.0	Nil
PH3101	FC	Engineering Physics	2	2	0	3	1.0	Nil
EG3102	FC	Professional Communication	2	0	0	2	1.0	Nil
CS3101	FC	Basics of Computer and C Programming	4	0	0	4	1.1	Nil
ME3102	FC	Basic Mechanical Engineering	3	0	0	3	1.0	Nil
PH3140	FC	Engineering Physics Lab	0	0	2	1	1.0	Nil
EG3140	FC	Professional Communication Lab	0	0	2	1	1.0	Nil
CS3140	FC	Basics of Computer and C Programming Lab	0	0	2	1	1.0	Nil
VP3101	VP	Communication and professional skills-I	0	0	2	1	1.0	Nil
CE3101		Disaster Management*	2	0	0	2*	1.0	Nil
GP3101	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**16**	**4**	**8**	**21**		

*Non-CGPA Audit Course

Contact Hrs: 28

SEMESTER 2

Common

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
CS3203	FC	Graph Theory and Probability	3	0	0	3	1.0	Nil
CS3206	FC	Advance C Programming	4	0	0	4	1.0	Nil
CS3204	FC	HTML5 and CSS	4	0	0	4	1.0	Nil
CS3205	FC	Web and Digital Analytics	3	0	0	3	1.0	Nil
CY3205	FC	Environmental Studies	2	0	0	2	1.0	Nil
PS3101	FC	Human Values and Ethics	2	0	0	2	1.0	Nil
CS3242	FC	Advance C Programming Lab	0	0	2	1	1.0	Nil
CS3243	FC	HTML5 and CSS Lab	0	0	2	1	1.0	Nil
CS3244	FC	Web and Digital Analytics Lab	0	0	2	1	1.0	Nil
VP3201	VP	Communication and Professional Skills-II	0	0	2	1	1.0	Nil
GP3201	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**18**	**0**	**8**	**23**		

Contact Hrs = 26

SEMESTER 3

Common

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3301	PC	Data Structure & Programming	4	0	0	4	1.0	Nil
EC3306	PC	Digital Electronics	3	0	0	3	1.0	Nil
CS3305	PC	Database Management System	3	0	0	3	1.0	Nil
CS3340	PC	Data Structure Programming Lab	0	0	2	1	1.0	Nil
EC3341	PC	Digital Electronics Lab	0	0	2	1	1.0	Nil
CS3342	PC	Oracle/SQL Server Lab	0	0	2	1	1.0	Nil
CS3346	PT	Project Lab I	0	0	4	2	1.0	Nil
VP3301	VP	Communication & Professional Skills - III	0	0	2	1	1.0	Nil
CS3371	FW	Internship Presentation	2	0	0	1	1.0	Nil
GP3301	GP	General Proficiency	0	0	0	1		
		TOTAL	**12**	**0**	**12**	**18**		

CSE without Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3307	PC	Discrete Design Structure	2	2	0	4	1.0	Nil
CS3304	PC	Linux and Open Source	3	0	0	3	1.0	Nil
CS3343	PC	Linux and Open Source Lab	0	0	2	1	1.0	Nil
		TOTAL	**5**	**2**	**2**	**8**		

Contact Hrs = 33

CSE-AIML Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3323	PE	Introduction to AI, Data Science, Ethics and Foundation of Data Analysis	3	0	0	4	1.0	Nil
CS3324	PE	Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn	3	0	0	3	1.0	Nil
CS3307	PC	Discrete Design Structure	2	2	0	4	1.0	Nil
		TOTAL	**8**	**2**	**0**	**11**		

CSE-CSCQ Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3351	PE	Basics of C++ Programming	0	0	5	3	1.0	Nil
CS3352	PE	Basics of Networking and Trusted Operating Systems	0	0	5	3	1.0	Nil
CS3304	PC	Linux and Open Source	3	0	0	3	1.0	Nil
CS3343	PC	Linux and Open Source Lab	0	0	2	1	1.0	Nil
		TOTAL	**3**	**0**	**12**	**10**		

SEMESTER 4

Common

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3403	PC	Object Oriented Programming and Systems with Java	3	0	0	3	1.0	Nil
CS3404	PC	Theory of Automata & Formal Language	3	1	0	4	1.0	Nil
---	OE	Open Elective I	3	0	0	3	1.0	Nil
CS3440	PC	Object Oriented Programming with Java Lab	0	0	2	1	1.0	Nil
CS3446	PT	Project Lab II	0	0	4	2	1.0	Nil
VP3401	VP	Employability Skills-I(Numerical abilities)	0	0	2	1	1.0	Nil
GP3401	GP	General Proficiency	0	0	0	1		
		TOTAL	**9**	**1**	**8**	**15**		
All students are required to attend 04 to 06 weeks Industrial Training after 4th semester. Performance of this training will be evaluated and awarded in 5th semester.								

CSE without Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3401	PC	Software Engineering	3	0	0	3	1.0	Nil
CS3402	PC	Computer Network	4	0	0	4	1.0	Nil
CS3442	PC	Computer Network Lab	0	0	2	1	1.0	Nil
CS3441	PC	Case Tools and Testing Lab	0	0	2	1	1.0	Nil
		TOTAL	**7**	**0**	**4**	**9**		

Contact Hrs = 29

CSE-AIML Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3423	PE	Probabilistic Modelling and Reasoning with Python	3	0	0	4	1.0	CS3323
CS3424	PE	R Programming for Data Science and Data Analysis	3	0	0	3	1.0	CS3324
CS3402	PC	Computer Network	4	0	0	4	1.0	Nil
CS3442	PC	Computer Network Lab	0	0	2	1	1.0	Nil
		TOTAL	**10**	**0**	**2**	**12**		

CSE-CSCQ Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3451	PE	Advanced Networking	0	0	5	3	1.0	CS3351
CS3452	PE	Basis of Information Security	0	0	5	3	1.0	CS3352
CS3445	PC	Advanced Networking Lab	0	0	2	1	1.0	Nil
CS3401	PC	Software Engineering	3	0	0	3	1.0	Nil
CS3441	PC	Case Tools and Testing Lab	0	0	2	1	1.0	Nil
		TOTAL	**3**	**0**	**14**	**11**		

Open Elective I

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3011	OE	Carbon Emission & Control	3	0	0	3	1.0	Nil
CS3011	OE	HTML5	3	0	0	3	1.0	Nil
CS3021	OE	Mining and Analysis of Big data	3	0	0	3	1.0	Nil
AG3011	OE	Ornamental Horticulture	3	0	0	3	1.0	Nil
BB3011	OE	Entrepreneurial Environment in India	3	0	0	3	1.0	Nil
JM3011	OE	Media Concept and Process (Print and Electronic)	3	0	0	3	1.0	Nil
HM3011	OE	Indian Cuisine	3	0	0	3	1.0	Nil
MB3011	OE	SAP 1	3	0	0	3	1.0	Nil
EG3011	OE	French Beginner A1	3	0	0	3	1.0	Nil
CS3031	OE	Microsoft Office Specialist (MSO-Word)	3	0	0	3	1.0	Nil
CS3004	OE	Digital Marketing	3	0	0	3	1.0	Nil
CS3002	OE	Introduction of IOT	3	0	0	3	1.0	Nil
MT3011	OE	Elementary Robotics	3	0	0	3	1.0	Nil

SEMESTER 5

Common

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3504	PC	Design and Analysis of Algorithm	3	2	0	4	1.0	CS3301
---	OE	Open Elective II	3	0	0	3	1.0	Nil
CS3540	PC	Web Technology Lab	0	0	2	1	1.0	Nil
CS3541	PC	Design and Analysis of Algorithm Lab	0	0	2	1	1.0	Nil
CS3546	PT	Project Lab III	0	0	4	2	1.0	Nil
CS3571	IN	Internship Presentation	2	0	0	2	1.0	Nil
VP3501	VP	Employability Skills -II (Aptitude & Reasoning)	2	0	0	2	1.0	Nil
GP3501	GP	General Proficiency	0	0	0	1		
		TOTAL	**10**	**2**	**8**	**16**		

CSE without Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3505	PC	Foundation of Cloud Computing	3	0	0	3	1.0	Nil
CS3501	PC	Operating System	2	2	0	3	1.0	Nil
CS3502	PC	Web Technology	3	0	0	3	1.0	CS3403
		TOTAL	**8**	**2**	**0**	**9**		

Contact Hours = 30

CSE-AIML Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3523	PE	Machine Learning and Pattern Recognition	3	0	0	3	1.0	CS3423
CS3524	PE	Machine Learning Practical with Python, Scikit-learn, Matplotlib, TensorFlow	2	0	0	2	1.0	CS3454
CS3505	PC	Foundation of Cloud Computing	3	0	0	3	1.0	Nil
		TOTAL	**8**	**0**	**0**	**8**		

CSE-CSCQ Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3551	PE	Linux and Virtualization	0	0	5	3	1.0	CS3451
CS3552	PE	Cryptography	0	0	5	3	1.0	CS3452
CS3553	PE	Advance of Information Security	0	0	5	3	1.0	CS3445
CS3502	PC	Web Technology	3	0	0	3	1.0	CS3403
		TOTAL	**3**	**0**	**15**	**12**		

Open Elective II

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3013	OE	Environment Pollution and Waste Management	3	0	0	3	1.0	Nil
CS3011	OE	Java Script	3	0	0	3	1.0	Nil
CS3023	OE	Big Data Analytics: HDOOP Framework	3	0	0	3	1.0	Nil
AG3013	OE	Organic farming	3	0	0	3	1.0	Nil
BB3013	OE	Establishing a New Business	3	0	0	3	1.0	Nil
JM3013	OE	Photo Journalism	3	0	0	3	1.0	Nil
HM3013	OE	Chinese Cuisine	3	0	0	3	1.0	Nil
MB3013	OE	SAP 3	3	0	0	3	1.0	Nil
EG3013	OE	French Intermediate B1	3	0	0	3	1.0	Nil
CS3033	OE	MS -Excel (Advanced) MSO Certification	3	0	0	3	1.0	Nil
EG3002	OE	Report Writing	3	0	0	3	1.0	Nil
MT3013	OE	Introduction to Automation	3	0	0	3	1.0	Nil

SEMESTER 6

Common

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3604	PC	Compiler Design	3	1	0	4	1.0	CS3304
---	OE	Open Elective III	3	0	0	3	1.0	Nil
---	PE	Program Elective I	3	0	0	3	1.0	Nil
CS3641	PC	Compiler Design Lab	0	0	2	1	1.0	Nil
CS3646	PT	Project Lab IV	0	0	4	2	1.0	Nil
VP3601	VP	Employability Skills-III(GDPI)	0	0	2	2	1.0	Nil
CS3642	PC	Technical VAP I	0	0	2	2	1.0	Nil
GP3601	GP	General Proficiency	0	0	0	1		
		TOTAL	**11**	**1**	**8**	**18**		
All students are required to attend 04 to 06 weeks Industrial Training after 6th semester. This training will be evaluated and awarded in 7th semester.								

CSE without Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3601	PC	Artificial Intelligence	2	2	0	3	1.0	Nil
CS3603	PC	Distributed Operating Systems	3	0	0	3	1.0	CS3501
CS3640	PC	Artificial Intelligence using Python Lab	0	0	2	1	1.0	Nil
		TOTAL	**5**	**2**	**2**	**7**		

Contact Hours = 29

CSE-AIML Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3624	PE	Deep Learning Practical with Python, TensorFlow and Keras	2	0	0	2	1.0	Nil
CS3648	PE	Advanced Python Programming Lab	0	0	4	2	1.0	Nil
CS3649	PE	Operating System Lab	0	0	2	1	1.0	Nil
CS3603	PC	Distributed Operating Systems	3	0	0	3	1.0	CS3501
		TOTAL	**5**	**0**	**6**	**8**		

CSE-CSCQ Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3652	PE	Digital Forensics Part-2	0	0	5	3	1.0	CS3551
CS3653	PE	Introduction to Risk Management and Cyber Laws	0	0	5	3	1.0	CS3552
CS3654	PE	Malware Analysis and Reverse Engineering I	0	0	5	3	1.0	Nil
CS3643	PC	Linux Administration Lab	0	0	2	1	1.0	Nil
		TOTAL	**0**	**0**	**17**	**10**		

Open Elective III

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3015	OE	Hydrology	3	0	0	3	1.0	Nil
CS3015	OE	J Query & Databases	3	0	0	3	1.0	Nil
CS3025	OE	Data Science Models : Regression, Classification and Clustering	3	0	0	3	1.0	Nil
AG3015	OE	Musroom Cultivation	3	0	0	3	1.0	Nil
BB3015	OE	E-commerce	3	0	0	3	1.0	Nil
JM3015	OE	Media industry and Management	3	0	0	3	1.0	Nil
HM3015	OE	Italian Cuisine	3	0	0	3	1.0	Nil
MB3015	OE	SAP 5	3	0	0	3	1.0	Nil
EG3015	OE	French Advance C1	3	0	0	3	1.0	Nil
CS3035	OE	MSO Access Certification	3	0	0	3	1.0	Nil
MT3015	OE	Robotic Industry 4.0	3	0	0	3	1.0	Nil

SEMESTER 7

Common

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3701	PC	System Administration	4	0	0	4	1.0	Nil
CS3702	PC	Big Data and Business Intelligence	4	0	0	4	1.0	CS3301
---	PE	Program Elective II	3	0	0	3	1.0	Nil
---	PE	Program Elective III	3	0	0	3	1.0	Nil
CS3771	IN	Internship Presentation	2	0	0	2	1.0	Nil
CS3746	PT	Project Lab V	0	0	4	2	1.0	Nil
CS3742	PC	Technical VAP II	0	0	2	2	1.0	Nil
GP3701	GP	General Proficiency	0	0	0	1		
		TOTAL	**16**	**0**	**6**	**21**		

CSE without Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3740	PC	System Administration Lab	0	0	2	1	1.0	Nil
		TOTAL	**0**	**0**	**2**	**1**		

Contact Hours = 24

CSE-AIML Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3740	PC	System Administration Lab	0	0	2	1	1.0	Nil
		TOTAL	**0**	**0**	**2**	**1**		

CSE-CSCQ Specialization

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3740	PC	System Administration Lab	0	0	2	1	1.0	Nil
		TOTAL	**0**	**0**	**2**	**1**		

SEMESTER 8

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
---	PE	Program Elective IV	3	0	0	3	1.0	Nil
---	PE	Program Elective V	3	0	0	3	1.0	Nil
CS3870	PT	Project	0	0	0	4		
		TOTAL	6	0	0	10		
							Contact Hrs:6	

OR

It is the prerogative of the University to allow the students to opt for this option only after completing the process of approval before proceed on full semester internship on an industrial project. The evaluation of the internal component will be done jointly by industry supervisor and University supervisor. End semester evaluation will be done by a
committee comprise of at least one expert from industry/corporate.

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CS3871	FW	Major Industrial Project	0	0	0	10	1.0	Nil
		TOTAL	0	0	0	10		

Program Electives CSE

Elective	Specialization	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
I	CSE	CS3609	Cryptography and Network Security	3	0	0	3	1.0	Nil
		CS3611	Digital Image Processing	3	0	0	3	1.0	Nil
II	CSE	CS3703	Wireless Network	3	0	0	3	1.0	Nil
		CS3707	Computer Vision	3	0	0	3	1.0	Nil
III	CSE	CS3705	Organization and Architecture of Computer	3	0	0	3	1.0	Nil
		CS3706	Data Compression	3	0	0	3	1.0	Nil
IV	CSE	CS3803	Parallel Computing	3	0	0	3	1.0	Nil
		CS3804	Cyber Laws and Security Policies	3	0	0	3	1.0	Nil
V	CSE	CS3807	Fault Tolerant Computing	3	0	0	3	1.0	Nil
		CS3806	Virtual Reality and Systems	3	0	0	3	1.0	Nil

Program Electives CSE-AIML

Elective	Specialization	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
I	AIML	CS3609	Cryptography and Network Security	3	0	0	3	1.0	Nil
		CS3623	Neural Networks and Deep Learning (Vision and NLP)	3	0	0	3	1.0	CS3521
II	AIML	CS3723	Data Science - Tools and Techniques	3	0	0	3	1.0	CS3621
		CS3704	Soft Computing	3	0	0	3	1.0	Nil
III	AIML	CS3724	Data Visualization	3	0	0	3	1.0	CS3621
		CS3706	Data Compression	3	0	0	3	1.0	Nil
IV	AIML	CS3801	Computer Organization and Architecture	3	0	0	3	1.0	Nil
		CS3804	Cyber Laws and Security Policies	3	0	0	3	1.0	Nil
V	AIML	CS3821	Reinforcement Learning	3	0	0	3	1.0	CS3722
		CS3806	Virtual Reality and Systems	3	0	0	3	1.0	Nil

Program Electives CSE-CSCQ

Elective	Specialization	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
I	Cyber Security	CS3610	Android Development	3	0	0	3	1.0	Nil
		CS3651	Digital Forensics Part-1	3	0	0	3	1.0	CS3551
II	Cyber Security	CS3703	Wireless Network	3	0	0	3	1.0	Nil
		CS3704	Soft Computing	3	0	0	3	1.0	Nil
III	Cyber Security	CS3751	Malware Analysis and Reverse Engineering II	0	0	5	3	1.0	CS3651
		CS3706	Data Compression	3	0	0	3	1.0	Nil
IV	Cyber Security	CS3801	Computer Organization and Architecture	3	0	0	3	1.0	Nil
		CS3804	Cyber Laws and Security Policies	3	0	0	3	1.0	CS3751
V	Cyber Security	CS3802	Cloud Computing Fundamentals	3	0	0	3	1.0	Nil
		CS3806	Virtual Reality and Systems	3	0	0	3	1.0	Nil

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our university.

The following is the course module designed for the B.Tech. Computer Science & Engineering program:

Core competency: Students will acquire core competency in Computer Science & Engineering and in allied subject areas.

Program/Discipline Specific Elective Course (DSEC):

Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic & advance knowledge and concepts of Computer Science & Engineering.

Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

Skilled project manager: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about mathematical project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

Ethical awareness/reasoning: A graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

Value Added Course (VAC): A value added audit course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be four courses of Aptitude in Semester I, II, III & IV semesters and two courses of Soft Skills in III & IV Semesters and will carry no credit, however, it will be compulsory for every student to pass these courses with minimum

45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to specifically be registered in the specific course of the respective semesters.

Skill Enhancement Course: This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Generic/Open Elective Course (OEC): Open Elective is an interdisciplinary additional subject that is compulsory in a program. The score of Open Elective is counted in the overall aggregate marks under Choice Based Credit System (CBCS). Each Open Elective paper will be of 3 Credits in III, IV and VI semesters. Each student has to take Open/Generic Electives from department other than the parent department. Core / Discipline Specific Electives will not be offered as Open Electives.

Mandatory Course (MC): This is a compulsory course but audit that does not have any choice and will be of 3 credits. Each student of B. Tech. Program has to compulsorily pass the Environmental Studies and Human values.

C. Program Outcomes of Bachelor of Technology in Computer Science & Engineering

PO-01	Engineering knowledge	Apply the knowledge of mathematical, scientific and engineering fundamentals in formulating and solving engineering problems.
PO-02	Problem analysis	Identify, analyze and provide substantial conclusions for complex engineering problems using mathematics, natural sciences, and engineering sciences
PO-03	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
PO-04	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO-05	Modern tool usage	Apply modern tools and techniques for prediction and modelling of complex engineering activities with an understanding of the limitations.
PO-06	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
PO-07	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
PO-08	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO-09	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	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.
PO-11	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.
PO-12	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

D. Program Specific Outcomes :

PSO1: Foundation of Computer System: Ability to understand the principles and working of computer systems. Students can assess the hardware and software aspects of computer systems.

PSO2: - Foundations of Software development: Ability to understand the structure and development methodologies of software systems. Possess professional skills and knowledge of software design process. Familiarity and practical competence with a broad range of programming language and open source platforms.

PSO3: Foundation of mathematical concepts: Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable diagram.

PSO4: Applications of Computing and Research Ability: Ability to use knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.

E. Program Educational Objectives (PEO's)

PEO1. To be well familiar with the concepts of Computer Engineering for leading a successful career in industry or as entrepreneur or to pursue higher education.

PEO2. To develop techno-commercial skills for providing effective solutions to complex problems using domain knowledge of Computer Engineering.

PEO3. To instill lifelong learning approach towards constantly evolving technologies with innovative and ethical mindset.

F. Pedagogy & Unique practices adopted:

"Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on experiential learning:

Role Play & Simulation: Role- play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share trading, marketing simulation etc. are being promoted for the practical-based experiential learning of our students.

Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our institute is promoting VBL & LTM, wherever possible.

Field/Live Projects: The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.

Industrial Visits: Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

MOOCs: Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval. Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.

For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

a) It will necessary for every student to take at least one MOOC Course throughout the programme.

b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.

c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.

d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the semester by the Coordinator MOOC through the Principal of the College.

e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.

f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.

g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

Special Guest Lectures (SGL) & Extra Mural Lectures (EML): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

Student Development Programs (SDP): Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

Industry Focused programmes: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice-based insight to the students.

Special assistance program for slow learners & fast learners: write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

Induction program: Every year 3 weeks induction program is organized for 1st year students and senior students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

Mentoring scheme: There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

Competitive exam preparation: Students are provided with one class in every week for GATE/ Competitive exams preparation.

Extra-curricular Activities: organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

Career & Personal Counseling: - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change. Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.

Participation in Flip Classes, Project based Learning(A2 Assignment), Workshops, Seminars & writing & Presenting Papers: Departments plan to organize the Flip Classes, Project based Learning(A2 Assignment), workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. This participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non-credit course.

Formation of Student Clubs, Membership & Organizing & Participating events: Every department has the departmental clubs with the specific club's name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

Capability Enhancement & Development Schemes: The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

Library Visit & Utilization of QLRC: Students may visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.

Detailed Syllabus (Semester wise /course wise)

Semester-1

MA3102	**Title: Mathematics I**	**L T P C** **3 2 0 4**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To provide essential knowledge of basic tools of Differential Calculus, Integral Calculus, Vector Calculus and Matrix Algebra.	
Expected Outcome	Students will be able to solve applied problems using differentiation and integration and will be able to demonstrate Matrix facility.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Matrix Algebra**	8
Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linear simultaneous equations. Eigen-values and Eigenvectors of a matrix, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Orthogonal and Unitary matrices and their properties, Cayley- Hamilton theorem, Diagonalization of a matrix.		
Unit II	**Differential Calculus**	8
Limit, Continuity and differentiability of functions of two variables, Euler's theorem for homogeneous equations,. Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Error approximations. Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers		
Unit III	**Integral Calculus**	6
Review of curve tracing and quadric surfaces, Double and Triple integrals, Change of order of integration. Change of variables.		
Unit IV	**Application of Multiple Integration**	6
Gamma and Beta functions. Dirichlet's integral. Applications of Multiple integrals such as surface area, volumes, centre of gravity and moment of inertia.		
Unit V	**Vector Calculus**	8
Differentiation of vectors, gradient, divergence, curl and their physical meaning. Identities involving gradient, divergence and curl. Line and surface integrals. Green's, Gauss and Stroke's theorem and their applications.		
Text Books	1. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, Narosa Publishing House	
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons 2. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for MA3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Emt)/ None (*Use , for more than One*)
CO1	Students should be able to Learn the basic principles of multi-variable calculus with their proofs. They should be able to classify partial differential equations and transform them into canonical form. They will also understand how to extract information from partial derivative models in order to interpret reality.	2	Emp
CO2	Students should be able to Understand and learn how to find the area and volume of any region and solid body respectively by integral and also find the moments of inertia for a thin plate in plane.	2	Emp
CO3	Students should be able to Understand theorems related to directional derivative of gradient and reproduce its proof. They should be able to Explain the concept of a vector integration in a plane and in space.	2	S
CO4	Know basic application problems described by second order linear differential equations with constant coefficients. They should be also able to understand and solve the applications associated with Laplace Transform.	2	S
CO5	Students should be able to Solve the linear equations using matrix properties and Determine characteristic equation, eigen values, eigenvectors and diagonalizable of a matrix.	1	Emp

CO-PO Mapping for MA3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	3	1	2	3	1	3	1	2	1	3	3	2	3
CO 2	3	2	3	1	2	3	1	2	1	2	3	1	1	2	3	1
CO 3	2	2	2	3	2	1	1	1	2	3	2	3	2	2	1	3
CO 4	3	2	1	3	2	1	2	1	3	2	1	3	2	1	3	2
CO 5	3	2	2	3	1	3	3	2	1	3	2	1	3	2	1	3
Avg	2.5	1.75	2	2.5	1.75	1.75	1.75	1.25	2.25	2	2	2	2	2	2.25	2.25

PH3101	Title: Engineering Physics	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Students will be able to understand the basic of classical and modern physics and quantum mechanics and electromagnetic concepts with basic knowledge of optics.	
Expected Outcome	Will have the ability to Analyze the intensity variation of light due to Polarization, interference and diffraction. Will also be able to explain working principle of lasers and Explain fundamentals of quantum mechanics.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Relativistic Mechanics	5
Inertial and Non-inertial Frames, Postulates of Special Theory of Relativity, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity. Radiation: Kirchhoff's Law, Stefan's law (only statement), Energy spectrum of Blackbody Radiation, Compton Effect.		
Unit II	Interference and Diffraction	5
Coherent Sources, Conditions of Interference, Fresnel's Bi-prism Experiment, Displacement of Fringes, Interference in Thin Films – Wedge Shaped Film, Newton's Rings. Diffraction: Single Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Grating.		
Unit III	Polarization and Laser	5
Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Production and Analysis of Plane, Circularly and Elliptically Polarized Light. Laser: Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.		
Unit IV	Electromagnetic and Magnetic Properties of Materials	5
Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Poynting Theorem. Basic Concept of Para, Dia and Ferro-Magnetism.		
Unit V	Wave Mechanics	4
Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle and its applications, Schrödinger Wave Equation and Its Applications: Particle in a Box (one dimensional only).		
Text Books	1. Beiser, Concepts of Modern Physics, Mc-Graw Hill 2. Dr Amit Dixit, Engineering Physics, Nano Edge Publicatons	
Reference Books	1. Robert Resnick, Introduction to Special theory of Relativity, Wiley 2. Ajoy Ghatak, Optics, TMH 3. David J. Griffith, Introduction to Electrodynamics, PHI 4. William Hayt, Engineering Electromagnetics, TMH	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome For PH3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Emt)/ None (*Use , for more than One*)
CO1	Students should be able to Understand special theory of realtivity (STR), concepts linked with STR and radiation laws.	2	Emp
CO2	Students should be able to Understand interference, diffraction and able to connect it to a few engineering applications.	2	S
CO3	Students should be able to Explain the phenomena of polarization in electromagnetic waves and their production, Detection and analysis. They will also understand the operation and working principle of laser.	2	S
CO4	Students should be able to Understand electromagnetic theory using maxwells equations, and its uses in various engineering application. They will also understand the difference between dia, para and ferromagnetic materials.	2	Emp
CO5	Students should be able to Explain fundamentals of quantum mechanics and apply it to problems on bound states.	1	Emp

CO-PO Mapping for PH3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CO 2	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CO 3	3	3	2	2	2	3	2	3	2	2	2	2	3	2	2	3
CO 4	3	2	1	1	1	2	1	2	1	1	1	1	3	1	1	3
CO 5	3	2	1	1	1	2	1	2	1	1	1	1	3	1	1	3
Avg	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3

EG3102	**Title: Professional Communication**	**L T P C** **2 0 0 2**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills	
Expected Outcome	The student will develop a sound knowledge of English which will be integral to personal, social and professional interactions.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Fundamentals of Communication**	5
Introduction–Communication Process, Distinction between General and Technical Communication. Language as a Tool of Communication; Interpersonal, Organizational, Mass Communication. Formal Communication: Downward, Upward, Lateral/ Horizontal, Diagonal; Informal Communication (Grapevine). Barriers to Communication		
Unit II	**Components of Technical Written Communication**	5
Vocabulary building: Synonyms and Antonyms, Homophones, Conversions. Common Grammatical Errors, Paragraph Development, Précis writing.Technical Papers: Project, Dissertation and Thesis.		
Unit III	**Forms of Business Communication**	5
Business Correspondence- Types:, Memorandum; Official letters.Job Application, Resume/CV/Bio-data; Notice, Agenda, Minutes of Meetings.Technical Proposal: Types, Significance, Format and Style of Writing Proposals. Technical Report: Types, Significance, Format and Style of Writing Reports.		
Unit IV	**Presentation Techniques and Soft Skills**	5
Presentation: Defining Purpose, Audience and Location; Organizing Contents; Preparing Outline; Audio-Visual Aids in Presentations.Non-Verbal Aspects of Presentation: Kinesics, Proxemics, Chronemics, Paralanguage. Listening Skills: Importance, Active and Passive listening. Speaking Skills: Common Errors in Pronunciation; Vowels, Consonants and Syllables; Accent, Rhythm and Intonation.		
Unit V	**Value-based Text Readings**	4
Thematic and value-based critical reading of the following essays with emphasis on the mechanics of writing and speaking:1.The Language Of Literature And Science by Aldous Huxley 2.Of Discourse by Francis Bacon		
Suggested Reference Books	1. Barun K. Mitra, Effective Technical Communication, Oxford Univ. Press 2. Meenakshi Raman and Sangeeta Sharma, Technical Communication-Principles and Practices, Oxford Univ.Press 3. Prof.R.C.Sharma and Krishna Mohan, Business Correspondence and Report Writing,Tata McGraw Hill and Co.Ltd. New Delhi 4. V.N.Arora and Laxmi Chandra, Improve Your Writing, Oxford Univ. Press, New Delhi 5. Ruby Gupta, Basic Technical Communication	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for EG3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Learn the fundamentals of communication process used within the organization.	2	Emp
CO2	Students should be able to Learn about the different forms of Business Communication.	2	Emp
CO3	Students should be able to Learn about the different forms of Business Communication.	2	S
CO4	Students should be able to Learn presentation techniques and soft skills.	2	Ent
CO5	Students should be able to Understand Value-based Text Readings.	1	Emp

CO-PO Mapping for EG3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	1	1	2	3	1	1	1	2	1	2	1	1	2
CO 2	3	2	3	1	2	3	1	1	1	2	3	1	2	1	1	3
CO 3	2	2	2	3	2	1	1	1	2	2	2	3	2	3	3	1
CO 4	2	2	1	3	2	1	2	1	3	2	1	3	2	3	3	1
CO 5	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1
Avg	2.25	1.75	2	2	1.75	1.75	1.75	1	1.75	1.75	2	2	2	2	2	1.75

CS3101	Title: Basics of Computer and C Programming	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This subjects aims to make student handy with the computers basics and programming.	
Expected Outcome	On completion of subject the students will be able to apply, Fundamental of Computers ,Architecture of Computer Arithmetic of Computer, Basics of Computer Programming	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Architecture of Computer	5
What is Computer: Brief History and Evolution Chain, Concept of Hardware, The Inside Computer [Hard Drives (HD), Solid State Drives (SSD), Concept of CPU, Concept Of RAM], The Peripherals [Input Devices: Keyboard, Mouse, Media Devices [Floppy, DVD ROM, CD ROM, USB Storage Drive], Scanner], Output Devices [Monitor, Printer, Speaker.		
Unit II	Arithmetic of Computer	4
Number System [Decimal, Binary, Octal, Hexadecimal], Conversions, Binary Arithmetic [Addition, Subtraction, Multiplication, Division, 1s Compliment, 2s Compliment], Floating Point Arithmetic [IEEE 754 Concept, Storage of Floating Point Numbers]		
Unit III	Algorithms and Flow Chart	4
Algorithm [What is Algorithm? Algorithm Writing Examples] Flow Chart [What is Flow Chart? Flow Chart Symbols, How to make Flow Chart? Types of Flow Chart, Flow Chart Examples]		
Unit IV	Basics of C Programming –Part 1	6
Types of Computer Languages:-Machine Language, Assembly Language and High Level Language, Concept of Compiler, Assembler, Linker and Loader. Fundamental Data Type: int, float, char and void. Qualifier for int (long and short), singed and unsigned numbers. Program vs. Process, Storage Classes: auto, static, extern and register. Operator vs. Operand. Operators: Arithmetic, Relational, Conditional and Logical.		
Unit V	Basics of C Programming – Part 2	5
Functions: Introduction [Function Definition, Declaration and Call], Types of Functions, Basic Programs, Recursive Function. Arrays: Introduction, Array Notation and Representation, Basic Programs, Types of Arrays [1-D, 2-D and n-D Array]. Pointer: Introduction, Declaration, Initialization and Access of data using pointer		
Text Books	1. KR Venugopal, Mastering C 2. Y. Kanetkar, Let us C	
Reference Books	1. Kernighan, B.W and Ritchie,D.M, The C Programming language, Pearson Education 2. Byron S Gottfried, Programming with C, Schaum's Outlines, Tata McGraw-Hill 3. R.G. Dromey, How to Solve it by Computer, Pearson Education 4. E. Balagurusamy, Programming in ANSI C	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Approach the programming tasks using techniques learned in Theory and write pseudo-codes based on the requirements of the problem.	2	None
CO2	Students should be able to Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.	2	S
CO3	Students should be able to Write the program based on numerical techniques learned and able to edit, compile, debug, correct, recompile and run it.	2	S
CO4	Students should be able to Develops the knowledge of different software on different Operating System Platform such as Linux/Windows (Open Source and Licensed) with understanding of different IDE	2	Emp
CO5	Students should be able to Makes students gain a broad perspective about the uses of computers in engineering industry	1	Emp

CO-PO Mapping for CS3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	3	2	2	2	2	1	3	3	3	3	3	2	3	2
CO 2	3	3	3	3	2	2	2	2	3	3	3	3	2	3	2	2
CO 3	3	3	3	2	2	2	2	1	3	3	3	3	3	2	2	2
CO 4	3	3	3	3	2	2	2	2	3	3	3	3	2	3	2	2
CO 5	3	3	3	2	2	2	2	1	3	3	3	3	3	2	2	2
Avg	3	3	3	2.5	2	2	2	1.5	3	3	3	3	2.5	2.5	2.25	2

ME3102	Title: Basic Mechanical Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge about various fields of Mechanical Engineering like Thermal Engineering, manufacturing, Mechanics and Materials.	
Expected Outcome	After learning the course the students will be able to understand basic laws of thermodynamics, basic manufacturing processes , working of IC engines and types of engineering materials available.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Thermodynamics and IC engines	8
Definition of thermodynamics, Energy and its forms, Enthalpy. Laws of thermodynamics, Processes - flow and non-flow, Steady flow energy equation, Heat engines, Efficiency; Heat pump, refrigerator, Coefficient of Performance. Internal Combustion Engines: Classification of I.C. Engines and their parts, working principle and comparison between 2 Stroke and 4 stroke engine, difference between SI and CI engines.		
Unit II	Mechanics	8
Basic concept: Review of laws of motion, transfer of force to parallel position, resultant of planer force system, Free Body Diagrams, Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions, Friction and Trusses.		
Unit III	Stress and Strain	8
Introduction, Normal shear stresses, Stress-strain diagrams for ductile and brittle materials, Elastic constants, One dimensional loading of members of varying cross-section, Strain energy.		
Unit IV	Introduction to Manufacturing	7
Introduction to manufacturing processes, Classification of the manufacturing processes, Cutting tools, Cutting tool materials, tool signature, Lathe and basic machining operations in lathe, Introduction to multi-point machining processes, Introduction to computerized numerical control (CNC) machines. Metal Forming: Forging and Sheet Metal operations. Joining Processes**:** Electric arc welding, Gas welding, Soldering and Brazing.		
Unit V	Engineering Materials	5
Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials. Introduction to Smart materials.		
Text Books	1. Hajra, Bose, Roy, Workshop Technology, Media Promotors 2. D.S. Kumar, Mechanical Engineering, S.K. Kataria and Sons	
Reference Books	1. Irving H. Shames I.H, Engineering Mechanics, P.H.I 2. Holman, J.P, Thermodynamics, Mc Graw Hill book Co. NY 3. Chapman W.A.J, Workshop Technology Part 1, Elsevier Science 4. Basant Agarwal, Basic Mechanical Engineering, Wiley India 5. Onkar Singh, Introduction to Mechanical Engineering, S.S. Bhavikatti	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for ME3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand application of the laws of thermodynamics to wide range of systems and aware about the basics of thermal engineering applications in IC engines and its working.	2	S
CO2	Students should be able toKnow and apply the types of forces and concepts used to analyze force mechanisms	2	Emp
CO3	Students should be able to Analyze and understand the Stress-strain diagrams and use of material.	2	S
CO4	Students should be able toUnderstand the various machining processes	2	Emp
CO5	Students should be able to Gain knowledge on the various engineering materials and their properties.	1	Emp

CO-PO Mapping for ME3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	2	2	2	2	2	2	2	2	2	3	1	2	3
CO 2	3	2	2	2	2	2	2	2	2	2	2	2	3	1	2	3
CO 3	3	3	2	3	3	3	2	3	2	2	2	2	3	2	2	3
CO 4	3	2	1	2	2	2	1	2	1	1	1	1	3	1	1	3
CO 5	3	2	1	2	2	2	1	2	1	1	1	1	3	1	1	3
Avg	3	2.25	1.75	2.25	2.25	2.25	1.75	2.25	1.75	1.75	1.75	1.75	3	1.25	1.75	3

PH3140	Title: Engineering Physics Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipments.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.	

List of Experiments

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall effects and determine Hall coefficient, carnier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy bank gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the balistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for PH3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the process of performing the experiments on wavelength and focal length practically.	2	Emp
CO2	Students should be able to Verify the theoretical calculations with observed results in practical experiments.	2	Emp
CO3	Students should be able to Enhance the skills of using apparatus for verification of different laws.	2	S

CO-PO Mapping for PH3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	3	1	2	3	3	3	1	2	1	3	3	2	3
CO 2	3	2	3	1	2	3	1	1	1	2	3	1	1	2	3	1
CO 3	2	2	2	3	2	1	1	2	2	3	2	3	2	2	1	3
Avg	1.75	1.25	1.75	1.75	1.25	1.5	1.25	1.5	1.5	1.5	1.75	1.25	1.5	1.75	1.5	1.75

EG3140	Title: Professional Communication Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide practice to students in an interactive manner to apply the fundamentals and tools of English communication to life situations	
Expected Outcome	The student will be able to retain and apply his skills of English communication effectively in personal, social and professional interactions.	

List of Experiments

1. Common conversation skills
2. Introductions
3. Making requests
4. Asking for permission
5. Asking questions
6. Describing events, people, places
7. Learning correct pronunciation, syllable, stress, intonation
8. Extempore speaking
9. Role play
10. Presentation skills
11. Grammar-tense practice
12. Mother tongue influence- correction
13. Speech making / public speaking
14. Listening effectively
15. E-mail Etiquettes

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for EG3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Improve communication skills (Reading, Writing, Speaking & Listening).	2	Emp
CO2	Students should be able to Achieve grammatical competency in drafting documents.	2	S
CO3	Students should be able to Identify different situations & react accordingly using appropriate communication skills.	2	Emp

CO-PO Mapping for EG3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	1	2	2	3	1	2	1	1	2	3	2	2	2	1	2	2
CO 2	1	2	2	3	1	2	1	1	2	3	2	2	1	1	2	2
CO 3	1	2	2	3	1	2	1	1	2	3	2	2	2	1	2	2
Avg	0.75	1.5	1.5	2.25	0.75	1.5	0.75	0.75	1.5	2.25	1.5	1.5	1.25	0.75	1.5	1.5

CS3140	Title: Basics of Computer and C Programming Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Learning objectives is to improve confidence in technology use and increased awareness of opportunities afforded to individuals with computer application skills.	
Expected Outcome	Recognize basic computer hardware architecture constructs such as instructions sets, memory, CPU, external devices, and data Representation	

List of Experiments

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Populate an array with height of persons and find how many persons are above the average height.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8. Given a string — a$bcd./fg‖ find its reverse without changing the position of special characters. (Example input: a@gh%;j and output: j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
10. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.
11. Solve towers of Hanoi using recursion.
12. Sort the list of numbers using pass by reference.
13. Generate salary slip of employees using structures and pointers.
14. Compute internal marks of students for five different subjects using structures and functions.
15. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Approach the programming tasks using techniques learned in Theory and write pseudo-codes based on the requirements of the problem.	2	Emp
CO2	Students should be able to Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.	2	S
CO3	Students should be able to Write the program based on numerical techniques learned and able to edit, compile, debug, correct, recompile and run it.	2	Emp

CO-PO Mapping for CS3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	3	2	2	3	2	3	3	3	3	3	3	2	3	3
CO 2	3	3	3	3	2	3	2	3	3	3	3	3	2	3	2	2
CO 3	3	3	3	2	2	3	2	3	3	3	3	3	3	2	2	2
Avg	2.25	2.25	2.25	1.75	1.5	2.25	1.5	2.25	2.25	2.25	2.25	2.25	2	1.75	1.75	1.75

CE3101	Title: Disaster Management	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.	
Expected Outcome	Enhance the knowledge by providing existing models in risk reduction strategies to prevent major causalities during disaster.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction on Disaster	5
Different Types of Disaster : A) Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc B) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail and Road), Structural failures(Building and Bridge), War and Terrorism etc. Causes, effects and practical examples for all disasters.		
Unit II	Risk and Vulnerability Analysis	4
Risk: Its concept and analysis 2. Risk Reduction 3. Vulnerability: Its concept and analysis 4. Strategic Development for Vulnerability Reduction		
Unit III	Disaster Preparedness	5
Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan Prediction, Early Warnings and Safety Measures of Disaster. Role of Information, Education, Communication, and Training, . Role of Government, International and NGO Bodies. . Role of IT in Disaster Preparedness. Role of Engineers on Disaster Management.		
Unit IV	Disaster Response	5
Introduction Disaster Response Plan Communication, Participation, and Activation of Emergency Preparedness Plan Search, Rescue, Evacuation and Logistic Management Role of Government, International and NGO Bodies Psychological Response and Management (Trauma, Stress, Rumor and Panic). Relief and Recovery Medical Health Response to Different Disasters		
Unit V	Rehabilitation, Reconstruction and Recovery	5
Reconstruction and Rehabilitation as a Means of Development. Damage Assessment Post Disaster effects and Remedial Measures. Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction Sanitation and Hygiene Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning Role of Educational Institute.		
Text Books	1. Bhattacharya, Disaster Science and Management, McGraw Hill Education Pvt. Ltd.	
Reference Books	1. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd. 2. Jagbir Singh, Disaster Management: Future Challenges and Opportunities, K W Publishers Pvt. Ltd.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for CE3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Understand the basic concepts of disasters and its relationships with development.	2	Em
CO2	Understand the approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.	2	S
CO3	Understand the Medical and Psycho-Social Response to Disasters.	2	Em
CO4	Prevent and control Public Health consequences of Disasters.	2	Em
CO5	Awareness of Disaster Risk Management institutional processes in India.	2	Em

CO-PO Mapping for CE3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	2	2	2	3	2	2	2	3	2	3	2	2	2
CO 2	2	2	2	2	2	2	3	2	2	2	3	2	3	2	2	2
CO 3	2	2	2	2	2	2	3	2	2	2	3	2	3	2	2	2
CO 4	2	2	2	2	3	2	3	2	2	3	3	2	3	3	2	2
CO 5	2	2	2	2	3	2	3	2	2	3	3	2	3	3	2	2
Avg	2	2	2	2	2.25	2	3	2	2	2.25	3	2	3	2.25	2	2

Semester-2

CS3203	Title: Graph Theory & Probability	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	In mathematics, graphs are a way to formally represent a network, which is basically just a collection of objects that are all interconnected. This subjects aims to make student aware of using different statistics and comparison with the help of Graphs.				
Expected Outcome	On completion of subject the students will be able to apply rules of graphs on different statistics and accomplish with best results.				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	Graphs & its basic property	7			
Graphs, Sub graphs, some basic properties, various example of graphs & their sub graphs, walks, trails, path & circuits, connected graphs, disconnected graphs and component, various operation on graphs, Euler graphs, Hamiltonian paths and circuits, the traveling salesman problem, directed graphs, some types of directed graphs, directed paths and connectedness, Hamiltonian and Euler digraphs.					
Unit II	Trees & Fundamental Circuits	7			
Trees and fundamental circuits, distance diameters, radius and pendent vertices, rooted and binary trees, on counting trees, spanning trees, fundamental circuits, finding all spanning trees of a graph and a weighted graph, trees with directed edges, fundamental circuits in digraph, algorithms of Prim, Kruskal and Dijkstra.					
Unit III	Cuts sets and cut vertices	6			
Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity and separability, network flows, planer graphs, Euler's formula and its corollaries, Kuratowski's theorem and its application to planarity detection of graphs, combinatorial and geometric dual, some more criterion of planarity, thickness and crossings.					
Unit IV	Matrix	9			
Incidence matrix of graph, sub matrices of A(G), circuit matrix, cut set matrix, fundamental circuit matrix and rank of B, path matrix and relationships among , ,& , adjacency matrices, adjacency matrix of a digraph, matrices A, B and C of digraphs, rank- nullity theorem, coloring and covering and partitioning of a graph, covering, enumeration, types of enumeration, counting of labeled and unlabeled trees.					
Unit V	Probability	7			
Recurrence Relation, Generating function., Permutation & Combination, Probabilistic Permutation & Combination					
Text Books	1. Deo, N: Graph theory, PHI 2. Bondy and Murthy: Graph theory and application. Addison Wesley. 3. Liptschutz, Seymour, " Discrete Mathematics", McGraw Hill.				
Reference Books	1. John M. Aldous and Robin J. Wilson: Graphs and Applications-An Introductory Approach, Springer 2. Robin J, Wilson: Introduction to Graph Theory, Addison Wesley. 3. Discrete Mathematics & its application with combinatory and graph theory, K. H. Rosen, TMH				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studied on	09-08-2021				
Date of Approval by the Academic Council on	14-11-2021				

Course Outcome for CS3203

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	knowthe basics of graph along with the definitions of related terminologies.	2	S
CO2	knowthe concepts of trees along with various theorems and related algorithms.	2	Em
CO3	Know the concepts of planarity in graphs along with related algorithms.	2	S
CO4	know the various graph matrices and ways to find out the rank of the matrices.	2	En
CO5	know the concepts of combinatorics like the counting theory related to permutation and combination	1	Em

CO-PO Mapping for CS3203

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	2	2	2	2	2	2	2	2	2	3	2	2	3
CO 2	3	2	3	2	3	2	2	2	2	2	2	2	3	1	2	3
CO 3	3	3	2	3	3	3	3	3	2	2	2	2	2	2	2	2
CO 4	3	2	2	2	2	2	1	2	3	3	3	2	3	3	3	3
CO 5	3	2	1	2	2	2	2	2	2	1	1	2	3	2	1	3
Avg	3	2.2	2	2.2	2.4	2.2	2	2.2	2.2	2	2	2	2.8	2	2	2.8

CS3206	Title: Advance C Programming	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This subject introduces the students with a deeper era of programming in C like Functions, Arrays, Pointer, Structure and Preprocessor Directive etc.	
Expected Outcome	On completion of subject the students will be able to apply Learning Advance C, Device Driver Programming, Embedded C, Robotics Programming	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Pointers & Beyond Pointers	9
About Pointer [Declaration, Initialization and Access], Concept of memory maps, Concept of Process Control Block, Dangling Pointer, Orphan Objects, Dynamic Memory Allocation [malloc; calloc, realloc, free], Segmentation Fault, Core Dump and Illegal Memory Access, Pointer Arithmetics, Multiple Indirections.		
Unit II	Pointers & Arrays	9
Arrays, Understanding in depth 1-D, 2-D and 3-D array, Converting an array [1-D, 2-D, 3-D, n-D] to its pointer notation, Accessing array[1-D, 2-D, 3-D, n-D]with pointer, Creating Variable length array [1-D, 2-D], Limitation with array, Array of Pointers		
Unit III	Pointers & Functions, Arrays & Function	10
Understanding of function, Pointer pointing to function with different declarations, Accessing function with its pointer, Concept of Function returning function. Variable length arguments, Implementation of myPrintf and myScanf.Mixed Concepts: Array containing function(s), Array Containing array(s) [1-D, 2-D], Function returning array [1-D, 2-D].		
Unit IV	Making Header File and C Library	10
Understanding Preprocessor Directives and Compilation Process, Concept of Multiple Inclusion, Guard Macros, Role of Guard macros, Making Sample Header file, Understanding Concept of Linker, Creating Object code of function definition, Storing Object code in library, Setting path for Linker, Running code with user defined Header file and Library.		
Unit V	System APIs and Programming Environment	10
Understanding UNIX architecture, Understanding File System Layout, CLI Terminal and Text Editors, Commands for programming [gcc, gcc –save-temps, ls, chmod, locate], Hardlinks vs Softlinks, System APIs [open, creat, read, write, lseek,mclose, dup, dup2, fcntl, link, unlink, fstat, stst, lstat, utime, fork, zombies, wait, orphan, kill, sleep, deamons], Concept of Process identification, Killing process and locating process. Concept of Command line arguments.		
Text Books	1. "Mastering C" by KR Venugopal 2. "Let us C" by Y. Kanetkar 3. "Programming in ANSI C" by E. Balagurusamy.	
Reference Books	1. Kernighan, B.W and Ritchie, D.M, "The C Programming language", , Pearson Education 2. 2. Byron S Gottfried, "Programming with C", Schaum's Outlines, Tata McGraw-Hill. 3. 3. R.G. Dromey, "How to Solve it by Computer", Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3206

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Have deep knowledge about pointers in a programming language.	2	None
CO2	Provide functionality of array and pointers in a programming language	2	Em
CO3	Implement pointers with arrays and functions.	2	S
CO4	Make header and C library file.	2	Em
CO5	System API in a programming language.	1	None

CO-PO Mapping for CS3206

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	2	3	1	3	2	2	2	2	3	3	3	2	3
CO 2	3	3	3	3	2	2	2	2	2	2	2	3	1	2	2	3
CO 3	2	2	3	3	3	3	2	2	2	3	2	3	2	3	2	2
CO 4	2	2	2	2	3	2	1	2	2	2	2	3	2	2	2	3
CO 5	3	2	2	2	3	2	2	2	3	2	2	3	2	1	3	1
Avg	2.4	2.2	2.4	2.4	2.8	2	2	2	2.2	2.2	2	3	2	2.2	2.2	2.4

CS3204	Title: HTML5 & CSS	L 4	T 0	P 0	C 4
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The HTML5 standard has a much broader goal to describe the content, styling and application interfaces behind a Web page when it's loaded in your browser. More specifically, HTML5 establishes a single syntax for interacting with all the elements that Web page has loaded into your computer's memory.				
Expected Outcome	This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.				

Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	HTML4 vs HTML5, Introduction of HTML5	10
History of www, Evolution of HTML, Different HTML versions, Why HTML5?, HTML4 vs HTML5, HTML5 New Features, Browser Supports, Backward Compatibility		
Unit II	HTML5 Document Structure and Syntax	10
Creating DOM, Doctype, Character Encoding, <Script> Tag, <Link> Tag, Deprecated Elements, HTML5 document (section, article, aside, header, footer, nav, dialog, figure) and Web Forms in detail		
Unit III	Introduction to CSS	9
What is CSS?, History of CSS, Versions of CSS, Browser support, What's new in CSS3, CSS vs CSS3, Types of CSS, How to use in HTML document?		
Unit IV	Selectors, Classes and Effects	10
Element selector, id selector, class selector, attribute selectors, anchor pseudo class, first child pseudo class, pseudo class and CSS classes, fonts and text effects, color, gradients, background images, masks, border, box effects, animations, transitions, transforms etc		
Unit V	Media tag in HTML5, Geo-location and Web Hosting	9
Embedding Audio & Video in Html file, Google map and web hosting		

Text Books	1. HTML5 Black Book by Dreamtech Press 2. Bootstrap: Responsive web development by Jake Spurlock, O'RELLY
Reference Books	1. HTML and CSS by Jon Duckett. 2. HTML5 for Masterminds by J.D.Gauchat
Mode of Evaluation	Internal and External Examination
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3204

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Know about the History of WWW, and evolution of HTML. They also get the knowledge about the different versions of HTML and why we use HTML5. Difference between the HTML4 and HTML5 and the new features of the HTML5. Able to understand about browser support and backward compatibility	2	S
CO2	Understand about creation of DOM, doctype, Character encoding. They will gain the knowledge of the tags like script tag, Link tag etc. and also about deprecated elements. Understand about HTML5 documents (section, article, aside, header, footer, nav, dialog, and figure) and also about Web forms in detail.	2	Em
CO3	the knowledge of the History of CSS, Versions of CSS. able to know the difference between CSS and CSS3. They will also know what's new in CSS3, types of CSS3, and how to use it in HTML document?	2	S
CO4	Gain the knowledge of Selectors, Classes and Effects. Also gain the knowledge of texteffects,color,gradients,backgroundimages,masks,border,boxeffects, animations ,transitions and transforms	2	Em
CO5	Introduction to MediataginHTML5,Geo-locationandWebHosting. able to understand about Embedding Audio &Video in Html file ,Google map and web hosting.	1	Em

CO-PO Mapping For CS3204

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PS O1	PS O2	PS O3	PS O4
CO 1	1	2	2	2	2	2	3	1	2	3	3	2	3	3	2	2
CO 2	3	2	1	2	1	2	2	2	2	1	3	3	2	2	2	2
CO 3	2	2	2	2	2	3	3	3	1	2	3	1	1	2	2	3
CO 4	2	3	2	2	2	3	3	2	2	2	2	1	2	1	3	2
CO 5	3	1	3	3	3	2	2	2	3	2	3	3	2	1	2	2
Avg	2.2	2	2	2.2	2	2.4	2.6	2	2	2	2.8	2	2	1.8	2.2	2.2

CS3205	Title: Web and Digital Analytics	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The Web Ide and Digital Analytics standard has a much broader goal to describe the power of digital Analytics and, styling and application interfaces behind a Web page when it's loaded in your browser. More specifically, HTML5 establishes a single syntax for interacting with all the elements that Web page has loaded into your computer's memory.				
Expected Outcome	This exposure will enable the students to enter their professions with confidence, liv in a harmonious way and contribute to the productivity.				

Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	HTML4 vs HTML5, Introduction of HTML5	7
History of www, Evolution of HTML, Different HTML versions, Why HTML5?, HTML4 vs HTML5, HTML5 New Features, Browser Supports, Backward Compatibility		
Unit II	HTML5 Document Structure and Syntax	8
Creating DOM, Doctype, Character Encoding, <Script> Tag, <Link> Tag, Deprecated Elements, HTML5 document (section, article, aside, header, footer, nav, dialog, figure) and Web Forms in detail		
Unit III	Introduction to CSS & Selectors	7
What is CSS?, History of CSS, Versions of CSS, Browser support, What's new in CSS3, CSS vs CSS3, Types of CSS, How to use in HTML document? CSS Selectors and Their Types.		
Unit IV	Introduction to Blogging and Webmaster	7
Introduction to Blog, Blog creation ,Post Management ,Page creation ,introduction to google webmaster, integration of google webmaster with blog .		
Unit V	Digital Analytics	7
Introduction to Google Analytics and digital Marketing. Google Analytics Integration with blogger. Google analytics certification .		

Text Books	1. HTML5 Black Book by Dreamtech Press 2. Bootstrap: Responsive web development by Jake Spurlock, O'RELLY
Reference Books	1. Digital Marketing For Dummies by By Ryan Deiss and Russ Hennesberry, 2. HTML5 for Masterminds by J.D. Gauchat
Mode of Evaluation	Internal and External Examination
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome For CS3205

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Understand the basic concepts of HTML	2	None
CO2	Understand about HTML 5 and the new tags introduced inHTML5	2	Em
CO3	Understand and apply the CSS in HTML document	2	S
CO4	Understand the concept of Blog and Google web master tool.	2	Em
CO5	Understand about Google analytics and certification available on google analytics.	1	None

CO-PO Mapping for CS3205

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	2	3	1	1	2	1	1	1	3	3	3	2	3
CO 2	3	3	3	3	2	2	2	2	2	2	2	3	2	2	2	3
CO 3	3	3	3	3	3	3	3	2	2	3	3	3	2	3	2	1
CO 4	2	2	2	2	3	2	2	2	2	2	2	3	1	2	2	3
CO 5	3	2	2	2	3	3	3	2	3	3	3	3	2	1	3	1
Avg	2.6	2.4	2.4	2.4	2.8	2.2	2.2	2	2	2.2	2.2	3	2	2.2	2.2	2.2

CY3205	Title: Environmental Studies	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Creating awareness among engineering students about the importance of environment, the effect of technology on the environment and ecological balance is the prime aim of the course.	
Expected Outcome	Students will understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Environmental studies and Ecosystems	5
Multidisciplinary nature of environmental studies, Scope and importance, Need for public awareness. Concept, Structure and function of an ecosystem, Energy flow in an ecosystem: food chains, food webs and ecological pyramids. Examples of various ecosystems such as: Forest, Grassland, Desert, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)		
Unit II	Natural Resources: Renewable and Non- renewable resources	5
Land as a resource, land degradation, landslides (natural and man-induced), soil erosion and desertification. Forests and forest resources: Use and over-exploitation, deforestation. Impacts of deforestation, mining, dam building on environment and forests. Resettlement and rehabilitation of project affected persons; problems and concerns with examples. Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international and inter-state). Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems with examples. Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs.		
Unit III	Biodiversity and Conservation	5
Levels of biological diversity: genetic, species and ecosystem diversity. Biogeographic zones of India. Ecosystem and biodiversity services. Biodiversity patterns and global biodiversity hot spots, India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		
Unit IV	Environmental Pollution	4
Environmental pollution and its types. Causes, effects and control measures of :a) Air pollution b) Water pollution – freshwater and marine c) Soil pollution d) Noise pollution e) Thermal pollution Nuclear hazards and human health risks, Solid waste management: Control measures of urban and industrial waste.		
Unit V	Environmental Policies and Practices	5
Concept of sustainability and sustainable development. Water conservation and watershed management. Climate change, global warming, acid rain, ozone layer depletion. Disaster management: floods, earthquake, cyclones and landslides. Wasteland reclamation. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation. Environment: rights and duties. Population growth. Field work Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of simple ecosystems-pond, river, hill slopes, etc.		
Text Books	1. Bharucha. E, Textbook of Environmental Studies for Undergraduate Courses	
Reference Books	1. Kaushik Anubha, Kaushik C P, Perspectives in Environmental Studies, New Age Publication 2. Rajagopalan , Environmental Studies from Crisis to Cure, Oxford University Press	
Mode of Evaluation	Internal and External Examinations	

Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome For CY3205

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to Correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and preventions.	2	Em
CO2	Students should be able to Understand the solutions related to environmental problems related with the renewable & non-renewable resources.	2	S
CO3	Students should be able to Understand the importance of ecosystem and biodiversity and the method of conservation of biological diversity.	2	S
CO4	Students should be able to Understand different components of the environment and their function and the effects pollution on environment and should be able to understand the concept of sustainable development.	2	En
CO5	Students should be able to Correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and preventions.	1	None

CO-PO Mapping for CY3205

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	2	3	1	1	2	1	2	1	3	3	3	2	3
CO 2	3	3	2	3	2	2	2	2	2	3	2	3	2	2	2	3
CO 3	2	3	3	2	3	3	3	2	2	3	2	3	2	3	3	3
CO 4	2	2	2	2	3	2	2	2	2	2	2	3	1	2	2	2
CO 5	3	2	2	2	3	3	3	2	3	2	3	3	2	2	3	2
Avg	2.6	2.4	2.2	2.2	2.8	2.2	2.2	2	2	2.4	2	3	2	2.4	2.4	2.6

PS3101	Title: Human Values and Ethics	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence	
Expected Outcome	This course will make the students aware and sensitive to value systems in real life situations. It will help them to discriminate between ephemeral and eternal value and to discriminate between essence and Form	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction of Value Education	5
1. Understanding the need, basic guidelines, content and process of Value Education 2. A look at basic Human Aspirations: Self Exploration–its content and process		
Unit II	Understanding Harmony - Harmony in Myself!	5
1. Thoughtful human being in harmony; as a co-existence of the sentient, attitude and its importance in relationship. 2. Understanding the needs, characteristics and activities of Self ('I')		
Unit III	Understanding Harmony in the Family and Society	5
1. Harmony in the family; values in human relationships; meaning of Nyaya , Trust (Vishwas) and Respect (Samman) as the foundation values of relationships. 2. Harmony in society:Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals.		
Unit IV	Understanding Harmony in the Nature and Existence	4
1. Understanding the harmony in Nature: Interconnectedness among the four orders of nature- recyclability and self-regulation in nature 2. Natural perception of harmony at all levels of existence		
Unit V	Understanding Professional Ethics	5
1. Competencies in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems.		
Text Books	1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and Professional Ethics, Excel books, New Delhi	
Reference Books	1. A.N. Tripathy, Human Values, New Age International Publishers 2. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow 2. B P Banerjee, Foundations of Ethics and Management, Excel Books	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for PS3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	2	S
CO2	Students should be able to Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.	2	Em
CO3	Students should be able to Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.	2	S
CO4	Students should be able to Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.	2	Em
CO5	Students should be able to Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	1	Em

CO-PO Mapping for PS3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	2	3	3	1	2	1	2	3	3	3	3	2	2
CO 2	3	3	2	3	2	2	2	2	2	3	2	3	2	2	2	3
CO 3	2	3	3	3	2	2	3	3	2	3	2	2	2	3	3	2
CO 4	2	2	2	2	3	3	2	2	2	2	3	3	1	2	2	3
CO 5	3	2	2	2	3	3	2	2	3	2	3	2	2	2	3	2
Avg	2.4	2.4	2.2	2.4	2.6	2.6	2	2.2	2	2.4	2.6	2.6	2	2.4	2.4	2.4

CS3242	Title: Advance C Programming Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Study of basic programming principles introduced in Programming Fundamentals. Advanced concepts of program design, implementation and testing.	
Expected Outcome	Know concepts in problem solving, to do programming in C language. To write diversified solutions using C language	

List of Experiments

1. WAP accessing function definition with the help of pointer.
2. WAP accessing 2-D Array with the help of pointer.
3. WAP declaring an array taking length from the user.
4. WAP declaring 2-D array by using Dynamic memory allocation technique.
5. WAP passing arguments to main function.
6. WAP making function accepting VAR_ARGS.
7. Practice of UNIX Programming Environment. (Complete command line environment for C Programming in GCC.)
8. Making of Header File and Library Object code.
9. Practice of System Calls / System APIs (Any 10 APIs).

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3242

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Apply advanced concepts of the C programming language to create advanced C applications.	2	Em
CO2	Understand Function and Double Pointers, Recursion, Bit Manipulation, Macros.	2	S
CO3	Write high quality C code, to make yourself more marketable for higher level programming positions and be apply for real-time/embedded programming positions.	2	S

CO-PO Mapping for CS3242

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	2	2	2	2	1	3	3	3	2	3	2	3	2
CO 2	2	2	3	3	2	1	2	2	3	2	3	3	2	3	2	3
CO 3	3	3	3	2	2	2	2	3	3	3	3	3	3	2	2	2
Avg	2.67	2.33	3.00	2.33	2.00	1.67	2.00	2.00	3.00	2.67	3.00	2.67	2.67	2.33	2.33	2.33

CS3243	Title: HTML5 and CSS Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and design WebPages.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution. Understand principle, concept, working and application of new technology and solve real life problems.	

List of Experiments

1. Implementation of HTML 5 Tags
2. Design a Form using HTML & CSS.
3. Implement Different types of CSS (internal, external, Inline)
4. Design a webpage having 4 Parts. Header, footer, left, right.
5. Implementation of Tables with CSS properties.
6. Integration of Bootstrap with The Webpage.
7. Design Responsive Student Registration Form with at least 10 field.
8. Implement the basic webpage using HTML CSS and Bootstrap.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3243

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Design static web pages for home page that includes hyperlinks for registration page, login page and forgot password pages. Use form elements to create required web pages for the applications considered	2	Em
CO2	Design Home page that comprises of 3 Frames. Top frame consists of Logo and title of the web page. Left frame comprises of links to different web pages and Right frame used to display the content of web pages	2	S
CO3	Left frame has links to Login page, Registration page, Contact us etc…	2	Em

CO-PO Mapping for CS3243

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	3	3	1	2	2	3	3	2	1	3	2	3	1
CO 2	2	3	2	2	2	2	1	2	2	2	2	3	2	3	2	3
CO 3	3	3	2	2	1	3	3	2	2	1	2	2	2	3	1	2
Avg	2.67	3.00	2.00	2.33	2.00	2.00	2.00	2.00	2.33	2.00	2.00	2.00	2.33	2.67	2.00	2.00

CS3244	Title: Web and Digital Analytics Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to web page and integration with Google Analytics.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution. Understand principle, concept, working and application of new technology.	

List of Experiments

1. Implementation of HTML 5 Tags.
2. Design a Form using HTML & CSS.
3. Implement Different types of CSS (Internal, External, Inline).
4. Design a webpage having 4 Parts. Header, footer, left, right.
5. Implementation of Tables with CSS properties.
6. Integration of webpage with Web-Master Tool.
7. Integration of webpage with Google Analytics.
8. Hosting of a webpage on Server.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3244

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Understand the basics of of HTML5 and CSS.	2	Em
CO2	Implement dynamic web pages using HTML5 and CSS.	2	S
CO3	Know the use of webmaster tool and the concept of Google analytics.	2	Em

CO-PO Mapping for CS3244

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	3	2	1	1	1	3	2	3	2	2	1	3	2	3	1
CO 2	3	2	2	3	2	2	2	2	2	1	2	3	2	3	2	3
CO 3	3	3	2	2	3	3	2	2	2	3	2	2	2	3	1	2
Avg	2.67	2.67	2.00	2.00	2.00	2.00	2.33	2.00	2.33	2.00	2.00	2.00	2.33	2.67	2.00	2.00

Semester-3

Common

CS3301	Title: Data Structure and Programming	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims to introduce the concept of arrays, recursion, stack, queue, linked list, trees and graph data structures.	
Expected Outcome	● The student should be able to understand the concept of Dynamic memory management, data types, algorithms, ADT,pointer, c programming, iteration method, efficiency of recursion ● The student should be able to understand the concepts of stack ,queue , linked list and implementation of insertion and deletion operation ● The student should be able to study about different types of tree, and how it will implement ● The student should be able to implement the different type of sorting searching algorithm ● The student should be able to implement the different types of graphs and how it will traverse using less cost	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction To Data Structures and Complexity of algorithm	10
Abstract data types, Introduction to Data Structure, Types of Data Structure, Arrays, Dynamic Arrays, Complexity of algorithms, Time Complexity and space complexity, Asymptotic notations, Dynamic allocation functions-malloc and calloc, Introduction to structures.		
Unit II	Stack, Queue and Linked List	10
Stack definition and examples – Primitive operations – Example - Representing stacks in C - Push and pop operation implementation. Implementation of queues - Insert operation - Priority queue - Array implementation of priority queue. Inserting and removing nodes from a list-linked implementation of stack, queue and priority queue		
Unit III	Trees	10
Binary trees: Operations on binary trees - Applications of binary trees - Binary tree representation - Node representation of binary trees - Implicit array representation of binary tree – Binary tree traversal in C - Threaded binary tree - Representing list as binary tree - Finding the Kth element - Deleting an element. Trees and their applications: C representation of trees - Tree traversals - Evaluating an expression tree - Constructing a tree.		
Unit IV	Sorting and Searching	9
General background of sorting, Efficiency considerations, Notations, Efficiency of sorting. Exchange sorts: Bubble sort; Quick sort; Selection sort; Binary tree sort; Heap sort. Heap as a priority queue - Sorting using a heap-heap sort procedure - Insertion sorts: Simple insertion - Shell sort - Address calculation sort - Merge sort - Radix sort. Sequential search: Indexed sequential search - Binary search - Interpolation search.		
Unit V	Hashing andGraphs	9
Introduction to Hashing, Hash Tables,Application of graph - C representation of graphs - Transitive closure - Warshall's algorithm – Shortest path algorithm - Linked representation of graphs - Dijkstra's algorithm - Graph traversal - Traversal methods for graphs.		
Text Books	1. E. Balagurusamy, "Programming in AnsiC",Tata McGraw Hill Publication.	
Reference Books	1. Aaron M. Tenenbaum, YeedidyahLangsam, Moshe J. Augenstein, "Data structures using C", Pearson Education, PHI. 2. Robert L. Kruse, Bruce P. Leung Clovis L.Tondo, "Data Structures and Program Design in C", Pearson Education, PHI.	
Mode of Evaluation	Internal and External Examinations	
Recommended by	09-08-2021	

Board of Studied on	
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3301

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	The Students should be able to Understand the concept of Dynamic memory management, data types, algorithms, ADT,pointer, c programming, iteration method, efficiency of recursion	2	Emp
CO2	The Students should be able to Understand the concepts of stack ,queue , linked list and implementation of insertion and deletion operation	2	Emp
CO3	The Students should be able to Study about different types of tree, and how it will implement	2	Emp
CO4	The Students should be able to Implement the different type of sorting searching algorithm	2	Emp
CO5	The Students should be able to Implement the different types of graphs and how it will traverse using less cost	1	Emp

CO-PO Mapping for CS3301

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	2	1	2	2	2	2	2	2	3	2	2	2	2
CO 2	3	3	2	3	2	1	2	2	3	2	2	3	3	1	1	2
CO 3	3	2	2	3	1	2	3	2	2	2	3	3	1	3	2	3
CO 4	2	3	2	2	3	2	3	3	1	2	3	3	2	2	1	3
CO 5	3	2	2	3	3	1	2	3	2	2	2	2	3	2	2	2
Avg	2.75	2.5	2.25	2.5	1.75	1.75	2.5	2.25	2	2	2.5	3	2	2	1.5	2.5

EC3306	Title: Digital Electronics	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Understand how basic arithmetic operations are automated in computer system and use these concepts to automate more complex real life problems after studying combinational circuits	
Expected Outcome	Apply concepts of mathematics, computer science and engineering after studying code conversions. Formulate and solve simple hardware design problems after studying gate level minimization (K- Map, Q- Map).Use their technical skills in designing simple sequential circuits which are basic building block of advanced computer hardware after learning the design procedure of synchronous sequential circuit.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Binary System	7
Binary Arithmetic, Decimal, Hexadecimal, Octal, Conversions, Complements (1's, 2's, 9's and 10's), Addition, Subtraction, Gray, Excess-3, and excess 3 Code conversion from one to another, ASCII code. Negative Numbers and their Arithmetic, Floating point representation, Binary Codes, Cyclic Codes, Error Detecting and Correcting Codes, Hamming Codes		
Unit II	Boolean Algebra	7
Minterms, Maxterms, Realization of Boolean Functions, Gate-level minimization: SOP and POS simplification, K map method up to five variable, don't care conditions, NAND and NOR implementation, Quine Mc- Cluskey Method.		
Unit III	Combinational Circuits & Logic	8
Combinational Digital Circuits: Adders, Subtractor, Parallel binary adder, Magnitude Comparator, Multiplexers and De multiplexers, Encoders (Octal to Binary, Decimal to BCD)- Decoder (Binary to Octal, BCD to Decimal). LOGIC FAMILIES: TTL logic, DTL logic, RTL Logic, CMOS Logic families (NAND & NOR Gates), Bi-CMOS inverter.		
Unit IV	Sequential Digital Circuits	7
Latch, Flip Flops: S-R FF , J-K FF, T and D type FFs, Master-Slave FFs, Excitation tables for J-K and T FFs, Shift registers(SISO,SIPO,PISO,PIPO),-shift left register, shift right register, Counters - Asynchronous-Mod16, Mod-10, Down counter,Synchronous-4-bit counter & Ring counter.		
Unit V	Memory Devices	7
General Memory Operations, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAROM, PLA (Programmable logic Array), PAL (Programmable Array Logic. Architecture, combinational logic design using PLA & PAL).		
Text Books	1. M.Morris Mano, "Digital Design ", PHI, New Delhi. 2. Ronald J. Tocci, "Digital Systems-Principles and Applications",PHI. New Delhi. 3. S. Salivahana & S. Arivazhagan, "Digital circuits and design", Vikas Publishing House.	
Reference Books	1. Herbert Taub,Donald Schilling,"Digital Integrated Electronics",McGraw Hill. 2. S.K. Bose, "Digital Systems", New Age International. 3. D.K. Anvekar and B.S. Sonade, "Electronic Data Converters: Fundamentals & Applications",TMH.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for EC3306

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	The Students should be able to Learn the Fundamental of Digital Electronics like number systems, inter conversion and binary codes.	2	Emp
CO2	The Students should be able to Understand Boolean algebra, k-map minimization, logic gates and NAND NOR implementation.	2	Emp
CO3	The Students should be able to Understand, analyze and design various combinational circuits.	2	Emp
CO4	The Students should be able to Understand sequential circuits, analyse and design flip flops and counters.	2	S
CO5	The Students should be able to Identify basic requirements for a design of memory devices	1	Emp

CO-PO Mapping for EC3306

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	1	2	2	2	3	2	2	2	2	1	3	3	3	1	2
CO 2	3	2	3	2	2	3	2	2	2	2	2	3	3	2	2	2
CO 3	3	1	3	3	3	3	3	2	3	2	1	3	3	3	1	2
CO 4	3	2	3	3	3	3	3	2	3	2	2	3	3	3	2	2
CO 5	2	2	3	2	2	3	2	3	2	2	2	3	3	2	2	2
Avg	3	1.5	2.75	2.5	2.5	3	2.5	2	2.5	2	1.5	3	3	2.75	1.5	2

CS3305	Title: Data Base Management System	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The Objective of this subject is to describe the concept of Data Base, and queries, maintain and manage the data into the DB, how to retrieved it from the DB.	
Expected Outcome	● The student should be able to know about Database Management System, a description of the Database Management structure, a Database, basic foundational terms of Database, Understand the applications of Databases, Explain and use design principles for logical design of databases, including the E -R method and normalization approach. ● The student should be able to Utilize the knowledge of basics of SQL and construct queries using SQL, Use commercial relational database system (Oracle) by writing Queries using SQL, Apply SQL commands to destroy and alter tables and views, Write queries in relational algebra using a collection of operators, Use their knowledge of SQL query to write nested and correlated queries, Apply aggregate operators to write SQL queries that are not expressible in relational algebra. ● The student should be able to apply normalization for the development of application software's. Enter or remove data from Forms, Demonstrate to modify Forms, ● The student should be able to know about Transaction system, Testing of serializability, Serializability of schedules, conflict and view serializable schedule, deadlock handling techniques. ● The student should be able to know about Concurrency control and locking Techniques for concurrency control with types of concurrency control techniques, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction. .	

Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction of Data Base and Entity-Relationship Modeling	8
Introduction: An overview of database management system, database system Vs file system, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.Data Modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, Candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables,		
Unit II	Relational Data Model and Database Languages	8
Relational data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus. Introduction to SQL: Characteristics of SQL. Advantage of SQL. SQL data types and literals. Types of SQL commands. SQL operators and their procedure. Tables, views, Queries and sub queries. Aggregate functions. Insert, update and delete operations. Joins, Unions, Intersection, Minus, Cursors in SQL, Procedures and PL/SQL.		
Unit III	Data Base Design and Normalization	7
Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependences, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.		
Unit IV	Transaction Processing and Concurrency Control	6
Transaction system, Testing of serializability, Serializability of schedules, conflict and view serializable schedule, Recovery from transaction failures, log based recovery, checkpoints, deadlock handling, Concurrency control,locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, Recovery with concurrent transaction.		
Unit V	Latest Trends in DBMS	7
SQL versus NoSQL, Single Database Versus Multi-Database systems, Business intelligence, Multidimensional expressions(MDX), Spatial data.		

Text Books	1 Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill. 2 Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley.
Reference Books	1 Date C J, "An Introduction To Database System", Pearson Publication. 2 Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication. 3 Leon and Leon, "Database Management System", Vikas Publishing House.
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3305

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The Students should be able to Know about Database Management System, a description of the Database Management structure, a Database, basic foundational terms of Database, Understand the applications of Databases, Explain & use design principles for logical design of databases, including the E -R method and normalization approach.	2	Emp
CO2	The Students should be able to Utilize the knowledge of basics of SQL and construct queries using SQL, Use commercial relational database system (Oracle) by writing Queries using SQL, Apply SQL commands to destroy and alter tables and views, Write queries in relational algebra using a collection of operators, Use their knowledge of SQL query to write nested and correlated queries, Apply aggregate operators to write SQL queries that are not expressible in relational algebra.	2	Emp
CO3	The Students should be able to Apply normalization for the development of application software's. Enter or remove data from Forms, Demonstrate to modify Forms,	2	Emp
CO4	The Students should be able to Know about Transaction system, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, deadlock handling techniques.	2	Emp
CO5	The Students should be able to Know about Concurrency control and locking Techniques for concurrency control with types of concurrency control techniques, Time stamping protocols for concurrency control, validation based protocol, multiple granularity, Multi version schemes, Recovery with concurrent transaction.	1	Emp

CO-PO Mapping for CS3305

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	2	2	2	2	2	2	2	1	3	2	2	2	2
CO 2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2	2
CO 3	3	2	3	2	3	2	3	2	3	2	1	3	3	2	3	2
CO 4	3	2	3	2	3	2	3	2	3	2	2	3	3	2	3	2
CO 5	2	3	2	2	2	3	2	3	2	2	2	3	2	3	2	2
Avg	2.5	2	2.5	2	2.5	2	2.5	2	2.5	2	1.5	3	2.5	2	2.5	2

CS3340	Title: Data Structure Programming Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	● The student should be able to understand the concept of Dynamic memory management, data types, algorithms, ADT,pointer, c programming, iteration method, efficiency of recursion ● The student should be able to understand the concepts of stack ,queue , linked list and implementation of insertion and deletion operation ● The student should be able to understand the concept of Dynamic memory management, data types, algorithms, ADT,pointer, c programming, iteration method, efficiency of recursion	
Expected Outcome	Have a good knowledge of heap, search tree data structures. Apply these data structures for solving other problems. Have a understanding of various algorithm design techniques4.Design algorithms for new problems using these techniques. Have a high level understanding and exposure to advanced topics in data structures and algorithms. Be able to implement the studied data structures and algorithms in a high level programming language	

List of Experiments

1. Write a C program to implement the following using an array a) Stack ADT b) Queue ADT.
2. Write a C program to implement the following using a singly linked list a. Stack ADT b. Queue ADT.
3. Write C Program to implement the DEQUE (double ended queue) ADT using arrays.
4. Write a C program to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree.
5. Write a C program that use recursive functions to traverse the given binary tree in a) Preorder b) Inorder and c) Postorder.
6. Write a C program for linear search and binary search.
7. Write C programs for the implementation of BFS and DFS for a given graph.
8. Write C programs for implementing the following sorting methods: a) Merge Sort b) Heap Sort.
9. Write a C program to perform the following operations. a) Insertion into a B-tree b) Deletion from a B-tree.
10. Write a C program to implement quick sort.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3340

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	The Students should be able to Understand the concept of Dynamic memory management, data types, algorithms, ADT,pointer, c programming, iteration method, efficiency of recursion	2	Emp
CO2	The Students should be able to Understand the concepts of stack ,queue , linked list and implementation of insertion and deletion operation	2	Emp
CO3	The Students should be able to Understand the concept of Dynamic memory management, data types, algorithms, ADT,pointer, c programming, iteration method, efficiency of recursion	2	Emp

CO-PO Mapping for CS3340

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)											Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	2	2	3	2	2	2	2	3	2	3	3	3	2	2
CO 2	3	2	2	2	3	2	2	3	2	2	3	3	3	3	2	3
CO 3	3	2	3	2	3	2	2	2	2	3	2	3	3	3	2	2
Avg	3.00	2.00	2.33	2.00	3.00	2.00	2.00	2.33	2.00	2.67	2.33	3.00	3.00	3.00	2.00	2.33

EC3341	Title: Digital Electronics Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits & to prepare the students to perform the analysis and design of various digital electronic circuits.	
Expected Outcome	● Students should be able to understand the verification and comparison of different Logic Gates, to design Boolean function by using Universal Gates. ● Students should be able to understand the Operation of Half Adder/Full Adder, Half Subtractor/Full Subtractor Circuit Multiplexer/De-Multiplexer, 7-segment Decoder. ● Students should be able to understand the verification of state table of RS,JK, T, D Flip flops and operation of UP/DOWN Counter.	

List of Experiments

1. To implement and verify the Truth Table of different Logic Gates.
2. To verify the Operation of different Logic Functions designed by using Universal Gates only.
3. To verify the Operation of Half Adder/Full Adder Circuit.
4. To verify the Operation of Half Subtractor/Full Subtractor Circuit.
5. To verify the Operation of 4-bit Parallel Adder using IC 7483.
6. To verify the Operation of Multiplexer circuit.
7. To verify the Operation of De-multiplexer circuit.
8. To verify the Operation of 7-Segment Decoder.
9. To verify the state table of RS,JK, T, D Flip flops.
10. To verify the Operation of BCD Decade UP/DOWN Counter.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for EC3341

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	Students should be able to Realize truth tables of different logic gates like OR,AND,NOT AND XOR. They will also learn Functions using universal gates.	2	Emp
CO2	Students should be able to Design and implement combinational circuits like half adder/full adder, half subtractor/full subtractor, code converters, comparators, MUX/DEMUX	2	S
CO3	Students should be able to Design and implement sequential circuits like flip-flops, counters and shift registers	2	Emp

CO-PO Mapping for EC3341

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	3	1	3	3	2	1	2	3	1	2	3	3	3
CO 2	2	2	2	2	1	3	2	2	2	3	3	3	3	1	2	2
CO 3	2	3	3	1	2	2	3	3	2	2	2	3	1	3	1	1
Avg	2.00	2.00	2.33	2.00	1.33	2.67	2.67	2.33	1.67	2.33	2.67	2.33	2.00	2.33	2.00	2.00

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CS3342	Title: Oracle/SQL Server Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The major objective of this lab is to provide a strong formal foundation in database concepts, technology and practice to the participants to groom them into well-informed database application developers	
Expected Outcome	• student should be able to write and execute DDL commands • student should be able to write and execute DML command • student should be able to write and execute DCL command	

List of Experiments

1. Installation of Oracle (min 11g version) of the Computer and description of SQL, Data Types, Constraints, DDL, DML, DCL, DQL
2. Create two tables (Employee and Department) in the database using SQL commands.
3. Insertion of Data into DB using SQL commands
4. Selection of Data from the DB using SQL
5. Manipulation or modification and Alteration of Data using SQL commands
6. Write SQL Commands to describe the foreign key, primary key concept.
7. Write SQL Commands to Join two table describe above such as natural join, Equi join, left outer join, right outer join and Cartesian product as well as differentiation between Natural join and Cartesian Product
8. Write a programme into PL/SQL to create, insert , update and delete the data into/from DB
9. Write relational algebra queries for a given set of relation.
10. How to declare and create Procedures and Cursors into PL/SQL through couple of examples

11.How to declare and create the triggers into SQL-PL/SQL with an example

12. Write PL/SQL program using FOR loop to insert 10 rows into a database table.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3342

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Write and execute DDL commands	2	Emp
CO2	Students should be able to Write and execute DML command	2	Emp
CO3	Students should be able to Write and execute DCL command	2	Emp

CO-PO Mapping for CS3342

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	3	2	2	2	2	1	3	3	3	3	3	2	2	2
CO 2	3	3	3	3	2	3	2	2	3	3	3	3	2	3	3	2
CO 3	3	3	3	2	2	2	2	1	3	3	3	3	3	2	2	2
Avg	3.00	3.00	3.00	2.33	2.00	2.33	2.00	1.33	3.00	3.00	3.00	3.00	2.67	2.33	2.33	2.00

CSE without Specialization

CS3307	Title: Discrete Design Structure	L T P C 2 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	We will be studying a body of mathematical concepts essential for the mastery of some of the higher-level computer science courses. Our goal is to obtain a useful mastery of discrete structures and methods basic to further work in computer science. To enhance your ability to formulate and solve applied problems	
Expected Outcome	● The student should be able to understand propositions and then would be able to find out the validity of the argument. ● Student should be able to understand the concepts of set along with proofs to prove equality in sets. Various operations on sets, Principle of inclusion and exclusion, and various properties of Relation. ● Students will get complete knowledge of function and mapping. Types of functions ● Students will understand the concepts of Group, Ring and Fields. Various related properties. They will also learn Lattice and types of lattice. ● Student should be able to solve the problems of Permutation, Probability and Combination. They will learn the concepts of counting theory along with recurrence relation and generating functions.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Mathematical Reasoning	8
Propositions Logic, Types of Statements, Logical Connectives: Basic Connectives and Derived Connectives, Truth Tables, Logical Equivalence, Predicate Logic, Quantifiers: Existential and Universal, Arguments: Validity of Arguments, Rules of Inference.		
Unit II	Set Theory	7
Set and various types of Sets, Representation of Sets, Terminologies, Algebra of Sets, Equivalence in Sets, Cardinality, Principle of Inclusion and Exclusion, Various Operations on Sets, Cartesian Product, Relations: Representation of Relation, Properties of Relations, Equivalence and Partial Order Relations, Posets.		
Unit III	Functions and Mappings	7
Function: Types of Function, Mappings and various types of mappings, Composition of Functions; Inverse functions; special functions, Pigeonhole Principle,Mathematical Induction.		
Unit IV	Groups and Lattice	7
Algebraic Structure, Properties of Binary Relation, Group, Semi-group, Monoid, Abelian Group, Ring, Fields, Partial ordered Set, Comparable and incomparable elements, Least Element, Maximal Element, Lattices.		
Unit V	Elementary Combinatorics	7
Elementary combinatorics; counting techniques; recurrence relation; generating functions		
Text Books	1. C.L.Liu, “Elements of Discrete Mathematics”, McGraw-Hill. 2. K.H.Rosen, “Discrete Mathematics and applications”, Tata McGraw Hill.	
Reference Books	1. J .L.Mott, A.Kandel, T.P .Baker, “Discrete Mathematics for Computer Scientists and Mathematicians”, Prentice Hall of India. 2. W.K.Grassmann and J.P.Trembnlay, “Logic and Discrete Mathematics”, Prentice Hall of India.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3307

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand propositions and then would be able to find out the validity of the argument.	2	None
CO2	Students should be able to understand the concepts of set along with proofs to prove equality in sets. Various operations on sets, Principle of inclusion and exclusion, and various properties of Relation.	2	S
CO3	Students should be able to Get complete knowledge of function and mapping. Types of functions	2	Emp
CO4	Students should be able to Understand the concepts of Group, Ring and Fields. Various related properties. They will also learn Lattice and types of lattice.	2	Emp
CO5	Students should be able to Solve the problems of Permutation, Probability and Combination. They will learn the concepts of counting theory along with recurrence relation and generating functions.	1	Emp

CO-PO Mapping for CS3307

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	3	2	1	2	2	2	2	2	1	3	2	2	2	2
CO 2	3	3	2	3	2	1	2	2	3	2	2	3	3	1	1	3
CO 3	3	2	2	3	1	2	3	2	2	2	1	3	1	3	2	2
CO 4	2	3	2	2	3	2	3	3	1	2	2	3	2	2	1	1
CO 5	3	2	2	3	3	1	2	3	2	2	2	2	3	2	2	2
Avg	2.75	2.5	2.25	2.5	1.75	1.75	2.5	2.25	2	2	1.5	3	2	2	1.5	2

CS3304	Title: Linux and Open Source	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This course covers the Linux operating system, its related applications, and the Open Source Software (OSS) model. Emphasis is on how Linux is different from other systems.	
Expected Outcome	● The student should be able to Know about the Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project. ● The student should be able to understand about Open Source History, Initiatives, Principle and methodologies. Philosophy : Software Freedom, Open Source Development Model Licenses and Patents: What Is A License, Important FOSS Licenses (Apache,BSD,GF LGPL), copyrights and copylefts, Patents Economics of FOSS : Zero Marginal Cost, Income generation opportunities, Problems with traditional commercial software, Internationalizatior ● Students will get the knowledge of the Linux – The Operating System, Open Source Software, GNU, GNU Public License, Advantages of Open Source Software, Difference between Windows and Linux. ● The student should be able to gain the knowledge of Installing Linux – Hardware ar Environmental Considerations, Server Design, Dual-Booting Issues, Methods of Installation, Installing Linux, Installing RedhatServer,Linux/Unix Commands,File Permissions in Linux/Unix ● The student should be able to introduce to shell and Kernel programming: Why shel programming? Creating a script, Variables, Shell commands and control structures, Kernel Basics, General kernel responsibilities, Kernel organization, Kernel modules	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Open Source	7
Introduction: Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.		
Unit II	Open Source History and Background	7
Open Source History, Initiatives, Principle and methodologies. Philosophy : Software Freedom, Open Source Development Model Licenses and Patents: What Is A License, Important FOSS Licenses (Apache,BSD,GPL, LGPL), copyrights and copylefts, Patents, Income-generation opportunities, Problems with traditional commercial software, Internationalization		
Unit III	Introduction to Linux	6
Linux – The Operating System, Open Source Software, GNU, GNU Public License, Advantages of Open Source Software, Difference between Windows and Linux.		
Unit IV	Installation and Configuration of Linux	8
Installing Linux – Hardware and Environmental Considerations, Server Design, Dual-Booting Issues, Methods of Installation, Installing Linux, Installing RedhatServer,Linux/Unix Commands,File Permissions in Linux/Unix		
Unit IV	Bash shell script	8
Introduction to shell, creating first shell script, Creating Interactive Scripts, Exporting Variables, Functions, Built-In Shell Commands, Command Substitution, Script Parameters, Features of Bourne Again Shell (BASH), Performing Calculations in Shell Scripting,Evaluation Expressions, Decision Making: If Statement, String Comparisons, File Checks, Loop Constructs: while, unit, for loop.		
Text Books	1.Linux for beginners by jason Cannon 2.The Linux Programming interfacebyMichael Kerrisk	
Reference Books	1.Linux Pocket Guide by Daniel J. Barrett 2.Forge Your Future with Open Source by VM (Vicky) Brasseur	
Mode of Evaluation	Internal and External Examination	

Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3304

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	The Students should be able to Know about the Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.	2	S
CO2	The Students should be able to Understand about Open Source History, Initiatives, Principle and methodologies. Philosophy : Software Freedom, Open Source Development Model Licenses and Patents: What Is A License, Important FOSS Licenses (Apache,BSD,GPL, LGPL), copyrights and copylefts, Patents Economics of FOSS : Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization	2	Emp
CO3	The Students should be able to Get the knowledge of the Linux – The Operating System, Open Source Software, GNU, GNU Public License, Advantages of Open Source Software, Difference between Windows and Linux.	2	Emp
CO4	The Students should be able to Gain the knowledge of Installing Linux – Hardware and Environmental Considerations, Server Design, Dual-Booting Issues, Methods of Installation, Installing Linux, Installing RedhatServer,Linux/Unix Commands,File Permissions in Linux/Unix	2	S
CO5	The Students should be able to Understand shell and Kernel programming: Why shell programming? Creating a script, Variables, Shell commands and control structures, Kernel Basics, General kernel responsibilities, Kernel organization, Kernel modules	1	Emp

CO-PO Mapping for CS3304

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	2	1	3	2	2	2	2	1	3	2	1	3	2
CO 2	3	2	3	2	2	3	2	2	2	2	2	3	2	2	3	2
CO 3	3	1	3	2	1	3	3	2	3	2	1	3	2	1	3	2
CO 4	3	2	3	2	2	3	3	2	3	2	2	3	2	2	3	2
CO 5	3	2	3	2	2	3	2	3	2	2	2	3	2	2	3	2
Avg	2.75	1.5	2.75	2	1.5	3	2.5	2	2.5	2	1.5	3	2	1.5	3	2

CS3343	Title: Linux and Open Source Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and use linux and implement open-source software.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution.Understand principle, concept, working and application of new technology and comparison of different application	

List of Experiments

1. Installation of Linux.
2. Installation of Open-source Software.
3. Executing shell level basic commands .
4. Create Files and apply permission on it.
5. Create Files and perform basic operation with the help of Vi- editor .
6. Write a shell script to calculate the cube of any number entered by the user
7. Write a shell script to display a menu driven facility for displaying a directory, to create a file, to display the logged in users and to terminate a program. Use case… esac

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3343

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the different kind of linux command and how to use these command in linux operating system	2	Emp
CO2	Students should be able to Give the permission in single file to user , to group ,to admin and students can implement it on server site as well as in different kind of website designing	2	S
CO3	Students should be able to Differentiate different kind of operating system and importance of every operating system	2	Emp

CO-PO Mapping for CS3343

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	3	2	1	2	3	2	2	2	3	2	3	2	2	3
CO 2	3	3	3	2	2	2	1	2	3	2	2	2	3	3	1	1
CO 3	2	3	2	1	2	2	2	1	2	3	2	2	3	3	1	2
Avg	2.67	3.00	2.67	1.67	1.67	2.00	2.00	1.67	2.33	2.33	2.33	2.00	3.00	2.67	1.33	2.00

CSE-AIML Specialization

CS3323	Title: Introduction to AI, Data Science, Ethics and Foundation of Data Analysis	L T P C 3 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The objective of this course is to teach students the concepts of current main conceptual frameworks at use in AI	
Expected Outcome	On completion of this course, the students are expected to learn 1. Uses of AI, Ethics present and future 2. Introduction to Machine Learning 3. Application of AI by domain, Role of AI in society.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Data Science	8
Defining Data Science and Big Data, Benefits and Uses of Data Science and Big Data, Facets of Data, Structured Data, Unstructured Data, Natural Language, Machine generated Data, Graph based or Network Data, Audio, Image, Video, Streaming data, Data Science Process, Big data ecosystem and data science, distributed file systems, Distributed programming framework, data integration framework, machine learning framework, No SQL Databases, scheduling tools, benchmarking tools, system deployments		
Unit II	Data Science Processes	7
Six steps of data science processes, define research goals, data retrieval, cleansing data, correct errors as early as possible, integrating – combine data from different sources, transforming data, exploratory data analysis, Data modelling, model and variable selection, model execution, model diagnostic and model comparison, presentation and automation.		
Unit III	Introduction to Machine Learning	7
What is Machine Learning, Learning from Data, History of Machine Learning, Big Data for Machine Learning, Leveraging Machine Learning, Descriptive vs Predictive Analytics, Machine Learning and Statistics, Artificial Intelligence and Machine Learning, Types of Machine Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Types of Machine Learning Algorithms, Classification vs Regression Problem, Bayesian, Clustering, Decision Tree, Dimensionality Reduction, Neural Network and Deep Learning, Training machine learning systems		
Unit IV	Introduction to AI	7
What is AI, Turing test, cognitive modelling approach, law of thoughts, the relational agent approach, the underlying assumptions about intelligence, techniques required to solve AI problems, level of details required to model human intelligence, successfully building an intelligent problem, history of AI		
Unit V	Introduction to Data Analytics	7
Working with Formula and Functions, Introduction to Power BI & Charts, Logical functions using Excel, Analysing Data with Excel.		
Text Books	1.Artificial Intelligence 3e: A Modern Approach Paperback – By Stuart J Russell & Peter Norvig; Publisher – Pearson 2.Artificial Intelligence Third Edition By Kevin Knight, Elaine Rich, B. Nair – McGrawHill	
Reference Books	1.Artificial Intelligence Third Edition By Patrick Henry Winston – Addison-Wesley Publishing Company	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of	09-08-2021	

Studies on	
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3323

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Uses of AI, Ethics present and future	2	Emp
CO2	Introduction to Machine Learning	2	S
CO3	Application of AI by domain, Role of AI in society.	2	Emp

CO-PO Mapping for CS3323

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	3	2	3	1	2	2	3	2	1	3	2	3	2	3
CO 2	2	1	2	2	2	1	2	1	2	2	2	2	1	2	1	2
CO 3	2	1	3	2	3	1	2	2	3	1	1	3	2	3	2	3
Avg	2	1	3	2	3	1	2	2	3	2	1	3	2	3	2	3

CS3324	Title: Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The objective of this course is to teach students the concepts of Python Programming Language with Libraries	
Expected Outcome	On completion of this course, the students are expected to learn Experiment with AI Tools & Language Experiment with Machine Learning Tools Experiment with application of AI in real life	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Python programming Basic	8
Python interpreter, IPython Basics, Tab completion, Introspection, %run command, magic commands, matplotlib integration, python programming, language semantics, scalar types. Control flow.		
Unit II	Data Structure, functions, files	8
tuple, list, built-in sequence function, dict, set, functions, namescape, scope, local function, returning multiple values, functions are objects, lambda functions, error and exception handling, file and operation systems		
Unit III	NumPy: Array and vectorized computation	9
Pandas data structure, series, DataFrame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format		
Unit IV	Pandas	7
Data validation and matching, Methods for detecting outliers, Outlier treatment, Creating derived variables and feature engineering, Basic exploratory data analysis		
Unit V	Visualization with Matplotlib & Plotting with pandas and seaborn	4
Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration, line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data		
Text Books	1.Achim Klenke, (2014), Probability Theory A Comprehensive Course Second Edition, Springer, ISBN 978-1-4471-5360-3 2.Christian Heumann, Michael Schomaker Shalabh (2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Springer International Publishing, ISBN 978-3-319-46160-1	
Reference Books	1.Douglas C. Montgomery, (2012), Applied Statistics and Probability for Engineers, 5th Edition, , Wiley India, ISBN: 978-8-126-53719-8.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for CS3324

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Experiment with AI Tools & Language	3	Emp
CO2	Experiment with Machine Learning Tools	3	Emp
CO3	Experiment with application of AI in real life	3	Emp

CO-PO Mapping for CS3324

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	1	2	1	2	2	1	3	3	2	2	1	2	2
CO 2	3	3	3	2	1	2	3	3	2	2	3	2	3	2	3	3
CO 3	3	3	3	2	2	2	3	3	3	2	2	2	3	3	3	3
Avg	3	3	3	2	2	2	3	3	2	2	3	2	3	2	3	3

CS3351	Title: Basics of C++ Programming	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The learning objectives of this course are: To understand how C++ improves C with object-oriented features. To learn how to write inline functions for efficiency and performance. To learn the syntax and semantics of the C++ programming language.	
Expected Outcome	Students should have the basic knowledge of c++ programming and they are able to do c++ programming with efficiency.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to C++	8
Dynamic memory Management, Preprocessor, c++ overview, Functions and variables, Classes in C++, Operator overloading, Initialization and Assignment, Storage Management		
Unit II	OOPs programming with C++	7
OOPs: Inheritance, Polymorphism		
Unit III	C++ programming (Input and output)	7
Input and Output in C++ programs, Exceptions, String management		
Unit IV	Stack	7
Stack Guiding, Templates, Code Scanners		
Unit V	Debuggers	7
Debuggers: GDP and EDP		
Text Books	1.Balaguruswamy" OOP with C++"	
Reference Books	1.Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo" C++ Primer", Paperback	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3351

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the concept of Data types, Variables, Constant, Operators and Enums, Decision making, Loop control and Control flow.	2	Emp
CO2	The student should be able to understand the concept of Array, String, Function, String, Recursion, Pointer, Structure, Union and File input/output.	2	Ent
CO3	The student should be able to understand the concept of Dynamic memory allocation and Preprocessor	2	S
CO4	The student should be able to understand the concept of Operator overloading, Initialization and Assignment, Storage Management, Inheritance and Polymorphism.	2	Emp
CO5	The student should be able to understand the concept of file and its handling	3	Emp

CO-PO Mapping for CS3351

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	3	2	3	3	2	2	3	3	3	3	3	3	3
CO 2	3	2	3	3	3	3	3	2	3	3	3	2	3	3	2	2
CO 3	3	2	3	2	2	3	3	1	2	3	3	2	2	3	2	2
Avg	3.00	2	3.00	2.67	2.33	3.00	3.00	1.67	2.33	3.00	3.00	2.33	2.67	3	2.33	2.33

CS3352	Title: Basics of Networking and Trusted Operating Systems	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The learning objectives of this course are: To understand how networking and a trusted operating system manages data to make sure that it cannot be altered or moved and that it can be viewed only by persons having appropriate and authorized access rights.	
Expected Outcome	Students should have basic understanding of networking and trusted operating systems and its practical approach.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basics of Networking and Operating Systems	8
Data model, Relational Algebra and SQL, Normalization, Architecture, Indexing, Understanding Linux Operating System Concepts		
Unit II	File System	7
File System :Linux, Windows ; CPU Scheduler, Secure System Design Concepts, Secure Hardware Architecture, Process and Threads, Synchronization.		
Unit III	OS Structure	7
Anatomy of an operating system, Concept of Kernel, Open Design Principles, Design Principles to restrict Privileges, Protecting Processes, The L3 Micro-Kernel Approach, The object reuse attack, Virtual Machines, Memory Protection, Secure OS and Software Architecture		
Unit IV	Virtualization	7
Intro to Virtualization, Memory Virtualization, CPU and Device Virtualization		
Unit V	Distributed Systems	7
Latency limits, Active networks, Systems from Components		
Text Books	1.Mayank Bhusan, “Fundamentals of Cyber Security”, BPB Publications	
Reference Books	1. Michael E. Whitman, “Principle of Information Security”, Course Technology	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3352

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	The student should be able to understand the concept of Process Management and Synchronization Memory and I/O Management.	2	Emp
CO2	The student should be able to understand the concept of Relational Algebra and SQL.	2	Ent
CO3	The student should be able to understand the concept of Network Devices and Routing Algorithms.	2	S
CO4	The student should be able to understand the concept of Linux Operating System	2	Emp
CO5	Students should be able to understand about how to work with Distributed System	3	Emp

CO-PO Mapping for CS3352

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	1	3	3	2	3	3	2	3	3	3	3	3	3	3	3
CO 2	3	2	3	3	3	3	3	2	3	3	3	2	3	2	2	2
CO 3	3	1	3	2	2	3	3	1	3	3	3	2	2	2	2	2
Avg	3.00	1.33	3.00	2.67	2.33	3.00	3.00	1.67	3	3.00	3.00	2.33	2.67	2.33	2.33	2.33

Semester-4

CS3403	Title: Object Oriented Programming Language and Systems with Java	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This course provides an introduction to object oriented programming (OOP) using the Java programming language. Its main objective is to teach the basic concepts and techniques which form the object oriented programming paradigm	
Expected Outcome	● The student should be able to understand the use of OOPs concepts. ● The student should be able to solve real world problems using OOP techniques ● The student should be able to develop and understand exception handling, multithreaded applications with synchronization. ● The student should be able to design GUI based applications ● The student should be able to understand the use of File I/O	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Object-Oriented thinking	8
A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling.		
Unit II	Inheritance	7
Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, preventing inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes.		
Unit III	Packages Exception Handling & Multithreading	7
Packages: Defining, creating and accessing a package, understanding CLASSPATH, importing packages. Exception Handling: Benefits of exception handling, the classification of exceptions , exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, exception specification, built in exceptions, creating own exception sub classes. Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication. The Collections Framework (java.util)		
Unit IV	Stream based I/O (java.io)	7
The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.		
Unit V	GUI Programming with Swing	7
Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.		
Text Books	1.Herbert Scheldt, "Java The complete reference", McGraw Hill Education (India) Pvt. Ltd.	
Reference Books	1. T. Budd, "Understanding Object-Oriented Programming with Java", Pearson Education. 2. J. Nino and F.A. Hosch,"An Introduction to programming and OO design using Java", John Wiley and sons.	
	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3403

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the use of OOPs concepts.	2	Emp
CO2	Students should be able to Solve real world problems using OOP techniques	2	Emp
CO3	Students should be able to Develop and understand exception handling, multithreaded applications with synchronization.	2	Emp
CO4	Students should be able to Design GUI based applications	2	Emp
CO5	Students should be able to Understand the use of File I/O	1	Emp

CO-PO Mapping for CS3403

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	2	2	2	3	3	2	2	3	2	3	2	2	3
CO 2	3	2	1	3	3	1	2	2	1	2	2	3	3	1	2	2
CO 3	2	3	3	3	2	1	3	3	2	3	2	3	3	2	3	2
CO 4	2	2	2	3	3	1	3	3	3	3	3	2	2	3	3	3
CO 5	3	2	3	3	2	1	3	3	3	2	2	3	3	3	2	2
Avg	2.5	2.5	2	2.75	2.5	1.25	2.75	2.75	2	2.5	2.5	2.5	2.75	2	2.5	2.5

CS3404	Title: Theory of Automata and Formal Languages	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims to introduce the concept of languages, grammars, different types of automata and various types of undecidable problems	
Expected Outcome	● The student should be able to explain basic models of computation, Introduce concepts in automata theory and theory of computation. ● The student should be able to identify different formal language classes and their relationships, to design grammars and automata (recognizers) for different language classes ● The student should be able to synthesize finite and pushdown automata with specific properties, Prove particular problems cannot be solved by finite or pushdown automata using the Pumping Lemma or the closure properties of regular and/or context-free languages ● The student should be able to design deterministic Turing machine for all inputs and all outputs, subdivide problem space based on input subdivision using constraints ● The student should be able to determine the decidability and intractability of computational problems, a fundamental understanding of core concepts relating to the theory of computation and computational models including decidability and intractability.	
Unit No.	Unit Title	No. of hours(per Unit)
Unit I	Introduction of Automata Theory	8
Alphabets, Strings and Languages; Automata and Grammars, Finite automata: Moore/Mealy machine, Equivalence of Moore and Mealy Machines, NFA/DFA: Definition, Language, Notation, State transition graph, Transition table, NFA with epsilon transition, Equivalence of NFA and DFA, Myhill-Nerode Theorem, Minimization of Finite Automata		
Unit II	Regular Expression Finite Automata	7
Definition, Algebraic Laws for RE, Kleen's Theorem, Arden Theorem, RE to FA, FA to RE, Non Regular Languages, Pumping Lemma for regular Languages and its Applications Closure properties of Regular Languages, Decision properties of Regular Language		
Unit III	Context Free Grammars and PDA	7
Definition, Derivation trees, Ambiguity, Simplification of CFG, Normal forms for CFG, Closure and Decision Properties of CFL, CNF &GNF,PUSH DOWN AUTOMATA: Language, definition, Instantaneous Description and Acceptance of PDA, Equivalence and Conversion of PDA and CFG.		
Unit IV	Turing Machines	7
Definition, Language acceptance by TM, Deterministic TM, NDTM, Turing Machine as Computer of Integer functions, Variants of Turing Machine, Universal Turing Machine, Turing Church Thesis, Recursive and recursively enumerable languages		
Unit V	Decidability and Computation Models	7
Undecidable problems, Halting problem of TM, PCP, Introduction to recursive function theory, NP Completeness, P, NP and NP Hard problems, Time and Space Complexity, Recent trends and applications of Automation, New Models of Computation.		
Text Books	1. Hopcroft, Ullman,"Introduction to Automata Theory, Language and Computation", Nerosa Publishing House. 2. Linz, Peter, "An introduction to formal languages and automata",Jonesand Bartlett. 3. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science (Automata, Languages and Computation)", PHI.	
Reference Books	1. Martin J. C., "Introduction to Languages and Theory of Computations", TM. 2. Papadimitrou, C. and Lewis, C.L., "Elements of theory of Computations", PHI. 3. Kumar Rajendra, "Theory of Automata (Languages and Computation)", PPM.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	

Date of Approval by the Academic Council on	14-11-2021

Course Outcome For CS3404

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	Students should be able to Explain basic models of computation, Introduce concepts in automata theory and theory of computation.	2	Emp
CO2	Identify different formal language classes and their relationships, to design grammars and automata (recognizers) for different language classes	2	Emp
CO3	Students should be able to Synthesize finite and pushdown automata with specific properties, Prove particular problems cannot be solved by finite or pushdown automata using the Pumping Lemma or the closure properties of regular and/or context-free languages	2	Emp
CO4	Students should be able to Design deterministic Turing machine for all inputs and all outputs, subdivide problem space based on input subdivision using constraints	2	Emp
CO5	Students should be able to Determine the decidability and intractability of computational problems, a fundamental understanding of core concepts relating to the theory of computation and computational models including decidability and intractability	1	Emp

CO-PO Mapping for CS3404

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	1	2	2	3	2	3	3	3	3	2	3	2	2	3	2
CO 2	3	2	2	2	3	2	3	2	3	2	2	2	3	2	3	2
CO 3	2	3	3	2	1	1	2	1	2	3	2	3	3	2	2	3
CO 4	3	2	2	2	3	2	3	2	3	2	2	2	3	2	3	2
CO 5	2	3	3	2	1	1	2	1	2	3	2	3	3	2	2	3
Avg	2.60	2.20	2.40	2.00	2.20	1.60	2.60	1.80	2.60	2.60	2.00	2.60	2.80	2.00	2.60	2.40

CS3440	Title: Object Oriented Programming Language and Systems with Java Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course is introduced to understand the basic concepts of Java, Classsyntax, data types, flow of control, classes, methods, objects, arrays, exception handling, recursion, and graphical user interfaces (GUIs). Writing and testing applets for potential inclusion in web pages. Understanding how to access enterprise data bases from the application programs	
Expected Outcome	● Students should be able to understand about class and object, also able to describe constructor, and overload the Constructors with instantiating its object. ● Students should be able to understand about polymorphism using methods in JAVA and also able to implement polymorphism. ● Students should be able to implement the concept of threading by extending Thread Class and Runnable Interface.	

List of Experiments

1. Use Eclipse or Net bean platform and acquaint with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
2. To write a program in JAVA to implement the concept of Call by Address and Call by Value.
3. Write a program to implement array using JAVA.
4. Write a JAVA Program to define a class, describe its constructor, overload the Constructors and instantiate its object.
5. Write a Java Program to define a class, define instance methods for setting and retrieving values of instance variables and instantiate its object.
6. Write a program to implement polymorphism using methods in JAVA.
7. Write a program to implement packages and interface in JAVA.
8. Write a JAVA program to practice using String class and its methods.
9. Write a program to implement the concept of threading by extending Thread Class
10. Write a program to use classes of collection framework.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome For CS3440

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	Students should be able to Understand about class & object, also able to describe constructor, & overload the Constructors with instantiating its object.	2	Emp
CO2	Students should be able to Understand about polymorphism using methods in JAVA amd also able to implement polymorphism.	2	S
CO3	Students should be able to Implement the concept of threading by extending Thread Class and Runnable Interface.	2	Emp

CO-PO Mapping for CS3440

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	1	2	2	3	2	3	3	3	3	3	3	2	2	1	3
CO 2	3	2	2	2	3	2	3	2	3	2	3	2	3	2	1	3
CO 3	2	3	3	2	1	1	2	1	2	3	2	3	3	2	1	2
Avg	2	1.5	1.75	1.5	1.75	1.25	2	1.5	2	2	2	2	2	1.5	0.75	2

CSE without Specialization

CS3401	Title: Software Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To understand the best practices in software engineering and to develop the necessary skills to handle software projects in a principled way.	
Expected Outcome	After the completion of this course, the students will be able to understand the ways of Software Development Models, Designing Testing and Maintenance.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Software Engineering	8
Introduction to Software Engineering, Software Characteristics, Software Crisis, Software Engineering Processes, SDLC Models :Water Fall Model, Prototype Model, Spiral Model, E-D Models, Iterative Enhancement Models.		
Unit II	Software Requirement Specifications (SRS)	7
Requirement Engineering Process: Elicitation, Decision Tables, SRS Document, IEEE Standards for SRS. SQA, SEI-CMM		
Unit III	Software Design	7
Fundamental design, concept design notations, design techniques, structured coding techniques coding styles, documentation guidelines.		
Unit IV	Coding &Testing	7
Top-Down and Bottom –Up programming, structured programming, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing, Functional Testing.		
Unit V	Maintenance	7
Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering &(COCOMO)		
Text Books	1. RS Pressman,"Software Engineering", Tata McGraw Hill Publishers, New Delhi. 2. Rajib Mall,"Software Engineering", PHI Publishers, New Delhi.	
Reference Books	1. Pankaj Jalote,"In Integrated Approach to Software Engineering", Narosa Publication House. 2. Sangeeta sabarwal,"Software Engineering", New Age International, New Delhi.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3401

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Appreciate the engineering nature of software development. Describe key activities in software development and the role of modeling.	2	Emp
CO2	Students should be able to Learn how to capture software requirements and handle difficult situations in the course addresses elicitation, specification, and management of software system requirements	2	Emp
CO3	Students should be able to Explain key concepts in software development such as risk and quality; explain the basics of an object-oriented approach to software development. Describe a simple workflow for interacting with the published literature on software development.	2	S
CO4	Students should be able to Apply modern software testing processes in relation to software development and project management,Create test strategies and plans, design test cases, prioritize and execute them.	2	Emp
CO5	Students should be able to Study a body of knowledge relating to Software Engineering, Software reengineering, and maintenance; Understand the principles of large scale software systems, and the processes that are used to build them;	1	Emp

CO-PO Mapping for CS3401

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	1	2	2	2	1	1	3	3	2	2	2	2	2
CO 2	3	3	3	2	3	3	3	2	2	2	3	2	3	3	3	3
CO 3	3	3	3	2	3	3	3	2	3	2	2	2	3	3	3	3
CO 4	2	3	2	1	2	3	2	1	2	3	2	2	3	2	3	2
CO 5	2	2	2	1	2	2	2	1	1	3	3	2	2	2	2	2
Avg	2.40	2.60	2.40	1.40	2.40	2.60	2.40	1.40	1.80	2.60	2.60	2.00	2.60	2.40	2.60	2.40

CS3402	Title: Computer Networks	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The main objective of his course is to introduce the fundamental types of computer networks and to demonstrate the TCP/IP and OSI models and basic functions of individual layers of studied models.	
Expected Outcome	● The student should be able to build an understanding of the fundamental concepts of computer networking. To master the concepts of protocols, network interfaces, and physical transmission media. ● The student should be able to have knowledge of terminology and concepts of the OSI reference model and the TCP/IP reference model. Study data link layer concepts, design issues, and responsibilities ● The student should be able to analyze, specify and design the topological and routing strategies for an IP based networking infrastructure ● The student should be able to study Transport layer services and protocols and gain knowledge about connection establishment and termination ● The student should be able to have a basic knowledge of the use of cryptography and network security	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Computer Networks	10
Introduction of Computer Network and the types, Network Components, Elements of Data communication ,Services and Protocols, Network Topologies, Transmission modes, Analog and digital signals,The OSI Reference Model and TCP/IP Model and Comparison, signal transmission, Switching Techniques- Circuit, Message switching, Packet Switching, Physical Transmission Media.		
Unit II	Layered Architecture and Data Link Layer	10
Introduction to Layered Architecture and Information Flow, , Data link Layer design issues, Error Detection and Error Correction Techniques, Flow Control (Sliding Window Protocol), Physical Addressing, Medium Access Techniques, Network Interfaces, ARP and RARP Protocol.		
Unit III	Network Layer and Its Protocols	10
Network Layer design issues, Internetworking, IPV4 and IPV6 Protocols, Logical Addressing-IP Addressing and Subnetting, Routing and Routing Protocols (RIP, OSPF, BGP), Network Address Translation (NAT), ICMP Protocol, Tunneling.		
Unit IV	Transport Layer and Its Protocols	9
Introduction to Transport Layer, Transport layer Services (Connection Oriented and Connectionless Services),Segmentation, port addressing , Error control (checksum) , Flow Control, Congestion Control Techniques, TCP and UDP Header, Three Way Handshaking Process(Connection Establishment and Termination), Quality of Services(QoS).		
Unit V	Application Layer	9
Introduction to Application Layer and its Services, Security - Cryptography Techniques (Public Key and Private Key Cryptography) , Firewall, Compression Techniques(Lossy and Lossless Compressions), Domain Name System(DNS), Internet Architecture, Telnet, HTTP, FTP, SMTP and E-mail. Wireless connectivity(cellular, IEEE 802.16 WiMax, Bluetooth, zigbee, infrared, LTE)		
Text Books	1. Behrouz Frozen,"Computer Networks- A Top-Down approach", McGraw Hill. 2. Andrew Tanenbaum,"Computer Networks (4th edition)", Prentice Hall.	
Reference Books	1. Behrouz Forouzan,"Data Communications and Networking", McGraw Hill. 2. Kurose and Ross, Pearson," Computer Networking- A Top-Down approach, 5th edition",Pearson India.	
Mode of Evaluation	Internal and External Examinations	

Recommended by Board of Studied on	09-08-2021
Date of Approval l Academic Council	14-11-2021

Course Outcome for CS3402

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Build an understanding of the fundamental concepts of computer networking. To master the concepts of protocols, network interfaces, and physical transmission media.	2	Emp
CO2	Students should be able to Have knowledge of terminology and concepts of the OSI reference model and the TCP/IP reference model. Study data link layer concepts, design issues, and responsibilities	2	Emp
CO3	Students should be able to Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure	2	Emp
CO4	Students should be able to Study Transport layer services and protocols and gain knowledge about connection establishment and termination	2	Emp
CO5	Students should be able to Have a basic knowledge of the use of cryptography and network security	1	Emp

CO-PO Mapping for CS3402

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	2	2	2	3	2	1	2	3	2	2	3	2	2
CO 2	3	1	2	1	2	2	1	2	3	2	2	3	2	2	1	2
CO 3	3	2	2	2	2	2	3	1	2	2	3	2	3	2	2	2
CO 4	2	3	2	3	2	1	2	2	1	2	2	2	2	3	3	2
CO 5	3	2	2	2	2	1	2	2	2	2	3	3	2	2	2	2
Avg	2.80	2.00	2.00	2.00	2.00	1.60	2.20	1.80	1.80	2.00	2.60	2.40	2.20	2.40	2.00	2.00

CS3442	Title: Computer Network Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work.	
Expected Outcome	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers. Understand the basic concepts of application layer protocol design; including client/server models, peer to peer models, and network naming.	

List of Experiments

1. Study of different – 2 Network Cables and Network Interfaces.
2. Study & Implementation of IP Addressing & Sub Netting Concept.
3. Study & Implementation of Basic Network Commands and Network Configuration Commands.
4. Installation of Network Simulator (NS2).
5. Installation of Packet Tracer Tool.
6. Configure a Network Topology with Packet Tracer Tool.
7. Simulate a small Network using Network Simulator (NS2) Tool.
8. Write a program to simulate Bit-Stuffing Data Framing Techniques.
9. Write a program to simulate Char-Stuffing Data Framing Techniques.
10. Write a program to simulate Hamming Code (7-Bit) Error Control Technique.

Mode of Evaluation	Internal and External Examinations
Recommendation	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3442

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Learn about basics of computer networking and IP addressing.	2	Emp
CO2	Students should be able to Analyse different simulation tools such as NS2	2	Emp
CO3	Students should be able to Learn about framing technique	2	Emp

CO-PO Mapping for CS3442

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PSO 4
CO 1	3	2	3	3	2	2	3	3	3	3	3	3	3	2	3	2
CO 2	2	3	3	3	2	3	3	3	2	3	3	3	3	2	3	2
CO 3	3	2	3	3	2	2	3	3	2	3	3	3	3	2	3	2
Avg	2.67	2.33	3.00	3.00	2.00	2.33	3.00	3.00	2.33	3.00	3.00	3.00	3.00	2.00	3.00	2.00

CS3441	Title: Case Tools and Testing Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Overview of UML,Basicand Advanced Models,Class , Object, Collaboration and Sequence,Use Cases Advanced Modeling,Component Diagram and Deployment Diagrams	
Expected Outcome	● Student will understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods. ● Student will able to apply software testing knowledge and engineering methods. ● Student will able to improve software testing knowledge and engineering methods.	

List of Experiments

1. Introduction of UML, Class Diagram for ATM & Bank
2. Use case diagram for ATM & Bank
3. Sequence diagram for ATM & Bank& Collaboration diagram for ATM & Bank
4. State chart diagram for ATM & Bank
5. Activity diagram for ATM & Bank
6. Component diagram of ATM & Bank
7. Deployment diagram for ATM & Bank
8. Study of testing tool (e.g.winrunner)
9. Study of bug tracking tool (e.g.bugzilla)
10. Study of any test management tool (e.g. test Director)
11. Mini Project on any case study using Umlet tool.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3441

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	2	Emp
CO2	Students should be able to Apply software testing knowledge and engineering methods.	2	Emp
CO3	Students should be able to Improve software testing knowledge and engineering methods.	2	S

CO-PO Mapping for CS3441

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	3	2	3	2	2	3	2	2	2	2	3	3	2	3
CO 2	3	1	3	1	3	2	1	3	2	2	2	2	3	3	1	3
CO 3	3	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2
Avg	2.25	1.25	2	1.25	2	1.5	1.25	2	1.5	1.5	1.5	1.5	2.25	2.25	1.25	2

CSE-AIML Specialization

CS3423	Title: Probabilistic Modelling and Reasoning with Python	L T P C 3 0 0 4
Version No.	1.0	
Course Prerequisites	CS3323	
Objectives	The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems.	
Expected Outcome	On completion of this course, the students are expected to learn 1. Basics of Statistics and Probability distributions 2. Sampling theory and Theory of Estimation 3. Various tests of Hypothesis and Significance, Correlation and Regression and fitting of different types of curves.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Statistics, Scientific data gathering & Data description	8
Introduction to Statistics. Role of statistics in scientific methods, current applications of statistics. Sampling techniques, scientific studies, observational studies, data management. Displaying data on a single variable (graphical methods, measure of central tendency, measure of spread), displaying relationship between two or more variables, measure of association between two or more variables.		
Unit II	Probability Theory & Random Variables	7
Sample space and events, probability, axioms of probability, independent events, conditional probability, Bayes' theorem. Discrete and continuous random variables. Probability distribution of discrete random variables, binomial distribution, poisson distribution. Probability distribution of continuous random variables, The uniform distribution, normal (gaussian) distribution, exponential distribution, gamma distribution, beta distribution, t-distribution, χ" distribution. Expectations, variance and covariance. Probability Inequalities. Bivariate distributions		
Unit III	Point Estimations & Interval Estimations	7
Methods of finding estimators, method of moments, maximum likelihood estimators, bayes estimators. Methods of evaluating estimators, mean squared error, best unbiased estimator, sufficiency and unbiasedness, Confidence interval of means and proportions, Distribution free confidence interval of percentiles		
Unit IV	Test of Statistical Hypothesis and p-values, Bayesian Statistics	7
Tests about one mean, tests of equality of two means, test about proportions, p-values, likelihood ratio test, Bayesian tests, Bayesian inference of discrete random variable, Bayesian inference of binomial proportion, comparing Bayesian and frequentist inferences of proportion, comparing Bayesian and frequentist inferences of mean.		
Unit V	Univariate Statistics using Python	7
Mean, Mode. Median, Variance, Standard Deviation, Normal Distribution, t-distribution, interval estimation, Hypothesis Testing, Pearson correlation test, ANOVA F-test		
Text Books	1.Achim Klenke, (2014), Probability Theory A Comprehensive Course Second Edition, Springer, ISBN 978-1-4471-5360-3	
Reference Books	1.Christian Heumann, Michael Schomaker Shalabh (2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Springer International Publishing, ISBN 978-3-319-46160-1	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for CS3423

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	the students are expected to learn- Basics of Statistics and Probability distributions	2	Emp
CO2	the students are expected to learn-Sampling theory and Theory of Estimation	2	Emp
CO3	the students are expected to learn-Various tests of Hypothesis and Significance, Correlation and Regression and fitting of different types of curves.	2	Emp

CO-PO Mapping for CS3423

Course Outcomes	Programme Outcomes												Programme Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	1	2	1	1	2	3	1	1	1	2	1	3	3	2	3
CO2	3	2	3	2	2	3	1	1	1	2	3	1	1	2	3	2
CO3	2	2	2	3	2	1	1	1	2	2	2	3	2	2	1	2
Avg	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2

CS3424	Title: R Programming for Data Science and Data Analysis	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	CS3324	
Objectives	R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods	
Expected Outcome	On completion of this course, the students are expected to learn- Open Source platform Machine Learning Operations and Exemplary support for data wrangling. ... Quality plotting and graphing & Statistics	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Getting Started with R and R Workspace	8
Introducing R, R as a programming Language, the need of R, Installing R, RStudio, RStudio's user interface, console, editor, environment pane, history pane, file pane, plots pane, package pane, help and viewer pane, R Workspace, R's working directory, R Project in R Studio, absolute and relative path, Inspecting an Environment, Inspect existing Symbols, View the structure of object, Removing symbols, Modifying Global Options, Modifying warning level, Library of Packages, Getting to know a package, Installing a Package from CRAN, Updating Package from CRAN, Installing package from online repository, Package Function, Masking and name conflicts		
Unit II	Basic Objects and Basic Expressions	7
Vectors, Numeric Vectors, Logical Vectors, Character Vectors, subset vectors, Named Vectors, extracting element, converting vector, Arithmetic operators, create Matrix, Naming row and columns, subsetting matrix, matrix operators, creating and subsetting an Array, Creating a List, extracting element from list, subsetting a list, setting value, creating a value of data frame, subsetting a data frame, setting values, factors, useful functions of a data frame, loading and writing data on disk, creating a function, calling a function, dynamic typing, generalizing a function. Assignment Operators, Conditional Expression, using if as expression and statement, using if with vectors, vectorized if: ifelse, using switch, using for loop, nested for loop, while loop		
Unit III	Working with Basic Objects and Strings	7
Working with object function, getting data dimensions, reshaping data structures, iterating over one dimension, logical operators, logical functions, dealing with missing values, logical coercion, math function, number rounding functions, trigonometric functions, hyperbolic functions, extreme functions, finding roots, derivatives and integration.		
Unit IV	Statistical function	7
sampling from a vector, Working with random distributions, computing summary statistics, covariance and correlation matrix, printing string, concatenating string, transforming text, Formatting text, formatting date and time, formatting date and time to string, finding string pattern, using group to extract data, reading data		
Unit V	Working with Data – Visualize and Analyze Data	7
Reading and Writing Data, importing data using built-in-function, READR package, export a data frame to file, reading and writing Excel worksheets, reading and writing native data files, loading built-in data sets, create scatter plot, bar chart, pie chart, histogram and density plots, box plot, fitting linear model and regression tree		
Text Books	1. Hands-On Programming with R by Garrett Grolemund	
Reference Books	1. R for Data Science by Hadley Wickham & Garrett Grolemund	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	09-08-2021	
Date of approval by the Academic Council	14-11-2021	

Course Outcome for CS3424

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The students are expected to learn-Open Source platform	2	Emp
CO2	The students are expected to learn-Machine Learning Operations and Exemplary support for data wrangling	2	Emp
CO3	The students are expected to learn-Quality plotting and graphing & Statistics	2	S

CO-PO Mapping for CS3424

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	3	2	2	2	3	3	2	2	2	3	3	2	2
CO 2	2	3	2	2	2	2	1	2	2	1	1	2	3	3	2	3
CO 3	3	2	3	2	3	2	2	3	2	2	2	3	3	2	3	2
Avg	3	2	2	2	2	2	2	3	2	2	2	2	3	3	2	2

CSE-CSCQ Specialization

CS3451	Title: Advanced Networking	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course objectives are to provide the student with knowledge of advanced network engineering concepts and techniques	
Expected Outcome	The learning outcomes include understanding the principles for implementing a multi layer network, management systems for the network and routing of information throughout the network.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Networking & Internet Fundamentals	8
History, IP Address, TCP / IP Model, Packets, DNS, ARP, IP subnetting		
Unit II	System Architectures	7
Overview, TCP/IP Naming and Addressing, TCP/IP Applications and Application Services, TCP/IP Protocol Details, Quality of Service (QoS), System Architectures, Cabling and network topologies, Ethernet basics		
Unit III	Client/Server Structure	7
Cabling and network topologies, Ethernet basics, The Client/Server Model, Remote Procedure Call (RPC), Routing Technologies, Port Security, How is data forwarded through a network?, RFC and NAT Terms		
Unit IV	Netcat	7
Connecting to a TCP/UDP Port, Listening on a TCP/UDP Port, Transferring Files with Netcat, Remote Administration with Netcat		
Unit V	Wire Shark	7
Wireshark Basics, Making Sense of Network Dumps, Capture and Display Filters, Following TCP Streams		
Text Books	1. Dr. Nitin Kulkarni, Anand Jain, “Advanced Networking”.Vision Publication	
Reference Books	1. Kurose James F., Pearson, “Computer Networking: A Top-Down Approach”, Publisher: Pearson Education.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3451

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the Networking and Internet fundamentals.	2	Emp
CO2	The student should be able to implement the basic Networking commands.	2	Ent
CO3	The student should be able to implement the Advanced Networking	2	Emp

CO-PO Mapping for CS3451

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	3	3	2	2	3	2	3	1	3	3	2	2	2
CO 2	3	3	2	3	2	2	2	3	2	3	2	3	3	2	2	2
CO 3	3	3	2	3	3	2	2	3	2	3	2	3	3	3	2	2
Avg	3.00	3.00	2.00	3.00	2.67	2.00	2.00	3.00	2.00	3.00	1.67	3.00	3.00	2.33	2.00	2.00

CS3452	Title: Basis of Information Security	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The Objective of this subject is To continually strengthen and improve the overall capabilities of the information security management system	
Expected Outcome	After completion of this subject students will be able to describe: computer security attempts to ensure the confidentiality, integrity, and availability of computing systems and their components. Three principal parts of a computing system are subject to attacks: hardware, software, and data.	
Unit No.	Unit Title	No. of Hrs. (Per Unit)
Unit I	Introduction to Information Security	7
What is Information Security, Goals of Information Security, Security is not just VAPT, Security Models :(CIA, Parkerian Hexad), Real World Cases		
Unit II	Domains of Cyber Security	8
Domains of Cyber Security, Career in Information Security(a. Entry Level Positions in Cyber Security Current &Expected Growth in Cyber Security Industry)		
Unit III	Information Security	7
Information Security Jargons, Knowing your Adversaries (Script Kiddies ,Hacktivists, Nation State Actors, etc.)		
Unit IV	User Authentication	7
Authentication Basics, Passwords, Certificate Based Authentication Security Mindset, Computer Security Concepts Threats, Attacks and Assets		
Unit V	Access Control& Physical and Environment Security	7
Basic concepts in access control Security/Emerging issues in Access Control Basic concepts in physical and Environment Security Emerging issues in Basic concepts in physical and Environment Security		
Text Books	1. Mayank Bhusan, “Fundamentals of Cyber Security”, BPB Publications.	
Reference Books	1. Michael E. Whitman, “Principle of Information Security”, Course Technology.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3452

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the Basics of information security.	2	Emp
CO2	The student should be able to implement the Basics of information security.	2	Ent
CO3	The student should be able to understand the Access control of information security.	2	Emp

CO-PO Mapping for CS3452

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	3	3	2	2	3	2	3	2	2	3	2	2	2
CO 2	2	2	2	3	2	2	2	3	2	3	2	2	3	2	2	2
CO 3	2	2	2	3	3	2	2	3	2	3	2	2	3	3	2	2
Avg	2.00	2.00	2.00	3.00	2.67	2.00	2.00	3.00	2.00	3.00	2.00	2.00	3.00	2.33	2.00	2.00

CS3445	Title: Advanced Networking Lab	L 0	T 0	P 2	C 1
Version No.	1.0				
Course Prerequisites	Nil				
Objectives	The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & implementation, LANs/VLANs,				
Expected Outcome	Combine and distinguish functionalities of different Layers. Describe and Analysis of basic protocols of computer networks, and how they can be used to assist in network design and implementation.				

List of Experiments

1. Design and build a wireless LAN.
2. Design and implement a network security policy using access lists.
3. Use VLANs in a switched network environment.
4. Troubleshoot wireless LANs and VLANs.
5. Troubleshoot security policies such as access lists.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course outcome for CS3445

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	Student should be able to understand the basic networking topology methods and their application	2	Emp
CO2	Student should be able to implement the wireless LANs and design access list to provide network security.	3	Emp
CO3	Student should be able to troubleshoot the security policies in LANs and VLANs.	3	S

CO-PO Mapping for CS3445

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	3	3	2	2	3	3	2	2	2	3	3	3	2
CO 2	2	2	2	3	2	2	2	3	2	2	2	2	3	3	2	2
CO 3	2	2	2	3	3	2	2	3	3	2	2	2	3	3	3	2
Avg	2.00	2.00	2.00	3.00	2.67	2.00	2.00	3.00	2.67	2.00	2.00	2.00	3.00	3.00	2.67	2.00

Semester-5

CS3504	Title: Design and Analysis of Algorithm	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Upon completion of this course, students will be able to do the following: Analyse the asymptotic performance of algorithms. Write rigorous correctness proofs for algorithms. Demonstrate a familiarity with major algorithms and data structures. Apply important algorithmic design paradigms and methods of analysis. Synthesize efficient algorithms in common engineering design situations.	
Expected Outcome	● The student should be able to describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it and differentiate with Greedy approach. Recite algorithms that employ this paradigm. Synthesize divide and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms. ● The student should be able to incorporate the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic programming algorithms, and analyses them. ● student should be able to explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyses them ● The student should be able to analyze the asymptotic performance of algorithms, Apply important algorithmic design paradigms and methods of analysis, Familiarizing students with specific algorithms for a number of important computational problems like sorting, searching. ● The student should be able to provide understanding of classes of problems and define the class of problem as P, NP, NP Hard, NP Complete.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Algorithm	8
Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Probabilistic analysis, Amortized analysis. Master Theorem, Analysis of algorithm, Divide and conquer: General method, Merge Sort, Quick Sort, Bubble Sort, Binary Search, Sorting in Linear Time, Strassen's matrix problem.		
Unit II	Introduction to Tree	7
RB Tree Rotate & Insert, RB Tree delete, B-Tree, B+ Tree, Binomial Heaps and Fibonacci Heaps, Disjoint Sets-connected components & bi-connected components, disjoint set operations, union and find algorithms, spanning trees,		
Unit III	Dynamic Programming & Greedy Techniques	7
General method, applications-Matrix chain multiplication, Optimal binary search trees, knapsack problem, 0/1 knapsack problem, Minimum Spanning tree-Prim's & Krushkal's Algorithms, Single-source shortest path and all pair's shortest paths. Travelling sales person problem, Reliability design.		
Unit IV	Back Tracking	8
General method, applications-n-queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles. Elementary graphs algorithms, Maximum Flow and Travelling Salesman Problem,		
Unit V	Problem Classes	6
NP-Hard and NP-Complete problems: Basic concepts, non-deterministic algorithms, NP - Hard and NP Complete classes, Vertex Cover problem, Cook's theorem, Approximation algorithms for NP Hard problems, Travelling Salesman Problem, Knap sack problem.		
Text Books	1. Introduction to Algorithms, secondedition ,T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, PHI Pvt. Ltd./ Pearson Education 2. Introduction to Design and Analysis of Algorithms A strategic approach, R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc Graw Hill.	
Reference Books	1. Data structures and Algorithm Analysis in C++, Allen Weiss, Pearson education. 2. Fundamentals of Computer Algorithms, Ellis Horowitz,Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.	
Mode of Evaluation	Internal and External Examinations	

Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3504

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Analyze the asymptotic performance of algorithms, Apply important algorithmic design paradigms and methods of analysis, Familiarizing students with specific algorithms for a number of important computational problems like sorting, searching.	2	Emp
CO2	Students should be able to Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it and differentiate with Greedy approach. Recite algorithms that employ this paradigm. Synthesize divide and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	2	Ent
CO3	Students should be able to Incorporate the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic programming algorithms, and analyses them.	2	S
CO4	Students should be able to Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyses them.	3	Emp
CO5	Students should be able to He provide understanding of classes of problems and define the class of problem as P, NP, NP Hard, NP Complete.	3	Emp

CO-PO Mapping for CS3504

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	3	3	2	2	2	3	2	2	2	2	2	3	2	2
CO 2	2	2	2	2	2	2	2	2	2	2	2	2	1	3	2	3
CO 3	3	3	2	2	3	2	3	3	3	3	3	2	2	2	3	2
CO 4	2	2	2	3	2	2	2	3	2	2	2	2	2	2	2	3
CO 5	2	2	2	2	2	3	2	2	3	2	2	3	2	2	2	2
Avg	2.20	2.20	2.20	2.40	2.20	2.20	2.20	2.60	2.40	2.20	2.20	2.20	1.80	2.40	2.20	2.40

CS3540	Title: Web Technology Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Deepen your knowledge of advanced features of the Java language syntax and SDK. Be able to put into use the advanced features of the Java language to build and compile robust enterprise-grade applications.	
Expected Outcome	Students will design and implement programs in the Java programming language that make strong use of classes and objects.	

List of Experiments

1. Installation and configuration of Apache server
2. Development of static website of an online Departmental Store. The website should be user friendly and should have the following pages:
   - Home page
   - Registration and user login
   - User profile page
   - Items catalog
   - Shopping cart
   - Payment by credit card
   - Order confirmation
3. Add validations to the above site for registration, user login, user profile and payment by credit card using Java Script.
4. Develop the Password Validations form using Java Script.
5. Design the Static Web Site or pages using HTML and DHTML for Quantum University.
6. Design the Dynamic Web Site or pages using XML, Java Script and Servlet for Quantum University.
7. Installation and configuration of TOMCAT web server. Convert the static web pages of into dynamic web pages using servlets and cookies.
8. Creation of a XML document of 20 students of Quantum University. Add their roll numbers, marks obtained in 5 subjects, total and percentage and save this XML document at the server. Write a program that takes students' roll number as an input and returns the student's marks, total and percentage by taking the students' information from the XML document.
9. Design a website using existing web services (Google map, weather forecast, market information etc.) using AJAX. Design a web form for online Registration and stored as well as retrieved the data to/from the database.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3540

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand about the validations using javascript and able to create a website with multiple pages.	2	Emp
CO2	Students should be able to Design the Dynamic Web Site or pages using XML, Java Script and Servlet.	2	Ent
CO3	Students should be able to Understand the installation and configuration of Apache and TOMCAT web server. Also abl	2	S

CO-PO Mapping for CS3504

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O 4
CO 1	2	2	2	1	2	2	2	1	2	1	2	2	2	3	2	2
CO 2	2	2	3	3	3	2	2	2	3	2	2	3	3	2	2	2
CO 3	2	2	2	3	2	2	2	2	3	2	2	3	2	3	2	2
Avg	2.00	2.00	2.33	2.33	2.33	2.00	2.00	1.67	2.67	1.67	2.00	2.67	2.33	2.67	2.00	2.00

CS3541	Title: Design and Analysis of Algorithm Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem, to solve problems using divide and conquer strategy and solve problems using backtracking strategy.	
Expected Outcome	● student should be able to identify the problem given and design the algorithm using various algorithm design techniques. ● Students can implement various algorithms in a high level language. ● student should be analyze the performance of various algorithms	

List of Experiments

1. Write a program to implement Quick sort algorithm for sorting a list of integers in ascending order
2. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.
3. Write a program to implement the bfs & dfs algorithm for a graph.
4. Write a. program to implement Floyd-Warshall Algorithm.
5. Write a program to implement backtracking algorithm for the N-queens problem.
6. Write a program to implement the backtracking algorithm for the sum of subsets problem.
7. Write a program to implement the backtracking algorithm for the Hamiltonian Circuits problem.
8. Write a program to implement Knapsack Problem.
9. Write a program to implement Dijkstra's algorithm & Bellman ford for the Single source shortest path problem.
10. Write a program that implements Prim's & Krushkal's algorithm to generate minimum cost spanning tree.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3541

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Identify the problem given and design the algorithm using various algorithm design techniques.	2	Emp
CO2	Students should be able to Students can implement various algorithms in a high level language.	2	Ent
CO3	Students should be able to Student should be analyze the performance of various algorithms.	2	S

CO-PO Mapping for CS3541

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PSO4
CO 1	3	2	2	1	2	1	2	3	2	1	2	3	2	3	2	2
CO 2	3	2	3	3	3	1	2	3	3	2	2	3	3	2	2	2
CO 3	3	2	2	3	2	1	2	3	3	2	2	3	2	3	2	2
Avg	3.00	2.00	2.33	2.33	2.33	1.00	2.00	3.00	2.67	1.67	2.00	3.00	2.33	2.67	2.00	2.00

CSE without Specialization

CS3505	Title: Foundation of Cloud Computing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To provide students with the fundamentals and essentials of Cloud Computing and also a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.	
Expected Outcome	● The student should be able to understand the use of Cloud Computing concepts ● The student should be able to solve real world application development problems using Google app engine, GKE. ● The student should be able to understand the need of Google cloud storage options. ● The student should be able to understand the use of networking and management tools ● The student should be able to manage machine learning applications over the cloud.	

Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Cloud computing	4
Origins of Cloud computing – Cloud components ,Cloud vs. Traditional architecture, Essential characteristics – On-demand self service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing. Services models (IaaS, PaaS, SaaS), The GCP (Google cloud platform) console		
Unit II	Use GCP to Build Your Apps	6
Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing, Computing services in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Exploring PaaS with App Engine, Event driven programs with cloud functions, Containerizing and orchestrating apps with Google Kubernetes Engine.		
Unit III	Structured and Unstructured Storage models	5
Storage options in the cloud, Structured and unstructured storage in the cloud, Unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL		
Unit IV	Cloud APIs and Cloud Security	5
The purpose of APIs, Cloud Endpoints, Using Apigee Edge, Managed message services, Exploring Cloud SQL, Cloud Pub/Sub, Introduction to security in the cloud, The shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM.		
Unit V	Introduction to Cloud Networking and VMWare	6
Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine		

Text Books	1. Marinescu D C, Cloud Computing Theory and Practice, Morgan Kaufmann.
Reference Books	1. Erl T, Mahmood Z and Martinez J W, Cloud Computing: Concepts, Technology and Architecture, Prentice Hall. 2. Stallings W, Foundations of Modern Networking, Pearson.
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3505

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the use of Cloud Computing concepts	2	Emp
CO2	Students should be able to Solve real world application development problems using Google app engine, GKE.	2	Ent
CO3	Students should be able to Understand the need of Google cloud storage options.	2	S
CO4	Students should be able to Understand the use of networking and management tools	3	Emp
CO5	Students should be able to Manage machine learning applications over the cloud.	3	Emp

CO-PO Mapping for CS3505

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	2	2	2	3	3	2	2	3	2	3	1	2	2
CO 2	3	2	1	3	3	1	2	2	1	2	1	2	2	3	3	3
CO 3	2	3	3	3	2	1	3	2	2	2	3	3	2	2	3	2
CO 4	2	2	2	3	3	1	3	3	3	3	2	2	2	3	3	3
CO 5	3	2	3	3	2	1	3	3	3	2	3	3	2	2	3	2
Avg	2.5	2.5	2	2.75	2.5	1.25	2.75	2.5	2	2.25	2.25	2.25	2.25	2.25	2.75	2.5

CS3501	Title: Operating System	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To study and apply concepts relating to operating systems, such as concurrency and control of asynchronous processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization	
Expected Outcome	Demonstrate an understanding of differences between processes and threads. The different process or thread synchronization methods and the tradeoffs between them.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to operating system	4
Introduction to OS, Its need and operating system services, Operating system Classification –Single user, Multi user, Simple batch Processing, Multiprogramming, Multitasking, Parallel systems, Distributed system & Real time system (overview).		
Unit II	Process Management	5
Process Concept, Interprocessor communication- Race conditions –Critical Sections –Mutual Exclusion – Busy waiting – Sleep and Wakeup – semaphores- Event counter – Monitors- Message passing, Threads, Process scheduling & CPU scheduling – Round robin scheduling – priority scheduling – multiple queues- shortest job first- guaranteed scheduling- two –level scheduling.		
Unit III	Memory Management	5
Logical versus Physical Address space, Swapping –Multiprogramming with fixed and variable partitions- Memory management with bit maps, linked list, buddy system- allocation of swap space. Virtual memory- paging and segmentation, page tables, associative memory- inverted page tables. Allocation algorithm, Page replacement algorithm, thrashing.		
Unit IV	File System	6
File systems and I/O files. Directories- file system implementation- security and protection mechanisms. Principles of I/O hardware – I/O devices- device controllers-DMA. Principle of I/ O software – Interrupt handles- device drivers – Disk Scheduling- Clock and terminals. I/O buffering –RAID –Disk cache, FCFS scheduling , SSTF scheduling, SCAN Scheduling, C- SCAN scheduling, Selecting disk scheduling algorithms,		
Unit V	Deadlock	4
Deadlock - conditions for deadlock. Deadlock detection and recovery. Deadlock avoidance - resource trajectories - safe and unsafe states - bankers' algorithm. Deadlock prevention. Two phase locking – non- resource deadlocks – starvation, security mechanism and policy, Domain of protection, access matrix.		
Text Books	1. Milenekovie , "Operating System Concept", McGraw Hill. 2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (ASIA) Pvt. Ltd.	
Reference Books	1. Harvey M. Deitel, Paul J. Deitel, and David R. Choffnes, "Operating Systems", Prentice Hall. 2. Petersons, "Operating Systems", Addision Wesley.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3501

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand basics of Operating System, Different types osOS,and importance of OS	2	Emp
CO2	Students should be able to Describe the working of process in detail , how cpu schedule and how dead lock occur and prevent from deadlock	2	Ent
CO3	Students should be able to Understand the concepts and implementation Memory management policies and virtual memory	2	S
CO4	Students should be able to Understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS	3	Emp
CO5	Students should be able to Understand the working of file management how data is stored into memory and how it will transmit from one side to another in computer system	3	Emp

CO-PO Mapping for CS3501

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	3	2	2	2	3	2	3	2	2	2	3	2	2
CO 2	2	2	2	2	2	2	1	2	2	2	1	2	2	2	2	3
CO 3	3	3	2	2	3	2	2	3	3	2	2	3	3	2	3	2
CO 4	3	2	3	3	2	2	2	3	2	3	2	2	2	3	2	3
CO 5	2	3	2	2	2	3	2	2	3	2	3	3	3	2	2	2
Avg	2.60	2.40	2.40	2.40	2.20	2.20	1.80	2.60	2.40	2.40	2.00	2.40	2.40	2.40	2.20	2.40

CS3502	Title: Web Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The Objective of this subject is to describe the concept of Web Technology, and queries, maintain and manage the data into the DB using Web, how to design Web Pages using HTML, XML, DHTML and Scripts.	
Expected Outcome	After completion o f this subject students will be able to: Designing of Web Sites/ Web Pages. Fetching Data from the backend to frontend. Perform the queries on the DB from front end. Handling of Data from frontend.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Internet Principles and Components	7
History of the Internet and World Wide Web-HTML; protocols – HTTP, SMTP, POP3, MIME, IMAP. Domain Name Server, Web Browsers and Web Servers.		
Unit II	Html, Dhtml And Xml	8
List, Tables, Images, Forms, Frames, CSS Document type definition, Dynamic HTML, XML schemes, Object Models, Presenting XML, Using XML Processors: DOM and SAX, Introduction to Java Script, Object in Java Script, Dynamic HTML with Java Script.		
Unit III	Web Services	7
Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. Ajax – Improving web page performance using Ajax, Programming in Ajax. CORBA		
Unit IV	Web 2.0	7
Interactive and social web: Blogs, wikis, and social networking sites – The technology behind these applications- AJAX, RSS and syndication, Ruby on Rails, Open APIs		
Unit V	Web 3.0	7
Semantic Web, Widgets, drag & drop mashups (I Google) - The technology behind these applications- RDF Web based Information Systems, Search engines, Recommender Systems, Web Mining		
Text Books	1. Burdman, “Collaborative Web Development” Addison Wesley. 2. Chris Bates, “Web Programing Building Internet Applications”, 2nd Edition, WILEY, Dreamtech	
Reference Books	1. Joel Sklar , “Principal of web Design” Vikash and Thomas Learning 2. Jon Duckett, “Beginning Web Programming with HTML, XHTML, and CSS”, Wiley India Pvt Ltd (June 2008) 3. http://ugweb.cs.ualberta.ca/~c410/F06/schedule/index.html	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3502

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Know about the History of the Internet and World Wide Web-HTML, gain the knowledge of protocols – HTTP, SMTP, POP3, MIME, IMAP. Domain Name Server, Web Browsers and Web Servers.	2	Emp
CO2	Students should be able to understand about List, Tables, Images, Forms, Frames, CSS Document type definition, Dynamic HTML, XML schemes, Object Models, Presenting XML, Using XML Processors: DOM and SAX, Introduction to Java Script, Object in Java Script, Dynamic HTML with Java Script.	2	Ent
CO3	Students should be able to get the knowledge of about Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. Ajax – Improving web page performance using Ajax, Programming in Ajax. CORBA	2	S
CO4	Students should be able to gain the knowledge of Interactive and social web: Blogs, wikis, and social networking sites – The technology behind these applications- AJAX, RSS and syndication, Ruby on Rails, Open APIs	3	Emp
CO5	Students should be able to Introduce to Semantic Web, Widgets, drag & drop mashups (I Google) - The technology behind these applications- RDF Web based Information Systems, Search engines, Recommender Systems, Web Mining.	3	Emp

CO-PO Mapping for CS3502

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	3	2	2	2	3	2	3	2	2	2	3	2	2
CO 2	2	3	2	2	2	2	1	2	2	2	2	2	1	3	2	3
CO 3	3	2	3	2	3	2	2	3	3	2	3	2	2	2	3	2
CO 4	3	2	2	3	2	2	2	3	2	3	2	2	2	2	2	3
CO 5	2	2	3	2	2	3	2	2	3	2	2	3	2	2	2	2
Avg	2.60	2.20	2.40	2.40	2.20	2.20	1.80	2.60	2.40	2.40	2.20	2.20	1.80	2.40	2.20	2.40

CSE-AIML Specialization

CS3523	Title: Machine Learning and Pattern Recognition	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning	
Expected Outcome	• On completion of this course, the students are expected to learn • 1. Basic Algorithms of Machine Learning • 2. Supervised and Unsupervised Learning • 3. Linear Regression, Classification, Tree, PCA, SVD, SVM, Resampling Methods and Optimization Techniques	

Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Learning systems, real world applications of machine learning, why machine learning, variable types and terminology, function approximation		
Unit II	Types of machine learning	7
Supervised learning, unsupervised learning, reinforcement learning		
Unit III	Important concepts of machine learning	7
Parametric vs non-parametric models, the trade-off between prediction accuracy and model interpretability, the curse of dimensionality, measuring the quality of fit, bias-variance trade off, overfitting, model selection, no free lunch theorem		
Unit IV	Linear Regression	7
Linear regression, estimating the coefficients, accessing the accuracy of coefficient estimates, accessing the accuracy of the model, multiple linear regression, qualitative predictors		
Unit V	Classification	8
Logistic regression, estimating regression coefficients, making predictions, multiple logistic regressions, linear discriminant analysis, bayes' theorem of classification, LDA for p=1, LDA for p>1, quadratic discriminant analysis		

Text Books	Machine Learning by Tom M. Mitchell - McGraw Hill Education; First edition
Reference Books	Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop - Springer; 1st ed. 2006. Corr. 2nd printing 2011 edition
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3523

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand Basic Algorithms of Machine Learning	2	Emp
CO2	The student should be able to understand about Supervised and Unsupervised Learning	2	S
CO3	The student should be able to learn about Linear Regression, Classification, Tree, PCA, SVD, SVM, Resampling Methods and Optimization Techniques	2	S

CO-PO Mapping for CS3523

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	2	2	1	2	1	2	3	2	3	1	2	1	2
CO 2	2	1	3	2	3	1	2	2	3	2	3	2	2	3	2	2
CO 3	2	3	3	2	2	3	2	3	2	2	3	2	1	2	1	2
Avg	2	1.5	2.75	2	2.5	1.5	2	2	2.5	2.25	2.75	2.25	1.5	2.5	1.5	2.25

CS3524	Title: Machine Learning Practical with Python, Scikit-learn, Matplotlib, TensorFlow	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning	
Expected Outcome	On completion of this course, the students are expected to learn 1. Experiment with basic Algorithms of Machine Learning 2. Experiment with Supervised and Unsupervised Learning 3. Experiment with Linear Regression, Classification, Tree, PCA, SVD, SVM, Resampling Methods and Optimization Techniques	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Resampling Methods, Model Selection and Regularization	7
Cross-validation, leave-one-out cross- validation, k-fold cross-validation, the bootstrap, subset selection, shrinkage methods, ridge and lasso regression, dimension reduction methods, principal components regression, partial least square		
Unit II	Tree Based Methods	7
Advantages and disadvantages of trees, regression Trees, classification trees, bagging, random forest, boosting		
Unit III	Support Vector Machine	8
Maximum margin classifier, classification using a separating hyperplane, the maximal margin classifier, support vector classifier, support vector machines		
Unit IV	Classification	7
Classification with non-linear decision boundaries, support vector machine, one-versus-one classification, one-versus-many classification		
Unit V	Unsupervised Learning	7
Principle component analysis, what are principal components, clustering methods, k-means clustering, hierarchical clustering, Independent component analysis, latent semantic indexing, Markov Models, Hidden Markov Models		
Text Books	Material Provided by Samatrix	
Reference Books	Material Provided by Samatrix	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3524

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Experiment with basic Algorithms of Machine Learning	3	Emp
CO2	Experiment with Supervised and Unsupervised Learning	3	Emp
CO3	Experiment with Linear Regression, Classification, Tree, PCA, SVD, SVM, Resampling Methods and Optimization Techniques.	3	S

CO-PO Mapping for CS3524

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO 11	PO1 2	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	2	1	2	3	2	1	1	2	2	3	3	2	3
CO 2	3	2	3	3	2	3	1	3	1	2	3	3	1	2	3	2
CO 3	2	2	2	2	2	1	1	2	2	2	2	2	2	2	1	2
Avg	2.5	1.75	2.5	2.5	2	2	1.75	2.5	1.5	1.75	2.25	2.5	2.25	2.25	2.25	2.25

CSE-CSCQ Specialization

CS3551	Title: Linux and Virtualization	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To understand and make effective use of linux utilities and shell scripting language to solve problems	
Expected Outcome	Students will be able to understand the basic commands of linux operating system and can write shell scripts.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Virtualization	6
Introduction, Virtual Machines Explanation, Key properties of VM, The connection of VM on the physical network.		
Unit II	Linux Installation	6
Installation, Connection with Putty, Apache server setup, WinScP, Backup of VM.		
Unit III	Booting up with Kali Linux	6
Managing Kali with Service, Default root password, SSH Service, HTTP Service		
Unit IV	Linux Commands	6
Basics and Networking.		
Unit V	Infrastructure Security	6
Securing the Network & User Devices		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3551

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	student should be able to install linux by using virtual machines.	2	Emp
CO2	student should be able to backup of virtual machines.	2	Emp
CO3	student should be able to create connection with putty.	3	S

CO-PO Mapping for CS3551

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	2	2	2	3	2	1	2	2	2	3	3	2	3
CO 2	3	2	3	3	3	3	1	3	1	3	3	3	1	2	3	2
CO 3	2	2	2	2	1	1	1	2	2	2	2	1	2	2	1	2
Avg	2.33	1.67	2.33	2.33	2.00	2.00	1.67	2.33	1.33	2.33	2.33	2.00	2.00	2.33	2.00	2.33

CS3552	Title: Cryptography	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To understand the fundamentals of Cryptography by acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.	
Expected Outcome	Students will be able to analyze the vulnerabilities in any computing system and hence be able to design a security solution. Identify the security issues in the network and resolve it	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Cryptography	6
History, Symmetric Key Cryptography, Asymmetric Key Cryptography, Data Integrity Algorithms , Digital Signature , Secure Communication		
Unit II	Cryptography Objectives	6
Secure Storage, DES, AES, RSA, Confidentiality, Data Integrity		
Unit III	Public Key Infrastructure	6
Authentication, Non-Repudiation		
Unit IV	Steganography & possible attack on it	6
Tools: S-Tool, Xiao and HxD		
Unit V	Cryptography in Internet Security Protocol	6
Basic Concepts, Secure Socket Layer , Transport Layer Security ,Email Security ,Secure Hyper Text Transfer Protocol		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3552

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the concept of Digital Signature	2	Emp
CO2	The student should be able to understand the concept of Data Integrity Algorithms	2	Emp
CO3	The student should be able to understand the concept of Public Key Infrastructure	2	S

CO-PO Mapping for CS3552

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	2	2	2	3	2	2	2	2	2	3	2	2	2
CO 2	3	2	3	3	3	3	1	3	3	3	3	3	1	3	3	3
CO 3	2	2	2	2	1	1	1	2	2	2	1	1	2	2	2	1
Avg	2.33	1.67	2.33	2.33	2.00	2.00	1.67	2.33	2.33	2.33	2.00	2.00	2.00	2.33	2.33	2.00

CS3553	Title: Advance of Information Security	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To understand the fundamentals of identify some of the factors driving the need for network security, identify and classify particular examples of attacks and define the terms vulnerability, threat and attack	
Expected Outcome	Students will be capable of demonstrating advanced knowledge in the field of cyber and information security in general and on the following particular topics: computer and network security, security management, incident response, computational and digital forensics, biometrics, privacy, and security of critical infrastructure.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Network Security	6
Basic concepts in network security, Network Security Technology		
Unit II	Security Lab Setup	6
Hardware Requirements , Software Requirements		
Unit III	Network Security Overview	6
Security Devices like - Firewall, UTM ,Packet Analysis Fundamentals ,DMZ, Network Segmentation, VLan		
Unit IV	Web App Security Testing	6
IPSec, VPN, DNSSEC, Damn Vulnerable Web App, Secure Deployment and Development, Basic concepts in software development security, Emerging issues in software development security		
Unit V	Software Development Security	6
What is VAPT,Linux Installation & Basic Commands ,VAPT Process, Vulnerability Assessment Tools ,Planning & Recon, Enumeration/Scanning, Exploitation , Reporting, Common Threats ,E-Mail Security, Firewalls-need and Features of firewall Types of Firewall LAB,Intruder Detection Systems LAB		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3553

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the concepts of information security	2	Emp
CO2	Students will able to understand and implement the various kind of algorithm for security	2	Ent
CO3	The student should be able to undersand the concepts of digital signature and get how to implement it on latest technology	2	Emp

CO-PO Mapping for CS3553

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	1	2	2	3	2	2	2	2	1	2	2	2	2
CO 2	3	2	3	2	3	3	1	3	3	3	3	2	3	3	3	3
CO 3	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	1
Avg	2.33	1.67	2.33	1.67	2.33	2.33	1.67	2.33	2.33	2.33	2.33	1.67	2.33	2.33	2.33	2.00

Semester-6

CS3604	Title: Compiler Design	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims to introduce the concept, working and internal structures of compilers as well as errors.	
Expected Outcome	● The student should be able to realize basics of compiler design and apply for real time applications, To develop an awareness of the function and complexity of modern compilers ● The student should be able to understand the different types of parsing techniques and should be in a position to solve the problem ● The student should be able to analyse the program and minimize the code which helps in reducing the no. of instructions in a program and also utilization of registers in an effective way. ● The student should be able to draw the flow graph for the intermediate codes,To apply the optimization techniques to have a better code for code generation ● The student should be able to apply the code generation algorithms to get the machine code for the optimized code, To represent the target code in any one of the code formats,To understand the machine dependent code	
Unit No.	**Unit Title**	**No. of Hrs (Per Unit)**
Unit I	**Introduction**	**5**
Compilation Process, Phases and passes of compiler, Bootstrapping, Cross Compiler Lexical Analysis: Regular expressions and their applications to lexical analysis, Optimization of DFA-Based Patterns in lexical analysis, Matcher's implementation of lexical analyzer, LEX compiler		
Unit II	**Syntax Analysis**	**4**
BNF, CFG and CFL, Parse Tree, Ambiguity, Elimination of Left-recursion & Left factoring, Top down parsing: Backtracking, LL (1), recursive descent parsing, Predictive parsing,. Bottom up parsing: Handles & handle pruning, Shift Reduce parsing, Stack implementation of Shift-reduce parsing, Conflicts during Shift-reduce parsing, SLR, LR (0), LR (1), CLR and LALR (LR (k)) parsing, Error recovery in parsing, handling ambiguous grammar, YACC – automatic parser generator		
Unit III	**Semantic Analysis**	**5**
Intermediate forms of source Programs – abstract syntax tree, polish notation and three address codes. Attributed grammars, Syntax directed translation, S-attributed, L-attributed translation schemes, Conversion of Programming language Constructs into Intermediate code forms, Type checking. Symbol table management, Organization for block structures, hashing, and Tree representation of scope information		
Unit IV	**Code Optimization**	**6**
Static and Dynamic storage allocation, storage allocation for heaps, arrays, strings and records. Code optimization: Scope of Optimization, local optimization, loop optimization, peephole optimization, frequency reduction, folding, DAG representation & DAG for register allocation. . Data flow analysis**:** Flow graph, data flow equation, global optimization, redundant sub expression elimination, Induction variable elements, Live variable analysis, Copy propagation		
Unit V	**Code Generation**	**4**
Object code forms, machine dependent code optimization, register allocation and assignment generic code generation algorithms,		
Text Books	1.Aho, Sethi and Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education 2.V Raghvan, " Principles of Compiler Design", TMH	
Reference Books	1.K. Muneeswaran,Compiler Design,First Edition,Oxford University Press. 2.J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill.	
Mode of Evaluation	Internal and External Examinations	

Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3604

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Realize basics of compiler design and apply for real time applications, To develop an awareness of the function and complexity of modern compilers	2	Emp
CO2	Students should be able to Understand the different types of parsing techniques and should be in a position to solve the problem	2	Ent
CO3	Students should be able to Analyse the program and minimize the code which helps in reducing the no. of instructions in a program and also utilization of registers in an effective way.	2	S
CO4	Students should be able to Draw the flow graph for the intermediate codes,To apply the optimization techniques to have a better code for code generation	3	Emp
CO5	Students should be able to Apply the code generation algorithms to get the machine code for the optimized code, To represent the target code in any one of the code formats,To understand the machine dependent code	3	Emp

CO-PO Mapping for CS3604

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	1	1	2	3	2	1	1	2	3	1	3	2	3
CO 2	3	2	3	1	2	3	1	3	1	2	3	1	1	2	3	2
CO 3	2	2	2	3	2	1	1	2	3	2	1	1	1	2	1	2
CO 4	3	2	3	2	3	2	2	3	2	3	2	2	3	2	3	2
CO 5	3	2	2	3	2	2	2	2	3	2	2	2	3	2	2	3
Avg	2.60	1.80	2.40	2.00	2.00	2.00	1.80	2.40	2.00	2.00	2.00	1.80	1.80	2.20	2.20	2.40

CS3641	Title: Compiler Design Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Explain the importance of compiler design. Design and implementation of lexical analyzer using lex tools. Explain the top down and bottom up parsing techniques using programming. Identify the understanding language peculiarities by designing a complete translator for mini language .Explain that computing science theory can be used as the basis for real applications.	
Expected Outcome	Understand the working of lex and yacc compiler for debugging of programs .Understand and define the role of lexical analyzer, use of regular expression and transition diagrams. Understand and use Context free grammar, and parse tree construction. Learn & use the new tools and technologies used for designing a compiler. Develop program for solving parser problems. Learn how to write programs that execute faster.	

List of Experiments

1. Write a C program to identify whether a given line is a comment or not.
2. Write a C program to recognize strings under 'a','a*b+','abb'.
3. Write a C program to test whether a given identifier is valid or not.
4. Write a C program to simulate lexical analyzer for validating operators.
5. Write a C program for constructing of LL(1) parsing.
6. Write a C program for constructing recursive descent parsing.
7. Write a C program to implement LALR parsing.
8. Write a C program to implement operator precedence parsing.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3641

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Realize basics of compiler design and apply for real time applications, To develop an awareness of the function and complexity of modern compilers.	2	Emp
CO2	Students should be able to Analyse and implement the program and minimize the code which helps in reducing the no. of instructions in a program and also utilization of registers in an effective way.	2	Ent
CO3	Students should be able to learn how to write programs that execute faster.	2	S

CO-PO Mapping for CS3641

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	1	2	2	2	2	1	1	2	2	2	2	2	1
CO 2	3	3	2	3	3	3	3	2	3	3	3	3	3	3	2	3
CO 3	2	2	2	3	2	2	2	2	3	2	3	3	2	2	2	3
Avg	2.33	2.33	2.00	2.33	2.33	2.33	2.33	2.00	2.33	2.00	2.67	2.67	2.33	2.33	2.00	2.33

CS3642	Title: Technical VAP I	L T P C 0 0 2 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims brush-up the topics important in terms of placement activity.	
Expected Outcome	• Students can take the basic concepts of programming languages • Students can be able to manage database system • Students can understood the concepts of machine learning	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	HTML,CSS & Java Script	5
HTML5,CSS, Java Script, Overview with implementation details, Interview Questions with Solutions SET-1(50 Questions) SET-2 For Exercise, Previous Year Placement Paper Discussion and solution		
Unit II	Python	4
Python Overview with implementation details and its libraries, Interview Questions with Solutions SET-1(50 Questions) SET-2 For Exercise for python and Machine Learning,		
Unit III	Machine Learning	5
Machine Learning Overview and Implementation Details with Interview Questions, Previous Year Placement Paper Discussion and solution for Python and Machine Learning		
Unit IV	PHP	6
Introduction to PHP and its platform configuration using XAMPP, Overiew of CMS (Wordpress) and PHP Framework, Interview Questions with Solutions SET-1(50 Questions) SET-2 For Exercise for PHP		
Unit V	Core & Advance Java, C & C++	4
Advance Java, C &C++ Overview and Implementation Details with Interview Questions, Previous Year Placement Paper Discussion and solution		
Text Books	1.Practice material	
Reference Books	1.Practice Material	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3642

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand the concepts of HTML,CSS	2	Emp
CO2	Understand the concepts of python language	2	Ent
CO3	Understand the concepts of Machine learning	2	S
CO4	Understand the concepts of PHP language	3	Emp
CO5	Understand the concepts of C++ programming language	3	Emp

CO-PO Mapping for CS3642

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	2	2	2	1	2	2	1	2	2	2	2	2	1
CO 2	3	3	2	3	3	2	3	3	3	3	3	3	3	3	2	3
CO 3	2	2	2	2	2	2	3	2	2	2	3	3	2	2	2	3
Avg	2.33	2.33	2.00	2.33	2.33	2.00	2.33	2.33	2.33	2.00	2.67	2.67	2.33	2.33	2.00	2.33

CSE without Specialization

CS3601	Title: Artificial Intelligence	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Introduce the concepts of Artificial Intelligence, Searching methods. Knowledge representation methods and expert system.	
Expected Outcome	● The student should be able to understand the concepts of artificial intelligence. Students will also learn the various searching methods. ● Student will understand the various types of knowledge representation techniques required in artificial intelligent machines ● Students will understand reasoning during the condition of uncertainty ● Students will learn about different types of learning methods ● Students will learn about the various methods of reducing the search path in a problem.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Al And Production Systems	6
Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics, Water Jug Problem, Search techniques- Hill Climbing, Best first search, A* algorithm, AO* algorithm, Constraint Satisfaction,.		
Unit II	Knowledge Representation	5
Approaches and issues in knowledge representation, Knowledge Based Agent, Propositional Logic, Predicate logic, Forward and backward deduction, Unification, Resolution, Weak slot – filler structure, Strong slot - filler structure.		
Unit III	Reasoning Under Uncertainty	4
Logics of non-monotonic reasoning, Implementation, Basic probability notation, Bayes rule, Certainty factors and rule based systems, Bayesian Theory - Bayesian networks, Dempster - Shafer Theory, Fuzzy Logic.		
Unit IV	Introduction to Learning	4
Planning with state space search, conditional planning, continuous planning, Multi-Agent planning. Forms of learning - inductive learning – Reinforcement Learning -- Neural Net learning, Supervised learning, unsupervised learning		
Unit V	Advanced Topics	5
Game Playing: Minimax search procedure - Adding alpha-beta cutoffs. Goal Stack Planning, Expert System, Roles of expert systems, Expert System shells - Knowledge Acquisition. Swarm Intelligent Systems – Ant Colony System		
Text Books	1.Elaine Rich, Kevin Knight and Shivashankar B.Nair, “Artificial Intelligence”, Tata Mc Graw-Hill. 2.Charnick “Introduction to Artificial Intelligence.” Addision Wesley.	
Reference Books	1.Winston, “LISP”, Addison Wesley. 2.Marcellous, “Expert Systems Programming”, PHI.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3601

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the concepts of artificial intelligence. also learn the various searching methods.	2	Emp
CO2	Student will understand the various types of knowledge representation techniques required in artificial intelligent machines	2	Ent
CO3	Student will Understand reasoning during the condition of uncertainty	2	S
CO4	Student will Learn about different types of learning methods	3	Emp
CO5	Student will Learn about the various methods of reducing the search path in a problem.	3	Emp

CO-PO Mapping for CS3601

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	3	3	3	3	2	3	2	2	2	3	3	3	3
CO 2	2	3	2	3	2	2	3	3	3	2	2	2	2	3	2	2
CO 3	2	2	3	2	3	3	3	3	2	2	3	2	3	2	3	3
CO 4	2	3	2	3	2	3	2	3	3	3	2	3	3	3	2	3
CO 5	3	3	2	3	2	3	3	3	2	2	3	2	2	3	2	3
Avg	2.25	2.5	2.5	2.75	2.5	2.75	2.75	2.75	2.75	2.25	2.25	2.25	2.75	2.75	2.5	2.75

CS3603	Title: Distributed Operating System	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The main objective of his course is to introduce the fundamental of Distributed Operating System and to demonstrate the Process, Memory, File Management, Communication and Synchronization, Naming, Consistency and replication, Fault Tolerance in Distributed Environment.	
Expected Outcome	● The student should be able to understand the use of DOS concepts, its architecture and various challenges and issues in DOS network ● The student should be able to understand the DOS processes, synchronization and communication ● The student should be able to develop and understand exception handling, multithreaded applications and recovery ● The student should be able to understand DFS implementation, page and object based distributed shared memory, replacement strategy and thrashing. ● The student should be able to develop andunderstand the use access control techniques, and web applications of distributed web-based system.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Fundamentals of Distributed Operating System	7
Introduction of Operating System and the types, Hardware Concept, Software Concept, Process Management, Memory Management and File Management, Design Issues of Distributed Operating System, True Distributed System and Real Time Sharing ,Multiprocessor System, Overview of Computer Network, Client Server Architecture, Resource Sharing and web challenges		
Unit II	Communication and Synchronization in Distributed Operating System	8
Critical Section Problem and Traditional Synchronization Problems, Inter Process Communication(IPC) and Remote Procedure Call(RPC), Synchronization in Object Based Systems, Election Algorithm ,Clock Synchronization(Logical, Physical and Vector) and related Algorithm, Transaction's Atomicity and Commit Protocols, Deadlock and Deadlock Handling, Agreement Protocols.		
Unit III	Process and Recovery in Distributed Operating System	7
Process Concept and Threads, Process Scheduling in Distributed Operating System, Process Migrations, Resource Management(Load Balancing and Sharing Approach), Fault Tolerance, Real Time Distributed Operating System(Design Issues, Communication and Scheduling), Synchronous and Asynchronous Check Pointing and Recovery, Distributed Debugging		
Unit IV	Distributed File System and Shared Memory	7
Introduction to Distributed File System, File Service Architecture, DFS Implementation (NFS, Google FS, Caching and Replication), Overview and Architecture of Distributed Shared Memory, Consistency Models, Shared Variable, Page and Object based Distributed Shared Memory, Distributed Scheduling, Replacement Strategy and Thrashing, Trends in Distributed Operating System		
Unit V	Security and Distributed Web Based System	7
Distributed Operating System Security, Need and Access Control Techniques, Naming Concept(DNS) and Name Cache, Distributed Web Based System – Architecture, Queues, Indexes and Load Balancers, Web Proxy Caching, Replication for Web Hosting System and Web Applications, Types of External Attacks		
Text Books	1.Asilberschatz P.B Garvin Operating System Concept, John Wiley and Sons(Asia). 2.P.K.Sinha, Distributed operating System: Concept and Design, IEEE Press	
Reference Books	1.Andrew.S.Tanenbaum, "Distributed Operating System", Pearson Education India. 2.Distributed System: Concept and Design by George Coulouris, Jean Dollimore, Tim Kindberg, Pearson.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of	14-11-2021	

Approval by the Academic Council on	

Course Outcome for CS3603

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the use of DOS concepts, its architecture and various challenges and issues in DOS network	2	Emp
CO2	Students should be able to Understand the DOS processes, synchronization and communication	2	Ent
CO3	Students should be able to Develop and understand exception handling, multithreaded applications and recovery	2	S
CO4	Students should be able to Understand DFS implementation, page and object based distributed shared memory, replacement strategy and thrashing	3	Emp
CO5	Students should be able to Develop and understand the use access control techniques, and web applications of distributed web-based system	3	Emp

CO-PO Mapping for CS3603

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	1	2	2	1	3	2	1	1	2	3	2	2	2	1
CO 2	3	2	2	2	3	2	2	1	2	1	2	2	2	3	1	1
CO 3	3	2	2	1	3	2	3	2	2	2	3	3	3	2	1	2
CO 4	2	3	2	2	2	1	2	1	1	1	2	2	2	1	1	1
CO 5	3	2	2	1	3	2	3	2	2	2	3	3	2	3	1	1
Avg	2.5	2	1.75	1.75	2.5	1.5	2.5	1.5	1.5	1.25	2.25	2.5	2.25	2	1.25	1.25

CS3640	Title: Artificial Intelligence using Python Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Identify innovative research directions in Artificial Intelligence. Providing quality education and practical skills to the students and faculty.	
Expected Outcome	● Students should be able to undersatand about the basic of AI programming languages ● Students should be able to understand the programming concepts of LISP ● Students should be able to understand the programming concepts of PROLOG	

List of Experiments

1. Explain the basic list manipulating functions.
2. Define the different basic structure of a function in python.
3. Write a program in python to add two numbers.
4. Write a program in python to show the use of arithmetic operators.
5. Write a program in python to find the factorial of a positive integer.
6. Write a program in python to add the elements of a list. With or without inbuilt functions.
7. Write a program in python to concatenate two lists with or without inbuilt functions.
8. Write a program in python to find nth element of a list.
9. Write a program of BFS in python and search an element.
10. Write a program of A* search in python and search an element.
11. Write a python program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 & 2000.
12. Write a python program to check the elements is in the list or not by using linear search or binary search.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3640

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to Understand about the basic of AI programming languages	2	Emp
CO2	Students should be able to Understand the programming concepts of LISP	2	Ent
CO3	Students should be able to Understand the programming concepts of PROLOG	2	S

CO-PO Mapping for CS3640

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	1	2	1	2	1	1	2	1	1	2	2	3	1	2	1
CO 2	3	3	2	3	3	1	3	2	3	3	3	3	3	3	2	3
CO 3	3	3	1	3	2	1	3	1	3	2	3	3	3	3	1	3
Avg	3.00	2.33	1.67	2.33	2.33	1.00	2.33	1.67	2.33	2.00	2.67	2.67	3.00	2.33	1.67	2.33

CSE-AIML Specialization

CS3624	Title: Deep Learning Practical with Python, TensorFlow and Keras	L 2	T 0	P 0	C 2
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.				
Expected Outcome	On completion of this course, the students are expected to learn 1. Experiment with Neural Network, Feed Forward and Backpropogation 2. Experiment with TensorFlow and Keras 3. Experiment with RNN, CNN, Autoencoders				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	Moving beyond gradient descent	5			
Local minima vs global minima vs saddle, model identifiability, correcting gradient points in wrong directions, Momentum based optimization, second order methods, learning rate adaption, adagrad, rmsprop, adam.					
Unit II	Convolutional Neural Network-I	4			
Convolution operation, filters and feature maps, motivation, sparse interactions, parameter sharing and equivariant representation, padding and stride.					
Unit III	Convolutional Neural Network-II	5			
Max pooling, full architectural description of convolutional network, build cnn using data augmentation, using pretrained convnet, visualize what convnet learn.					
Unit IV	Embedding and Representation Learning	6			
Principle component analysis, working with text data, one-hot encoding of words and characters, word embedding, autoencoder architecture, denoising, sparsity, Word2vec framework, Skip-Gram architecture.					
Unit V	Models for Sequence Analysis	4			
Analysing Variable-length inputs, Seq2seq with neural n-gram, part of speech tagger, dependency parse, syntaxnet, recurrent neural network, challenges with vanishing gradients, long short term memory units					
Text Books	Material Provided by Samatrix				
Reference Books	Material Provided by Samatrix				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studied on	09-08-2021				
Date of Approval by the Academic Council on	14-11-2021				

Course Outcome for CS3624

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The students are expected to learn-Experiment with Neural Network, Feed Forward and Backpropagation	2	Emp
CO2	The students are expected to learn-Experiment with TensorFlow and Keras	2	S
CO3	The students are expected to learn-Experiment with RNN, CNN, Autoencoders.	2	Emp..

CO-PO Mapping for CS3624

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	3	1	1	2	3	3	2	2	2	1	3	2	3
CO 2	3	2	3	2	1	2	3	2	2	3	3	3	1	2	3	2
CO 3	2	2	2	2	3	2	1	2	2	1	1	2	1	2	1	2
Avg	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2

CS3648	Title: Advanced Python Programming Lab	L T P C 0 0 4 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Identify innovative research directions in Artificial Intelligence. Providing quality education and practical skills to the students and faculty.	
Expected Outcome	Recent advances in computational speed, data storage, data retrieval, sensors, and algorithms have combined to dramatically reduce the cost of machine learning-based predictions.	

List of Experiments

1. Numpy , Pandas ,and matplotlib library basic implementation.
2. Write a NumPy program to save a given array to a text file and load it.
3. Write a NumPy program to create a 3x3x3 array filled with arbitrary values
4. Write a NumPy program to convert a given array into a list and then convert it into a list again.
5. Write a NumPy program to create a 10x10 matrix, in which the elements on the borders will be equal to 1, and inside 0.
6. Write a NumPy program to compute the x and y coordinates for points on a sine curve and plot the points using matplotlib
7. Write a Pandas program to get the powers of an array values element-wise. Note: First array elements raised to powers from second array

Sample data: {'X':[78,85,96,80,86], 'Y':[84,94,89,83,86],'Z':[86,97,96,72,83]}
Expected Output:
X Y Z
0 78 84 86
1 85 94 97
2 96 89 96
3 80 83 72
4 86 86 83

8. Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels. Sample Python dictionary data and list labels:

exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily', 'Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'],
'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],
'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],
'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}
labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j'] Expected Output:
attempts name qualify score a 1
Anastasia yes 12.5
b 3 Dima no 9.0
.... i 2 Kevin no 8.0
j 1 Jonas yes 19.0

9. Write a Python program to draw a line with suitable label in the x axis, y axis and a title
10. Write a Python program to draw a line using given axis values taken from a text file, with suitable label in the x axis, y axis and a title.

Test Data: test.txt 1 2
2 4
3 1

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021

Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3648

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Student should be able to implement different library functions	2	Emp
CO2	Student should be able to perform different programs for different libaries in Python	2	S
CO3	Student should be able to implement real problem based projects based on machine learning, deep learning etc.	2	S

CO-PO Mapping for CS3648

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	3	2	2	2	3	2	2	3	2	3	3	3	3	2
CO 2	3	3	3	2	3	3	2	3	3	3	3	3	3	2	3	3
CO 3	3	3	3	3	2	3	3	3	2	2	3	3	2	2	3	3
Avg	3.00	2.67	3.00	2.33	2.33	2.67	2.67	2.67	2.33	2.67	2.67	3.00	2.67	2.33	3.00	2.67

CS3649	Title: Operating System Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To implement different threats, process scheduling and memory.	
Expected Outcome	.Ability to understand the components of operating system and interaction among various components.	

List of Experiments

1. Design, develop and execute a program using any thread library to create number of threads specified by the user ,each thread independently generate a random integer as an upper limit and then computes and prints the number of primes less than or equal to that upper limit along with that upper limit.

2. Rewrite above program such that the processes instead of threads are created and the number of child processes created is fixed as two. The program should make use of kernel timer to measure and print the real time, processor time user space time and kernel space for each process

3. Design, develop and implement a process with a producer thread and a consumer thread which make use of bounded buffer (size can be prefixed at a suitable value) for communication. Use any suitable synchronization construct.

4. Design and execute a program to solve a system of n linear equations using Successive Over relaxation method and n processes which use Shared Memory API.

5. Design, develop, and execute a program to demonstrate the use of RPC.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3649

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students should be able to identify basic components of operating system.	2	Emp
CO2	Students should be able to conceptualize synchronization amongst various components of a typical operating system.	2	S
CO3	Students should be able to understand and simulate activities of various operating system components.	2	Emp

CO-PO Mapping for CS3649

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	3	3	3	3	2	2	3	2	3	3	3	3	2
CO 2	3	2	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO 3	2	3	2	2	2	3	3	3	2	2	3	3	2	2	3	3
Avg	2.33	2.33	2.33	2.67	2.33	3.00	2.67	2.67	2.33	2.67	2.67	3.00	2.67	2.33	3.00	2.67

CSE-CSCQ Specialization

CS3652	Title: Digital Forensics Part-2	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, Examination, analysis, and reporting.	
Expected Outcome	Students will be able to understand the origins of forensic science, explain the difference between scientific conclusions and legal decision-making and explain the role of digital forensics and the relationship of digital forensics to traditional forensic science, traditional science and the appropriate use of scientific methods	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Live Forensics	6
Evidence Analysi, Gathering RAM Dump, Analyzing RAM Dump, Identifying trace between RAM data & Storage Media		
Unit II	Tools	6
Dumpit, Redline, Volatility, Ram Capturer, Registry Forensics		
Unit III	Important Windows Artifacts	6
Introduction, Pagefile, Temp File, Hyberfil.sys, Thumb file, Prefetch file, Registry, App Data, Host File, SAM file		
Unit IV	Password Bypass - offensive & Forensics	6
Live Usb, Cain & Able, Passware Kit Forensics		
Unit V	USB Forensics	6
Introduction to USB Forensics		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3652

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the Windows Forensics.	2	Emp
CO2	The student should be able to understand the Live Forensics.	2	Ent
CO3	The student should be able to understand Password recovery techniques.	2	Emp

CO-PO Mapping for CS3652

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	3	3	3	3	3	2	2	3	2	3	3	3	3	2
CO 2	3	2	2	3	2	3	2	3	3	3	3	2	3	2	3	3
CO 3	2	3	2	3	3	3	3	3	2	2	3	2	3	3	3	3
Avg	2.33	2.33	2.33	3.00	2.67	3.00	2.67	2.67	2.33	2.67	2.67	2.33	3.00	2.67	3.00	2.67

CS3653	Title: Introduction to Risk Management and Cyber Laws	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To examine how the online digital world has been inflicted with new cybercrimes, implications for society and law enforcement response and investigating how the computer and electronic devices have become both a target of attack and a tool for criminal activity	
Expected Outcome	Students will be able to implications for society and law enforcement response and investigating how the computer and electronic devices have become both a target of attack and a tool for criminal activity	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Standards, Frameworks and Guidelines	6
Introduction Risk, threats, vulnerabilities, Risk management ,Risk Management Standards, ISO 27001, CoBit, PCI DSS, Business Continuity Plan		
Unit II	Understanding Risk	6
How to Perform a Simple Risk Assessment , Risk Assessment Case Study, Formal Risk Management Models & Tools, Control Focused Risk Management, Event Focused Risk Management, Presenting Risk to Business Owners		
Unit III	Email- Offences & Investigation	6
Email Working, Email Header Analysis, Crafting Tracing Email		
Unit IV	Server Log- Offences & Investigation	6
Server Log Investigation, Risk Remediation & Response, Tracking Long Term Risk		
Unit V	Cyber Laws and Case Studies	6
Cyber Laws and Case Studies		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3653

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the Introduction to Standards, frameworks and guidelines.	2	Emp
CO2	The student should be able to implement the Email offences and Investigation.	2	Ent
CO3	The student should be able to understand the Server log offences and Investigation	2	Emp

CO-PO Mapping for CS3653

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	2
CO 2	2	2	2	3	2	3	2	3	2	3	3	2	3	2	3	3
CO 3	2	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3
Avg	2.33	2.33	2.33	3.00	2.67	3.00	2.67	3.00	2.67	3.00	2.67	2.33	3.00	2.67	3.00	2.67

CS3654	Title: Malware Analysis and Reverse Engineering I	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.	
Expected Outcome	Students will be able to understand the origins of forensic science, explain the difference between scientific conclusions and legal decision-making and explain the role of digital forensics and the relationship of digital forensics to traditional forensic science, traditional science and the appropriate use of scientific methods	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	C/C++ from Reverse Engineering Perspective	6
Data Types and Memory layout		
Unit II	Windows Internals - Part 1	6
Windows Environment - User mode, Windows APIs, File System, Windows Registry, Process and Threads, Memory Management, Network functions		
Unit III	Malware Analysis Lab Setup - Part 1	6
Malware Analysis - Part 1,Trojan, Worm, Backdoor, Virus, Spyware, Keylogger		
Unit IV	Static Malware Analysis	6
Looking for uncommon and malicious traits , Secure SDLC		
Unit V	x86 Assembly Language	6
Registers, Instruction Types, Stack Basic		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3654

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the Windows Internals - Part 1	2	Emp
CO2	The student should be able to implement the C/C++ from reverse engineering perspective.	3	Ent
CO3	The student should be able to implement the x86 Assembly language.	3	Emp

CO-PO Mapping for CS3654

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	3	3	3	3	2	2	3	2	3	3	3	3	2
CO 2	3	2	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO 3	2	3	2	2	2	3	3	3	2	2	3	3	2	2	3	2
Avg	2.33	2.33	2.33	2.67	2.33	3.00	2.67	2.67	2.33	2.67	2.67	3.00	2.67	2.33	3.00	2.33

CS3643	Title: Linux Administration Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Identify innovative research directions in Artificial Intelligence. Providing quality education and practical skills to the students and faculty.	
Expected Outcome	Recent advances in computational speed, data storage, data retrieval, sensors, and algorithms have combined to dramatically reduce the cost of machine learning-based predictions.	

List of Experiments

1. Installation of Red HAT Linux operating system..
2. Partitioning drives
3. Configuring boot loader(GRUB/LILO)
4. Network configuration
5. Setting time zones, Creating password and user accounts
6. Software selection and installation.
7. Basic Commands.
8. Configure a Linux server and transfer files to a windows client.(Setting up NFS File Server)

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	09-08-2021
Date of approval by the Academic Council	14-11-2021

Course Outcome for CS3643

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to realize basics of compiler design and apply for real time applications, To develop an awareness of the function and complexity of modern compilers.	2	Emp
CO2	The student should be able to analyse and implement the program and minimize the code which helps in reducing the no. of instructions in a program and also utilization of registers in an effective way.	3	Emp
CO3	The student should be able to understand and implement the different types of parsing techniques and should be in a position to solve the problem	2	S

CO-PO Mapping for CS3643

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2
CO 2	3	3	2	3	2	3	2	3	3	2	3	2	3	2	3	3
CO 3	2	2	2	3	3	3	3	2	2	2	3	3	2	2	3	2
Avg	2.33	2.67	2.33	3.00	2.67	3.00	2.67	2.33	2.67	2.33	3.00	2.67	2.67	2.33	3.00	2.33

Semester-7

CS3701	Title: System Administration	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The main objective of his course is to introduce the fundamental of System Administration and to demonstrate the Process of Managing User Accounts, File Management, Configuring Firewall Security and Network Address Translation, Role of Network Information System with Backup and Recovery by a system administrator.	
Expected Outcome	After successful completion of the course students should be able to: ● To introduce the fundamental of System Administration. ● To demonstrate the Process of Managing User Accounts, File Management, Configuring Firewall Security. ● To comprehend and analyze the File System Management and Configuring TCP/IP Networking ● To understand the Network Address Translation, Role of Network Information System with Backup and Recovery by a system administrator. ● To understand the Concept of System Administration and describe challenges and problems associated with it.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Fundamentals of System Software Administration	7
Introduction of Assemblers, Cross Assemblers and Macro Processors, Features of a macro facility, Macro Assemblers, Loader schemes, Linking, Reallocation (static and dynamic linking), Overview of Binders, Overlays, Editors, andDebuggers.		
Unit II	Introduction to System Administration	8
Duties of the Administrator, Administration tools, Overview of permissions. Processes: Process status, Killing processes, process priority. Starting up and Shut down: Peripherals, Kernel loading, Console, The scheduler, init and the inittab file, Run-levels, Run level scripts. Managing User Accounts: Principles, password file, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users.		
Unit III	File System Management and Configuring TCP/IP Networking	8
Managing Unix File Systems: Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Boot disks Configuring the TCP/IP Networking : Kernel Configuration; Mounting the /proc File system, Installing the Binaries, Setting the Hostname, Assigning IP Addresses, Creating Subnets, Writing hosts and networks Files, Interface Configuration for IP, ifconfig, netstat command, Checking the ARP Tables; Name service and resolver configuration.		
Unit IV	Configuring Firewall Security and Network Address Translation	7
TCP/IP Firewall: Methods of Attack, What Is a Firewall? What Is IP Filtering? Setting Up Linux for Firewalling Testing a Firewall Configuration; A Sample Firewall Configuration:IP Accounting, Configuring the Kernel for IP Accounting, Configuring IP Accounting, Using IP Accounting ResultsIP Masquerade and Network Address Translation: Side Effects and Fringe Benefits, Configuring the Kernel for IP Masquerade, Configuring IP Masquerade.		
Unit V	Role of Network Information System with Backup and Recovery	6
Introduction to Network Information System: Getting Acquainted with NIS, The Client Side of NIS, Running an NIS Server, NIS vs NIS+, NIS Server Security.Network file system: Preparing NFS, Mounting an NFS Volume, The NFS Daemons, The exports File.System Backup and Recovery: Log files for system and applications; Backup schedules and methods (manual and automated)		

Text Books	1. L.L. Beck – "System Software" Pearson Education 2. Michel Ticher – "PC System Programming" , Abacus. 3. Limoncelli"The Practice of System and Network Administration"Pearson
Reference Books	1.W. R. Stevens"Unix network programming, vol. 1"Pearson Education 2. W. R. Stevens – "TCP/IP illustrated, vol. 1" – PHI/Pearson Education 3. Comer – "Internetworking with TCP/IP, vol. 1"Pearson Education/PHI
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3701

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To introduce the fundamentals of System Administration.	2	Emp
CO2	To demonstrate the Process of Managing User Accounts, File Management, Configuring Firewall Security	2	S
CO3	To comprehend and analyse the File System Management & Configuring TCP/IP Networking	2	S
CO4	To understand the Network Address Translation, Role of Network Information System with Backup & Recovery by a system administrator.	2	Ent
CO5	After the completion of the course, the students will gain knowledge about System Administration or Windows Administration.	1	Emp

CO-PO Mapping for CS3701

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	2	2	2	3	2	3	3	2	2	2	3	2	3
CO 2	3	2	3	3	2	3	2	3	3	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	1	2	2	2	1	2
CO 4	3	2	3	3	2	3	2	3	2	2	2	3	3	2	3	2
CO 5	3	2	3	3	2	3	2	3	2	2	2	3	3	2	2	3
Avg	2.60	2.00	2.60	2.60	2.00	2.60	2.20	2.60	2.40	2.20	2.00	2.60	2.60	2.20	2.20	2.40

CS3702	Title: Big Data and Business Intelligence	L T P C 4 0 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Upon completion of this course, students will be able to do the following: • To understand big data technologies used in storage, analysis and data manipulation. • To understand the concept of BIG data in Business Intelligence • To understand the basics of design and management of BI systems • Recognize the key concepts of Hadoop framework, map reduce.	
Expected Outcome	On completion of the course, learner will be able to: • To understand big data technologies used in storage, analysis and data manipulation. • To understand the concept of BIG data in Business Intelligence. • To understand the basics of design and management of BI systems, Recognize the key concepts of Hadoop framework, map reduce. • To expose students to real market problems deriving solutions from business intelligence. • Explore and use the data warehousing wherever necessary, Manage practical BI systems.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Big Data Analytics	6
Introduction to Big Data: Types of Digital Data-Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, 3Vs of Big Data, Business Intelligence vs. Big Data, Data warehouse and Hadoop environment – Coexistence		
Unit II	BIG Data Analytics Methods and Tools	6
Classification of BIG data analytics, Terminologies in Big Data, CAP Theorem, BASE Concept. Types of Databases – comparison of NewSQL - SQL vs. NOSQL vs NewSQL, Overview of Hadoop: Features, Hadoop vs. SQL, RDBMS vs. Hadoop.Introduction to Machine learning: Linear Regression – Clustering - Collaborative filtering - Association rule mining - Decision tree.		
Unit III	BI and Decision Making	8
Introduction to Business Intelligence with data, Information and knowledge, Decision Support System, Operational data vs. informational data, Determining BI Cycle, BI Environment and Architecture, Role of Business Intelligence in an Organization Decision Making Concepts : Concepts of Decision Making, Techniques of Decision Support System (DSS), Development of Decision Support System (DSS), Applications of DSS, Data-Warehouse: Data warehouse Modelling, data warehouse design, Distributed data warehouse, and materialized view		
Unit IV	Data Pre-processing and Outliers	6
Data Analytics life cycle, Discovery, Data preparation, Preprocessing requirements, data cleaning, data integration, data reduction, data transformation, Data discretization, and concept hierarchy generation. Types of outliers, Outlier detection Methods, Proximity-Based Outlier analysis, Clustering Based Outlier analysis. Introduction to Data visualization: Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization.		
Unit V	BI with Hadoop Eco systems	6
HADOOP for Analytics of unstructured data- Hadoop Components: Architecture, HDFS, Map Reduce: Mapper – Reducer – Combiner, Partitioner – Searching – Sorting - Compression. Hadoop (YARN): Architecture, The Hadoop Ecosystem- overview of Pig, HIVE, HBase, Mahout, NoSQL. Interacting with Hadoop Eco systems. Use cases, Map Reduce, Apache Hadoop.		
Text Books	1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publications, 2012. 2. Introduction to business Intelligence and data warehousing, IBM, PHI.	
Reference Books	1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill. 2. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications. 3. R. Sharda, D. Delen, and E. Turban, Business Intelligence and Analytics. Systems for Decision Support,10th Edition. Pearson/Prentice Hall, 2015	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	

Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3702

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To understand big data technologies used in storage, analysis & data manipulation.	2	Emp
CO2	To understand the concept of BIG data in Business Intelligence.	2	S
CO3	To understand the basics of design and management of BI systems, Recognize the key concepts of Hadoop framework, map reduce.	2	S
CO4	To expose students to real market problems deriving solutions from business intelligence.	2	Emp
CO5	Explore and use the data warehousing wherever necessary, Manage practical BI systems.	1	Emp

CO-PO Mapping for CS3702

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	3	2	3	2	3	2	3	2	2	3	2	3	3
CO 2	3	2	3	2	3	2	3	2	3	2	3	3	2	3	2	2
CO 3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2
CO 4	3	2	3	2	3	2	3	2	3	2	3	3	2	3	2	2
CO 5	3	2	3	2	3	2	2	3	3	2	3	3	2	3	2	3
Avg	2.60	1.80	2.60	2.20	2.60	2.20	2.60	2.40	2.60	2.20	2.60	2.60	2.20	2.60	2.20	2.40

CS3742	Title: Technical VAP II	L T P C 0 0 2 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims brush-up the topics important in terms of placement activity.	
Expected Outcome	To clear different placement drives.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Object oriented programming (Advanced C++,Java)	6
Overview and revision of (C++ and its importance in industry) Previous Year Placement Paper Discussion and solution , online Quizzes.		
Unit II	Python with Machine learning	4
Python with ML Overview with implementation details and Interview Questions with Solutions, Online Quizzes , SET-1(50 Questions) SET-2 For Exercise for python and Machine Learning.		
Unit III	Advanced Data structures	4
Overview and revision of different data structures usage and syntax, Implementation Details with Interview Questions, Previous Year Placement Paper Discussion and solution for Data structures, Online Quizzes.		
Unit IV	Advanced Database Management System	4
Revision of Database management system concept with industry overview of SQL, basics Interview Questions with Solutions SET-1(50 Questions) SET-2 For Exercise for SQL queries, Online Quizzes.		
Unit V	Trends in Web technology	6
Overview of different trends in Web technology (HTML5, CSS, Javascript, PHP with mysql), Interview Questions with Solutions SET-1(50 Questions) SET-2 For Exercise, Previous Year Placement Paper Discussion and solution, Online Quizzes.		
Text Books	1.Practice material	
Reference Books	1.Practice Material	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3742

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand Object oriented programming (Advanced C++,Java)	2	Emp
CO2	Understand Python with Machine learning	2	Emp
CO3	Understand Advanced Data structures	2	Emp
CO4	Understand Advanced Database Management System	2	Emp
CO5	Understand Trends in Web technology	1	Emp

CO-PO Mapping for CS3742

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	2	2	3	3	1	1	3	3	2	3	3	3	2
CO 2	1	1	1	2	2	2	2	2	2	3	3	3	2	2	2	3
CO 3	2	2	2	2	2	3	3	1	1	2	3	1	1	2	3	1
Avg	1.67	1.67	1.67	2.00	2.00	2.67	2.67	1.33	1.33	2.67	3.00	2.00	2.00	2.33	2.67	2.00

CSE without Specialization

CS3740	Title: System Administration Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Explain the importance of Software installation concepts. Understand Multi-user basics, politics, policies and ethics techniques using programming. Identify and learn Automating Administrative Tasks. Students will Learn to manage File systems and disks, Networking, Configuration management and Distributed computing.Acquaint students with SNMP, NFS Configuration and monitoring System security	
Expected Outcome	● To explain the importance of Software installation concepts. ● To Understand Multi-user basics, politics, policies and ethics techniques using programming. ● To Identify and learn Automating Administrative Tasks. ● Students will Learn to manage File systems and disks, Networking, Configuration management and Distributed computing. Acquaint students with SNMP, NFS Configuration and monitoring System security	

List of Experiments

1. Install and acquaint with Packet Monitoring software (tcpdump, snort, ethereal)
2. Perform following operations: Trace route, Ping, Finger, Nmap
3. Execute given commands : Server configuration (FTP, SMTP, DNS)
4. Perform NFS Configuration
5. Implement Firewall Configuration using iptables/ipchains (Linux only)
6. Execute Experiments using Turbo C Assembler

Note: All the above experiments may be performed in both Unix /Linux and Windows

Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

CO-PO Mapping for CS3740

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To explain the importance of Software installation concepts.	2	Emp
CO2	To Understand Multi-user basics, politics, policies and ethics techniques using programming.	2	Emp
CO3	To Identify and learn Automating Administrative Tasks.	2	Emp

CO-PO Mapping for CS3740

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	3	3	3	3	3	2	3	2	3	3	3	3	2
CO 2	3	2	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO 3	2	3	2	3	2	3	3	3	2	2	3	3	2	2	3	3
Avg	2.33	2.33	2.33	3.00	2.33	3.00	2.67	3.00	2.33	2.67	2.67	3.00	2.67	2.33	3.00	2.67

Semester-8

Program Elective IV

CS3803	Title: Parallel Computing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Students who elected this course are subjected to study parallel computing hardware and programming models. Will be enabled to be conversant with performance analysis and modeling of parallel programs. Understand the logic to parallelize the programming task and operating system requirements to qualify in handling the Parallelization	
Expected Outcome	On completion of the course, student will be able to– ● To understand parallel computing hardware and programming models. ● Will be enabled to be conversant with performance analysis and modeling of parallel programs. ● To Understand the logic to parallelize the programming task and operating system requirements to qualify in handling the parallelization ● Describe different parallel architectures, inter-connect networks, programming models. ● Develop an efficient parallel algorithm to solve given problem. Analyze and measure performance of modern parallel computing systems.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Fundamentals of Parallel Computing	8
Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance. Parallel Programming Models – Shared Memory Programming – Message Passing Paradigm – Interaction and Communication – Interconnection Networks.PRAM algorithms: model of serial computation, PRAM model of parallel computation, PRAM algorithms, reducing the number of processors.		
Unit II	Basic process Processes and Shared Memory Communication	6
Processes and processors. Processor organizations, Processor arrays, Multiprocessors, Multicomputer, FLYNN's taxonomy, Shared memory, Fork, Join constructs. Basic parallel programming techniques- loop splitting, spin locks, contention barriers and row conditions.		
Unit III	Challenges of Parallel Programming	6
Identifying Potential Parallelism – Techniques for Parallelizing Programs, Issues, Cache Coherence issues – Memory Consistency Models – Maintaining Memory Consistency, Synchronization Issues – Performance Considerations.		
Unit IV	MPI Programming	6
The MPI Programming Model – MPI Basics, Global Operations, Asynchronous Communication – Collective Communication – Other MPI Features –Performance Issues – Combining OpenMP and MPI.		
Unit V	Programming Heterogeneous Processors	5
GPU Architecture –Introduction to CUDA Architecture (Threads-Memories-Synchronization), Using the CUDA Architecture, Applications of to CUDA		
Text Books	1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", Addison-Wesley 2. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann	
Reference Books	1. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann 2. Michael J Quinn, "Parallel programming inC with MPI and OpenMP", Tata McGraw hill	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic	14-11-2021	

Council on	

Course Outcome for CS3803

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Student will be able to To understand parallel computing hardware and programming models	2	Emp
CO2	Student Will be enabled to be conversant with performance analysis and modeling of parallel programs.	2	Emp
CO3	Student will be able to Understand the logic to parallelize the programming task and operating system requirements to qualify in handling the parallelization	2	S
CO4	Student will be able to Describe different parallel architectures, inter-connect networks, programming models.	2	Emp
CO5	Student will be able to Develop an efficient parallel algorithm to solve given problem.Analyze and measure performance of modern parallel computing systems.	1	Emp

CO-PO Mapping for CS3803

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	3	2	2	2	3	2	2	3	2	2	3	3	2	3
CO 2	3	2	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2
CO 4	3	2	3	2	2	3	2	3	2	2	2	3	3	2	3	2
CO 5	3	2	3	2	2	3	2	3	2	2	2	3	3	2	2	3
Avg	2.60	2.00	2.80	2.00	2.00	2.60	2.20	2.60	2.00	2.20	2.40	2.60	2.80	2.40	2.40	2.40

CS3804	Title: Cyber Laws and Security Policies	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To recognize the developing trends in Cyber law and the legislation impacting cyberspace in the current situation. To generate better awareness to battle the latest kinds of cybercrimes impacting all investors in the digital and mobile network.	
Expected Outcome	● To recognize the developing trends in Cyber law ● To understand legislation impacting cyberspace in the current situation. ● To generate better awareness to battle the latest kinds of cybercrimes impacting all investors in the digital and mobile network. ● Make Learner Conversant With The Social And Intellectual Property Issues Emerging From 'Cyberspace. ● Explore The Legal And Policy Developments In Various Countries To Regulate Cyberspace.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Computer Security	7
Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.		
Unit II	Introduction to Mobile Forensics Mobile Forensic	8
Types of Evidence present in mobile phones - Files present in SIM card, phone memory dump, and evidences in memory card. Seizure and Preservation of mobile phones and PDA. Mobile phone evidence extraction process, Data Acquisition Methods – Physical, Logical and File System\Manual Acquisition., Mobile Forensic Investigation Toolkit. Challenges to Mobile forensics. CDR and IPDR analysis.		
Unit III	Information Security Policies and Procedures	7
Corporate policies- Tier 1, Tier 2 and Tier3 policies - process management-planning and preparation-developing policies-asset classification policy-developing standards.		
Unit IV	Information Security	7
fundamentals-Employee responsibilities information classification Information handling- Tools of information security-Information processing-secure program administration.		
Unit V	Organizational and Human Security	7
Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.		
Text Books	1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basicsn(Paperback)", O' Reilly Media 2. Thomas R. Peltier, "Information Security policies and procedures: A Practitioner's Reference", Prentice Hall	
Reference Books	1. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2.Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springerverlag,	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3804

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To recognize the developing trends in Cyber law	2	Emp
CO2	To understand legislation impacting cyberspace in the current situation.	2	Emp
CO3	To generate better awareness to battle the latest kinds of cybercrimes impacting all investors in the digital and mobile network.	2	S
CO4	To Make Learner Conversant With The Social And Intellectual Property Issues Emerging From 'Cyberspace	2	Emp
CO5	To Explore The Legal And Policy Developments In Various Countries To Regulate Cyberspace	1	Emp

CO-PO Mapping for CS3804

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	3	2	2	2	3	2	2	3	3	2	3	3	2	3
CO 2	3	2	3	2	2	3	3	3	2	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2
CO 4	3	2	3	2	2	3	3	3	2	2	3	3	3	2	3	2
CO 5	3	2	3	2	2	3	3	3	2	2	3	3	3	2	2	3
Avg	2.60	2.00	2.80	2.00	2.00	2.60	2.80	2.60	2.00	2.20	2.80	2.60	2.80	2.40	2.40	2.40

CS3801	Title: Computer Organization and Architecture	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	Study of the basic structure and operation of a digital computer system. Analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating point arithmetic operations. Understanding the hierarchical memory system, cache memories and virtual memory ,I/O Communication.	
Expected Outcome	• Able to understand the organization and functionalities of computer system. • To understand basic structure and operation of a digital computer system. • To introduce the processor architectures, memory organization and mapping techniques to students. • To be able to analyze the design of arithmetic & logic unit and understanding of the fixed point and floating point arithmetic operations. • To give the students an elaborate idea about the different memory systems and buses. • To understand the hierarchical memory system, cache memories and virtual memory, I/O Communication.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction	8
Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes, Neumann architecture, Software, Performance, Multi-processor, Multi-computers, data representation, fixed & floating point, Error detection & correction codes.		
Unit II	Arithmetic and Logic Unit	7
Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Decimal arithmetic operations,Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers,		
Unit III	Control Unit	7
Design of control unit, Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control concept.		
Unit IV	Memory	7
Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks, Cache memory, Performance consideration, Virtual memory, paging, secondary storage, RAID		
Unit V	Input Output	7
Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors.		
Text Books	1. J.P.Hayes, "Computer Architecture and organization", Third Edition, McGraw Hill 2. Hwang and Briggs, "Computer Architecture and parallel processing", McGraw Hill	
Reference Books	1. David A. Patterson and John L. Hennessy, "Computer Organization and Desin", Third Edition, Morgan Kaufmann Publication.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3801

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To understand basic structure and operation of a digital computer system.	2	Emp
CO2	To introduce the processor architectures, memory organization and mapping techniques to students.	2	S
CO3	To be able to analyze the design of arithmetic and logic unit and understanding of the fixed point and floating point arithmetic operations.	2	S
CO4	To give the students an elaborate idea about the different memory systems and buses.	2	Emp
CO5	To understand the hierarchical memory system, cache memories and virtual memory, I/O Communication	1	Emp

CO-PO Mapping for CS3801

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	1	2	2	2	2	2	1	1	1	3	3	2	3	3	3	2
CO 2	1	1	1	2	1	2	2	1	1	1	3	3	2	2	2	2
CO 3	2	2	2	2	2	3	3	1	1	2	3	1	1	2	2	2
CO 4	2	1	2	2	2	3	3	2	2	2	2	1	1	1	1	2
CO 5	1	1	1	1	1	2	2	2	1	2	3	3	2	1	1	2
Avg	1.5	1.5	1.75	2	1.75	2.5	2.25	1.25	1.25	2	2.75	1.75	1.75	2	2	2

Program Elective V

CS3806	Title: Virtual Reality and Systems	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	Understand the underlying enabling technologies of VR systems, Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR experiences2	
Expected Outcome	● To understand the underlying enabling technologies of VR systems. ● To Identify, examine, and develop software that reflects fundamental techniques for the design. ● To get familiar with deployment of VR experiences2 ● Design and create a basic virtual environment. ● Design an appropriate virtual reality solution for an application.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Virtual Reality and Virtual Environments	8
The historical development of VR: The benefits of Virtual Reality, Generic Virtual Reality Systems, Real-time computer graphics, Virtual environments, Requirements for VR, Virtual Reality Applications: Types of VR technology, VR design		
Unit II	Hardware Technologies For 3d User Interfaces	7
Computers: Graphics and workstation architectures, Choosing Output Devices for 3D User Interfaces: 3D Sound, Graphics; Haptic Displays, Force feedback Transducers, HMD, Input device characteristics, Choosing Input Devices for 3D Interfaces : Sensors and transducers, Gloves, Navigation and Gesture Interfaces, Tracking Devices, 3D Mice, Direct Human Input, Home - Brewed Input Devices, Visual representation in VR, aural representation in VR		
Unit III	Software Technologies	7
Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, Computer Vision for augumented reality and AR software		
Unit IV	3D Interaction Techniques	7
3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design, AR techniques, marker based and marker less tracking		
Unit V	Advances In 3D User Interfaces	7
3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development, 3D UI Evaluation and Other Issues.		
Text Books	1. Gerard Jounghyun Kim, Designing Virtual Reality Systems, the Structured Approach, Springer London 2. Grigore C Burdea abd Philippe Coiffet, Virtual Reality Technology, 2nd Eds., Wiley Interscienc 3. John Vince, Introduction in Virtual Reality, Springer,	
Reference Books	1. Virtual Reality Application Centre, Iowa State University, http://www.vrac.iastate.edu/	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	

Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3806

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand Virtual Reality and Virtual Environments	2	Emp
CO2	Understand Hardware Technologies used for 3d User Interfaces	2	Emp
CO3	Understand Software Technologies used in VRS	2	S
CO4	Understand 3D Interaction Techniques	2	Emp
CO5	Understand various Advances In 3dDUser Interfaces	1	S

CO-PO Mapping for CS3806

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	3	2	2	3	2	3	3	2	2	2	3	3	2	2
CO 2	3	2	3	2	2	3	2	2	3	3	2	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2
CO 4	3	2	3	2	2	3	2	2	3	3	2	3	3	2	3	2
CO 5	3	2	3	2	2	3	2	2	3	3	2	3	3	2	2	2
Avg	2.60	2.00	2.80	2.00	2.00	2.80	2.00	2.20	2.80	2.60	2.00	2.60	2.80	2.40	2.40	2.00

CS3807	Title: Fault Tolerant Computing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	Dependability is now a major requirement for all computing systems and applications. Computer hardware, software, data, networks and systems are always subject to faults. The faults cannot be eliminated, however their impact can be limited and a suitably designed fault-tolerant system can function even in the presence of faults. This course introduces the widely applicable concepts in reliable and fault-tolerant computing. Topics to be covered include basic testing concepts, hardware and software faults, reliability evaluation, design and evaluation of redundant systems, relationship between testing and reliability, software reliability growth, security vulnerabilities and emerging issues.	
Expected Outcome	● The course will provide the students a background so that they can: understand techniques to model faults and know how to generate tests and evaluate effectiveness; ● evaluate reliability of systems with permanent and temporary faults; determine applicability of these forms of redundancy to enhance reliability: spatial, temporal, procedural; ● assess the relation between software testing and residual defects and security vulnerabilities, devise and analyse potential solutions for emerging issues.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction	8
Computer and Computation Distribution, System models and Fault models.Test generation for combinational circuits, sequential circuits and Fault simulation.		
Unit II	Fault Tolerance Concepts	7
Recovery in time, Fault detection techniques, Modeling Fault tolerant systems - Rollback modular redundancy and Exception Handling.		
Unit III	Fault Tolerant in Real time Systems	7
Architecture of Fault - tolerant computers general purpose commercial systems - High availability systems - Critical computations Fault Tolerant multiprocessor - Communication Architectures, Shared memory		
Unit IV	Interconnections	7
loop architectures, Tree Networks, Graph Network and in Binary cube interconnection.		
Unit V	Fault Tolerant Software	7
Design of fault Tolerant software - Reliability Models, Construction of acceptance tests, validation of Fault tolerant software.		
Text Books	1. Israel & Krishnan, "Fault Tolerant Systems" Elsevier Publications, 2007.	
Reference Books	1,D. K. Pradhan, "Fault Tolerant computing - Theory and Techniques "Prentice Hall.Inc. 1986.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3807

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The course will provide the students a background so that they can: understand techniques to model faults and know how to generate tests and evaluate effectiveness;	2	Emp
CO2	evaluate reliability of systems with permanent and temporary faults;	2	Emp
CO3	determine applicability of these forms of redundancy to enhance reliability: spatial, temporal, procedural;	2	S
CO4	assess the relation between software testing and residual defects and security vulnerabilities,	2	Emp
CO5	devise and analyse potential solutions for emerging issues.	1	Emp

CO-PO Mapping for CS3807

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	3	2	2	2	3	2	2	3	2	2	3	3	2	3
CO 2	3	2	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2
CO 4	3	2	3	2	2	3	2	3	2	2	2	3	3	2	3	2
CO 5	3	2	3	2	2	3	2	3	2	2	2	3	3	2	2	3
Avg	2.60	2.00	2.80	2.00	2.00	2.60	2.20	2.60	2.00	2.20	2.40	2.60	2.80	2.40	2.40	2.40

CS3821	Title: Reinforcement Learning	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The goal of reinforcement learning is to pick the best known action for any given st which means the actions have to be ranked, and assigned values relative to another.				
Expected Outcome	• To comprehend the goal of reinforcement learning. • To Familiarize the basics of Reinforcement Learning • To provide a clear and simple account of the key ideas and algorithms reinforcement learning. • To characterize different classes of RL algorithms according to their advantages drawbacks with respect to various domain characteristics. • To learn in an interactive environment by trial and error using feedback from own actions and experiences				
Unit No.	Title	No. of Hrs(Per Unit)			
Unit I	Introduction to Reinforcement Learning	8			
Reinforcement Learning Overview, Elements of RL, Exemplary explanation , Origin and Overview, Challenge ofReinforcement Learning, Evaluative Feedback, Evaluation & Instruction, Incremental Implementation, Relation with other fields					
Unit II	Multi Armed Bandits	7			
Action Value Methods, k-armed Bandit Problem, The 10-armed Test Bed, Tracking a Nonstationary Problem, Optimistic Initial Values, Reinforcement Comparison, Pursuit Methods, Associative Search, Gradient Bandit Algorithms, Upper-Confidence-Bound Action Selection.					
Unit III	Agent Environment	7			
Interface, Goals & Rewards, The Markov Property, Markov Decision Processes, Value Functions, Returns & Episodes, Finite Markov-Decision, Optimality & Approximation Markov Decision Process, Markov chains, Markovreward process (MRP). Introduction to and proof of Bellman, Bellman equations in MRP.					
Unit IV	Dynamic Programming	7			
Policy Evaluation, Improvement, Iteration, Value Iteration, Asynchronous DP, Generalized Policy, Efficiency of Dynamic programming, Prediction and Control by Dynamic Programming.					
Unit V	Monte Carlo Methods	7			
MonteCarlo Prediction, Estimation of Action Values, Monte Carlo Control, Off-Policy Prediction, Inremental, On policy and off policy learning, Importance sampling, TD Prediction, Optimality of TD, Actor Critic Method					
Text Books	Course Material provided by Xebia Academy				
Reference Books	Course Material provided by Xebia Academy				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board ofStudied on	11-07-2020				
Date of Approval by theAcademic Council on	13-09-2020				

Course Outcome for CS3821

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Knowledge of basic and advanced reinforcement learning techniques.	2	Emp
CO2	Identification of suitable learning tasks to which these learning techniques can be applied.	2	Emp
CO3	Appreciation of some of the current limitations of reinforcement learning techniques.	2	S
CO4	Training agents and evaluating performance	2	Emp
CO5	Formulation of decision problems, set up and run computational experiments, evaluation of results from experiments.	1	Emp

CO-PO Mapping for CS3821

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	1	2	2	2	2	2	1	1	1	3	3	2	3	3	3	2
CO 2	1	1	1	2	1	2	2	1	1	1	3	3	2	2	2	2
CO 3	2	2	2	2	2	3	3	1	1	2	3	1	1	2	2	3
CO 4	2	1	2	2	2	3	3	2	2	2	2	1	1	1	1	3
CO 5	1	1	1	1	1	2	2	2	1	2	3	3	2	1	1	2
Avg	1.5	1.5	1.75	2	1.75	2.5	2.25	1.25	1.25	2	2.75	1.75	1.75	2	2	2.5

CS3802	Title: **Cloud Computing Fundamentals**	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	To provide students with the fundamentals and essentials of Cloud Computing and also a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.				
Expected Outcome	Explain the core concepts of the cloud computing paradigm. To provide students with the fundamentals and essentials of Cloud Computing. To lay a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research. Apply the fundamental concepts in datacenters to understand the tradeoffs in power, efficiency and cost.				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	**Cloud Technological and Business Game Changer**	4			
Cloud Computing, Cloud vs. Traditional architecture, Services models (IaaS, PaaS, SaaS), Google cloud architecture, The GCP (Google cloud platform) console, install and configure Cloud SDK, Google cloud shell, GCP APIs, Cloud shell code editor, Cloud console mobile app.					
Unit II	**Use GCP to Build Your Apps**	6			
Computing services in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Exploring PaaS with App Engine, Event driven programs with cloud functions, Containerizing and orchestrating apps with Google Kubernetes Engine.					
Unit III	**Structured and Unstructured Storage models**	5			
Storage options in the cloud, Structured and unstructured storage in the cloud, Unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL					
Unit IV	**Cloud APIs and Cloud Security**	5			
The purpose of APIs, Cloud Endpoints, Using Apigee Edge, Managed message services, Exploring Cloud SQL, Cloud Pub/Sub, Introduction to security in the cloud, The shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM.					
Unit V	**Cloud Networking, Automation and Management Tools**	6			
Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, Building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing, Introduction to Infrastructure as Code, Cloud Deployment Manager, Public and private IP address basics.					
Text Books	1. Marinescu D C, Cloud Computing Theory and Practice, Morgan Kaufmann.				
Reference Books	1. Erl T, Mahmood Z and Martinez J W, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall. 2. Stallings W, Foundations of Modern Networking, Pearson.				
Mode of Evaluation	Internal and External Examinations				

Recommended by Board of Studied on	11-07-2020
Date of Approval by the Academic Council on	13-09-2020

Course Outcome for CS3802

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand the fundamental principles of distributed computing.	2	Emp
CO2	Understand how the distributed computing environments known as Grids can be built from lower level services.	2	Emp
CO3	Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.	2	S
CO4	Understand the concept of Cloud Security.	2	Emp
CO5	Analyze the performance of Cloud Computing	1	S

CO-PO Mapping for CS3802

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	1	2	2	2	2	2	1	1	1	3	3	2	3	3	1	2
CO 2	1	1	1	2	1	2	2	1	1	1	3	3	2	2	1	2
CO 3	2	2	2	2	2	3	3	1	1	2	3	1	1	2	1	2
CO 4	2	1	2	2	2	3	3	2	2	2	2	1	1	1	1	2
CO 5	1	1	1	1	1	2	2	2	1	2	3	3	2	1	1	2
Avg	1.5	1.5	1.75	2	1.75	2.5	2.25	1.25	1.25	2	2.75	1.75	1.75	2	1	2

Program Elective I

CS3609	Title: Cryptography and Network Security	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites					
Objective	To know the methods of conventional encryption. To understand the concepts of public key encryption and number theory. To understand authentication and Hash functions. To know the network security tools and applications. To understand the system level security used.				
Expected Outcome	● Understand the most common type of cryptographic algorithm and the number theory ● Students will learn and Understand the Public-Key Infrastructure. Understand security protocols for protecting data on networks ● Be able to digitally sign emails and files. Understand vulnerability assessments and the weakness of using passwords for authentication. Be able to perform simple vulnerability assessments and password audits ● Be able to configure simple firewall architectures ● To Understand the concepts of Virtual Private Networks				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	Introduction and Number Theory	7			
Information Security, Security Objectives, OSI Security Architecture, Cryptography: Symmetric and Asymmetric Cryptography, Steganography, Symetric Encryption Model, Introduction to Group, Conventional Encryption Techniques: Substitution ciphers and Transposition ciphers, Stream and Block Ciphers, Cryptanalysis.					
Unit II	Block Ciphers and Public Key Cryptography	7			
Modern Block Ciphers: Components of Modern Block Ciphers, Product Ciphers, Shannon's Theory of Confusion and Diffusion, Fiestal Structure: Improved and Final Design, Data Encryption Standard(DES): Rounds, Round Functions, Key Generation. Introduction to Prime and relative prime numbers, Key Distribution, Random Number Generation. Public Key Cryptography, RSA algorithm, Diffie-Hellman Key Exchange Algorithm.					
Unit III	Hash Functions and Digital Signatures	8			
Message Authentication: Message Authentication Code (MAC) and Message Digest Code (MDC), Hash Functions: Security of Hash Functions and MAC, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA). Private and Public Key, Digital Signatures: Authentication Protocols, Digital Signature Standards (DSS).					
Unit IV	Network and System Security	7			
Key Distribution, Key Exchange, Authentication- Kerberos: Operation and Servers, X.509 Certificate, Electronic Mail Security- Pretty Good Privacy (PGP), S/MIME. Network Protocols: TCP/IP, HTTP. System Security: Intruders – Intrusion Detection System (IDS), Viruses and Worms: Types of Threats, Firewall – Types of Firewall, Trusted Systems.					
Unit V	IP and Web Security	7			
IP Security: Architecture, Authentication Header, Encapsulating Security Payloads (ESP), Security Associations, Key Management – Internet Key Exchange. Web Security: Secure Socket Layer (SSL) Transport Layer Security, Secure Electronic Transaction (SET).					
Text Books	1. William Stallings, "Cryptography And Network Security – Principles and Practices", Pearson Education. 2. Behrouz A. Ferouzan, "Cryptography and Network Security", Tata McGraw-Hill. 3. Atul Kahate, ""Cryptography and Network Security", Second Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi.				
Reference Books	1. Bruce Schneier, "Applied Cryptography", second edition, John Wiley and Sons, New York. 2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing Third Edition – Prentice Hall of India.				
Mode of	Internal and External Examinations				

Evaluation	
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3609

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand the most common type of cryptographic algorithm and the number theory	2	Emp
CO2	Learn and Understand the Public-Key Infra	2	Ent
CO3	Be able to digitally sign emails and files. Understand vulnerability assessments and the weakness of using passwords for authentication. Be able to perform simple vulnerability assessments and password audits	2	S
CO4	Be able to configure simple firewall architectures	3	Emp
CO5	Understand Virtual Private Networks	3	Emp

CO-PO Mapping for CS3609

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	2	1	2	1	2	1	1	2	2	3	1	3	2	3
CO 2	3	2	3	1	3	2	3	1	2	3	3	1	1	2	3	2
CO 3	2	2	2	3	2	2	2	3	2	1	1	1	1	2	1	2
CO 4	3	2	3	2	3	2	3	2	3	2	2	2	3	2	3	2
CO 5	3	2	2	3	3	2	2	3	2	2	2	2	3	2	2	3
Avg	2.60	1.80	2.40	2.00	2.60	1.80	2.40	2.00	2.00	2.00	2.00	1.80	1.80	2.20	2.20	2.40

CS3610	Title: Android Development	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	1. To understand mobile application development trends and Android platform 2. To analyze the need of simple applications, game development, Location map based services				
Expected Outcome	To enable the learner for aspiring careers in Android Mobile application development areas				
Unit No.	Unit Title	No. of hours (per Unit)			
Unit I	Android Fundamentals	7			
Mobile Application development and trends , Android overview and Versions , Android open stack, features , Setting up Android environment (Eclipse, SDK, AVD)- Simple Android application development , Anatomy of Android applications, Activity and Life cycle , Intents, services and Content Providers					
Unit II	Android User Interface	8			
Layouts: Linear, Absolute, Table, Relative, Frame, Scrollview, Resize and reposition - Screen orientation , Views: Textview, EditText, Button, ImageButton, Checkbox, ToggleButton, RadioButton, RadioGroup, ProgressBar, AutocompleteText, Picker, Listviews and Webview, Displaying pictures with views: Gallery and ImageView, ImageSwitcher, Gridview , Displaying Menus: Helper methods, Option and Context.					
Unit III	Data Persistence	6			
Shared User preferences , File Handling: File system, System partition, SD card partition, user partition, security, Internal and External Storage , Managing data using SQLite , Content providers: Data sharing with query string, projections, filters and sort and User defined content providers.					
Unit IV	Messaging, Networking and Services	7			
SMS Messaging: Sending and Receiving , Sending email and networking , Downloading binary and text data files , Access Web services , Local and remote services, Asynchronous threading, communication and binding services					
Unit V	Location Access and Publish Android Application	8			
Location based services: Display map, zoom control, view and change, Marking, Geocoding, Get location - Publish Android applications and Deployment..					
Text Books	1.WeiMeng Lee “Beginning Android Application Development”, Wrox Publications John Wiley				
Reference Books	1. Ed Burnette “Hello Android: Introducing Google's Mobile Development Platform”, The Pragmatic Publishers 2. Reto Meier “Professional Android 4 Application Development”,Wrox Publications				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studied on	09-08-2021				
Date of Approval by the Academic Council on	14-11-2021				

Course Outcome for CS3610

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	To understand mobile application development trends and Android platform	2	Emp
CO2	To analyze the need of simple applications, game development, Location map based services	2	Ent
CO3	Students can take the knowledge of various interface application.	2	S
CO4	Students can able to link their application to google platform.	3	Emp
CO5	To be able to understand the concepts of digital marketing on android platform.	3	Emp

CO-PO Mapping for CS3610

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1	1	1	2	3	2	3	3	2	2	3	1	3	2	3
CO 2	3	2	1	2	3	2	3	2	2	3	3	1	1	2	3	2
CO 3	2	2	3	2	1	2	1	2	2	1	1	1	1	2	1	2
CO 4	3	2	2	3	2	2	3	2	2	2	2	2	3	2	3	2
CO 5	3	2	3	2	2	2	2	3	2	2	2	2	3	2	2	3
Avg	2.60	1.80	2.00	2.00	2.00	2.20	2.20	2.40	2.20	2.00	2.00	1.80	1.80	2.20	2.20	2.40

CS3611	Title: Digital Image Processing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	To study the image fundamentals and mathematical transforms necessary for image processing. To study the image enhancement techniques. To study image restoration procedures. To study the image compression procedures.	
Expected Outcome	● Review the fundamental concepts of a digital image processing system. ● Analyze images in the frequency domain using various transforms. ● Evaluate the techniques for image enhancement and image restoration. ● Categorize various compression techniques. CO5: Interpret Image compression standards. ● Interpret image segmentation and representation techniques.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction and Fundamentals	8
Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization.Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise- Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.		
Unit II	Image Enhancement in Frequency Domain	7
Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters –Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian High pass Filters; Homomorphic Filtering.Image Restoration: A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Red		
Unit III	Color Image Processing	7
Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation. Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components.		
Unit IV	Registration & Segmentation	7
Introduction, Geometric Transformation – Plane to Plane transformation, Mapping, Stereo Imaging – Algorithms to Establish Correspondence, Algorithms to Recover Depth Introduction, Region Extraction, Pixel-Based Approach, Multi-level Thresholding, Local Thresholding, Region-based Approach, Edge and Line Detection: Edge Detection, Edge Operators, Pattern Fitting Approach, Edge Linking and Edge Following.		
Unit V	Feature Extraction	7
Representation, Topological Attributes, Geometric Attributes, Description: Boundary-based Description, Region-based Description, Relationship. Object Recognition: Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching		
Text Books	1. Rafael C. Gonzalvez and Richard E. Woods, Digital Image Processing 2nd Edition,.; PHI. 2. B. Chanda, D.D. Majumder, "Digital Image Processing & Analysis", PHI	
Reference Books	1. R.J. Schalkoff; Digital Image Processing and Computer Vision, John Wiley and Sons, NY 2. A.K. Jain; Fundamentals of Digital Image Processing, Prentice Hall, Upper Saddle River, NJ.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of	09-08-2021	

Studied on	
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3611

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Students would be able to develop Mathematical background required for Machine learning architecture algorithmic/ Programming based on real life application using text and speech	2	Emp
CO2	Students would be able to develop the syntax and architecture of word and sentence architecture with its basic copra of Natural Language	2	Emp..
CO3	Students would be able to develop model and parsing the text for language modeling and limitations of these models also explored	2	S
CO4	Students would be able to apply applications of advanced NLP with Deep learning and machine learning framework are developed.	2	Ent
CO5	Students would be able to Find out the future direction and limitation of AI	1	S

CO-PO Mapping for CS3611

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	3	1	1	2	3	3	2	2	2	1	3	2	3
CO 2	3	2	3	2	1	2	3	2	2	3	3	3	1	2	3	2
CO 3	2	2	2	2	3	2	1	2	2	1	1	2	1	2	1	2
CO 4	3	2	3	2	2	3	3	2	2	2	2	3	3	2	3	2
CO 5	3	2	3	2	3	2	2	3	2	2	2	3	3	2	2	3
Avg	2.60	1.80	2.60	2.20	2.00	2.00	2.20	2.40	2.20	2.00	2.00	2.60	1.80	2.20	2.20	2.40

CS3623	Title: Neural Networks and Deep Learning (Vision and NLP)	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.	
Expected Outcome	On completion of this course, the students are expected to learn 1. Neural Network, Feed Forward and Backpropagation 2. TensorFlow and Keras 3. RNN, CNN, Autoencoders	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	The neural network	5
The neuron, linear perceptron, feed-forward neural network, limitations of linear neurons, sigmoid, tanh, relu neurons, softmax output layer, information theory, cross entropy, Kullback-Leibler divergence.		
Unit II	Training feed-forward neural network-I	4
Gradient Descent, delta rules and learning rates, gradient descent with sigmoidal neurons.		
Unit III	Training feed-forward neural network-II	5
Backpropagation algorithms, stochastic and minibatch gradient descent, test sets, validation sets and overfitting, preventing overfitting		
Unit IV	TensorFlow	6
Computation graphs, graphs, sessions and fetches, constructing and managing graph, flowing tensors, sessions, data types, tensor arrays and shapes, names, variables, placeholders and simple optimization, linear regression and logistic regression using tensorflow		
Unit V	Implement Neural Network	4
Introduction to Keras, Build neural network using Keras, Evaluating models, data preprocessing, feature engineering, feature learning, overfitting, underfitting, weight regularization, dropout, universal workflow of deep learning.		
Text Books	Material Provided by Samatrix	
Reference Books	Material Provided by Samatrix	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3623

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The students are expected to learn-Neural Network, Feed Forward and Backpropagation	2	Emp
CO2	The students are expected to learn-TensorFlow and Keras	2	Emp..
CO3	The students are expected to learn-RNN, CNN, Autoencoders	2	S

CO-PO Mapping for CS3623

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped-3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	3	2	3	2	3	2	3	2	2	2	3	2	3
CO 2	3	2	3	2	3	2	3	2	3	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	3	2	2	2	1	2	2	2	1	2
Avg	2.60	1.80	2.60	2.20	2.60	2.20	2.60	2.40	2.60	2.20	2.00	2.60	2.60	2.20	2.20	2.40

CS3651	Title: Digital Forensics Part-1	L T P C 0 0 5 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	To conduct digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.	
Expected Outcome	Students will be able to understand the origins of forensic science, explain the difference between scientific conclusions and legal decision-making and explain the role of digital forensics and the relationship of digital forensics to traditional forensic science, traditional science and the appropriate use of scientific methods	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to Cyber Crime	6
Basic concepts in network security, Network Security Technology		
Unit II	File system	6
Filesystem Introduction, FAT, NTFS, Allocated & Unallocated Space, Slack Space, Free Space, Volatile Memory, Not Volatile Memory, Deleted File, Overwritten & Wiped File		
Unit III	Introduction to Digital Forensics	6
Introduction, What is Digital Forensics, Uses of Digital Forensics ,What skills should a computer forensic expert have, Locard's exchange principle		
Unit IV	Digital Evidence Acquisition Essentials	6
RFS, COC, Securing Evidence & Crime Scene, Evidence Hash, Imaging & Cloning		
Unit V	Digital Forensics Analysis Process	6
Live Forensics Tools, Winhex, FTK Imager, Autopsy, Encase		
Text Books	1.Learning material provided by Quick Heal	
Reference Books	1. Learning material provided by Quick Heal	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3651

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The student should be able to understand the Digital Evidence Acquisition Essentials.	2	Emp
CO2	The student should be able to understand the Process of Non-Live Forensics	2	Emp
CO3	The student should be able to understand the live forensics.	2	S

CO-PO Mapping for CS3651

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	3	3	3	3	2	2	3	2	3	3	3	3	2
CO 2	3	2	3	3	2	3	2	3	3	3	3	3	3	2	3	3
CO 3	2	3	2	2	2	3	3	3	2	2	3	3	2	2	3	3
Avg	2.33	2.33	2.33	2.67	2.33	3.00	2.67	2.67	2.33	2.67	2.67	3.00	2.67	2.33	3.00	2.67

Program Elective II

CS3703	Title: Wireless Networks	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims to understand the concept about Wireless networks, protocol stack and standards and analyze the network layer solutions for Wireless networks. To study about fundamentals of internetworking of WLAN and WWAN and learn about evolution of 5G Networks, its architecture and applications.	
Expected Outcome	After learning the course the students should be able to: ● To understand the concept about Wireless networks, protocol stack and standards and analyze the network layer solutions for Wireless networks. ● To study about fundamentals of internetworking of WLAN and WWAN. ● To learn about evolution of 5G Networks, its architecture and applications. ● Understand basics of propagation of radio signals and radio resource management techniques. Gain knowledge and awareness of multiple access techniques i.e. TDMA, CDMA, FDMA etc. ● Understanding emerging trends in Wireless communication like WiFi, WiMAX,	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction	5
Introduction to wireless network architectures: cellular networks, wireless local area networks, multi-hop networks, WLAN technologies: IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, WirelessHART , Types of Wireless communication System, Comparison of Common wireless system.		
Unit II	Multiple Access & Control Techniques	4
Introduction, Comparisons of multiple Access Strategies Carrier sense multiple access with collision avoidance (CSMA/CA), Carrier sense multiple access with collision detection (CSMA/CD),TDMA, CDMA, FDMA, OFDM , CSMA Protocols.		
Unit III	The Cellular Design Fundamentals	8
Cellular system, Hexagonal geometry cell and concept of frequency reuse,Channel Assignment Strategies Distance to frequency reuse ratio,Channel and co-channel interference reduction factor, S/I ratio consideration and calculation for Minimum Cochannel and adjacent interference, Handoff Strategies, Umbrella Cell Concept, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular System-cell splitting, Cell sectorization, Repeaters, Micro cell zone concept, Channel antenna system design considerations		
Unit IV	Internetworking Between WLANS And WWANS	6
Internetworking objectives and requirements, Schemes to connect WLANS and 4G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.		
Unit V	Recent Trends	4
Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software, Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile, Portability, Security issues and challenges in a Wireless network ,Introduction – 5G vision – 5G features and challenges - Applications of 4G & 5G Technologies		
Text Books	1. Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications 2. Wireless Communications and Networking,Vijay Garg, Elsevier 3.Mobile Communications Engineering, William C. Y. Lee, Mc Graw Hill Publications	
Reference Books	1. Jochen Schiller, ‖Mobile Communications‖, Second Edition, Pearson Education 2. Anurag Kumar, D.Manjunath, Joy kuri, —Wireless Networking‖, First Edition, Elsevier	

Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome for CS3703

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To understand the concept about Wireless networks, protocol stack and standards and analyze the network layer solutions for Wireless networks	2	Emp
CO2	To study about fundamentals of internetworking of WLAN and WWAN.	2	Emp
CO3	To learn about evolution of 5G Networks, its architecture and applications.	2	S
CO4	Understand basics of propagation of radio signals and radio resource management techniques	2	Emp
CO5	Understanding emerging trends in Wireless communication like WiFi , WiFimax	1	S

CO-PO Mapping for CS3703

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	2	2	2	2	3	2	3	3	2	2	2	3	2	3
CO 2	3	2	3	3	2	3	2	3	3	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	1	2	2	2	1	2
CO 4	3	2	3	3	2	3	2	3	2	2	2	3	3	2	3	2
CO 5	3	2	3	3	2	3	2	3	2	2	2	3	3	2	2	3
Avg	2.60	2.00	2.60	2.60	2.00	2.60	2.20	2.60	2.40	2.20	2.00	2.60	2.60	2.20	2.20	2.40

CS3704	Title: Soft Computing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The student should be made to Learn the various soft computing frame works, Be familiar with design of various neural networks, Be exposed to fuzzy logic, Learn genetic programming	
Expected Outcome	Upon completion of the course, the student should be able to: ● To Learn the various soft computing frame works. ● To familiarize with design of various neural networks. ● To exposed to fuzzy logic, Learn genetic programming ● Apply various soft computing frame works .Design of various neural networks. Use fuzzy logic. ● Apply genetic programming. Discuss hybrid soft computing.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction	8
Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm		
Unit II	Neural Network	7
McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network		
Unit III	Fuzzy Logic	8
Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning		
Unit IV	Genetic Algorithm	6
Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA		
Unit V	Hybrid Soft Computing Techniques and Applications	7
Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.		
Text Books	1.J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004. 2.S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd	
Reference Books	1.S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice-Hall of India Pvt. Ltd.	
Mode of Evaluation	Internal and External Examinations	

Recommended by Board of Studied on	09-08-2021
Date of Approval by the Academic Council on	14-11-2021

Course Outcome For CS3704

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To Learn the various soft computing frame works.	2	Emp
CO2	To familiarize with design of various neural networks.	2	Emp
CO3	To exposed to fuzzy logic, Learn genetic programming	2	S
CO4	Apply various soft computing frame works .Design of various neural networks.	2	Ent
CO5	Apply genetic programming. Discuss hybrid soft computing.	1	Emp

CO-PO Mapping for CS3704

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	2	2	2	2	3	2	2	2	2	2	3	2	3	2
CO 2	3	2	3	3	2	3	2	2	3	3	2	3	2	3	2	3
CO 3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
CO 4	3	2	3	3	2	3	2	2	3	3	2	3	2	3	2	3
CO 5	3	2	3	3	2	3	2	2	3	3	2	3	2	3	2	2
Avg	2.60	2.00	2.60	2.60	2.00	2.60	2.20	2.00	2.60	2.60	2.00	2.60	2.20	2.60	2.40	2.40

CS3707	Title: Computer Vision	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	To introduce students the fundamentals of image formation; To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; To develop an appreciation for various issues in the design of computer vision and object recognition systems; and To provide the student with programming experience from implementing computer vision and object recognition applications.	
Expected Outcome	● identify basic concepts, terminology, theories, models and methods in the field of computer vision, ● describe known principles of human visual system, ● describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition, ● suggest a design of a computer vision system for a specific problem	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Image Formation Models	8
Monocular imaging system, Orthographic& Perspective Projection, Camera model and Camera calibration, Binocular imaging systems		
Unit II	Image Processing and Feature Extraction	7
:Image representations (continuous and discrete), Edge detection		
Unit III	Motion Estimation	7
Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion		
Unit IV	Shape Representation and Segmentation	7
Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis		
Unit V	Object recognition	7
Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component analysis, Shape priors for recognition		
Text Books	1. Ballard D., Brown C., Computer Vision, Prentice Hall	
Reference Books	1.Sonka M., Hlavac V., Boyle R., Image Processing Analysis and Machine Design. PWS Publishers	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3707

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To introduce students the fundamentals of image formation; To introduce students the major ideas, methods,	2	Emp
CO2	To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition;	2	Emp
CO3	To develop an appreciation for various issues in the design of computer vision and object recognition systems;	2	Emp
CO4	To provide the student with programming experience from implementing computer vision and object recognition applications.	2	Emp
CO5	The Students should be able to build image processing applications	2	Emp

CO-PO Mapping for CS3707

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	3	2	3	2	3	2	3	2	2	3	2	3	3
CO 2	3	2	3	2	3	2	3	2	3	2	3	3	2	3	2	2
CO 3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2
CO 4	3	2	3	2	3	2	3	2	3	2	3	3	2	3	2	2
CO 5	3	2	3	2	3	2	2	3	3	2	3	3	2	3	2	3
Avg	2.60	1.80	2.60	2.20	2.60	2.20	2.60	2.40	2.60	2.20	2.60	2.60	2.20	2.60	2.20	2.40

CS3723	Title: Data Science - Tools and Techniques	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	The objective of this course is to teach students the conceptual framework of Big Data, Virtualization, MapReduce, HDFS, Pig, Hive, Spark, ZooKeeper, HBase	
Expected Outcome	On completion of this course, the students are expected to learn 1. Concepts of Hadoop and HDFS 2. Concepts of MapReduce 3. Big data tools Pig, Hive, Spark, Zookeeper, HBase	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Big Data	8
Fundamentals of Big Data, defining big data, building successful big data management architecture, big data journey, Big Data Types: Structured and unstructured data types, real time and non-real time requirements,Distributed Computing: History of distributed computing, basics of distributed computing		
Unit II	Big Data Technology Foundation	7
Big Data stack, redundant physical infrastructure, security infrastructure, operational databases, organizing data services and tools, analytical data warehouse, big data analytics, Virtualization: Basics of virtualization, hypervisor, abstraction and virtualization, implementing virtualization with big data, Cloud and Big Data: Defining cloud, cloud deployment and delivery models, cloud as an imperative for big data, use the cloud for big data		
Unit III	Operational Databases	7
Relational database, nonrelational database, key-value pair databases, document databases, columnar databases, graph databases, spatial databases, MapReduce Fundamentals: Origin of MapReduce, map function, reduce function, putting map and reduce together, optimizing map reduce, Hadoop: Discovering Hadoop, Hadoop distributed file system, Hadoop MapReduce, Hadoop file system, dataflow, Hadoop I/O, data integrity, compression, serialization, file-based data structure		
Unit IV	Avro & Pig	7
Avro data types and schemas, in-memory serialization and deserialization, avro datafiles, schema resolution Comparison with databases, pig latin, user defined functions, data processing operators		
Unit V	Hive, Apark, HBase & ZooKeeper	7
Hive: Running hive, comparison with traditional databases, HiveQL, tables, querying data, user- defined functions Spark: Resilient distributed datasets, shared variables, anatomy of a spark job run, executors and cluster managers, HBase: HBasics, concepts, clients, HBase vs RDBMS, Praxis ZooKeeper: ZooKeeper services, building application with ZooKeeper		
Text Books	1. Hadoop: The Definitive Guide, 4th Edition by Tom White - Shroff Publishers & Distributers Private Limited - Mumbai; Fourth edition (2015)	
Reference Books	1.Big Data: Principles and Best Practices of Scalable Real-time Data Systems by James Warren and Nathan Marz, Manning Publications (2015)	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3723

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None *(Use , for more than One)*
CO1	The students are expected to learn- Concepts of Hadoop and HDFS	2	Emp
CO2	The students are expected to learn- Concepts of MapReduce	2	Emp
CO3	The students are expected to learn- Big data tools Pig, Hive, Spark, Zookeeper, HBase	2	Emp

CO-PO Mapping for CS3723

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	1	2	3	2	3	2	3	2	3	2	2	3	2	3	3
CO 2	3	2	3	2	3	2	3	2	3	2	3	3	2	3	2	2
CO 3	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2
Avg	2.60	1.80	2.60	2.20	2.60	2.20	2.60	2.40	2.60	2.20	2.60	2.60	2.20	2.60	2.20	2.40

Program Elective III

CS3705	Title: Organization and Architecture of Computer	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	None	
Objective	Study of the basic structure and operation of a digital computer system. Analysis of the design of arithmetic and logic unit and understanding of the fixed point and floating point arithmetic operations. Understanding the hierarchical memory system, cache memories and virtual memory ,I/O Communication.	
Expected Outcome	● To understand basic structure and operation of a digital computer system. ● To introduce the processor architectures, memory organization and mapping techniques to students. ● To be able to analyze the design of arithmetic and logic unit and understanding of the fixed point and floating point arithmetic operations. ● To give the students an elaborate idea about the different memory systems and buses. ● To understand the hierarchical memory system, cache memories and virtual memory, I/O Communication.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction	8
Types of computer, Functional units of digital system and their interconnections, basic operational concepts, von neuman architecture, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes.		
Unit II	Arithmetic and Logic Unit	7
Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic and logic unit design. IEEE Standard for Floating Point Numbers		
Unit III	Control Unit	7
Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, CISC, RISC vs CISC, Pipelining. Hardwire and micro programmed control concept of horizontal and vertical microprogramming.		
Unit IV	Memory	7
Basic concept and hierarchy, semiconductor RAM memories, 2D and 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues and performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks, Paging, RAID		
Unit V	Input Output	7
Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors.		
Text Books	1. J.P.Hayes, "Computer Architecture and organization", Third Edition, McGraw Hill 2. Hwang and Briggs, "Computer Architecture and parallel processing", McGraw Hill	
Reference Books	1. David A. Patterson and John L. Hennessy, "Computer Organization and Desin", Third Edition, Morgan Kaufmann Publication.	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic Council on	14-11-2021	

Course Outcome for CS3705

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To understand basic structure and operation of a digital computer system.	2	Emp
CO2	To introduce the processor architectures, memory organization and mapping techniques to students.	2	S
CO3	To be able to analyze the design of arithmetic and logic unit and understanding of the fixed point and floating point arithmetic operations.	2	S
CO4	To give the students an elaborate idea about the different memory systems and buses.	2	Emp
CO5	To understand the hierarchical memory system, cache memories and virtual memory, I/O Communication	1	Emp

CO-PO Mapping for CS3705

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	3	2	2	2	3	2	2	3	2	2	3	3	2	3
CO 2	3	2	3	2	2	3	2	3	2	2	3	3	3	2	3	2
CO 3	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2
CO 4	3	2	3	2	2	3	2	3	2	2	2	3	3	2	3	2
CO 5	3	2	3	2	2	3	2	3	2	2	2	3	3	2	2	3
Avg	2.60	2.00	2.80	2.00	2.00	2.60	2.20	2.60	2.00	2.20	2.40	2.60	2.80	2.40	2.40	2.40

CS3706	Title: Data Compression	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	Gain a fundamental understanding of data compression methods for text, images, and video, and related issues in the storage, access, and use of large data sets. illustrate the concept of various algorithms for compressing text, audio, image and video information.	
Expected Outcome	•To gain a fundamental understanding of data compression methods for text, images, and video. •To understand related issues in the storage, access and use of large data sets. •To illustrate the concept of various algorithms for compressing text, audio, image and video information. •Understand the structural basis for and performance metrics for commonly used lossy compression techniques. • Understand conceptual basis for commonly used lossy compression techniques.	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Compression Techniques	8
Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model,		
Unit II	Compression Algorithms	6
The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.		
Unit III	Coding Algorithm	6
Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach		
Unit IV	Applications	6
File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Moveto-front coding, CALIC, JPEG-LS, Multi-resolution Approaches		
Unit V	Models	5
Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.		
Text Books	1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers 2. Elements of Data Compression,Drozdek, Cengage Learning 3. Introduction to Data Compression, Second Edition,KhalidSayood,The Morgan aufmannSeries	
Reference Books	1. Data Compression: The Complete Reference 4th Edition byDavid Salomon, Springer 2. Text Compression1st Edition by Timothy C. Bell Prentice Hall	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	09-08-2021	
Date of Approval by the Academic	14-11-2021	

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Course Outcome for CS3706

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	To gain a fundamental understanding of data compression methods for text, images, and video.	2	Emp
CO2	To understand related issues in the storage, access and use of large data sets.	2	Emp
CO3	To illustrate the concept of various algorithms for compressing text, audio, image and video.	2	S
CO4	Understand the structural basis for and performance metrics for commonly used lossy techniques.	2	Emp
CO5	Understand conceptual basis for commonly used lossy compression techniques.	1	S

CO-PO Mapping for CS3706

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	2	2	3	2	2	2	3	2	2	3	2	2	3	3	2	3
CO 2	3	2	3	2	2	3	2	3	2	3	3	3	3	2	3	3
CO 3	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2
CO 4	3	2	3	2	2	3	2	3	2	3	2	3	3	2	3	3
CO 5	3	2	3	2	2	3	2	3	2	3	2	3	3	2	2	3
Avg	2.60	2.00	2.80	2.00	2.00	2.60	2.20	2.60	2.00	2.80	2.40	2.60	2.80	2.40	2.40	2.80

CS3724	Title: Data Visualization	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.				
Expected Outcome	The learners will be able to- Conduct exploratory data analysis using Python Interpret results of exploratory data analysis Paraphrase the results for documentation				

Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Introduction to data handling	8
Overview of Data analysis, Introduction to Data visualization,Working with statistical formulas - Logical and financial functions , Data Validation & data models,Power Map for visualize data , Power BI-Business Intelligence , Data Analysis using statistical methods, Dashboard designing.		
Unit II	Introduction to data manipulation using function	6
Heat Map, Tree Map, Smart Chart, Azure Machine learning , Column Chart, Line Chart , Pie,Bar, Area, Scatter Chart, Data Series, Axes ,Chart Sheet , Trendline , Error Bars, Sparklines, Combination Chart, Gauge, Thermometer Chart , Gantt Chart , Pareto Chart etc , Frequency Distribution, Pivot Chart, Slicers , Tables: Structured , References, Table Styles , What-If Analysis: Data Tables| Correlation model |Regression model		
Unit III	Data Strategy & Consumer behaviour Analytics	6
Understanding Product & Category, Competitive, Analysis, Market Share understanding- Market potential Index, Seasonality-Sales Trending, Consumer behaviour Analytics-MIND AND MARKET FACTORS.		
Unit IV	Budget planning & Execution	6
MIMI, Regression & Correlation Analysis for Sales trending, Forecasting method with predictive investment modelling, Cohort Analysis, Google Analytics(GA), Case Studies-Assignments		
Unit V	Tableau software: getting started with tableau software	5
What is Tableau? What does the Tableau product suite comprise of? How Does Tableau Work? Tableau Architecture, What is My Tableau Repository? Connecting to Data & Introduction to data source concepts, Understanding the Tableau workspace, Dimensions and Measures, Data Types & Default Properties, Building basic views, Saving and Sharing your work-overview		

Text Books	1."Information Dashboard Design: Displaying Data for At-a-glance Monitoring" by Stephen Few 2. "Beautiful Visualization, Looking at Data Through the Eyes of Experts by Julie Steele, Noah Iliinsky
Reference Books	3. Data Compression: The Complete Reference 4th Edition byDavid Salomon, Springer 4. Text Compression1st Edition by Timothy C. Bell Prentice Hall
Mode of Evaluation	Internal and External Examinations
Recommended by Board of Studied on	09-08-2021
Date of Approval by	14-11-2021

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Course Outcome for CS3724

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	The learners will be able to-Conduct exploratory data analysis using Python	2	Emp
CO2	The learners will be able to-Interpret results of exploratory data analysis	2	Emp
CO3	The learners will be able to-Paraphrase the results for documentation	2	S

CO-PO Mapping for CS3724

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	2	3	2	2	2	3	2	2	3	2	2	3	3	2	3
CO 2	3	2	3	2	2	3	2	3	2	3	3	3	3	2	3	3
CO 3	2	2	2	2	2	2	2	2	2	2	3	2	2	3	2	2
Avg	2.60	2.00	2.80	2.00	2.00	2.60	2.20	2.60	2.00	2.80	2.40	2.60	2.80	2.40	2.40	2.80

CS3751	Title: Malware Analysis and Reverse Engineering II	L 3	T 0	P 0	C 3
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The course aims to understand the concept about Malware Analysis and Reverse Engineering applications.				
Expected Outcome	After learning the course the students should be able to: • Understand basics of Malware Analysis and Reverse Engineering-2. • Comprehend the intricate concept of malware analysis. • Able to decode cyber security issues in malware based attacks. • Perform evaluation of user support & dynamic malware analysis • Learn Automated Malware Analysis Tools				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	Network Support Analysis	5			
Network Support Analysis					
Unit II	User Support Analysis	4			
User Support Analysis					
Unit III	Advance Assembly Language	8			
Advance Assembly Language , Windows Executable(PE) file format 1. PE File Header 2. Sections 3. Data Directories 4. Imports & Export					
Unit IV	Windows Executable(PE) File Formats	6			
Windows Executable(PE) file formats					
Unit V	Dynamic Malware Analysis	4			
Dynamic Malware Analysis					
Unit VI	Automated Malware Analysis Tools				
Automated Malware Analysis Tools					
Text Books	Material Provided by Quick Heal				
Reference Books	Material Provided by Quick Heal				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studied on	11-07-2020				
Date of Approval by the Academic Council on	13-09-2020				

Course Outcome for CS3751

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Emp)/ Skill(S)/ Entrepreneurship (Ent)/ None (*Use , for more than One*)
CO1	Understand basics of Malware Analysis and Reverse Engineering-2.	2	Emp
CO2	Comprehend the intricate concept of malware analysis.	2	Emp
CO3	Able to decode cyber security issues in malware based attacks.	2	S
CO4	Perform evaluation of user support & dynamic malware analysis	2	Emp
CO5	Learn Automated Malware Analysis Tools	1	S

CO-PO Mapping for CS3751

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO 1	1	2	2	2	2	2	1	1	1	3	3	2	3	3	3	3
CO 2	1	1	1	2	1	2	2	1	1	1	3	3	2	2	2	2
CO 3	2	2	2	2	2	3	3	1	1	2	3	1	1	2	1	1
CO 4	2	1	2	2	2	3	3	2	2	2	2	1	1	1	1	1
CO 5	1	1	1	1	1	2	2	2	1	2	3	3	2	1	2	2
Avg	1.5	1.5	1.75	2	1.75	2.5	2.25	1.25	1.25	2	2.75	1.75	1.75	2	1.75	1.75