File Ref.No.233344/GA - IV - J1/2021/Admn

UNIVERSITY OF CALICUT

Abstract

General & Academic IV - Faculty of Science - Scheme and Syllabus of BSc Information Technology Honours Programme-in tune with the CUFYUGP Regulations 2024, with effect from 2024 admission - Approved-Subject to ratification by the Academic Council-Implemented- Orders Issued

G & A - IV - J

U.O.No. 10406/2024/Admn Dated, Calicut University.P.O, 01.07.2024

Read:-1. U.O.No. 3103/2024/Admn dated 22/02/2024.

2. Minutes of the online meeting of the Board of Studies in Computer Science and Application UG held on 29/05/2024

3. Remarks of the Dean, Faculty of Science dated 20/06/2024.

4. Orders of the Vice Chancellor in the file of even No and dated 26/06/2024.

ORDER

1. The Regulations of the Calicut University Four Year UG Programmes (CUFYUGP Regulations 2024) for Affiliated Colleges, has been implemented with effect from 2024 admission , vide paper read as (1).
2. The Board of Studies in Computer Science and Application UG in the meeting held on 29/05/2024, vide paper read as (2), has approved the Scheme and Syllabus of BSc Information Technology Honours Programme in tune with CUFYUGP Regulations 2024, with effect from 2024 admission.
3. The Dean, Faculty of Science vide paper read as (3), has approved the minutes of the meeting of the Board of Studies in Computer Science and Application UG held on 29/05/2024.
4. Considering the urgency, the Vice Chancellor has approved the minutes of the meeting of Board of Studies in Computer Science and Application UG held on 29/05/2024 and accorded sanction to implement the Scheme and Syllabus of BSc Information Technology Honours Programme in tune with CUFYUGP Regulations 2024, with effect from 2024 admission, subject to ratification by the Academic Council.
5. The Scheme and Syllabus of BSc Information Technology Honours Programme in tune with CUFYUGP Regulations 2024 is thus implemented with effect from 2024 admission, subject to ratification by the Academic Council.

Orders are issued accordingly. (Syllabus appended)

Ajayakumar T.K

Assistant Registrar

To

Principals of all Affiliated Colleges

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Section Officer

UNIVERSITY OF CALICUT

THENHIPALAM, CALICUT UNIVERSITY P.O

DEGREE OF

BACHELOR OF SCIENCE (B.Sc.)

HONOURS IN

Information technology

(FOUR YEAR UNDERGRADUATE PROGRAMME CURRICULUM)

UNDER THE FACULTY OF SCIENCE

SYLLABUS

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2024 – '25 ONWARDS)

BOARD OF STUDIES IN COMPUTER SCIENCE (UG)

THENHIPALAM, CALICUT
UNIVERSITY P.O., KERALA,
673635, INDIA

APRIL 2024

UNIVERSITY OF CALICUT

B.Sc. Information technology Honours

(MAJOR, MINOR AND GENERAL FOUNDATION COURSES)

SYLLABUS

(w.e.f. 2024 admission onwards)

(CUFYUGP Regulations 2024)

PROGRAMME OUTCOMES (PO):

At the end of the graduate programme at Calicut University, a student would:

Knowledge Acquisition:	
PO1	Demonstrate a profound understanding of knowledge trends and their impact on the chosen discipline of study.
Communication, Collaboration, Inclusiveness, and Leadership:	
PO2	Become a team player who drives positive change through effective communication, collaborative acumen, transformative leadership, and a dedication to inclusivity.
Professional Skills:	
PO3	Demonstrate professional skills to navigate diverse career paths with confidence and adaptability.
Digital Intelligence	
PO4	Demonstrate proficiency in varied digital and technological tools to understand and interact with the digital world, thus effectively processing complex information.
Scientific Awareness and Critical Thinking:	
PO5	Emerge as an innovative problem-solver and impactful mediator, applying scientific understanding and critical thinking to address challenges and advance sustainable solutions.
Human Values, Professional Ethics, and Societal and Environmental Responsibility:	
PO6	Become a responsible leader, characterized by an unwavering commitment to human values, ethical conduct, and a fervent dedication to the well-being of society and the environment.
Research, Innovation, and Entrepreneurship:	
PO7	Emerge as a researcher and entrepreneurial leader, forging collaborative partnerships with industry, academia, and communities to contribute enduring solutions for local, regional, and global development.

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the BSc IT Honours programme at Calicut University, a student would:

PSO1	Focuses on preparing students for roles pertaining to information Technology
PSO2	Understand the concepts of system architecture, hardware, software and network configuration
PSO3	Acquire logical thinking and problem-solving skills to find solutions in the software domain
PSO4	Design, analyse and develop code-based solutions for the algorithms
PSO5	Address the industry demands and assimilate technical, logical and ethical skills needed for the industry
PSO6	Adapt to emerging trends and tackle the challenges in the software field.

MINIMUM CREDIT REQUIREMENTS OF THE DIFFERENT PATHWAYS IN THE THREE-YEAR PROGRAMME IN CUFYUGP

Sl. No.	Academic Pathway	Major	Minor/ Other Disciplines	Foundation Courses AEC: 4 MDC: 3 SEC: 3 VAC: 3	Intern -ship	Total Credits	Example
		Each course has 4 credits		Each course has 3 credits			
1	Single Major (A)	68 (17 courses)	24 (6 courses)	39 (13 courses)	2	133	Major: IT + six courses in different disciplines in different combinations
2	Major (A) with Multiple Disciplines (B, C)	68 (17 courses)	12 + 12 (3 + 3 = 6 courses)	39 (13 courses)	2	133	Major: IT + Mathematics and Physics
3	Major (A) with Minor (B)	68 (17 courses)	24 (6 courses)	39 (13 courses)	2	133	Major: IT Minor: Electronics
4	Major (A) with Vocational Minor (B)	68 (17 courses)	24 (6 courses)	39 (13 courses)	2	133	Major: IT Minor: Data Science/Web Technology
5	Double Major (A, B)	A: 48 (12 courses) B: 44 (11 courses)	-	12 + 18 + 9	2	133	IT and Statistics Double Major
			The 24 credits in the Minor stream are distributed between the two Majors. 2 MDC, 2 SEC, 2 VAC and the Internship should be in Major A. Total credits in Major A should be 48 + 20 = 68 (50% of 133) 1 MDC, 1 SEC and 1 VAC should be in Major B. Total credits in Major B should be 44 + 9 = 53 (40% of 133)				
Exit with UG degree / Proceed to fourth year with 133 credits							

B.Sc. Information Technology HONOURS PROGRAMME

COURSE STRUCTURE FOR PATHWAYS 1 – 4

1. Single Major
2. Major with Multiple Disciplines
3. Major with Minor
4. Major with Vocational Minor

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	ITY1CJ101/ ITY1MN100	Fundamentals of IT and Computational thinking	75	5	4	30	70	100
	XXX1MNXXX	Minor Course 1	75	5	4	30	70	100
	XXX1MNXXX	Minor Course 2	75	5	4	30	70	100
	ENG1FA101 (2)	Ability Enhancement Course 1	60	4	3	25	50	75
	XXX1FA102 (2)	Ability Enhancement Course 2 Additional language	45	3	3	25	50	75
	XXX1FM103	Multi-Disciplinary Course 1 Other than major	45	3	3	25	50	75
		Total		**25**	**21**			**525**
2	ITY2CJ101/ ITY2MN100	Fundamentals of Programming (C Language)	75	5	4	30	70	100
	XXX1MNXXX	Minor Course 3	75	5	4	30	70	100
	XXX1MNXXX	Minor Course 4	75	5	4	30	70	100
	ENG2FA103 (2)	Ability Enhancement Course 3	60	4	3	25	50	75
	XXX2FA104 (2)	Ability Enhancement Course 4 Additional language	45	3	3	25	50	75
	XXX2FM106	Multi-Disciplinary Course 2 Other than major	45	3	3	25	50	75
		Total		**25**	**21**			**525**
3	ITY3CJ201	Digital Electronics	60	4	4	30	70	100
	ITY3CJ202/ ITY3MN200	Data Structures and Algorithm	75	5	4	30	70	100
	XXX1MNXXX	Minor Course 5	75	5	4	30	70	100
	XXX1MNXXX	Minor Course 6	75	5	4	30	70	100
	XXX3FM107 (2)	Multi-Disciplinary Course 3 – Kerala Knowledge System	45	3	3	25	50	75
	ENG3FV108 (2)	Value-Added Course 1	45	3	3	25	50	75
		Total		**25**	**22**			**550**
4	ITY4CJ203	Database Management System	75	5	4	30	70	100

	ITY4CJ204	Python Programming	75	5	4	30	70	100
	ITY4CJ205	Operating Systems	75	5	4	30	70	100
	ENG4FV109 (2)	Value-Added Course 2	45	3	3	25	50	75
	XXX4FV110(2)	Value-Added Course 3	45	3	3	25	50	75
	ENG4FS111 (2)	Skill Enhancement Course – 1 (P)	60	4	3	25	50	75
		Total		**25**	**21**			**525**
5	ITY5CJ301	Numerical Analysis and Optimization Techniques	60	4	4	30	70	100
	ITY5CJ302	Object Oriented Programming (Java)	75	5	4	30	70	100
	ITY5CJ303	Full Stack Web Development	75	5	4	30	70	100
	ITY5EJ305	Elective Course 1 in Major	60	4	4	30	70	100
	ITY5EJ306	Elective Course 2 in Major	60	4	4	30	70	100
	ITY5FS112	Skill Enhancement Course 2 - Digital Marketing	45	3	3	25	50	75
		Total		**25**	**23**			**575**
6	ITY6CJ304/ ITY8MN304	Software project management	60	4	4	30	70	100
	ITY6CJ305/ ITY8MN305	Computer Networks	75	5	4	30	70	100
	ITY6CJ306/ ITY8MN306	Introduction to AI and ML	75	5	4	30	70	100
	ITY6CJ311	Elective Course 3 in Major	60	4	4	30	70	100
	ITY6CJ312	Elective Course 4 in Major	60	4	4	30	70	100
	ITY6FS113	Skill Enhancement Course 3 - Project Implementation	45	3	3	25	50	75
	ITY6CJ349	Internship in Major (Credit for internship to be awarded only at the end of Semester 6)	60		2	50	-	50
		Total		**25**	**25**			**625**
Total Credits for Three Years					**133**			**3325**
7	ITY7CJ401	Data Communication and Fiber optics	75	4	4	30	70	100
	ITY7CJ402	System Security	60	4	4	30	70	100
	ITY7CJ403	Advanced Data Structures and Algorithms	75	5	4	30	70	100

	ITY7CJ404	Block Chain Technology	60	4	4	30	70	100
	ITY7CJ405	Mastering Java Web Development	75	5	4	30	70	100
		Total		**22**	**20**			**500**
8	ITY8CJ406	Compiler Design	60	4	4	30	70	100
	ITY8CJ407	Cloud Computing	60	4	4	30	70	100
	ITY8CJ408	Enterprise Resource Planning	60	4	4	30	70	100
	OR (instead of Core Courses ITY8CJ406, ITY8CJ407 and ITY8CJ408 in Major)							
	ITY8EJXXX* /ITY8MN406	Elective Course 5	60	4	4	30	70	100
	ITY8EJXXX* /ITY8MN407	Elective Course 6	60	4	4	30	70	100
	ITY8EJXXX* /ITY8MN408	Elective Course 7	60	4	4	30	70	100
	ITY8CJ449**	Project (in Honours programme)	360	13	12	90	210	300
	ITY8CJ499**	Research Project (in Honours with Research programme)	360	13	12	90	210	300
	OR (instead of Elective Course 7 in Major, in the case of Honours with Research Programme)							
	ITY8CJ489	Research Methodology	60	4	4	30	70	100
		Total		**25**	**24**			**600**
Total Credits for Four Years					**177**			**4425**

Choose any four elective courses (two in fifth and two in sixth semester) from the basket of electives with specialization

Choose three elective courses in semester 8 from elective basket with no specialization

CREDIT DISTRIBUTION FOR PATHWAYS 1 – 4

1. Single Major
2. Major with Multiple Disciplines
3. Major with Minor
4. Major with Vocational Minor

Semester	Major Courses	Minor Courses	General Foundation Courses	Internship/ Project	Total
1	4	4 + 4	3 + 3 + 3	-	21
2	4	4 + 4	3 + 3 + 3	-	21
3	4 + 4	4 + 4	3 + 3	-	22
4	4 + 4 + 4	-	3 + 3 + 3	-	21
5	4 + 4 + 4 + 4 + 4	-	3	-	23
6	4 + 4 + 4 + 4 + 4	-	3	2	25
Total for Three Years	**68**	**24**	**39**	**2**	**133**
7	4 + 4 + 4 + 4 + 4	-	-	-	20
8	4 + 4 + 4	4 + 4 + 4	-	12	24
Total for Four Years	**88 + 12 = 100**	**36**	**39**	**2**	**177**

DISTRIBUTION OF MAJOR COURSES IN INFORMATIOM TECHNOLOGY FOR PATHWAYS 1 – 4

1. Single Major
2. Major with Multiple Disciplines
3. Major with Minor
4. Major with Vocational Minor

Semester	Course Code	Course Title	Hours/ Week	Credits
1	ITY1CJ101/ ITY1MN100	Fundamentals of IT & Computational Thinking	5	4
2	ITY2CJ101/ ITY2MN100	Fundamentals of Programming(C Language)	5	4
3	ITY3CJ201	Digital Electronics	4	4
	ITY3CJ202/ ITY3MN200	Data Structures and Algorithms	5	4
4	ITY4CJ203	Database Management System	5	4
	ITY4CJ204	Python Programming	5	4

	ITY4CJ205	Operating Systems	5	4
5	ITY5CJ301	Numerical Analysis and Optimization Techniques	4	4
	ITY5CJ302	Object Oriented Programming (JAVA)	5	4
	ITY5CJ303	Full Stack Web Development	5	4
	ITY5EJ305	Elective Course 1	4	4
	ITY5EJ306	Elective Course 2	4	4
6	ITY6CJ304/ ITY8MN304	Software project management	4	4
	ITY6CJ305/ ITY8MN305	Computer Networks	5	4
	ITY6CJ306/ ITY8MN306	Introduction to AI and ML	5	4
	ITY6CJ311	Elective Course 3	4	4
	ITY6CJ311	Elective Course 4	4	4
	ITY6CJ349	Internship in Major	-	2
Total for the Three Years				**70**
7	ITY7CJ401	Data Communication and Fiber optics	4	4
	ITY7CJ402	System Security	4	4
	ITY7CJ403	Advanced Data Structures and Algorithms	5	4
	ITY7CJ404	Block chain Technology	4	4
	ITY7CJ405	Mastering Java Web Development	5	4
8	ITY8CJ406	Compiler Design	4	4
	ITY8CJ407	Cloud Computing	4	4
	ITY8CJ408	Enterprise Resource Planning	4	4
	OR (instead of Core Courses ITY8CJ406, ITY8CJ407 and ITY8CJ408 in Major)			
	ITY8EJ405*	Elective Course 5	4	4
	ITY8EJ405*	Elective Course 6	4	4
	ITY8EJ405*	Elective Course 7	4	4
	ITY8CJ449**	Project Work (in Honours Programme)/ Project with Research	13	12
	ITY8CJ499**	Research Project (in Honours with Research Programme)	13	12
	OR (instead of Elective Course 7 in Major, in the case of Honours with Research Programme)			

	ITY8CJ489	Research Methodology	4	4
Total for the Four Years				**114**

ELECTIVE COURSES IN INFORMATIOM TECHNOLOGY WITH SPECIALISATION

Group No.	Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
								Internal	External	Total
1		**AI and ML**								
	1	ITY5EJ 301(1)	Machine Learning Algorithms	5	60	4	4	30	70	100
	2	ITY5EJ 302(1)	Knowledge Engineering	5	60	4	4	30	70	100
	3	ITY6EJ 301(1)	Soft Computing	6	60	4	4	30	70	100
	4	ITY6EJ 302(1)	Deep Learning	6	60	4	4	30	70	100
2	**Computer Networks**									
	1	ITY5EJ 303(2)	Wireless Communication	5	60	4	4	30	70	100
	2	ITY5EJ 304(2)	Cryptography and Network Security	5	60	4	4	30	70	100
	3	ITY6EJ 303(2)	Storage Area Network	6	60	4	4	30	70	100
	4	ITY6EJ 304(2)	Internet of Things	6	60	4	4	30	70	100

ELECTIVE COURSES IN INFORMATIOM TECHNOLOGY WITH NO SPECIALISATION

Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
							Internal	External	Total
1	ITY8EJ401	Microprocessor and its Applications	8	60	4	4	30	70	100
2	ITY8EJ402	System Software	8	60	4	4	30	70	100
3	ITY8EJ403	Client Server Architecture	8	60	4	4	30	70	100
4	ITY8EJ404	Digital and Mobile Forensics	8	60	4	4	30	70	100
5	ITY8EJ405	Social Networks Analysis	8	60	4	4	30	70	100
6	ITY8EJ406	Parallel Computing	8	60	4	4	30	70	100

Minor Courses

BSc Information Technology is a Course designed to mould professionals in the IT field. So it is advisable to the student to opt their minor course from minor /vocational minor courses offered in the same subject to acquire more knowledge in subject area and become a well-equipped professional in IT field

GROUPING OF MINOR COURSES IN INFORMATIOM TECHNOLOGY

(Title of the Minor: **Computer Science)**

Group No.	Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
								Internal	External	Total
1		**FOUNDATIONS OF DATA ANALYTICS**								
	1	ITY1MN 102	Data analysis using Spreadsheet	1	75	5	4	30	70	100
	2	ITY2MN 102	Fundamentals of SPSS and R programming	2	75	5	4	30	70	100
	3	ITY3MN 202	Data Visualisation using Python	3	75	5	4	30	70	100

2		**FOUNDATIONS OF COMPUTING**								
	1	ITY1MN 103	Computer Essentials with Word processing & Presentation	1	75	5	4	30	70	100
	2	ITY2MN 103	Web Design Trends and Techniques	2	75	5	4	30	70	100
	3	ITY3MN 203	Exploring Cybersecurity in social media	3	75	5	4	30	70	100
3		**FOUNDATIONS OF WEB TECHNOLOGY**								
	1	ITY1MN 104	Fundamentals Of Scripting	1	75	5	4	30	70	100
	2	ITY2MN 104	API Fundamentals: Developing RESTful APIs	2	75	5	4	30	70	100
	3	ITY3MN 204	UI/UX	3	75	5	4	30	70	100

GROUPING OF VOCATIONAL MINOR COURSES IN INFORMATIOM TECHNOLOGY

(Title of the Vocational Minor: **DATA SCIENCE)**

Group No.	Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
								Internal	External	Total
1		**DATA SCIENCE**								
	1	ITY1VN101	Mathematics for Data Science	1	75	5	4	30	70	100
	2	ITY1VN102	Statistics for Data Science	1	75	5	4	30	70	100
	3	ITY2VN103	Discrete Structures for Data Science	2	75	5	4	30	70	100
	4	ITY2VN104	Introduction to Data Science	2	75	5	4	30	70	100
	5	ITY3VN201	Tools and Methodologies for Data Science	3	75	5	4	30	70	100
	6	ITY3VN202	Data Analysis and	3	75	5	4	30	70	100

			Visualization Using Spreadsheets							
	7	ITY8VN401	Data Science Programming using R	8	75	5	4	30	70	100
	8	ITY8VN402	Predictive Modeling	8	60	4	4	30	70	100

i. Students in Single Major pathway can choose course/courses from any of the Minor/ Vocational Minor groups offered by any discipline.

ii. Students in Major with Multiple Disciplines pathway can choose as one of the multiple disciplines, all the three courses from any one of the Minor/ Vocational Minor groups offered by any discipline, including their Major discipline. If they choose one of the Minor/ Vocational Minor groups offered by their Major discipline as the first one of the multiple disciplines, then their choice as the second one of the multiple disciplines should be any one of the Minor/ Vocational Minor groups offered by a discipline other than the Major discipline. If the students choose any one of the Minor/ Vocational Minor groups in IT as given above, then the title of the group will be the title of that multiple discipline.

(iii). Students in Major with Minor pathway can choose all the courses from any two Minor groups offered by any discipline. If the students choose two Minor groups in IT (three courses from foundations of computing and three courses from foundations of data analytics) as given above, then the title of the Minor will be **Computer Science**

(iv). Students in Major with Vocational Minor pathway can choose all the courses from any two Vocational Minor groups offered by any discipline. If the students choose Vocational Minor group in IT as given above, then the title of the Vocational Minor will be **Data Science**

DISTRIBUTION OF GENERAL FOUNDATION COURSES IN IT

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	ITY1FM105	Introduction To Computers and Office Automation	45	3	3	25	50	75
2	ITY2FM106	Digital Empowerment Through Ethical Standards	45	3	3	25	50	75
3	ITY3FV108	Professional Skill Development for IT Career Excellence	45	3	3	25	50	75

4	ITY4FV110	Introduction to Cyber Laws	45	3	3	25	50	75
5	ITY5FS112	Introduction to Digital Marketing	45	3	3	25	50	75
6	ITY6FS113	Project Implementation (Mini Project)	45	3	3	25	50	75

COURSE STRUCTURE FOR BATCH A1(B2)
IN PATHWAY 5: DOUBLE MAJOR

A1: 68 credits in IT (Major A) ***B1: 68 credits in Major B***
A2: 53 credits in IT (Major A) ***B2: 53 credits in Major B***
The combinations available to the students: (A1 & B2), (B1 & A2)

Note: Unless the batch is specified, the course is for all the students of the class

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	ITY1CJ101 / ITY1MN100	Fundamentals of IT & Computational Thinking/Minor in IT	75	5	4	30	70	100
	XXX1CJ101	Core Course 1 in Major B –	60/ 75	4/ 5	4	30	70	100
	ITY1CJ102 / ITY2CJ102 / ITY4CJ203*	Database Management System (for batch A1 only)	75	5	4	30	70	100
	ENG1FA101 (2)	Ability Enhancement Course 1	60	4	3	25	50	75
	XXX1FA102(2)	Ability Enhancement Course 2	45	3	3	25	50	75
	ITY1FM105	Multi-Disciplinary Course 1 – Introduction To Computers and Office Automation	45	3	3	25	50	75
		Total		**24/ 25**	**21**			**525**
2	ITY2CJ101 / ITY2MN100	Fundamentals of Programming C Language	75	5	4	30	70	100
	XXX2CJ101	Core Course 2 in Major B –	60/ 75	4/ 5	4	30	70	100
	XXX2CJ102 / XXX1CJ102	Core Course 3 in Major B – (for batch B2 only)	60/ 75	4/ 5	4	30	70	100

	ENG2FA103 (2)	Ability Enhancement Course 3	60	4	3	25	50	75
	XXX2FA108(2)	Ability Enhancement Course 4	45	3	3	25	50	75
	ITY2FM106	Multi-Disciplinary Course 2 – Digital Empowerment Through Ethical Standards	45	3	3	25	50	75
		Total		**23 – 25**	**21**			**525**
3	ITY3CJ201	Core Course 4 in Major – Digital Electronics	60	4	4	30	70	100
	ITY3CJ202	Core Course 5 in Major – Data Structures and Algorithms	75	5	4	30	70	100
	XXX3CJ201	Core Course 4 in Major B	60/ 75	4/ 5	4	30	70	100
	XXX3CJ202	Core Course 5 in Major B	60/ 75	4/ 5	4	30	70	100
	XXX3FM106	Multi-Disciplinary Course 1 in B –	45	3	3	25	50	75
	ITY3FV108	Value-Added Course 1 Professional Skill Development for IT Career Excellence	45	3	3	25	50	75
		Total		**23 – 25**	**22**			**550**
4	ITY4CJ204	Core Course 6 in Major – Python Programming	75	5	4	30	70	100
	XXX4CJXXX	Core Course 6 in Major B	60/ 75	4/ 5	4	30	70	100
	ITY4CJ205	Core Course 7 in Major – Operating Systems	75	5	4	30	70	100
	ITY4FV110	Value-Added Course 2 Introduction to Cyber Laws	45	3	3	25	50	75
	XXX4FV110	Value-Added Course 1 in B	45	3	3	25	50	75
	ITY5FS112	Skill Enhancement Course 1 Introduction to Digital Marketing	45	3	3	25	50	75
		Total		**23/ 24**	**21**			**525**
5	ITY5CJ302	Core Course 8 in Major – Object Oriented Programming	75	5	4	30	70	100
	XXX5CJXXX	Core Course 7 in Major B –	60/ 75	4/ 5	4	30	70	100
	ITY5CJ303	Core Course 9 in Major Full Stack Web Development	60	4	4	30	70	100
	ITY5EJ305	Elective Course 1 in Major	60	4	4	30	70	100

	XXX5CJXXX	Elective Course 1 in Major B	60	4	4	30	70	100
	XXX5FSXXX	Skill Enhancement Course 1 in B	45	3	3	25	50	75
		Total		**24/ 25**	**23**			**575**
6	ITY6CJ305/ ITY8MN305	Core Course 10 in Major – Computer Networks	75	5	4	30	70	100
	XXX6CJXXX	Core Course 8 in Major B –	60/ 75	4/ 5	4			
	XXX6CJXXX	Core Course 9 in Major B – (for batch B2 only)	60	4	4	30	70	100
	ITY6EJ306	Elective Course 2 in Major IT	60	4	4	30	70	100
	XXX6EJXXX	Elective Course 2 in Major B	60	4	4	30	70	100
	ITY6FS113	Skill Enhancement Course 3 – Project Implementation	45	3	3	25	50	75
	ITY6CJ349	Internship in Major IT (Credit for internship to be awarded only at the end of Semester 6)	60		2	50	-	50
		Total		**24/ 25**	**25**			**625**
Total Credits for Three Years					**133**			**3325**
For batch A1(B2), the course structure in semesters 7 and 8 is the same as for pathways 1 – 4, except that the number of the core and elective courses is in continuation of the number of courses in the two categories completed at the end of semester 6.								

* The course code of the same course as used for the pathways 1 – 4

CREDIT DISTRIBUTION FOR BATCH A1(B2)
IN PATHWAY 5: DOUBLE MAJOR

Semester	Major Courses in IT	General Foundation Courses in IT	Internship/ Project in IT	Major Courses in B	General Foundation Courses in B	AEC	Total
1	4 + 4	3	-	4	-	3 + 3	21
2	4	3	-	4 + 4	-	3 + 3	21
3	4 + 4	3	-	4 + 4	3	-	22
4	4 + 4	3 + 3	-	4	3	-	21
5	4 + 4 + 4	-	-	4 + 4	3	-	23
6	4 + 4	3	2	4 + 4 + 4	-	-	25
Total for Three Years	**48**	**18**	**2**	**44**	**9**	**12**	**133**
	68			**53**		**12**	**133**
	Major	Minor					

	Courses in IT	Courses					
7	4 + 4 + 4 + 4 + 4	-			-	-	20
8	4 + 4 + 4	4 + 4 + 4	12		-	-	24
Total for Four Years	**88 + 12 = 100**	**12**					**177**

COURSE STRUCTURE FOR BATCH B1(A2)
IN PATHWAY 5: DOUBLE MAJOR

A1: 68 credits in IT (Major A) ***B1: 68 credits in Major B***

A2: 53 credits in IT (Major A) ***B2: 53 credits in Major B***

The combinations available to the students: (A1 & B2), (B1 & A2)

Note: Unless the batch is specified, the course is for all the students of the class

Semester	Course Code	Course Title	Total Hours	Hours/ Week	Credits	Marks		
						Internal	External	Total
1	**XXX**1CJ101	Core Course 1 in Major B –	75	5	4	30	70	100
	ITY1CJ101	Fundamentals of IT & Computational Thinking	60/ 75	4/ 5	4	30	70	100
	XXX1CJ 102 / XXX2CJ 102	Core Course 2 in Major B – (for batch B1 only)	60/ 75	4/ 5	4	30	70	100
	ENG1FA101(2)	Ability Enhancement Course – 1 (P) (E)	60	4	3	25	50	75
	XXX1FA102(2)	Ability Enhancement Course – 2 (AL)	45	3	3	25	50	75
	XXX1FM 105	Multi-Disciplinary Course 1 in B – (for batch B1 only)	45	3	3	25	50	75
		Total		**23 – 25**	**21**			**525**
2	XXX2CJ101	Core Course 2 in Major B –	75	5	4	30	70	100
	ITY2CJ101	Fundamentals of Programming (C Language)	60/ 75	4/ 5	4	30	70	100

	ITY2CJ 102 / ITY1CJ 102 / ITY3CJ 201*	Digital Electronics	75	5	4	30	70	100
	ENG2FA103(2)	Ability Enhancement Course – 3 (P) (E)	60	4	3	25	50	75
	XXX2FA108(2)	Ability Enhancement Course – 4 (AL)	45	3	3	25	50	75
	XXX2FM 106 / XXX3FM 106	Multi-Disciplinary Course 1	45	3	3	25	50	75
		Total		**24/ 25**	**21**			**525**
3	XXX3CJ203	Core Course 4 in Major B	60	4	4	30	70	100
	XXX3CJ202	Core Course 5 in Major B	75	5	4	30	70	100
	ITY3CJ203	Database Management System	60/ 75	4/ 5	4	30	70	100
	ITY3CJ204	Python Programming	60/ 75	4/ 5	4	30	70	100
	XXX3FM 106 / XXX2FM 106	Multi-Disciplinary Course 2 in B –	45	3	3	25	50	75
	XXX3FV 108	Value-Added Course 1 in B – (for batch B1 only)	45	3	3	25	50	75
		Total		**23 – 25**	**22**			**550**
4	ITY4CJ205	Core Course 6 in Major A Operating Systems	75	5	4	30	70	100
	XXX4CJXXX	Core Course 6 in Major B	60/ 75	4/ 5	4	30	70	100
	XXX4CJXXX	Core Course 7 in Major B – (for batch B1 only)	60/ 75	4/ 5	4	30	70	100
	ITY4FV 110	Value-Added Course Introduction to Cyber Laws	45	3	3	25	50	75
	XXX4FV 110	Value-Added Course 2 in B –	45	3	3	25	50	75

	ITY5FS 112	Skill Enhancement Course Introduction to Digital Marketing	45	3	3	25	50	75
		Total		**22 – 24**	**21**			**525**
5	ITY5CJ 301	Core Course Numerical Analysis and Optimization Techniques	75	5	4	30	70	100
	XXX5CJXXX	Core Course 8 in Major B –	60/ 75	4/ 5	4	30	70	100
	XXX5CJXXX	Core Course 9 in Major B – (for batch B1 only)	60	4	4	30	70	100
	XXX5EJXXX	Elective Course 1 in Major A	60	4	4	30	70	100
	XXX5EJXXX	Elective Course 1 in Major B	60	4	4	30	70	100
	XXX5FS 112 / XXX4FS 112	Skill Enhancement Course 1 in B	45	3	3	25	50	75
		Total		**24/ 25**	**23**			**575**
6	ITY6CJ 305	Core Course Computer Networks	75	5	4	30	70	100
	XXX6CJXXX	Core Course 10 in Major B –	60/ 75	4/ 5	4	30	70	100
	ITY6CJ 306	Core Course (for batch A2 only) Introduction to AI and ML	60	4	4	30	70	100
	XXX6EJXXX	Elective Course 2 in Major A	60	4	4	30	70	100
	XXX6EJXXX	Elective Course 2 in Major B	60	4	4	30	70	100
	XXX6FS 113	Skill Enhancement Course 2 in B (for batch B1 only)	45	3	3	25	50	75
	XXX6CJ 349	Internship in Major B (Credit for internship to be awarded only at the end of Semester 6)	60		2	50	-	50

		Total		**24/ 25**	**25**			**625**
Total Credits for Three Years					**133**			**3325**
To continue to study IT in semesters 7 and 8, batch B1(A2) needs to earn additional 15 credits in IT to make the total credits of 68. Suppose this condition is achieved, and the student of batch B1(A2) proceeds to the next semesters to study IT IT. The course structure in semesters 7 and 8 is the same as for pathways 1 – 4, except that the number of the core and elective courses is in continuation of the number of courses in the two categories completed at the end of semester 6, taking into account the number of courses in IT taken online to earn the additional 15 credits.								

* The course code of the same course as used for the pathways 1 – 4

CREDIT DISTRIBUTION FOR BATCH B1(A2) IN PATHWAY 5: DOUBLE MAJOR

Semester	Major Courses in B	General Foundation Courses in B	Internship/ Project in B	Major Courses in IT	General Foundation Courses in IT	AEC	Total
1	4 + 4	3	-	4	-	3 + 3	21
2	4	-	-	4 + 4	3	3 + 3	21
3	4 + 4	3 + 3	-	4 + 4	-	-	22
4	4 + 4	3	-	4	3 + 3	-	21
5	4 + 4 + 4	3	-	4 + 4	-	-	23
6	4 + 4	3	2	4 + 4 + 4	-	-	25
Total for Three Years	**48**	**18**	**2**	**44**	**9**	**12**	**133**
	68			**53**		**12**	**133**
	Major Courses in B	Minor Courses					
7	4 + 4 + 4 + 4 + 4	-			-	-	20
8	4 + 4 + 4	4 + 4 + 4	12		-	-	24
Total for Four Years	**88 + 12 = 100**	**12**					**177**

EVALUATION SCHEME

1. The evaluation scheme for each course contains two parts: internal evaluation (about 30%) and external evaluation (about 70%). Each of the Major and Minor courses is of 4-credits. It is evaluated for 100 marks, out of which 30 marks is from internal evaluation and 70 marks, from external evaluation. Each of the General Foundation course is of 3-credits. It is evaluated for 75 marks, out of which 25 marks is from internal evaluation and 50 marks, from external evaluation.

2. The 4-credit courses (Major and Minor courses) are of two types: (i) courses with only theory and (ii) courses with 3-credit theory and 1-credit practical.

- In 4-credit courses with only theory component, out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 10 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.
- In 4-credit courses with 3-credit theory and 1-credit practical components, out of the total 5 modules of the syllabus, 4 modules are for theory and the fifth module is for practical. The practical component is internally evaluated for 20 marks. The internal evaluation of the 4 theory modules is for 10 marks.

3. All the 3-credit courses (General Foundational Courses) in IT are with only theory component. Out of the total 5 modules of the syllabus, one open-ended module with 20% content is designed by the faculty member teaching that course, and it is internally evaluated for 5 marks. The internal evaluation of the remaining 4 theory modules is for 20 marks.

Sl. No.	Nature of the Course		Internal Evaluation in Marks (about 30% of the total)		External Exam on 4 modules (Marks)	Total Marks
			Open-ended module / Practical	On the other 4 modules		
1	4-credit course	only theory (5 modules)	10	20	70	100
2	4-credit course	Theory (4 modules) + Practical	20	10	70	100

3	3-credit course	only theory (5 modules)	5	20	50	75

1. MAJOR AND MINOR COURSES

1.1. INTERNAL EVALUATION OF THEORY COMPONENT

Sl. No.	Components of Internal Evaluation of Theory Part of a Major / Minor Course	Internal Marks for the Theory Part of a Major / Minor Course of 4-credits			
		Theory Only		Theory + Practical	
		4 Theory Modules	Open-ended Module	4 Theory Modules	Practical
1	Test paper/ Mid-semester Exam	10	4	5	-
2	Seminar/ Viva/ Quiz	6	4	3	-
3	Assignment	4	2	2	-
		20	10	10	20*
	Total	30		30	

* Refer the table in section 1.2 for the evaluation of practical component

1.2. EVALUATION OF PRACTICAL COMPONENT

The evaluation of practical component in Major and Minor courses is completely by internal evaluation.

- Continuous evaluation of practical by the teacher-in-charge shall carry a weightage of 50%.
- The end-semester practical examination and viva-voce, and the evaluation of practical records shall be conducted by the teacher in-charge and an internal examiner appointed by the Department Council.
- The process of continuous evaluation of practical courses shall be completed before 10 days from the commencement of the end-semester examination.
- Those who passed in continuous evaluation alone will be permitted to appear for the end-semester examination and viva-voce.

The scheme of continuous evaluation and the end-semester examination and viva-voce of practical component shall be as given below:

Sl. No.	Evaluation of Practical Component of Credit-1 in a Major / Minor Course	Marks for Practical	Weightage

1	Continuous evaluation of practical/ exercise performed in practical classes by the students	10	50%
2	End-semester examination and viva-voce to be conducted by teacher-in-charge along with an additional examiner arranged internally by the Department Council	7	35%
3	Evaluation of the Practical records submitted for the end semester viva–voce examination by the teacher-in-charge and additional examiner	3	15%
	Total Marks	20	

1.3. EXTERNAL EVALUATION OF THEORY COMPONENT

External evaluation carries 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5).

PATTERN OF QUESTION PAPER FOR MAJOR AND MINOR COURSES

Duration	Type	Total No. of Questions	No. of Questions to be Answered	Marks for Each Question	Ceiling of Marks
2 Hours	Short Answer	10	8 – 10	3	24
	Paragraph/ Problem	8	6 – 8	6	36
	Essay	2	1	10	10
				Total Marks	70

2. INTERNSHIP

- All students should undergo Internship of 2-credits during the first six semesters in a firm, industry or organization, or training in labs with faculty and researchers of their own institution or other Higher Educational Institutions (HEIs) or research institutions.
- Internship can be for enhancing the employability of the student or for developing the research aptitude.
- Internship can involve hands-on training on a particular skill/ equipment/ software. It can be a short project on a specific problem or area. Attending seminars or workshops related to an area of learning or skill can be a component of Internship.
- A faculty member/ scientist/ instructor of the respective institution, where the student does the Internship, should be the supervisor of the Internship.

2.1. GUIDELINES FOR INTERNSHIP

1. Internship can be in IT or allied disciplines.
2. There should be minimum 60 hrs. of engagement from the student in the Internship.
3. Summer vacations and other holidays can be used for completing the Internship.
4. In BSc. IT Honours programme, institute/ industry visit or study tour is a requirement for the completion of Internship. Visit to minimum one national research institute, research laboratory and place of scientific importance should be part of the study tour. A brief report of the study tour has to be submitted with photos and analysis.
5. The students should make regular and detailed entries in to a personal log book through the period of Internship. The log book will be a record of the progress of the Internship and the time spent on the work, and it will be useful in writing the final report. It may contain experimental conditions and results, ideas, mathematical expressions, rough work and calculation, computer file names etc. All entries should be dated. The Internship supervisor should periodically examine and countersign the log book.
6. The log book and the typed report must be submitted at the end of the Internship.
7. The institution at which the Internship will be carried out should be prior-approved by the Department Council of the college where the student has enrolled for the UG (Honours) programme.

2.2. EVALUATION OF INTERNSHIP

- The evaluation of Internship shall be done internally through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG (Honours) programme.
- The credits and marks for the Internship will be awarded only at the end of semester 6.
- The scheme of continuous evaluation and the end-semester viva-voce examination based on the submitted report shall be as given below:

Sl. No.	Components of Evaluation of Internship		Marks for Internship 2 Credits	Weightage
1	Continuous evaluation of internship through interim presentations and reports by the committee internally constituted by the Department Council	Acquisition of skill set	10	40%
2		Interim Presentation and Viva-voce	5	
3		Punctuality and Log Book	5	
4	Report of Institute Visit/ Study Tour		5	10%

5	End-semester viva-voce examination to be conducted by the committee internally constituted by the Department Council	Quality of the work	6	35%
6		Presentation of the work	5	
7		Viva-voce	6	
8	Evaluation of the day-to-day records, the report of internship supervisor, and final report submitted for the end semester viva–voce examination before the committee internally constituted by the Department Council		8	15%
	Total Marks		50	

3 MINI PROJECT WORK (Skill Enhancement Course 3 - ITY6FS113

A mandatory mini-project (SEC 3) is scheduled in the VI Semester of the BSc (Honours) Information Technology program. It is designed to cultivate students' research and software development skills. It will serve as a capstone experience, allowing students to bridge the gap between theoretical knowledge acquired in the classroom and its practical application to real-world problems.

Project Selection and Approval:

- Student groups (at most four members) can propose projects in Information Technology or related disciplines.
- Projects can be experimental (building a prototype), theoretical (a research paper), or computational (implementing an algorithm).
- Project proposals must be submitted for prior approval from the Department Council.
- Each project team will be assigned a project supervisor for guidance.

Project Duration:

- The mini-project duration is one semester.
- Minimum engagement: 90 hours per student.

Project Deliverables:

- Two hard copies and one softcopy of a well-structured typed report outlining:
  - Project objectives and requirements analysis
  - System design and architecture
  - Implementation details (including sample code snippets)
  - Test cases and results
  - Conclusion and future work

- A signed undertaking by the student declaring the originality of the work and the absence of plagiarism.
- A certificate from the project supervisor confirming the same.

Evaluation Criteria and Rubrics:

1. **Internal Evaluation (25 Marks)** - Conducted by the project supervisor throughout the semester. This could involve:
    - **Project Proposal and Planning**
        - Clarity of project goals and objectives.
        - Feasibility of the chosen approach.
        - Quality of system study/literature review and proposed methodology.
        - Clarity of project schedule and division of tasks within the team.
    - **Project Progress and Implementation**
        - Regular code reviews and adoption of feedback provided by the supervisor.
        - Attendance and active participation in project meetings.
        - Completion of project milestones as planned.
        - Quality of code documentation and adherence to coding standards.
    - **Interim Presentations**
        - Effectiveness of communication and presentation skills.
        - Clarity of technical details and progress made.
        - Ability to answer questions about the project effectively.

Sl. No	Components of Evaluation of Project	Marks for the Internal Evaluation of Mini project
1	Project Proposal and Planning	5
2	Project Progress and Implementation	10
3	Interim Presentations	10
	Total Marks	25

2. **External Evaluation (50 Marks)** - Conducted by an external examiner appointed by the University. This will take place at the end of the VIth semester:
    - **Project Report:**
        - **Content:** Completeness, organisation, clarity, and technical accuracy.
        - **Structure:** Introduction, System Design/literature review, methodology, implementation details, results, discussion, conclusion, future work, and references.
        - **Presentation:** Quality of writing, grammar, and formatting.
    - **Project Demonstration**
        - **Demonstration:** Ability to showcase the functionality of the project or present the research findings effectively.
    - **Viva-voce**

- **Viva-voce:** Understanding of project concepts, ability to answer questions confidently, and critical thinking skills.

Sl. No	Components of Evaluation of Project	Marks for the End Semester Evaluation of Mini project
1	Project Report	15
2	Project Demonstration	20
3	Viva-voce	15
Total Marks		50

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4. PROJECT

4.1. PROJECT IN HONOURS PROGRAMME

- In Honours programme, the student has the option to do a Project of 12-credits instead of three Core Courses in Major in semester 8.
- The Project can be done in the same institution or any other higher educational institution (HEI) or research Centre.
- A faculty member of the respective institution, where the student does the Project, should be the supervisor of the Project.

4.2. PROJECT IN HONOURS WITH RESEARCH PROGRAMME

- Students who secure 75% marks and above (equivalently, CGPA 7.5 and above) cumulatively in the first six semesters are eligible to get selected to Honours with Research stream in the fourth year.
- In Honours with Research programme, the student has to do a mandatory Research Project of 12-credits in semester 8.
- The approved research centres of University of Calicut or any other university/ HEI can offer the Honours with Research programme. The departments in the affiliated colleges under University of Calicut, which are not the approved research centres of the University, should get prior approval from the University to offer the Honours with Research programme. Such

departments should have minimum one faculty member with Ph.D., and they should also have the necessary infrastructure to offer Honours with Research programme.

- A faculty member of the University/ College with a Ph.D. degree can supervise the research project of the students who have enrolled for Honours with Research. One such faculty member can supervise maximum four students in Honours with Research stream.

4.3. GUIDELINES FOR THE PROJECT IN HONOURS PROGRAMME AND HONOURS WITH RESEARCH PROGRAMME

1. Project can be in IT or allied disciplines.
2. Project should be done individually.
3. Project work can be of experimental/ theoretical/ computational in nature.
4. There should be minimum 360 hrs. of engagement from the student in the Project work in Honours programme and Honours with Research programme
5. The various steps in project works are the following:
    - Wide review of a topic.
    - Investigation on a problem in systematic way using appropriate techniques.
    - Systematic recording of the work.
    - Reporting the results with interpretation in a standard documented form.
    - Presenting the results before the examiners.
7. During the Project the students should make regular and detailed entries in to a personal log book through the period of investigation. The log book will be a record of the progress of the Project and the time spent on the work, and it will be useful in writing the final report. It may contain experimental conditions and results, ideas, mathematical expressions, rough work and calculation, computer file names etc. All entries should be dated. The Project supervisor should periodically examine and countersign the log book.
8. The log book and the typed report must be submitted at the end of the Project. A copy of the report should be kept for reference at the department. A soft copy of the report too should be submitted, to be sent to the external examiner in advance.
9. It is desirable, but not mandatory, to publish the results of the Project in a peer reviewed journal.
10. The project report shall have an undertaking from the student and a certificate from the research supervisor for originality of the work, stating that there is no plagiarism, and that the work has not been submitted for the award of any other degree/ diploma in the same institution or any other institution.

11. The project proposal, the institution at which the project is being carried out, and the project supervisor should be prior-approved by the Department Council of the college where the student has enrolled for the UG (Honours) programme.

4.4. EVALUATION OF PROJECT

- The evaluation of Project will be conducted at the end of the eighth semester by both internal and external modes.
- The Project in Honours programme /Honours with Research programme will be evaluated for 300 marks. Out of this, 90 marks is from internal evaluation and 210 marks, from external evaluation.
- The internal evaluation of the Project work shall be done through continuous assessment mode by a committee internally constituted by the Department Council of the college where the student has enrolled for the UG (Honours) programme. 30% of the weightage shall be given through this mode.
- The remaining 70% shall be awarded by the external examiner appointed by the University.
- The scheme of continuous evaluation and the end-semester viva-voce of the Project shall be as given below:

Components of Evaluation of Project	Marks for the Research Project Honours programme/ Honours with Research 12 Credits	Weightage
Continuous evaluation of project work through interim presentations and reports by the committee internally constituted by the Department Council	90	30%
End-semester viva-voce examination to be conducted by the external examiner appointed by the university	150	50%
Evaluation of the day-to-day records and project report submitted for the end-semester viva–voce examination conducted by the external examiner	60	20%

Total Marks	300	

INTERNAL EVALUATION OF PROJECT

Sl. No	Components of Evaluation of Project	Marks for the Research Project (Honours programme)/ (Honours with Research programme) 12 credits
1	Skill in doing project work	30
2	Interim Presentation and Viva-Voce	20
3	Punctuality and Log book	20
4	Scheme/ Organization of Project Report	20
	Total Marks	90

EXTERNAL EVALUATION OF PROJECT

Sl. No	Components of Evaluation of Project	Marks for the Research Project (Honours programme)/ (Honours with Research programme) 12 credits
1	Content and relevance of the Project, Methodology, Quality of analysis, and Innovations of Research	50
2	Presentation of the Project	50
3	Project Report (typed copy), Log Book and References	60
4	Viva-Voce	50
	Total Marks	210

5. GENERAL FOUNDATION COURSES

- All the General Foundation Courses (3-credits) in IT are with only theory component.

5.1. INTERNAL EVALUATION

Sl. No.	Components of Internal Evaluation of a General	Internal Marks of a General Foundation Course of 3-credits in IT

	Foundation Course in IT	4 Theory Modules	Open-ended Module
1	Test paper/ Mid-semester Exam	10	2
2	Seminar/ Viva/ Quiz	6	2
3	Assignment	4	1
		20	5
	Total	25	

5.2. EXTERNAL EVALUATION

External evaluation carries about 70% marks. Examinations will be conducted at the end of each semester. Individual questions are evaluated in marks and the total marks are converted into grades by the University based on 10-point grading system (refer section 5).

PATTERN OF QUESTION PAPER FOR GENERAL FOUNDATION COURSES

Duration	Type	Total No. of Questions	No. of Questions to be Answered	Marks for Each Question	Ceiling of Marks
1.5 Hours	Short Answer	10	8 – 10	2	16
	Paragraph/ Problem	5	4 – 5	6	24
	Essay	2	1	10	10
				Total Marks	50

6. LETTER GRADES AND GRADE POINTS

- Mark system is followed for evaluating each question.
- For each course in the semester letter grade and grade point are introduced in 10-point indirect grading system as per guidelines given below.
- The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester.
- The Cumulative GPA (CGPA) is based on the grades in all courses taken after joining the programme of study.
- Only the weighted grade point based on marks obtained shall be displayed on the grade card issued to the students.

LETTER GRADES AND GRADE POINTS

Sl. No.	Percentage of Marks (Internal & External Put Together)	Description	Letter Grade	Grade Point	Range of Grade Points	Class

1	95% and above	Outstanding	O	10	9.50 – 10	First Class with Distinction
2	Above 85% and below 95%	Excellent	A+	9	8.50 – 9. 49	
3	75% to below 85%	Very Good	A	8	7.50 – 8.49	
4	65% to below 75%	Good	B+	7	6.50 – 7.49	First Class
5	55% to below 65%	Above Average	B	6	5.50 – 6.49	
6	45% to below 55%	Average	C	5	4.50 – 5.49	Second Class
7	35% to below 45% aggregate (internal and external put together) with a minimum of 30% in external valuation	Pass	P	4	3.50 – 4.49	Third Class
8	Below an aggregate of 35% or below 30% in external evaluation	Fail	F	0	0 – 3.49	Fail
9	Not attending the examination	Absent	Ab	0	0	Fail

- When students take audit courses, they will be given Pass (P) or Fail (F) grade without any credits.
- The successful completion of all the courses and capstone components prescribed for the three-year or four-year programme with 'P' grade shall be the minimum requirement for the award of UG Degree or UG Degree Honours or UG Degree Honours with Research, as the case may be.

6.1. COMPUTATION OF SGPA AND CGPA

- The following method shall be used to compute the Semester Grade Point Average (SGPA):
  The SGPA equals the product of the number of credits (Ci) with the grade points (Gi) scored by a student in each course in a semester, summed over all the courses taken by a student in the semester, and then divided by the total number of credits of all the courses taken by the student in the semester,

  $$\text{i.e. SGPA (Si)} = \Sigma i\ (Ci \times Gi) / \Sigma i\ (Ci)$$

  where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course in the given semester. Credit Point of a course is the value obtained by multiplying the credit (Ci) of the course by the grade point (Gi) of the course.

$$\text{SGPA} = \frac{\text{Sum of the credit points of all the courses in a semester}}{\text{Total credits in that semester}}$$

ILLUSTRATION – COMPUTATION OF SGPA

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 x 8 = 24
I	Course 2	4	B+	7	4 x 7 = 28
I	Course 3	3	B	6	3 x 6 = 18
I	Course 4	3	O	10	3 x 10 = 30
I	Course 5	3	C	5	3 x 5 = 15
I	Course 6	4	B	6	4 x 6 = 24
	Total	20			139
	SGPA				139/20 = 6.950

- The Cumulative Grade Point Average (CGPA) of the student shall be calculated at the end of a programme. The CGPA of a student determines the overall academic level of the student in a programme and is the criterion for ranking the students.

  CGPA for the three-year programme in CUFYUGP shall be calculated by the following formula.

$$\text{CGPA} = \frac{\text{Sum of the credit points of all the courses in six semesters}}{\text{Total credits in six semesters (133)}}$$

  CGPA for the four-year programme in CUFYUGP shall be calculated by the following formula.

$$\text{CGPA} = \frac{\text{Sum of the credit points of all the courses in eight semesters}}{\text{Total credits in eight semesters (177)}}$$

- The SGPA and CGPA shall be rounded off to three decimal points and reported in the transcripts.
- Based on the above letter grades, grade points, SGPA and CGPA, the University shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

Major Courses

Programme	BSc IT				
Course Code	ITY1CJ101/ITY1MN100				
Course Title	Fundamentals of IT and Computational Thinking				
Type of Course	Major				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of electronic components 2. Basic mathematical operations				
Course Summary	This course provides a comprehensive overview of computing, covering historical milestones, hardware components, software systems, and computational thinking principles. Students will explore the evolution of computing systems, from early pioneers to modern processors and quantum units. The curriculum delves into hardware intricacies, software distinctions, and essential concepts in IT, emphasizing problem-solving skills and algorithmic thinking. Practical aspects include hands-on experiences with hardware assembling, operating system installation, algorithm and flowchart visualization.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Develop a foundational knowledge of computing systems, encompassing their historical development, evolutionary milestones, and the notable contributions of key figures in the field.	U	F	Instructor-created exams / Quiz
CO2	Acquire familiarity with diverse hardware components constituting a computer system.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Gain practical expertise by engaging in hands-on activities focused on the installation and configuration of diverse hardware components within a computer system.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Explore the spectrum of software types, and actively participate in the partitioning, installation, and configuration of operating systems to cultivate a comprehensive understanding of software systems.	Ap	P	Practical Assignment / Observation of Practical Skills
CO5	Develop a foundational understanding of IT as a discipline, examining problems through the lens of computational thinking and cultivating	An	C	Instructor-created exams / Quiz

	analytical skills to address challenges in the field.			
CO6	Represent complex problems using algorithmic approaches and enhance problem-solving skills by visualizing solutions through the utilization of various software tools.	Ap	P	Practical Assignment / Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**History and Evolution of Computing System**		**9**	
	1	**Introduction** Characteristics of a computer, Stored Programme Concept,Generations	1	
	2	**Overview of Computer System**- Von Neumann Model, Number Systems (Binary, Hexa, Octal, Decimal)	2	
	3	**Number Conversion and Digital Codes** - Conversion from one number system to another, Digital Codes (Gray, Excess-3, BCD)	2	
	4	**Pioneers and Contributors of Computing Systems** - First Mechanical computer - Charles Babbage, Stored-Program Architecture - John von Neumann, Turing machine - Alan Turing, First General-Purpose Electronic Digital Computer - John Mauchly and J. Presper Eckert, Artificial Intelligence- John McCarthy (Contributions only).	2	**15**
	5	**Computing Systems: Past to Present** - Single Core, Dual-Core and Multi-Core Processors, Graphics Processing Unit (GPU), Accelerated Processing Unit, Quantum Processing Units (QPU) (Concept only).	2	
II	**Hardware**		**11**	
	6	**Electronic Components** – Active Components - Diode, Transistor, Integrated Circuits (Definition, Symbol and Function).	1	
	7	**Electronic Components** - Passive Components – Resistors, Capacitors, Inductors (Definition, Symbol and Function).	1	
	8	**Motherboard Components –** CPU and Cooling Fan, RAM, Expansion Slots (PCIe), Input/Output Ports, Chipset (Concept only).	2	**20**
	9	**Motherboard Components –** BIOS/UEFI Chip, SATA/NVMe Slots, Network Interface, Ports- Ethernet, VGA, HDMI, USB (Concept only).	3	
	10	**Computer Components** – SMPS, Motherboard, Storage Devises (HDD, SSD, NVMe (Concept only).	2	
	11	**Computer Components** – RAM (DRAM, SRAM, DDR SDRAM), ROM, Cache (Concept only).	2	
III	**Software**		**10**	
	12	**Software** - Application Software, System Software, Examples	1	
	13	**Operating System** – Need of OS, Types – Proprietary and Open	4	

		Source, Hardware Software Compatibility, POST, Booting.		
	14	**OS Installation –** Bootable Media, UEFI/Legacy BIOS, Disk Partitioning, Dual Booting, Boot Manager – BOOTMGR, Grub, File Systems- FAT, NTFS, ext4.	4	**15**
	15	**Device Drivers –** Need of Device Drivers, Driver Interactions (Basic concept only).	1	
IV		**Information Technology and Computational Thinking**	**15**	
	16	**Information Technology** - Role of IT in the Modern Era.	1	
	17	**Problem Solving -** Defining the Problem, Systematic Approach.	2	**20**
	18	**Computational Thinking** – Problem Decomposition, Pattern Identification, Abstraction, Generalization.	2	
	19	**Logical Thinking** – Inductive and Deductive Reasoning, Logical Expressions.	2	
	20	**Algorithmic Thinking** – Intuition vs Precision, Defining algorithms.	2	
	21	**Algorithm** – Need of Algorithm, Qualities of a Good Algorithm, Examples.	3	
	22	**Flowchart** - Flowchart Symbols, Examples. Raptor.	3	
V		**Lab Activities**	**30**	
		1. Identify, categorize and list out specifications of given **electronic components**. 2. Identify and list out specifications of given **motherboard components**. 3. Identify and Describe various **ports and connectors on motherboard**. 4. Installation of various **components on motherboard** (Processor, Fan, Heat Sink, RAM etc.) 5. Hands-on experience in **assembling and disassembling** a computer system (SMPS, Motherboard, Storage Device etc.). 6. Accessing and configuring the **Basic Input/Output System (BIOS) or Unified Extensible Firmware Interface (UEFI)** settings. 7. Preparation of **Bootable media** with software like ***Rufus***. 8. Check the hardware compatibility and **Install operating system** (single booting) on given computer. 9. Check the hardware compatibility and **Install operating systems** (dual booting – Windows and Linux) on given computer. **Develop algorithms and implement** the solutions using ***RAPTOR*** flowchart execution tool for the following problems. 10. Read and print a number. 11. Read the price of three items and print the total bill amount. 12. Read ages of two persons and print the elder one. 13. Read the number of units of electricity consumed and print the bill amount for various slabs. 14. Read a year and check whether it is a leap year. 15. Print first N numbers (using loop).	30	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	-	-	-	1							
CO 2	1	3	-	-	1	-							
CO 3	1	3	-	-	2	2							
CO 4	1	3	-	-	2	2							
CO 5	2	1	3	1	1	-							
CO 6	2	1	3	2	2	1							

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4		✓	✓	✓
CO 5		✓		✓
CO 6	✓	✓	✓	✓

References:

1. Gary B. Shelly, Thomas J. Cashman, and Misty E. Vermaat. “Introduction to Computers”, Cengage Learning, 2008.

2. Pradeep K. Sinha and Priti Sinha, Computer Fundamentals: Concepts, Systems & Applications. BPB Publications.

3. Kevin Wilson, Computer Hardware: The Illustrated Guide to Understanding Computer Hardware. Amazon Digital Services LLC – KDP, 2018.

4. John Hanna, OS Installation 101: A Step-by-Step Approach for Newbies.

5. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman & Hall/CRC, 2014.

6. R.G. Dromey, How to solve it by Computer, PHI, 2008.

Programme	BSc IT				
Course Code	ITY2CJ101/ITY2MN100				
Course Title	Fundamentals of Programming (C Language)				
Type of Course	Major				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of Algorithms and Flowcharts 2. ITY1CJ101 – Fundamentals of IT and Computational Thinking				
Course Summary	The objectives of this course are to make the student understand programming language, programming, concepts of Loops, reading a set of Data, stepwise refinement, Functions, Control structure, Arrays, Structures, Unions, and Pointers. After completion of this course the student is expected to analyze the real-life problem and write a program in 'C' language to solve the problem. The main emphasis of the course will be on problem solving aspect i.e. developing proper algorithms.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Remember the program structure of C with its syntax and semantics	U	C	Instructor-created exams / Quiz
CO2	Use the various constructs of a programming language viz. conditional, iteration and recursion.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Implement the algorithms in C language.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Use simple data structure like array in solving problems.	Ap	C	Practical Assignment / Observation of Practical Skills
CO5	Handling pointers and memory management functions in C.	Ap	P	Practical Assignment / Observation of Practical Skills
CO6	Develop efficient programs for solving a problem.	Ap	P	Viva Voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Introduction to C Language**		**10**	
	1	History of C, Importance of C, and sample programs	2	
	2	Character set, Tokens, Constants, Variables, and Data types	2	
	3	Operators - Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators. Arithmetic expressions, operator precedence, type conversions, mathematical functions	3	
	4	Managing Input and Output Operators: Reading and writing a character, formatted input, formatted output.	3	
II	**Decision Making Branching and Looping**		**10**	
	5	Decision making with If - simple If, If else, nested If else, else If ladder	3	
	6	Switch statement, conditional operator, Goto statement	2	
	7	Loops: while, do while, for statements and nested loops	3	
	8	Jumps in loops – break, continue	2	
III	**Arrays and Functions**		**15**	
	9	One dimensional array – declaration, initialization and accessing	2	
	10	Two-dimensional array – declaration, initialization and accessing	2	
	11	Multi dimensional array, dynamic array	1	
	12	Strings – Reading, Writing. Arithmetic operations on characters, Comparisons and string handling functions	2	
	13	Functions – Need, Elements of user defined functions and definition	2	
	14	Return values and their types, function call and declaration, call by value and call by reference	2	
	15	Categories of functions, Nesting of functions	1	
	16	Recursion	1	
	17	Passing arrays to functions and passing strings to functions	2	
IV	**Storage Classes, Structure and Union, Pointers**		**10**	
	18	Storage classes – The scope, visibility and lifetime of variables. Auto, Extern, Static and Register storage classes	2	
	19	Structure and Union - Defining, giving values to members, initialization of structure variables, arrays of structure, unions	2	
	20	Pointers definition, declaring and initializing pointers, accessing a variable ,Pointers and arrays, pointers and functions, pointers and structure	3	
	21	Pre-processor directives	2	
	22	File handling: modes of files, file operations	2	
V	**Hands-on Problem-Solving Using C Practical Applications, Case Study and Course Project**		**30**	
	1	Implement the following: **1. Variables, Data types, Constants and Operators:** 1.Evaluation of expression ex: ((x+y) ^2 * (x+z))/w 2.Temperature conversion problem (Fahrenheit to Celsius) 3.Program to convert days to months and days (Ex: 364 days = 12 months and 4 days)	30	

		4. Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales) **2. Decision making (Branch / Loop) Statements:** 5.Solution of quadratic equation 6.Maximum of three numbers 7.Calculate Square root of five numbers (using goto statement) 8.Pay-Bill Calculation for different levels of employee (Switch statement) 9. Fibonacci series 10.Armstrong numbers 11.Pascal ‘s Triangle **3. Arrays, Functions and Strings:** 12.Prime numbers in an array 13.Sorting data (Ascending and Descending) 14.Matrix Addition and Subtraction 15.Matrix Multiplication 16.Transpose of a matrix 17Function with no arguments and no return value 18. Functions with argument and return value 19.Functions with argument and multiple return values 20.Function that convert lower case letters to upper case 21. Factorial using recursion. 22. Perform String Operations using Switch Case 23. Largest among a set of numbers using command line argument **4. Structures and Union:** 24. Structure that describes a hotel (name, address, grade, avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.) **5. Pointers:** 25.Evaluation of Pointer expressions 26.Function to exchange two pointer values 27. Reverse a string using pointers 28.Insertion, deletion, and searching in an array **6.Files** 29. Programs using files		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	1	-	-						
CO 2	-	1	2	2	-	-						
CO 3	-	1	3	3	-	-						
CO 4	-	1	2	2	-	-						
CO 5	-	2	2	2	-	-						

CO 6	-	1	3	3	1	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6			✓	

Programme	BSc IT				
Course Code	ITY3CJ201				
Course Title	Digital Electronics				
Type of Course	Major				
Semester	III				
Academic Level	200 – 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1 ITY1CJ10 – Fundamentals of IT and Computational Thinking .				
Course Summary	This course provides a comprehensive introduction to the fundamentals of digital systems, covering topics related to binary arithmetic, basic computer logic, combinational and sequential logic circuits				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the fundamentals of number systems.	U	C	Instructor-created exams / Quiz
CO2	Develop digital circuits using logic gates	Ap	P	Instructor-created exams/ Home Assignments
CO3	Use the principles of Boolean algebra for simplifying logical expressions.	Ap	P	Instructor-created exams/ Home Assignments
CO4	Construct various combinational digital circuits	Ap	C	Instructor-created exams/ Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (60)	Marks
I		**Number Systems**	**10**	
	1	Introduction to various Number Systems	2	
	2	Conversion between Number Systems	2	
	3	Binary Arithmetic (Addition, Subtraction, Multiplication, and	2	

		Division)		
	4	1’s and 2’s complement subtraction methods.	2	
	5	Computer Codes	2	
II	**Logic gates**		**17**	
	6	Basic Gates(AND, OR, NOT)	2	
	7	Universal gates(NAND, NOR), XOR and XNOR gates	2	
	8	Universal property of NAND and NOR gates	3	
	9	Applications of Logic gates	1	
	10	Rules and laws of Boolean algebra	2	
	11	DeMorgan's theorem	1	
	12	Minterms, maxterms, SOP and POS form of Boolean expressions	3	
	13	Simplification of Boolean expressions using Boolean algebra and Karnaugh map techniques	3	
III	**Logic Circuits I**		**7**	
	14	Combinational Logic Circuits	1	
	15	Half adder , Full adder	2	
	16	Decoders - BCD to 7-segment decoder	2	
	17	Multiplexers and demultiplexers	2	
IV	**Logic Circuits II**		**10**	
	18	Sequential Logic Circuits	1	
	19	Flipflops	1	
	20	SR flip flop ,JK flip flop ,Master Slave JK flip flop, D type flip flop, T type flip flop	3	
	21	Shift register	2	
	22	Counters	3	
V	**Open Ended Module**		**15**	
	1	Memory units: types, working principle, and interfacing technique		
	2	Simplification of Boolean expressions Karnaugh map techniques		

REFERENCES:

1. Thomas L. Floyd, Digital Fundamentals, Pearson, 11th edition

2. M. Morris Mano, Digital Logic and Computer Design, Pearson, 2023

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	1	-	-						
CO 2	-	1	2	2	-	-						
CO 3	-	1	3	3	-	-						

CO 4	-	1	2	2	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

Programme	BSc IT				
Course Code	ITY3CJ202/ ITY3MN200				
Course Title	Data Structures and Algorithm				
Type of Course	Major				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Mathematics Concepts: Set, Functions, Logic 2. ITY2CJ101 – Fundamentals of Programming				
Course Summary	This course explores implementations of linked list and array-based data structures, delving into the inner workings of basic data structures including lists, stacks, queues, trees, and graphs.				

Course Outcomes (CO)

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Differentiate basic data structures (arrays, linked lists, stacks, queues) based on their characteristics, operations, and real-world applications.	U	C	Instructor-created exams / Quiz
CO2	Perform basic operations (e.g., insertion, deletion, search) on fundamental data structures using a chosen programming language.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Identify the properties and applications of advanced data structures (trees, graphs).	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Investigate the properties of various searching and sorting Techniques	U	C	Practical Assignment / Seminar
CO5	Demonstrate critical thinking and problem-solving skills by applying data structures and algorithms to address complex computational challenges.	Ap	P	Viva Voce/ Observation of Practical Skills
CO6	Implement and analyse different data structure algorithms (to solve practical problems.	Ap	P	Case study/ Project
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I		**Introduction to Data Structures and Basic Algorithms**	**9**	**15**
	1	Introduction to Data Structures: Definition, Classification of data structures -Linear and Non- Linear, Static and Dynamic, Data Structure Operations, Applications of Data Structures	1	
	2	Introduction to Arrays: Definition, Types (1 Dimensional, 2 Dimensional, Multi-Dimensional, Sparse matrix), Different Array Operations with Algorithm (insertion, deletion, traversal)	3	
	3	Structures and Self-referential structures	1	
	4	Introduction to Linked list: Definition, Types (Single linked list, Doublelinked list, Circular linked list- concept only).	2	
	5	Singly Linked List Operations with Algorithm (insertion, deletion, traversal)	2	
II		**Stack and Queue**	**10**	**20**
	6	Introduction to Stack: Definition, stack operations with Algorithm, Applications: recursion, infix to postfix - example and Algorithm	3	
	7	Implementation of Stack: using array (overflow & underflow) and Linkedlist (with algorithm)	2	
	8	Introduction to Queue: Definition, queue operations with Algorithm, Types: Double ended queue (Input Restricted and Output restricted), Circularqueue, Applications	2	
	9	Implementation of Queue: using array and Linked list (with algorithm)	3	
III		**Non- Linear Data Structures**	**16**	**20**
	10	Introduction to Trees: Basic terminology, Types (Binary tree-complete,full, skewed etc., Expression Tree)	2	
	11	Properties of Binary tree, Applications.	2	
	12	Binary tree representations- using array and linked list	2	
	13	Operations on Binary tree- Insertion, Deletion, Traversal- inorder, preorder, postorder - (concepts with examples)	3	
	14	Algorithm of non-recursive Binary tree traversal	3	
	15	Introduction to Graph: Definition, Basic terminology, Types (Directed, Undirected, Weighted).	2	
	16	Graph representation –Adjacency list and Adjacency Matrix, Applications.	2	
IV		**Sorting and Searching**	**10**	**15**
	17	Introduction to Sorting: Definition, Classification (Internal, External)	1	
	18	Internal Sorting Algorithms: Selection sort- Selection sort algorithm, Exchange sort- Bubble sort algorithm	2	
	19	External Sorting Algorithms: Merge sort- Demonstrate with example (NoAlgorithm needed)	1	
	20	Advanced sorting Algorithm-: Quick sort- Demonstrate with example. (NoAlgorithm needed)	1	
	21	Introduction to Searching: Linear search and Binary search (Algorithm needed) with example.	2	

	22	Hashing: Hash Tables, Hash Functions, Different Hash Functions – Division method, Multiplication method, Mid square method, Folding Method	2	
V	**Hands-on Programming in Data Structures: Practical Applications, Case Study and Course Project**		**30**	
	1	**Implement the following using C Language** **1.** Basic Operations in a single linked list (Menu driven) **2.** Sort the elements in given singly linked list **3.** Stack using array. **4.** Stack using Linked list **5.** Queue using Array **6.** Queue using Linked list **7.** Sorting algorithms- Selection, Bubble Sort **8.** Searching Algorithms- Linear and Binary search	25	
	2	Project/ Case study	5	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	1	1	-	-	-						
CO 2	2	1	2	3	-	-						
CO 3	2	1	2	3	-	-						
CO 4	2	-	2	3	-	-						
CO 5	1	1	2	3	1	-						
CO 6	1	1	3	3	1	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5		✓		✓
CO 6			✓	

References:

1. Seymour Lipschutz, “Data Structures with C”, McGraw Hill Education (Schaum's Outline Series).
2. Reema Thareja, “Data Structures Using C”, Oxford University Press.

Programme	BSc IT				
Course Code	ITY4CJ203				
Course Title	Database Management System				
Type of Course	Major				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Discrete Mathematics, Data structures and Programming Basics				
Course Summary	This course provides an introduction to database management systems. The topics covered include the concept of Database Management System, ER Model, Relational model, SQL, Database design, Transactions, concepts of other data model-NoSQL and practical session to implement Database Concepts.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	A comprehensive understanding of fundamental concepts in database management systems and its application	U	C	Instructor-created exams / Quiz
CO2	Understand concepts of Relational Data Model and Normalization Techniques	U	C	Instructor-created exams / Quiz
CO3	Apply principles of entity-relationship modeling and normalization techniques to design efficient and well-structured databases that meet specified requirements.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Acquire expertise in crafting and executing SQL queries for the retrieval, updating, and manipulation of data, showcasing adept skills in database querying and data manipulation	Ap	p	Practical Assignment / Observation of Practical Skills
CO5	Comprehend and apply strategies for managing transactions and implementing mechanisms for controlling concurrency, ensuring the database's consistency and reliability in environments with multiple users.	Ap	P	Practical Assignment / Observation of Practical Skills
CO6	Explore and analyze recent trends in database management systems, with a focus on unstructured databases, NoSQL technologies	An	P	Practical Assignment / Observation of Practical Skills

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs	Mark

			(45+30)	
I	**Database System- Concept**		**10**	**15**
	1	Introduction, Characteristics of the Database Approach	2	
	2	Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach, File system vs Database	2	
	3	Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence	3	
	4	Database Languages and Interfaces	2	
	5	Structured, Semi Structured and Unstructured Database	1	
II	**Database Design**		**14**	**20**
	6	ER Model- Basic concepts, entity set & attributes, notations	2	
	7	Relationships and constraints, cardinality, participation, notations, weak entities	2	
	8	Relational Model Concepts-Domains, Attributes, Tuples, and Relations, Values and NULLs in the Tuple	2	
	9	Relational Model Constraints and Relational Database Schemas	2	
	10	Relational Database Design- Atomic Domain and Normalization	2	
	11	INF, 2NF,3NF, BCNF	4	
III	**Query Languages**		**11**	**20**
	12	SQL-, introduction to Structured Query Language (SQL)	1	
	13	Data Definition Language (DDL), Table definitions and operations	2	
	14	SQL DML (Data Manipulation Language) - SQL queries on single and multiple tables	4	
	15	Nested queries (correlated and non-correlated), Aggregation and grouping, Views, assertions, Triggers, SQL data types.		
	16	Introduction to NoSQL Databases	2	
	17	Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB)	2	
IV	**Transaction Processing, Concurrency Control**		**10**	**15**
	18	Transaction Processing: Introduction, Transaction and System Concepts	3	
	19	Desirable Properties of Transactions	1	
	20	Characterizing Schedules Based on Recoverability & Serializability	2	
	21	Transaction Support in SQL.	1	
	22	Introduction to Concurrency Control: Two-Phase Locking Techniques	3	
V	**DBMS LAB**		**30**	
	1	Students should decide on a case study and formulate the problem statement.	3	
	2	Based on Identified problem Statement, Design ER Diagram (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher.	3	
	3	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as	2	

		columns, identifying keys) Note: Student is required to submit a document showing the database tables created from ER Model.		
	4	Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form	3	
	5	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables	3	
	6	Practicing DML commands-Insert, Select, Update, Delete	2	
	7	Experiment 7: Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc.	2	
	8	Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).	2	
	9	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping.	4	
	10	Install and Configure MongoDB to execute NoSQL Commands.	6	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	-	-	-	-						
CO 2	2	2	1	-	-	-						
CO 3	-	-	2	3	-	-						
CO 4	-	-	-	3	3	-						
CO 5	-	-	-	3	3	-						
CO 6	2	-	-	-	2	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3		✓	✓	✓
CO 4		✓	✓	✓
CO 5	✓	✓		✓
CO 6		✓	✓	✓

References:

1. Database System Concepts (Sixth Edition) Avi Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill 2011 ISBN 978-0071325226/ 0-07-352332-1.

2. Database Management Systems, Third Edition Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill ©2003 ISBN: 978-0072465631/ 0-07-246563-8.

Programme	BSc IT				
Course Code	ITY4CJ204				
Course Title	Python Programming				
Type of Course	Major				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Knowledge in Fundamentals of Programming				
Course Summary	This course explores the versatility of Python language in programming and teaches the application of various data structures using Python. The course also introduces fundamental concepts of object-oriented programming and insights into leveraging Python packages.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic concepts of Python programming language.	U	C	Instructor-created exams / Quiz
CO2	Apply problem-solving skills using the basic constructs in Python programming	Ap	P	Coding Assignments/ Code reading and review
CO3	Apply modular programming using functions in Python	Ap	P	Coding Assignments/ Code reading and review
CO4	Analyse the various data structures and operations on it using Python	An	C	Instructor-created exams / Case studies
CO5	Apply various packages available in Python	Ap	P	Coding Assignments/ Case studies
CO6	Apply visualization tools in Python	Ap	P	Coding Assignments/ Case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Introduction to Python and Control Flow Statements**		**10**	**15**
	1	Tokens in Python	2	
	2	Operators Precedence & Associativity & Type Conversion	1	
	3	Built-in functions	1	
	4	Decision-making Structures	3	
	5	Looping Structures	3	
I I	**Introduction to Functions & Modules**		**12**	**20**
	6	Introduction to functions	2	
	7	Scope and lifetime of variables	1	
	8	Types of arguments	3	
	9	Types of functions – recursive, anonymous, returning more than onevalue	3	
	10	Introduction to Modules	1	
	11	User-defined modules and packages	2	
III			**12**	**20**
	12	Introduction to Strings and traversal	2	
	13	Slicing, splitting, and joining methods on Strings	1	
	14	Introduction to Lists and traversal	1	
	15	List methods	2	
	16	Introduction to Dictionaries and traversal	1	
	17	Dictionaries methods	2	
IV	**Introduction to Scientific Computing in Python**		**11**	**15**
	18	Basics of NumPy Arrays	2	
	19	Computation on NumPy Arrays	2	
	20	Basics of Pandas objects	3	
	21	Basics of Matplotlib	1	
	22	Plotting in Matplotlib	3	
V	**Hands-on Data Structures: Practical Applications, Case Study and Course Project**		**30**	
	1	**Introduction to Python** • Running instructions in Interactive interpreter and a PythonScript. • Generate output with print statements • Read input, including casting that input to the appropriate type • Perform calculations involving integers and floating point numbers using Python operators like +, -, *, /, //, %, and ** • Call functions residing in the math module	20	

	2	**If Statement** • Make a decision with an if statement • Select one of two alternatives with an if-else statement • Select from one of several alternatives by using an if-elif or if-elif-else statement Construct a complex condition for an if statement that includes theBoolean operators and, or and not		
	3	**Loops** • Iterate over a sequence using a for loop		
		• Use the range () function in a form loop • Create a while loop to repeat a block of code • Use the break and continue statement • Nested loops For loop with else clause • While loop with else clause		
	4	**Function** • Define a function for later use • Pass one or more values into a function • Perform a complex calculation within a function • Return one or more results from a function • Call a function that you have defined previously		
	5	**Strings** • Create a string • String Indexing • Looping through a String • String Slicing		
	6	**Lists** • Create a list • List Indexing • Looping through a list • Adding items to a list • Modifying items of a list • Removing elements • List Slicing		
	7	**Tuples** • Create a tuple • Tuple Indexing • Looping through a tuple • Adding items to a tuple • Tuple Slicing		
	8	**Dictionary** • Create a dictionary and access values with key • Adding a key-value pair • Adding to an empty dictionary • Modifying values in a dictionary • Removing key-value pair • Looping through a dictionary- Looping through all key-valuepairs, Looping through all the keys, Looping through all the values		

	9	**NumPy** • Create NumPy(1 D, 2D, and 3D) arrays from a sequence • Create NumPy Arrays using functions • Arithmetic Computations using Universal Functions • Broadcasting • Fancy Logic		
	10	**Pandas** • Create a data frame from a dictionary • Create an explicitly indexed series object from an array or list • Create Index objects of various types		
		• Perform set operations on Index objects		
	11	**Matplotlib** • Create and format a simple line plot • Create and format a simple scatter plot • Create and format a simple histogram • Create and format a contour plot		
	12	Case study	3	
	13	Capstone (/Course) Project: Build a practical application using any onepackage and implement the visualization tools	7	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	-	-	-	-	-						
CO2	1	-	2	-	1	-						
CO3	1	-	2	1	-	-						
CO4	1	-	1	-	-	-						
CO5	3	2	2	2	2	2						
CO6	3	2	2	-	2	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	BSc IT				
Course Code	**ITY4CJ205**				
Course Title	**Operating System**				
Type of Course	Major				
Semester	IV				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Knowledge in Basic System Architecture				
Course Summary	This course provides students with a comprehensive understanding of the fundamental principles, design concepts, and practical implementation aspects of operating systems. The course covers key topics such as Process Management, CPU Scheduling, Memory Management and Linux Shell Programming concepts.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize the History, Objectives and Functions of an operating system	U	C	Instructor-created exams / Quiz
CO2	Understand process management concepts: Process Control Block, States, Scheduling, Operations, Inter process Communication	U	C	Instructor-created exams
CO3	Evaluate various processor scheduling strategies, algorithms	E	P	Seminar Presentation / Group Tutorial Work
	Apply process synchronisation concepts for effective process management	Ap	P	Viva Voce
CO5	Analyse conditions for deadlock occurrence and methods of resolving.	An	C	Instructor-created exams/Assignments
CO6	Describe various memory management techniques, including paging , segmentation and virtual memory	U	C	Instructor-created exams / Home Assignments
CO7	Develop Shell Scripts using Linux	C	P	Practical Assignment / Observation of Practical Skills

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks (70)
I	**Introduction to Operating Systems & Process Management**		**10**	**15**
	1	Operating System: History, Types, Objectives and Functions	2	
	2	Process Concepts: Process States, Process Control Block	2	
	3	Types of Process Schedulers and Operations on Process	2	
	4	Co operating Processes	2	
	5	Inter Process Communication	2	
II	**CPU Scheduling, Process Synchronisation and Deadlocks**		**15**	**20**
	6	Basic Scheduling Concepts, Scheduling Criteria	1	
	7	CPU Scheduling Algorithms	2	
	8	Process Synchronisation: Critical Section	2	
	9	Semaphores	2	
	10	Classical Problems of Synchronisation: Reader Writer, Dining Philosopher	2	
	11	Introduction to Deadlock: Necessary Conditions, Resource Allocation Graph	2	
	12	Handling Deadlocks: Prevention, Avoidance, Detection & Recovery	4	
III	**Memory Management Techniques**		**10**	**20**
	13	Basic Concepts: Physical VS Logical Address, Continuous Memory Allocation	2	
	14	Fragmentation Problem and Solutions	2	
	15	Non contiguous Memory Allocation: Paging	2	
	16	Non contiguous Memory Allocation: Segmentation,	2	
	17	Virtual Memory Concepts (Concept only)	2	
IV	**Linux Shell Programming**		**10**	**15**
	18	Introduction: Types of Linux Shells, File Directory & File Management Commands:ls, cd,pwd,mkdir,rm,cp,mv, chmod,touch Input/Output Commands: read, echo, Text Processing Commands: grep , cat	2	
	19	Piping and Redirection operators: |,>,<,>>,<< Arithmetic, Logical and Relational Operator	2	
	20	Iterative and Conditional Commands : if, while, for, break, continue, case	2	
	21	Arrays and functions	2	
	22	Command line arguments, Network commands: ipconfig, ping, date and time commands, Informative commands: random, w, ps, free, uptime	2	

V	**Practical Applications using Linux Shell Programming**		**30**	
		Implement the following: 1. Write a Shell Script to find the roots of a quadratic equation. 2. Write a shell script for a menu driven program to perform file management (File creation, display content, remove, write content to a file). 3. Write a shell script to count no of line, words and characters of an input file. 4. Write a shell script to find the average of the number entered as command line arguments. 5. Write a shell script to copy the contents of file to another. Input file names through command line. The copy should not be allowed if second file exists. 6. Write a shell script to check network connectivity. 7. Write a shell script that analyzes a log file, extracting and summarizing relevant information such as error counts ,warning messages, info and debug messages using grep command. 8. Write a shell script to display current date and time, list all user account names, count of logged in user accounts, list all logged in user accounts with login time. 9. Write a simple game script using random function to implement number guessing game. 10. Write a shell script to display your system details (number of users, current processes, memory usage , system running time).	30	

References

1. Silberschatz, Galvin and Gagne, Operating System Concepts, John Willey & Sons

2. William Stallings, Operating Systems, Internals and Design Principles, PHI

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	-	-	-						
CO 2	-	2	-	-	-	-						
CO 3	-	3	-	1	-	-						
CO 4	-	2	2	-	-	-						
CO 5	-	3	-	-	-	-						
CO 6	-	3	-	-	-	-						
CO7	-	-	2	2	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5	✓			✓
CO 6	✓			✓
CO7			✓	

Programme	BSc IT				
Course Code	ITY5CJ301				
Course Title	Numerical Analysis and Optimization Techniques				
Type of Course	Major				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Understanding of algebraic concepts, including solving equations and inequalities. 2. Familiarity with the concept of derivatives and integrals.				
Course Summary	This course covers foundational concepts in numerical methods and operations research, emphasizing error analysis and solution techniques for algebraic and transcendental equations. Students will develop skills in polynomial interpolation, numerical integration, and explore fundamental principles of operations research, including linear programming.				

Course Outcomes (CO)

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Develop a solid foundation in numerical methods, acquiring the skills to analyze and solve algebraic and transcendental equations, and gaining a practical understanding of the sources and management of errors in numerical computations.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO2	Cultivate both a comprehensive grasp and practical proficiency in polynomial interpolation techniques, alongside acquiring expertise in numerical methods for the solution of definite integrals.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO3	Establish a robust groundwork in Operations Research, nurturing a discerning capability to critically evaluate its applications across diverse problem-solving scenarios.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	Develop expertise in Linear Programming, mastering the art of employing sophisticated optimization techniques for the effective resolution of Linear Programming problems.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO5	Impart a comprehensive understanding	Ap	P	Practical

	of transportation problems and cultivate an appreciation for the methods used in finding basic feasible solutions.			Assignment / Instructor-created exams / Quiz
CO6	Develop proficiency in addressing assignment problems and employ the method to attain optimal solutions, providing a holistic skill set for logistical optimization.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Marks
I		**Numerical Analysis I**	**10**	**15**
	1	Errors in numerical calculations - Sources of errors	1	
	2	Solution of Algebraic and Transcendental Equations - Bisection method	3	
	3	Method of false position	3	
	4	Newton Raphson method	3	
II		**Numerical Analysis II**	**12**	**15**
	5	Polynomial Interpolation - Lagrange interpolation	3	
	6	Newton's forward and backward difference interpolation	3	
	7	Numerical Solution of Definite Integral - Simpson's 1/3rd rule	2	
	8	Simpson's 3/8 Rule	2	
	9	Trapezoidal method	2	
III		**Operations Research I**	**13**	**20**
	10	Introduction to Operations Research – Definition, Advantages and Limitations of Operations Research	1	
	11	Linear Programming Problem – Definition, Formulation of LPP, Feasible solution and Optimal solution	2	
	12	Dual of LPP	2	
	13	Graphical solution of LPP	2	
	14	Simplex Method	3	
	15	Big-M method	3	
IV		**Operations Research II**	**13**	**20**
	16	Transportation Problem – Definition, Balanced and unbalanced Transportation problems	1	
	17	Finding basic feasible solutions – Northwest corner method	2	
	18	Least cost method	1	
	19	Vogel's approximation method	2	
	20	Optimized (MODI) method	3	
	21	Assignment model - Definition, Balanced and unbalanced Assignment problems	1	
	22	Hungarian method for optimal solution	3	
V		**Open Ended Module – Other Numerical Methods**	**12**	

	1	• Any other two methods to solve Algebraic and Transcendental Equations • Any other two methods for Polynomial Interpolation • Any other two methods to solve Solution of Definite Integral • Any other method to solve LPP	12	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	1	-	3	-						
CO 2	1	-	1	-	3	-						
CO 3	3	-	1	-	3	-						
CO 4	3	-	1	-	3	-						
CO 5	3	-	1	-	3	-						
CO 6	3	-	1	-	3	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall India.

2. E. Carl Froberg and Erik Carl Frhoberg, Introduction to Numerical Analysis, Addition Wesley.

3. Hamdy A. Taha, Operations Research an Introduction, Pearson Education Limited.

4. P. Sankara Iyer, Operations Research, Tata McGraw-Hill, 2008.

Programme	BSc IT				
Course Code	ITY5CJ302				
Course Title	Object Oriented Programming (Java)				
Type of Course	**Major**				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Knowledge in basic programming 2. Knowledge in OOP Concepts				
Course Summary	The aim of this course is to provide students with an understanding of the basic concepts in Java programming. This course will help students create GUI applications in Java and establish database connectivity.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the concepts and features of Object-Oriented Programming (OOPs)	U	C	Practical Assignment / Instructor-created exams / Quiz
CO2	To practice programming in Java	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO3	To learn java's exception handling mechanism, I/O operations and multithreading.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	To learn java's O operations and multithreading.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO5	Implement programs using Java Database Connectivity	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO6	Students will be capable of developing Graphical User Interface (GUI) applications using Swing, understanding layout management, and implementing basic event	Ap	P	Practical Assignment / Instructor-created exams / Quiz

	handling.			

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Review of OOPs and Introduction to Java**		**17**	**20**
	1	Overview of OOPs Concept	1	
	2	History of Java and Java Virtual Machine	1	
	3	Basic Structure of Java Programming: Data Types, Operators, Expression and Control Statement	2	
	5	Arrays and String: One Dimensional Array, Multidimensional Array, String Operations	2	
	6	Scanner, Type Conversion and Casting	2	
	7	Introduction to Class and Objects: Definition of Class and Objects, Access Modifier	2	
	8	Constructor and Inheritance: Types of Constructors, Types of Inheritance, use of extends, super, final, this keyword	3	
	9	Method Overriding, Method Overloading and Dynamic Method Dispatch: Programming implementation of Method Overriding and Overloading	2	
	10	Interface, Abstract Class and Packages; Programming implementation of Interface, Abstract class and Packages	2	
II	**Exception and I/O Operations**		**8**	**15**
	11	Exception: Baic Concept of exception and Exception Hierarchy	2	
	12	Managing Exception: Use of try….catch ….. finally blocks, throw and throws keyword	2	
	13	Managing Input/Output files in Java: Importance of I/O Operations, BufferedInputStream, BufferedOutputStream	2	
	14	File Operations: Programming implementation of FileInputStream, FileOutputStream, FileReader, FileWriter	2	
III	**Multithreading and Database Connectivity**		**9**	**20**
	15	Thread: Concept of Thread and Thread state	2	
	16	Programming Implementation of Thread: Using extending thread class and Runnable interface, Thread Priorities	2	

	17	Database Programming: Basic Concept of Database and JDBC Driver, Connecting with Database	2	
	18	Querying Database: Programming implementation of creating table, insert and update values to the table using preparedStatement, Statement object and querying the values using ResultSet and ResultSetMetadata	3	
IV	**GUI Programming**		**11**	**15**
	19	Introduction to GUI Application: AWT Basics, Introduction to IDE	2	
	20	Swing Programming: Introduction of Model-View-Controller Pattern	2	
	21	Introduction to layout Management: Fundamental controls used in SWING	4	
	22	Event Handling: Basic Knowledge of Event Handling (Event Class and Event Listener)	3	
V	**Hands-on Programming in Java(Using IDE NetBeans, Eclipse, VSCode):**		**30**	**30**
	Practical Applications, Case Study and Course Project			
	1	Implement the following:		
		1. String and Arrays:	20	
		Write a program to perform various String operations in Java (Hint: charAt, substring, concat, equals,, isEmpty..)		
		Write a program to implement Multi-Dimensional Array (Hint : Matrix multiplication)		
		2. Object Oriented Programming Concept:		
		Write a program to implement the concept of class and object (Hint: Complex Number addition)		
		Write a program to demonstrate the order in which constructors are invoked in multilevel inheritance.		
		Write a program to implement method overloading		
		Write a program to implement method overriding.		
		3. Exception Handling and Multithreading:		
		Write a program to implement try…cacth, finally block (Hint: Arithmetic and ArrayOutOfBound Exception)		
		Write a multi thread java program for displaying odd numbers and even numbers up to a limit (Hint: Create thread by inheriting Thread class).		
		Write a multi thread java program for displaying odd numbers and even numbers up to a limit (Hint: Implement thread using Runnable interface).		
		4. GUI Application with Database:		
		Write a swing program to track mouse & key events		
		Write a swing program to fetch data from TextFiled		

		and display it in Label		
		Write a swing program to perform form validation		
		Write a swing program to display data in tabular form		
		Write a simple login program without database connectivity		
		Write a swing program to create a registration form (Hint: Create table student in any database and link the registration form with database using JDBC)		
	2	Case Study	2	
	3	**Project:** Build a application for shop management system (Eg: Admin Login, Product registration, stock management, product selling, employee salary)	8	

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	3	3	-	-						
CO 2	1	-	3	3	-	-						
CO 3	-	-	3	3	2	3						
CO 4	-	-	2	3	-	-						
CO 5	-	-	3	3	2	3						
CO 6			3	3	3							

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations

CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓

References:

1. Herbert Scheldt, Java: The Complete Reference, 12th Edition, Tata McGraw-Hill Edition, ISBN: 9781260463415.

2. C. Thomas Wu, An introduction to Object-oriented programming with Java, 5e, McGraw-Hill, 2009.
3. Y. Daniel Liang, Introduction to Java programming, Comprehensive Version, 10e, Prentice Hall India, 2013.
4. K. Arnold, J. Gosling, David Holmes, The JAVA programming language, 4e, Addision-Wesley, 2005.

Programme	BSc IT				
Course Code	**ITY5CJ303**				
Course Title	**Full Stack Web Development**				
Type of Course	**Major**				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental of Web Pages and web servers 2. Basics of HTML				
Course Summary	This course provides the ideas, techniques, and applications for efficient Web Development. The advanced industry demand and emerging trends are covered in this syllabus.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concepts to create responsive web pages using HTML and CSS	U	C	Instructor-created exams / Quiz
CO2	Familiarization of development environment and react js	U	C	Practical Assignment / Observation of Practical Skills
CO3	Understand Node.JS and equip learners with a comprehensive understanding of NodeJS and its functionalities.	U	F	Seminar Presentation / Group Tutorial Work/ Viva Voce

CO4	Familiarization with SQL and NoSQL	Ap	P	Writing assignments/ Instructor-created exams/ practicals
CO5	Explore MongoDB and Develop real-world web applications using various technologies learned in the course	Ap	P	Case Study/ mini Project/ practicals

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge

(P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks (70)
I	**WEB SERVERS & WEB PROGRAMMING**		**9**	**12**
	1	Working of web browser - Browser & Server Communication - Web Server Functions	2	2
	2	Web Security - Fire Wall- Proxy Servers - Virtual Directories - MIME	1	2
	3	Forms and Tables Introduction CSS Applying CSS to HTML.	2	2
	4	Selectors, Properties and Values CSS Colors and Backgrounds CSS Box Model	3	5
	5	CSS Margins, Padding, and Borders CSS Text and Font Properties Webpage Layout Responsive web design	1	1
II	**JavaScript & Node.JS**		**11**	**15**
	6	Introduction to JavaScript Applying JavaScript (internal and external) Understanding JS Syntax	1	2

	7	Introduction to Document and Window Object Variables and Operators Data Types and Num Type Conversion	1	2
	8	Math and String Manipulation Objects and Arrays Date and Time Conditional Statements	2	3
	9	Switch Case Looping in JS Functions	2	2
	10	Node.JS Overview Node.JS - Basics and Setup Node.JS Console Node.JS Command Utilities Node.JS Modules	3	3
	11	Node.JS Concepts Node.JS Events Node.JS with Express js Node.JS Database Access	2	3
II I	**React.JS**		**12**	**15**
	12	Introduction Templating using JSX	2	3
	13	Components, State and Props Lifecycle of Components Rendering List and Portals	3	3
	14	Redux and Redux Saga Immutable.js Service Side Rendering	2	3
	15	Unit Testing	2	3
	16	Webpack	3	3
I V		**MongoDB**	**13**	**20**
	17	SQL and NoSQL Concepts	3	4
	18	Create and Manage MongoDB	2	3
	19	Migration of Data into MongoDB	1	3
	20	MongoDB with PHP	1	3
	21	MongoDB with NodeJS.	2	4
	22	Services Offered by MongoDB	3	3
V	**Practical Implementations of Full Stack Web Development**		**30**	**20**
	1	● Webpage Development using HTML And CSS	25	
		● Webpage Development using Javascript & Node.JS ● Webpage Development using React.JS With Backend MongoDB		
	2	Case Study/ Project	**5**	

References Books

1. Hawramani, Ikram. HTML, CSS and JavaScript for Complete Beginners: A

Step by Step Guide to Learning HTML5, CSS3 and the JavaScript Programming Language. United States, Amazon Digital Services LLC - KDP Print US, 2018.

2. Soni, Ravi Kant. Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful. United States, Apress, 2017.

3. Northwood, Chris. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer. Germany, Apress, 2018.

4. Sharma, Aneeta. Full-Stack Web Development with Vue. Js and Node: Build Scalable and Powerful Web Apps with Modern Web Stack: MongoDB, Vue, Node. Js, and Express. United Kingdom, Packt Publishing, Limited, 2018.

5. Sharma, Manu. Mongodb Complete Guide: Develop a Strong Understanding of Administering Mongodb, Crud Operations, and Mongodb Commands. India, Bpb Publications, 2021.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	3	2	2	3						
CO 2	-	1	3	3	3	2						
CO 3	-	1	3	3	3	2						
CO 4	-	1	3	3	3	2						
CO 5	-	1	3	3	3	2						
CO 6	-	1	3	3	3	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations	Practical
CO 1	✓		✓	
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	
CO 5	✓	✓	✓	✓
CO 6	✓		✓	✓

Programme	BSc IT				
Course Code	ITY6CJ304/ITY8MN304				
Course Title	Software Project Management				
Type of Course	**Major**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Computer Science knowledge 2. Understanding fundamental information technology concepts , data structures, and algorithms 3. Basic knowledge of project planning and scheduling				
Course Summary	Students are introduced to the concepts, procedures, and resources of software project management in this course. Project scheduling, budgeting, quality assurance, risk management, and teamwork are among the subjects covered. The goal of the course is to equip students with the skills necessary for efficient project management in software development settings.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define and explain the fundamental concepts, principles, and terminologies related to software project management. Differentiate between various software engineering process models. Understand the agile principle and methodologies and appreciate the need for iterative approaches to software development	U	C	Instructor-created exams / Quiz
CO2	Master various design concepts used during project development life cycle.	U	P	Assignments/ Test papers/ Viva Voce
CO3	Master various SPM techniques	U	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Develop project plans, Create project schedules using tools like Gantt charts and network diagrams	Ap	C	Instructor-created exams / Home Assignments
CO5	Understand the importance of quality in software development by mastering quality assurance processes, methodologies, and testing strategies.	U	P	Writing assignments/ Exams

CO6	Prepare and deliver effective project presentations.	Ap	P	Case Study/ mini Project/ Seminar Presentation/ Group Presentations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (48+12)	Marks (70)
I		**Introduction to Software Engineering and Process Models**	**10**	**12**
	1	Software and Software Engineering- nature of software, Software Engineering, Software Process	2	
	2	Software Development Life Cycle (SDLC)	2	
	3	Prescriptive Process Model- Water fall model, Incremental Model, Evolutionary Process Model	2	
	4	Agile Development- What is Agility, What is agile Process?	2	
	5	Extreme Programming	2	
II		**Software requirements and Design Concepts**	**16**	**22**
	6	Understanding requirements- requirement engineering process	3	
	7	Feasibility studies	1	
	8	Design Concepts- Design process, Design Concepts	2	
	9	Design Model Elements- Data design elements, Architectural design elements, Interface Design Elements, Component-Level Design Elements, Deployment-Level Design Elements	2	
	10	Architectural design using DFD	2	
	11	Component level design guidelines	2	
	12	Modelling with UML – Class diagram Use Case Diagram, State chart Diagram, Activity Diagram,	4	
III		**Software Project Management**	**11**	**18**
	13	Introduction to Software Project Management- Overview of software project management, Importance of project management in software engineering, Role of a project manager	2	
	14	Project Planning and Scope Management- Work breakdown structure (WBS) and project estimation techniques	2	
	15	Project Scheduling and Resource Allocation- Gantt charts and network diagrams,	2	
	16	Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT)	2	
	17	Risk Management-reactive vs proactive risk strategies, Risk identification, risk projection, RMMMM plan	3	
IV		**Software Quality Assurance**	**11**	**18**
	18	Quality Concepts- Software quality, Achieving Software quality,	2	
	19	Testing Strategies	2	
	20	Software testing- levels of software testing	1	
	21	Types of software test- Unit testing, Integration testing, Black box	4	

		testing, white box testing, System testing		
	22	Art of debugging	2	
V	**Open Ended Module- Trends in Software Engineering**		**12**	
	1	• Case study of CASE tools • Prepare a project report • Analysis of real-world software project management case studies • Group project presentations		

References

- Roger S, "Software Engineering – A Practitioner's Approach", seventh edition, Pressman, 2010.
- Pearson Education, "Software Engineering by Ian Sommerville", 9th edition, 2010.
- Pankaj Jalote, An Integrated Approach to Software Engineering, 3rd Edition, Narosa Publishing House.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	1	-	-	3	-						
CO 2	1	1	2	-	3	-						
CO 3	1	1	-	-	3	-						
CO 4	1	1	-	-	3	-						
CO 5	1	1	-	-	3	-						
CO 6	1	1	-	-	3	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4		✓	✓
CO 5		✓	✓
CO 6	✓	✓	

Programme	BSc IT				
Course Code	ITY6CJ305/ITY8MN305				
Course Title	Computer Networks				
Type of Course	Major				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1.Knowledge in Computer Organization and Architecture. 2.Knowledge in Operating System.				
Course Summary	This course covers the concepts of data communication and computer networks. It comprises of the study of the standard models for the layered protocol architecture to communicate between autonomous computers in a network and also the main features and issues of communication protocols for different layers. Topics covered comprise of introduction to OSI and TCP/IP models also.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the fundamentals of computer networks including concepts like data communication, network topologies and the reference models	U	C	Instructor-Create Exams or Quiz
CO2	Proficiency in Transmission Media and Multiplexing Techniques:	A	P	Discussions and Quizzes
CO3	To familiarise with the common networking protocols and standards	U	F	Instructor created exams or Home assignments
CO4	Describe, analyse and compare different data link, network and transport layer protocols	A, E	P	Discussions, Quizzes
CO5	Design/implement data link and network layer protocols in simulated networking environment	Ap	P	Viva Voce Observation of practical skills
CO6	To understand the need of various Application layer protocols	U	M	Instructor Created - Exams, Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Introduction to Computer networks and Network models**		**12**	**17**
	1	Types of computer networks, Internet, Intranet, Network topologies, Network classifications.	2	

	2	Network Architecture Models: Layered architecture approach, OSI Reference Model, TCP/IP	2	
	3	Physical Layer: Analog signal, digital signal, Analog to Digital, Digital to Analog, maximum data rate of a channel transmission	4	
	4	Transmission media (guided transmission media, wireless transmission, satellite communication).	2	
	5	multiplexing (frequency division multiplexing, time division multiplexing, wavelength division multiplexing	2	
II	**Data Link Layer**		**11**	**18**
	6	Data link layer services, error-detection Types of errors, Single bit error and Burst error, Vertical redundancy check (VRC), longitudinal redundancy Check (LRC), Cyclic Redundancy Check (CRC),Check sum Error correction - Single bit error correction, Hamming code	2	
	7	Error correction techniques, error recovery protocols (stop and wait, go back n, selective repeat),	3	
	8	multiple access protocols, (TDMA/FDP, CDMA/FDD/CSMA/CD, CSMA/CA),	2	
	9	Datalink and MAC addressing, Ethernet, Polling	1	
	10	IEEE Standards- Wireless LANS,Ethernet,Blueetooth	3	
III	**Network layer**		**11**	**18**
	11	Networking and Internetworking devices - Repeaters, Bridges, Routers, Gateways, Firewall	2	
	12	Logical addressing - IPv4 & IPv6 addresses, Network Address Translation (NAT), Internet protocols, internetworking, Datagram,	2	
	13	Transition from IPv4 to IPv6	1	
	14	Address Mapping-Error reporting and multicasting - Delivery,	2	
	15	Forwarding and Routing algorithms, Distance Vector Routing,	2	
	16	Link State Routing. Dijkstra	2	
IV	**Transport Layer and Application layer**		**11**	**17**
	17	Transport layer, Process-to-process Delivery: UDP, TCP	2	
	18	Congestion control and Quality of Service,	2	
	19	Domain Name Systems-Remote Login, Email	2	
	20	FTP, WWW, HTTP	2	
	21	Introductory concepts on Network management& Mail transfer: SNMP,	2	
	22	SMTP	1	
V	**Hands-on Computer Networks: Practical Applications,**		**30**	
	1	LAB1: identifying Networking Hardware components (Jacks, Cables, Tools) Lab 2: IP address - configuring. Lab3: Crimping Lab 4: Configuring network host - setting hostname - assigning IP address Lab 5: configuring the Network Interface card – Lab 6: Setup a Wired LAN with more than two systems	20	

		Lab 7: Setup a Wireless LAN with more than two systems Lab 8: Setting up Internet services File Transfer Protocol (FTP), Lab 9: Simple Mail Transfer Protocol (SMTP) and Post Office Protocol (POP) Lab 10: Setting up Intranet Services - Network File System (NFS),		
	2	Case study	3	
	3	**Capstone (/Course) Project:** Build a practical application using Wired Network	7	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	3	-	-	-	-						
CO 2	2	2	1	-	-	-						
CO 3	-	2	1	-	-	-						
CO 4	-	2	1	1	1	-						
CO 5	1	1	2	2	-	-						
CO 6	1	2	1	3	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations

CO 1	✓		✓	✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5		✓	✓	✓
CO6			✓	

References:

1. Behurouz A Forozan, Introduction to Data Communications & Networking, TMH
2. Andrew S. Tanenbaum, Computer Networks, PHI
3. William Stallings, Data and Computer Communications, VIIth Edition, Pearson Education

Programme	BSc IT				
Course Code	ITY6CJ306/ITY8MN306				
Course Title	Introduction to AI and ML				
Type of Course	Major				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Mathematics Concepts: Sets 2. Fundamentals of Python Programming				
Course Summary	This course provides an introduction to the ideas, techniques, and applications of artificial intelligence (AI) is given in this course. The fundamentals of knowledge representation, machine learning, and problem solving will be taught to the students.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Differentiate various knowledge representation methods, AI operations, Machine learning approaches and real-world applications.	U	C	Instructor-created exams / Quiz
CO2	Master Problem-Solving Techniques (search algorithms, heuristic approaches, and informed search strategies). Analyse and evaluate its efficiency.	U	P	Practical Assignment / Observation of Practical Skills
CO3	Investigate the properties and applications of various machine learning techniques	Ap	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Evaluate Artificial Intelligence Search algorithms and Machine learning approaches' efficiency.	U	C	Instructor-created exams / Home Assignments
CO5	Implement and analyse Machine learning algorithms to solve practical problems.	Ap	P	One Minute Reflection Writing assignments
CO6	Apply Concepts in Real-World Projects	Ap	P	Case Study/ mini Project

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Introduction to Artificial Intelligence & Problem Solving and Searching**		**15**	**15**
	1	Introduction to AI – AI problems, AI Techniques	2	
	2	Various AI Domains (Introduction only)	1	
	3	Problem Solving Techniques - Search Algorithms, Knowledge representation and reasoning, constraint satisfaction problems, Game playing, Machine learning, Simulated Annealing (Concepts only)	3	
	4	Uninformed search algorithms (breadth-first, depth-first)	3	
	5	Informed search algorithms (A*, heuristic search- Generate and Test, Hill Climbing, Best First Search)	6	
II	**Knowledge Representation & Reasoning**		**10**	**20**
	6	Knowledge representation using Propositional & Predicate Logic	3	
	7	Semantic Networks & Frames	3	
	8	Rule based system & Introduction to Expert System (Concepts only)	2	
	9	Reasoning- Forward Vs Backward reasoning & logics for non-monotonic Reasoning	2	
III	**Introduction to Neural Networks**		**8**	**15**
	10	Introduction to Artificial Neural Network	1	
	11	Understanding Brain & Perceptron Model	1	
	12	Single Layer Perceptron Model & Learning in Single layer Perceptron Model	2	
	13	Multi-Layer Perceptron Model & Learning in Multi-layer Perceptron Model	2	
	14	Introduction to python packages- keras & sklearn	2	
IV		**Machine Learning Fundamentals**	**12**	**20**
	15	Introduction to Machine learning- Applications of Machine Learning	1	
	16	Supervised Machine learning- Classification & regression algorithms (Introduction: Linear Regression, Decision tree)	2	
	17	Unsupervised Machine Learning-Clustering & Dimensionality Reduction (Introduction: K means Clustering, PCA)	2	
	18	Reinforcement Learning: Elements of Reinforcement Learning	2	
	19	Feature Engineering & Feature Selection	2	
	20	Building a classification model by training with data	1	
	21	Classification model evaluation- Introduction to confusion matrix	1	
	22	Practical implementation to set up a machine learning model	1	
V	**Hands-on Artificial Intelligence & Machine Learning using Python: Practical Applications, Case Study and Course Project**		**30**	
	1	Implement the following: **1. Search algorithms** BFS DFS **2. Neural Network** Building a single layer perceptron using Keras **3. Multi-layer Neural Network**	20	

		Setting up a multi-layer perceptron model **4. Supervised machine learning** Linear regression Decision tree **5. Unsupervised machine learning** K means clustering PCA **6. Feature Engineering** Feature selection from a dataset		
	2	Case study – AI tools / Use of AI in any movie	3	
	3	**Implementation of Comparison of any two machine learning algorithms on a dataset**	7	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	1	1	2	1						
CO 2	1	3	2	3	2	2						
CO 3	2	3	2	3	2	3						
CO 4	2	-	1	2	-	-						
CO 5	2	-	2	3	3	3						
CO 6	3	-	-	3	3	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓	✓	✓
CO 6		✓	✓	

References

1. Elaine Rich, Kevin Knight, Shivsankar B Nair, “Artificial Intelligence”, Third Edition, Tata McGraw Hill Publisher
2. Tom M. Mitchell, Machine Learning, McGraw-Hill, 1st Ed.
3. Ethem Alpaydin, Introduction to Machine Learning- 3rd Edition, PHI.

Programme	BSc IT				
Course Code	ITY7CJ401				
Course Title	Data Communication and Fiber optics				
Type of Course	Major				
Semester	VII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Awareness in basic concepts of digital electronics is necessary.				
Course Summary	To develop an understanding of the various aspects of data communications, fundamentals of signaling , basic transmission concepts and fiber optics				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental concepts of data communication and transmission media.	U	C	Instructor-created exams / Quiz
CO2	:Analyze and evaluate mobile communication systems, including GSM.	An	P	Instructor-created exams/ Home Assignments
CO3	Design and analyze data link protocols for reliable data transmission.	Ap	P	Instructor-created exams/ Home Assignments
CO4	: Design and optimize optical fiber communication systems for specific applications	Ap	C	Instructor-created exams/ Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (60)	Marks
I		**Introduction to Data Communication**	**15**	

	1	Introduction to Data Communication: Components, Networks, Protocols, and Standards		
	2	Basic Concepts: Line Configuration, Topology, Transmission Mode		
	3	Analog and Digital Signals ,		
	4	Encoding and Modulating		
	5	Analog-to-Digital Conversion and Digital-to-Analog Conversion		
	6	Digital Data Transmission		
	7	DTE-DCE Interface and Modems		
	8	Cable Modems		
	9	Transmission Media: Guided Media, Unguided Media, and Transmission Impairment		
II	**Multiplexing and Mobile Communication**		**8**	
	10	. Multiplexing Applications: Telephone System, Cellular System		
	11	. Mobile Communication: GSM, GSM System Architecture		
	12	. Radio Interface in GSM		
III	**Data Link Control and Local Area Networks**		12	
	13	Data Link Protocols: Asynchronous, Synchronous, Character-oriented		
	14	. Link Access Procedures		
	15	. Local Area Networks: Ethernet, Token Bus, Token Ring, FDDI		
	16	. Switching: Circuit Switching, Packet Switching, Message Switching		
	17	. Integrated Services Digital Networks (ISDN): Services, History, Subscriber Access to ISDN		
IV	**Optical Fiber Communication**		**10**	
	18	Overview of Optical Fiber Communication: Historical Development, General System		
	19	. Advantages, Disadvantages, and Applications of Optical Fiber Communication		

	20	. Optical Fiber Waveguides, Fiber Materials		
	21	. Optical Sources and Detectors: LEDs, LASER Diodes, Photo Detectors		
	22	. Ray Theory, Cylindrical Fiber, Single Mode Fiber, Cutoff Wavelength, Mode Field Diameter		
V	**Open Ended Module**		**15**	
	1	Latest trends in data communication and fiber optics.		
	2	Interdisciplinary Applications: How data communication and fiber optics are merging with other fields like IoT, AI, and biomedical engineering.		
	3	Real-world applications and their impact.		

Reference

1. Behrouz A.Forouzan, Data Communication and Networking,TMH
2. Mobile Communications–JochenH.Schiller ,Second Edition,Pearson
3. Optical Fiber Communication–GerdKeiser,4thEd.,MGH,2008.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	1	1	-	-						
CO 2	-	1	1	2	-	-						
CO 3	-	1	3	2	-	-						
CO 4	-	1	2	2	1	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium

3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

Programme	BSc IT				
Course Code	ITY7CJ402				
Course Title	System Security				
Type of Course	Major				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge in Fundamentals of Network and Operating System				
Course Summary	The syllabus is prepared with the view of preparing BSc IT Graduates to build effective an understanding of the differences between various forms of computer system security, where they arise, and appropriate tools to achieve them				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the different types of securities in information and computer systems, security goals and confidentiality, integrity, availability	U	C	Instructor-created exams / Quiz
CO2	Outline computer system threats and various types of system attacks	U	C	Instructor-created exams / Quiz
CO3	Identify different issues associated with system attacks and how attacking occurs and various types of attackers	U	P	Instructor-created exams / Quiz
CO4	Provide knowledge in operating system security, file protections, security assurance	U	C	Instructor-created exams / Case studies
CO5	Understand important elements of Database security	U	P	Instructor-created exams / Quiz Case studies
CO6	Define security planning, various types of security policies and risk analysis	U	P	Instructor-created exams / Quiz /Case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (60)	Marks
I		**Notion of Different types of Securities**	**12**	**15**
	1	Information security - computer security - security goals, relation between security, confidentiality, integrity, availability and authorization, vulnerabilities - principles of adequate protection.	3	
	2	Notions of operating security, database security, program security, network security attacks - threats, vulnerabilities and controls.	3	
	3	The kind of problems - interception, interruption, modification, fabrication.	2	
	4	Computer criminals - amateurs, crackers, career criminals.	2	
	5	Methods of defence control, hardware controls, software controls, effectiveness of controls.	2	
II		**Program security**	**12**	**15**
	6	Secure programs - fixing faults, unexpected behaviour, types of flaws.	2	
	7	Non-malicious program errors - buffer overflows, incomplete mediation.	1	
	8	Viruses and other malicious code - kinds of malicious code, how viruses attach, how viruses gain control, prevention,	3	
	9	Control example - the brain virus, the internet worm, web bugs.	3	
	10	Targeted malicious code - trapdoors, Salami attack	1	
	11	Controls against program threats - development controls, peer reviews, hazard analysis	2	
III		**Operating system security**	**12**	**20**
	12	Protected objects and methods of protection - memory address protection - fence, relocation, base/bounds registers, tagged architecture, segmentation, paging.	2	
	13	Control of access to general objects - directory, access control list	2	
	14	File protection mechanism - basics forms of protection, single permissions.	2	
	15	Authentication - authentication basics, password, authentication process challenge - response, biometrics	2	
	16	Trusted operating systems - security policies for operating systems	2	
	17	Models of security - requirement of security systems, multilevel security, access security, limitations of security systems	2	
IV		**Database Security**	**12**	**20**
	18	Security requirements - integrity, confidentiality and availability of database	2	
	19	Reliability and integrity of database	2	
	20	Sensitive data, interface	3	
	21	Multilevel database	2	
	22	Proposals for multilevel database security	3	
V		**Open Ended Module**	**12**	

	CASE STUDY: Administrating security Security planning – Contents of a security planning, team members, commitment to a security plan, business continuity plans. Risk analysis – the nature of risk, steps of risk analysis.	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	2	-	-	1	1						
CO2	-	3	1	-	1	1						
CO3	-	2	1	-	1	1						
CO4	-	2	1	-	1	1						
CO5	1	3	1	-	1	2						
CO6	1	2	1	1	1	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Reference Books:

1. C. P. Pfleeger and S. L. Pfleeger, Security in Computing, 4th Edition, Pearson India, ISBN: 9788131727256.

2. Matt Bishop, Computer Security: Art & Science, 1st Edition, Pearson, ISBN: 0201440997.

3. William Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Pearson India, ISBN: 9332518777.

4. Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, 4th Edition, Ceneage Learning India Pvt Ltd, ISBN: 8131516458.

Programme	BSc IT				
Course Code	ITY7CJ403				
Course Title	Advanced Data Structures and algorithms				
Type of Course	Major				
Semester	VII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Mathematics Concepts: Sets, matrices 2. Awareness of Data structures and operations like array, stack, queue 3. Fundamentals of Java, C Programming				
Course Summary	This course provides an introduction to the ideas, techniques, and applications of advanced data structures) is given in this course. The advanced data structures and its variants like tree, graph, heaps are covered in this syllabus.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the concepts of advanced data structures like tree, graphs, heaps.	U	C	Instructor-created exams / Quiz
CO2	Understand familiarity with algorithmic techniques such as brute force, greedy, and divide and conquer.	U	C	Practical Assignment / Observation of Practical Skills
CO3	Understand Asymptotic analysis (big-O notation, time and space complexity).	U	F	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Application of advanced abstract data type (ADT) and data structures in solving real world problems.	AP	P	Instructor-created exams / Home Assignments
CO5	Effectively combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem	Ap	P	Writing assignments/ Instructor-created exams/ practicals
CO6	Apply Concepts of data structures in real world problem solving	Ap	P	Case Study/ mini Project/ practicals

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Introduction to Data Structures and Analysis of Quality of an Algorithm**		**9**	**12**
	1	Data structure - definition - types & operations, characteristics of data structures	2	
	2	Abstract Data Type (ADT) – algorithms - concepts - definition - objectives of algorithms -	1	
	3	Quality of an algorithm - space complexity and time complexity of an algorithm.	2	
	4	Growth of Functions: Asymptotic notations, Cost estimation based on key operations- Big Oh, Big Omega, Little Oh, Little Omega and Theta notations	3	
	5	Algorithm Design: Introduction, Steps in developing algorithm, Methods of specifying an algorithm	1	
II	**Basic Technique for Design of Efficient Algorithm**		**11**	**15**
	6	Brute Force approach (String pattern matching)	1	
	7	Divide-and-Conquer approach (Merge sort)	1	
	8	Branch-and-Bound technique (Knapsack problem)	2	
	9	Greedy approach (Kruskal's algorithm and Prim's Algorithm)	3	
	10	Dynamic Programming (Longest Common Subsequence)	2	
	11	Backtracking (Sum of subsets problem)	2	
III	**Linked lists - operations and implementations**		**12**	**15**
	12	Introduction to Singly Linked list and its operations	2	
	13	Circular Linked list and its operations	3	
	14	Doubly Linked list and its operations	2	
	15	Circular Doubly Linked list and its operations	2	
	16	Recursive lists, heterogeneous lists, deterministic skip lists- Creation & Searching	3	
IV		**Non-linear Data Structures**	**13**	**20**
	17	Binary search trees - traversals and operations on BST	3	
	18	AVL tree, Red Black Tree (concept only)	2	
	19	Balanced trees - M-way trees - B Tree (Concepts only)	1	
	20	Graphs - representation of graphs	1	
	21	Graphs- operations - traversals and their implementation.	2	
	22	Heap structures- Min-Max heaps - Deaps - leftist heaps - binomial heaps (concepts only) - Applications	3	
V	**Practical Implementations of Data Structures and its Operations in Java or C Programming Language**		**30**	**20**
	1	• Implementation of linear linked list • Implementation of circular linked list • Implementation of doubly linked list • Implementation of BST operations • Implementation of Depth First Search using graph • Implementation of Breadth First Search using graph • Implementation of max heap and delete a node from it. • Sort a set of data using Heap tree	25	
	2	Case Study/ Project	5	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	1	3	3	2	1						
CO 2	1	1	3	3	2	1						
CO 3	1	1	3	3	2	1						
CO 4	1	1	3	3	-	-						
CO 5	1	1	3	3	3	1						
CO 6	1	1	3	3	3	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓

CO 6	✓	✓	✓	

References:

1. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Addison-Wesley, ISBN: 978-0201000238.
2. Horowitz E and Sahni S, Fundamentals of Data Structures, Computer Science Press, ISBN: 9780716780427.
3. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, ISBN: 0929306406.
4. Thomas H Cormen, Charles E Leiserson, and Ronald L Rivest, Introduction to Algorithms, 3rd Edition, Prentice Hall of India Private Limited, New Delhi, ISBN: 9780262033848
5. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, 1st Edition. Addison Wesley, ISBN: 0534915728

Programme	BSc IT				
Course Code	ITY7CJ404				
Course Title	BLOCKCHAIN TECHNOLOGY				
Type of Course	Major				
Semester	VII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Strong programming skills in at least one popular language, such as Java or Python and data structures (like linked lists and arrays). Good understanding of networking concepts				
Course Summary	The syllabus is prepared with the view of preparing the BSc IT Graduates to create awareness and understanding among students on the foundation of blockchain technology. The course introduces the cryptographic principles behind blockchain and helps the students understand concepts like consensus, crypto-currency, smart contracts, use cases etc.				

ourse Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basics of cryptographic building blocks in blockchain technology.	U	C	Instructor-created exams / Quiz
CO2	Explain the fundamental concepts of blockchain technology.	U	C	Instructor-created exams / Quiz
CO3	Summarize the classification of consensus algorithms	U	P	Instructor-created exams / Quiz
CO4	Explain the concepts of first decentralized cryptocurrency bitcoin	U	C	Instructor-created exams / Case studies
CO5	Describe the use of smart contracts and its use cases	U	P	Instructor-created exams / Quiz Case studies
CO6	Develop simple block chain applications	U	P	Instructor-created exams / Quiz /Case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Fundamentals of Cryptography**	**12**	**15**
	1	Introduction to Cryptography, Symmetric cryptography – AES. Asymmetric cryptography –RSA. Elliptic curve cryptography,	3	
	2	Digital signatures – RSA digital signature algorithms.	2	
	3	Secure Hash Algorithms – SHA-256.	2	
	4	Applications of cryptographic hash functions – Merkle trees	3	
	5	Distributed hash tables	2	
II		**Fundamentals of Blockchain Technology**	**12**	**15**
	6	Blockchain – Definition, architecture, elements of blockchain, benefits and limitations.	2	
	7	Types of blockchain	1	
	8	Consensus – definition, types, consensus in blockchain,	3	
	9	Decentralization – Decentralization using blockchain	3	
	10	Methods of decentralization, Routes to decentralization,	1	
	11	Blockchain and full ecosystem decentralization	2	
III		**Consensus Algorithms and Bitcoin**	**12**	**20**
	12	Consensus Algorithms, Crash fault-tolerance (CFT) algorithms – Paxos, Raft. Byzantine fault tolerance(BFT) algorithms – Practical Byzantine Fault Tolerance (PBFT),.	2	
	13	Proof of work (PoW),Proof of stake (PoS), Types of PoS	2	
	14	Bitcoin – Definition, Cryptographic keys – Private keys, public keys, addresses	2	
	15	Transactions –Lifecycle, Coinbase transactions, transaction validation Blockchain – The genesis block.	2	
	16	Mining – Tasks of miners, mining algorithm, hash rate	2	
	17	Wallets – Types of wallets..	2	
IV		**Smart Contracts and Use cases**	**12**	**20**
	18	Smart Contracts – Definition, Smart contract templates, Deploying smart contracts	2	
	19	Oracles, Types of oracles.	2	
	20	Decentralization terminology – Decentralized applications, Decentralized Autonomous Organizations	3	
	21	Use cases of Blockchain technology – Government, Health care, Finance, Supply chain management.	2	
	22	Blockchain and allied technologies – Blockchain and Cloud Computing, Blockchain and Artificial Intelligence	3	
V		**Open Ended Module**	**12**	
		CASE STUDY: BLOCKCHAIN TECHNOLOGY Solidity language Ethereum platform		

Reference Books:

1.Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus

protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, Packt Publishing,

Third edition, 2020.

2. Ritesh Modi, Solidity Programming Essentials: A beginner's guide to build smart contracts

for Ethereum and blockchain, Packt Publishing, First edition, 2018.

3. Kumar Saurabh, Ashutosh Saxena, Blockchain Technology: Concepts and Applications,

First Edition, Wiley Publications, First edition, 2020.

4. Chandramouli Subramanian, Asha A George, et al, Blockchain Technology, Universities

Press (India) Pvt. Ltd, First edition, August 2020

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	-	-	-						
CO2	-	2	-	-	-	-						
CO3	-	2	3	3	-	-						
CO4	-	2	3	3	1	1						
CO5	-	1	1	-	2	3						
CO6	-	1	1	-	2	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	BSc IT				
Course Code	ITY7CJ405				
Course Title	Mastering Java Web Development				
Type of Course	Major				
Semester	VII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Knowledge in core concept of Java Programming 2. Knowledge of database concept and SQL 3. Knowledge in basic web concept like HTML, CSS, JavaScript				
Course Summary	The aim of this course is to provide students with a thorough understanding of building dynamic web applications using Java technologies. This course covers essential concepts, frameworks, and tools necessary for developing robust, scalable, and secure web applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the concept of web development principles, including client-server architecture, HTTP protocol, and web application lifecycle.	U	C	
CO2	Acquire proficiency in Java web technologies as Java Server Page.	Ap	P	
CO3	Understand the Model-View-Controller (MVC) architecture pattern and its implementation in Java web applications using frameworks like Spring MVC.	Ap	P	
CO4	Gain knowledge of web services concepts, including RESTful web services and SOAP-based web services, and learn to develop and consume web services using Java technologies.	Ap	P	
CO5	Gain a deep understanding of the principles behind AJAX, including asynchronous communication.	Ap	P	
CO6	Understand how to handle AJAX requests on the server-side using technologies such as JSP and Spring MVC.	Ap	P	
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)				

Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I	**Over View of Core Java**		**6**	**9**
	1	Core Java Concept: Class, Inheritance, Constructor, Exception and Multithreading	3	
	2	Overview of JDBC: JDBC Concept, Execution of SQL Statements, Transaction Management	2	
	3	Introduction to Web Applications, Web Servers Overview of J2EE Technologies.	1	
II	**Introduction to JSP**		**12**	**15**
	3	Fundamental Concept of JSP: JSP & Servlet as Web Components, Servlets vs. JSP	2	
	4	Working with JSP: JSP Lifecycle, JSP Page Lifecycle Phases	2	
	5	General Rules of Syntax: JSP syntactic elements, JSP element syntax, Template content	3	
	6	JSP elements: Directives, Declarations, Expressions, Scriptlets, Actions	3	
	7	JSP Standard Actions: jsp:useBean, jsp:getPreoperty, jsp:setProperty, jsp:include, jsp:forward, jsp:plugin,jsp:param, Java Server Pages Standard Tag Library(JSTL).	2	
III	**Introduction to Spring MVC**		**16**	**23**
	8	Getting Started with Spring: Overview of the MVC Architecture, Spring Framework and its relevance in web development, Advantages and benefits of using Spring MVC for building web applications.	2	
	9	Initializing a Spring project with Spring Tool Suite: Simple Example and Sample example analysis, Spring Project Structure	2	
	10	Writing a Spring Application: Handling Web request, Defining the view, Testing the Controller, Building and Running application	2	
	11	Developing Web Application: Establishing the domain, creating the controller class, Desigining the view, Form submission.	2	
	12	Working with View Controller: Declaring validation rule, Performing validation, Caching templates.	2	
	13	Working with Data: Working with JDBC, Defining the Schema and pre-loading data, Inserting data	2	

	14	Working with Spring Data JDBC: Adding Spring data JDBC, Defining the repositary interface, Preloading data with CommandLineRunner	2	
	15	Exception Handling: Handling exceptions gracefully in Spring MVC applications, Implementing global exception handlers and custom error pages.	1	
	16	Securing Spring: Introduction to Spring Security, Configuring authentication, authorization, and access control.	1	
IV		**Integrated Spring and AJAX**	**11**	**23**
	17	Creating REST Service: Building RESTful APIs using Spring MVC controllers. Handling HTTP methods (GET, POST, PUT, DELETE) and request parameters.	2	
	18	Introduction to AJAX\: Ajax Fundamentals, JavaScript Libraries, The Prototype Library, Technique Library, Form Completion	1	
	19	Validation: Realtime Validation, Propagating Client-Side View State, Direct Web Remoting	2	
	20	Handling Ajax Requests in Spring MVC: Mapping Ajax request URLs using @RequestMapping annotations. Parsing request parameters and payloads in Spring MVC controllers. Implementing server-side processing logic for Ajax requests.	2	
	21	Form Submission and Validation with Ajax: Submitting forms via Ajax requests in Spring MVC. Validating form inputs on the server-side using Spring's validation framework. Displaying validation errors and messages to the user without page reloads.	2	
	22	Advanced Ajax Technique: Cross-Origin Resource Sharing, CSRF protection, Content Security Policy, caching, throttling, lazy loading.	2	
V	**Hands-on Programming in Java (Using IDE NetBeans, Eclipse, VSCode):**		20	
	Practical Applications, Case Study and Course Project			
	1	Create a Java Web Application using JSP contain 1. User Register Form 2. Login Form		
		Develop a Java web application for an online bookstore using JSP perform the task 1. Insert the book details (Title Name, Author Name, Price, Quantity). 2. View a list of available books with details such as title, author, price, and quantity in stock.		

		Create Java Web Application using JSP to perform the JSP standard Action.		
		Create Sample Java Web Application using Spring MVC (Hint: Show a message)		
		Create Java Web Application using Spring MVC perform data validation		
		Create Java Web Application using Spring MVC with JDBC (Hint: Perform user registration and Login)		
		Create Java Web Application using Spring MVC to perform exception handling		
		Create Java Web Application using Spring MVC to perform custom error page		
		Create sample web application with Spring Boot		
		Create a simple web application that allows users to perform real-time search for products using AJAX with JSP.		
		Develop a web application that allows users to dynamically load and display additional content when scrolling down the page using AJAX with Spring MVC.		
	2	Case Study	2	
	3	Project: Build a web application for library management system using Spring MVC (Eg: Admin Login, Inserting Book details, stock management, Book issue, display book catelog)	8	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	3	3	-	-						
CO 2	1	-	3	3	-	-						
CO 3	-	-	3	3	2	3						
CO 4	-	-	2	3	-	-						
CO 5	-	-	3	3	2	3						
CO 6			3	3	3							

Correlation Levels:

Level	Correlation
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓

References:

1. Spring in Action, Sixth Edition by Craig Walls - 2022
2. Introducing Spring Framework 6: Learning and Building Java-based Applications with Spring - 2022 by Felipe Gutierrez, Joseph B. Ottinger

Programme	BSc IT				
Course Code	ITY8CJ406				
Course Title	Compiler Design				
Type of Course	Major				
Semester	VIII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1.Formal Languages & Automata Theory. 2.Data Structure and Algorithms				
Course Summary	This course covers the fundamental concepts of different phases of compilation such as lexical analysis, syntax analysis, semantic analysis, intermediate code generation, code optimization and code generation. Students can apply this knowledge in design and development of compilers.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To identify different phases in compilation process and model a lexical analyser.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO2	To model language syntax using Context Free Grammar and develop parse tree representation using leftmost and rightmost derivations.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO3	To compare different types of parsers and construct parser for a given grammar.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	To build Syntax Directed Translation for a context free grammar, compare various storage allocation strategies and classify intermediate representations.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO5	Students will demonstrate the ability to design and implement lexical analyzers to recognize tokens in source programs.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO6	Illustrate code optimization and code generation techniques in compilation	Ap	P	Practical Assignment / Instructor-

				created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Mark
I	**COMPILERS AND LEXICAL ANALYSIS**		**10**	**15**
	1	Analysis of the source program - Analysis and synthesis phases	2	
	2	Phases of a compiler, The grouping of Phases	2	
	3	Compiler writing tools. Bootstrapping.	2	
	4	Lexical Analysis: Parsing, Abstract stack machine, Role of Lexical Analyser	2	
	5	Input Buffering, Specification of Tokens, Recognition of Tokens.	2	
II	**SYNTAX ANALYSIS**		**18**	**25**
	6	Role of the Syntax Analyser, Role of the Parser	2	
	7	Context-free grammars, Prase Tree and Derivations, Eliminating Ambiguity	2	
	8	Basic Parsing Approaches – Eliminating left recursion, left factoring	3	
	9	Top Down parsing - Recursive Descent Parsing	2	
	10	Predictive Parsing - LL(1) Grammars	3	
	11	Bottom-up parsing -Handle Pruning - Shift Reduce Parsing - Operator Precedent Parsing	3	
	12	LR Parsers - SLR Parser- Canonical LR Parser - LALR Parser	3	
III	**SEMANTIC ANALYSIS AND INTERMEDIATE CODE GENERATION**		**10**	**15**
	13	Syntax directed translation - Syntax directed definitions	2	
	14	S-attributed definitions, L-attributed definitions, Bottom-up evaluation of S-attributed definitions. Run-Time Environments	2	
	15	Source Language issues, Storage organization, Storage-allocation strategies.	2	
	16	Intermediate Code Generation - Intermediate languages, Graphical representations,	2	
	17	Three-Address code, Quadruples, Triples.	2	
IV	**CODE OPTIMIZATION AND CODE GENERATION**		**10**	**15**
	18	Code Optimization - Principal sources of optimization	2	
	19	Machine dependent and machine independent optimizations,	2	
	20	Local and global optimizations.	2	

	21	Code generation - Issues in the design of a code generator,	2	
	22	Target Language, A simple code generator.	2	
V	**Open Ended Module – Application Level**		**12**	
		1. Learn the fundamentals of lexical analysis and parsing using Lex and Yacc, essential tools in compiler construction. 2. Apply the concepts learned to develop a small compiler, progressively enhancing its functionality while implementing error handling and optimization strategies. 3. Apply the concept of Bootstrapping and its significance in compiler construction. 4. Understanding of run-time environments and storage allocation strategies. 5. Development of a simple code generator for translating intermediate code into target code.		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	2	2	2	-						
CO 2	-	1	2	2	2	-						
CO 3	1	1	2	3	3	-						
CO 4	1	-	2	3	3	-						
CO 5	1	-	2	2	2	-						
CO 6	-	-	2	1	2	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Aho A.V., Ravi Sethi and D. Ullman. Compilers – Principles Techniques and Tools, Addison Wesley, 2006.

2. D.M. Dhamdhere, System Programming and Operating Systems, Tata McGraw Hill &Company, 1996.

3. Kenneth C. Louden, Compiler Construction – Principles and Practice, Cengage Learning Indian Edition, 2006.

Programme	BSc IT				
Course Code	ITY8CJ407				
Course Title	Cloud Computing				
Type of Course	Major				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic understanding of computer networks, operating systems, and programming.				
Course Summary	This course introduces students to the fundamental concepts, technologies, and practices of cloud computing. It covers the basics of cloud infrastructure, deployment models, and service models.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand fundamentals of cloud Computing	U	C	Instructor-created exams / Quiz
CO2	Describe and compare Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)	U	C	Assignment / Seminar presentations/ Exams
CO3	Analyze various deployment models such as public, private, and hybrid clouds.	U	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Understand the principles of virtualization and its role in cloud computing.	U	C	Instructor-created exams / Home Assignments
CO5	Compare and contrast different virtualization technologies, including hypervisors and containerization.	U	P	Writing assignments/ Exams/ Seminar Presentations
CO6	Explore various cloud platforms in industry	U	F	Case Study/ Exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs	Marks

			(48+12)	
I	**Introduction to Cloud Computing**		**8**	**12**
	1	Cloud computing in a glance	2	
	2	Historical context and evolution	1	
	3	Building cloud computing environments- Cloud components	2	
	4	Desired features of cloud	2	
	5	Advantages of Cloud	1	
II	**Cloud Computing Architecture**		**14**	**20**
	6	Cloud reference model	4	
	7	Types of cloud- private, public, hybrid, community	3	
	8	Cloud service models (IaaS)	2	
	9	Cloud service models (PaaS)	2	
	10	Cloud service models (SaaS)	2	
	11	Open Challenges	1	
III	**Virtualization Technologies**		**16**	**23**
	12	Virtual machine basics	2	
	13	hypervisor	2	
	14	Virtualisation structure	3	
	15	Implementation levels of virtualisation	2	
	16	Virtualisation types- Full Virtualisation, Para Virtualisation, Hardware Virtualisation	3	
	17	Virtualisation of CPU, Memory	2	
	18	Virtualisation of I/O devices	2	
IV	**Virtualisation Infrastructure & Dockers**		**10**	**15**
	17	Desktop Virtualisation, Network Virtualisation & Storage Virtualisation	2	
	18	Containers vs Virtual Machines	2	
	19	Basics of Dockers	2	
	20	Docker Components	2	
	21	Docker Containers	1	
	22	Docker Images and repositories	1	
V	**Open Ended Module**		**12**	
	1	• Cloud platforms in Industry ✓ **Amazon web services**- computation services, storage services, communication services ✓ **Google AppEngine**- Architecture and core concepts ✓ **Microsoft Azure**- Azure core concepts		
	2	• Future Trends		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	--	2	--	-	1	1						

CO 2	-	2	-	-	1	1						
CO 3	-	1	-	-	1	1						
CO 4	-	1	-	-	2	1						
CO 5	1	1	-	-	2	1						
CO 6	-	1	-	-	2	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4		✓	✓
CO 5		✓	✓
CO 6		✓	

References

1. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition, Willey Publications", William Voorsluys, James Broberg, Rajkumar Buyya

2. "Cloud Computing: A Hands-On Approach" by Arshdeep Bahga and Vijay Madiset

Programme	BSc IT				
Course Code	ITY8CJ408				
Course Title	Enterprise Resource Planning				
Type of Course	Major				
Semester	VIII				
Academic Level	400 – 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Awareness in basic concepts of software development				
Course Summary	To develop an understanding of the various aspects Enterprise Resource Planning				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic concepts, benefits, and architecture of ERP systems.	U	C	Instructor-created exams / Quiz
CO2	Analyze ERP Modules and gain insights into various ERP modules and their functionalities..	An	P	Instructor-created exams/ Home Assignments
CO3	Analyze real-world ERP implementation case studies to understand practical challenges and solutions..	A	P	Instructor-created exams/ Home Assignments
CO4	Understand the relationship between ERP and related technologies like DBMS, data warehousing	U	C	Instructor-created exams/ Home Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (60)	Marks
I		Introduction to Enterprise Resource Planning	**11**	
	1	Introduction to ERP: Definition, evolution, and importance	1	

	2	. Benefits of ERP Systems: Operational, managerial, and strategic advantages	2	
	3	. Overview of ERP architecture and components	2	
	4	. Stages from planning to implementation and maintenance	2	
	5	. Key ERP vendors and market trends	2	
	6	Common issues and pitfalls in ERP implementation	2	
II	ERP Implementation		**11**	
	7	. Phases of ERP implementation	3	
	8	. Project Management in ERP: Key principles and practices	2	
	9	. Business Process Reengineering (BPR)**:** Role in ERP implementation	2	
	10	Change Management**:** Importance and strategies	2	
	11	Key factors for successful ERP implementation	2	
III	ERP and Related Technologies		12	
	12	ERP and Database Management: Integration with DBMS		
	13	. ERP and Data Warehousing: Role and benefits		
	14	. ERP and Business Intelligence: Enhancing decision-making		
	15	. ERP Security**:** Ensuring data security and compliance		
IV	ERP Module		**10**	
	16	Finance and Accounting Module: Features and functions		
	17	. Human Resource Management (HRM) Module: Features and functions		
	18	. Manufacturing and Production Planning Module**:** Features and functions		
	19	. Sales and Distribution Module: Features and functions		
	20	. Materials Management		
	21	. Customer Relationship Management		
V	**Open Ended Module**		**15**	
	1	Introductionto ERP tools		
	2	Emerging trends in ERP		
	3	Case Studies		

Reference

1. Jagan NathanVaman, ERP in Practice,Tata McGraw-Hill,2008
2. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill,2008.
3. Mahadeo Jaiswal and GaneshVanapalli, ERP Macmillan India,2009
4. Vinod Kumar Grag and N.K.Venkitakrishnan, ERP-Concepts and Practice,PHI,2006.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	1	1	-	-						
CO 2	-	1	1	2	-	-						
CO 3	-	2	3	2	-	-						
CO 4	-	1	2	2	1	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

Programme	BSc				
Course Code	ITY8CJ489				
Course Title	**Research Methodology**				
Type of Course	Major				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge of Planning a research project, problem formulation, framing objectives				
Course Summary	This course introduces and discusses approaches, strategies, and data collection methods relating to research. Students will consider how to select the appropriate methodology for use in a study to be performed. Additionally, these students will learn how to collect data based on different data collection methods, construct these tools, and pilot them before they become ready for use. To culminate this final stage, students will learn to write a comprehensive research proposal that may be conducted in the future				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the psychology of research which includes different perspectives and necessity of research.	U	C	Instructor- created exams / Quiz
CO2	Apply the research knowledge to formulate a suitable problem statement by adopting different research methods and models	U	C	Instructor-created exams / Quiz
CO3	Understand different methods of Collection, Validation and Testing of Data	U	P	Instructor-Created exams / Quiz
CO4	To understand the data processing and analysis techniques	U	C	Instructor-created exams / Case studies
CO5	Analyze the research outcome by using suitable statistical tool.	U	P	Instructor-created exams / Quiz Case studies

CO6	To write or present a scientific report and research proposal	U	P	Instructor-created exams / Quiz /Case studies
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Introduction to Research Methodology**	**12**	**15**
	1	Research Methodology: An Introduction to the Meaning of Research and Objectives of Research	2	
	2	Motivation in Research ,Types of Research	2	
	3	Research Approaches	2	
	4	Significance of Research	3	
	5	Research Methods versus Methodology .	3	
II		**Identifying, Defining and Designing Research Problem**	**12**	**15**
	6	Defining the Research Problem What is a Research Problem? Selecting the Problem, Necessity of Defining the Problem	2	
	7	Technique Involved in Defining a Problem	1	
	8	Research Design: Meaning of Research Design, Need for Research Design	3	
	9	Research Methodology,Features of a Good Design	3	
	10	Important Concepts Relating to Research Design	1	
	11	Different Research Designs	2	
III		**Collection, Validation and Testing of Data**	**12**	**20**
	12	Sources of Data: Primary and Secondary, Validation of Data , Data Collection Methods: Questionnaire Designing	2	
	13	Construction Sampling Design & Techniques – Probability Sampling and Non Probability Sampling Scaling Techniques:	2	
	14	Meaning & Types Reliability: Test – Retest Reliability,	2	
	15	Alternative Form Reliability	2	
	16	Internal Comparison Reliability and Scorer Reliability	2	
	17	Validity: Content Validity, Criterion Related Validity and Construct Validity	2	
IV		**Data Processing and Analysis**	**12**	**20**
	18	Processing and Analysis of Data, Processing Operations, Some Problems in Processing, Elements/Types of Analysis	2	
	19	Statistics in Research Measures of Central Tendency	2	
	20	Measures of Dispersion Interpretation and Report Writing	3	
	21	Meaning of Interpretation Why Interpretation? Technique of Interpretation:Precaution in Interpretation	2	
	22	Significance of Report Writing Different Steps in Writing Report Layout of the Research Report	3	

V	**Open Ended Module**	**12**	
	CASE STUDY: RESEARCH METHODOLOGY Methods of Research Applications of Statistical tools & Methods Structure and components of scientific reports		

Reference Books:

1. C.R .Kothari, 'Research Methodology Methods & Techniques', Revised 2 nd Edn., New Age International Publishers.Research Methodology and Scientific Writing by C George Thomas, Ane Books Pvt. Ltd.

2. An Introduction to Research Methodology; Garg B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002., RBSA Publishers.

3. Research Methodology ; Panneerselvam R., PHI, Learning Pvt. Ltd., New Delhi - 2009

4. Research Methodology: Concepts and cases, Chawala D. and N. Sondhi ; Vikas Publishing House Pvt. Ltd.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	-	-						
CO2	-	-	1	-	-	-						
CO3	2	2	1	-	1	1						
CO4	2	2	2	2	1	2						
CO5	2	1	2	2	1	2						
CO6	-	-	-	-	-	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

AI and ML									
No	**Course Code**	**Course Name**	**C**	**Marks**			**Hrs/wk**		
				I	**E**	**T**	**L**	**P**	**T**
29	ITY5EJ301(1)	Machine Learning Algorithms	4	30	70	100	4	0	4
30	ITY5EJ302(1)	Knowledge Engineering	4	30	70	100	4	0	4
35	ITY6EJ301(1)	Soft Computing	4	30	70	100	4	0	4
36	ITY6EJ302(1)	Deep Learning	4	30	70	100	4	0	4

Programme	BSc IT				
Course Code	**ITY5EJ301(1)**				
Course Title	**Machine Learning Algorithms**				
Type of Course	**Elective**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Understanding of basic mathematics and statistics (linear algebra, calculus, probability)				
Course Summary	This course introduces the fundamental concepts, algorithms, and applications of machine learning				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand basic concepts of machine learning, including supervised learning, unsupervised learning, and reinforcement learning	U	C	Instructor-created exams / Quiz
CO2	Understand the mathematical foundations of machine learning algorithms, including concepts such as optimization, linear algebra, probability, and statistics	U	C	Assignment / Seminar presentations/ Exams

CO3	Demonstrate proficiency in various machine learning algorithms, such as linear regression, logistic regression, decision trees, support vector machines, k-nearest neighbors, clustering algorithms, and neural network	U	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Explore techniques for feature engineering and feature selection to improve the performance of machine learning models.	U	P	Instructor-created exams / Home Assignments
CO5	Evaluate machine learning models using appropriate metrics and techniques, including cross-validation, precision, recall, F1 score, ROC curves, and confusion matrices.	Ap	P	Writing assignments/ Exams/ Seminar Presentations
CO6	Develop critical thinking skills to analyze and solve complex problems using machine learning approaches.	Ap	P	Case Study/ Group discussions/ Presentations

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (48+12)	Marks (70)
I		**Mathematical Foundation for Machine learning**	**14**	**20**
	1	Introduction to key concepts: features, labels, training, and testing	2	
	2	Designing a Learning system	1	
	3	Types of learning; supervised, unsupervised and reinforcement	2	
	4	Introduction to linear algebra- Vector :-Vector operations: addition, subtraction, scalar multiplication	2	
	5	Matrices- Matrix operations	2	
	6	Eigenvalues and Eigenvectors	2	
	7	Foundations of Probability for ML:- Introduction to probabilty	1	
	8	Random Variable, Probability distributions (Normal and gaussian-basics only), Naïve bayes	2	
II		**Feature Engineering and Preprocessing**	**12**	**15**
	9	Data Preprocessing and Feature Engineering: Data Representation, Data Preprocessing	2	
	10	Features and Types	3	
	11	Dimensionality Reduction – Feature Identification	2	
	12	Feature selection	2	
	13	Feature extraction - Feature Importance	3	
III		**Regression and Classification**	**12**	**20**

	14	Regression: Linear Regression – Non-Linear regression	2	
	15	Evaluation metrics for regression	1	
	16	Classification: Binary, multi-class, and multi-label classification	1	
	17	lazy leaners- (KNN) - tree-based techniques (Decision Tree)- kernel based techniques (SVM) - probabilistic techniques (Naïve bayes)- and ensembled techniques (bagging, boosting, voting)	7	
	18	Evaluation metrics for classification.	1	
IV	**Clustering and Rule Mining**		**10**	**15**
	19	Clustering: Partitioning based (K Means)	2	
	20	Hierarchical based (Divisive)	2	
	21	Rule mining: Apriori algorithm, FB Growth - association rules.	4	
	22	Outlier Detection - LOF	2	
V	**Open Ended Module**		**12**	
	1	Ethical considerations in machine learning	3	
	2	McCulloch-Pitts neurons, Hebb's networks	3	
	3	Hopfield networks, Boltzmann machines	2	
	4	Reinforcement Learning: Markov Decision Processes (MDPs), Q-learning.	4	

References

- Ethem Alpaydin, Introduction to Machine Learning- 3rd Edition, PHI
- Machine Learning by Mitchell, Tom M. (Tom Michael), McGraw-Hill
- Mathematics For Machine Learning, Marc Peter Deisenroth A. Aldo Faisal Cheng Soon Ong
- "Pattern Recognition and Machine Learning" by Christopher M. Bishop.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	1	-	-	1	-						
CO 2	3	-	-	-	1	-						
CO 3	1	3	1	1	2	3						
CO 4	1	-	1	1	2	3						
CO 5	1	-	-	-	2	3						
CO 6	1	2	2	2	3	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4	✓	✓	✓
CO 5	✓	✓	✓
CO 6		✓	

Programme	BSc IT				
Course Code	**ITY5EJ302(1)**				
Course Title	**Knowledge Engineering**				
Type of Course	**Elective**				
Semester	V				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Understanding of basic mathematics and statistics Basic understanding of computer science concepts				
Course Summary	This course introduces students to the principles, techniques, and tools used in Knowledge Engineering. It covers the design and development of knowledge-based systems, including knowledge representation, reasoning, and acquisition.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand basics of Knowledge Engineering	U	C	Instructor-created exams / Quiz
CO2	Apply methodologies and modelling for agent design and development	Ap	P	Assignment / Seminar presentations/ Exams
CO3	Design and develop ontologies	Ap	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Apply reasoning with ontologies and rules	Ap	P	Instructor-created exams / Home Assignments
CO5	Understand learning and rule learning	U	C	Writing assignments/ Exams/ Seminar Presentations
CO6	Develop theoretical knowledge to design a knowledge based system	Ap	P	Case Study/ Group discussions/ Presentations
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (48+12)	Marks (70)
I	**Reasoning under uncertainity**		**15**	**15**
	1	Understanding the World through Evidence-based Reasoning: - Evidence, Data, and Information, Evidence and Fact, Evidence and Knowledge	2	
	2	Abductive Reasoning	1	
	3	Probabilistic Reasoning: - Enumerative Probabilities: Obtained by Counting, Subjective Bayesian View of Probability	2	
	4	Belief Functions	1	
	5	Baconian Probability, Fuzzy Probability	3	
	6	Evidence-based Reasoning	2	
	7	Artificial Intelligence: - Intelligent Agents, Mixed-Initiative Reasoning	2	
	8	Knowledge Engineering: - An Ontology of Problem-Solving Tasks, Building Knowledge-based Agents	2	
II	**Methodologies and Tools for Agent Design and Development ,Modelling the Problem-Solving Process**		**12**	**20**
	9	A Conventional Design and Development Scenario	2	
	10	Development Tools and Reusable Ontologies	2	
	11	Agent Design and Development Using Learning Technology	2	
	12	Problem Solving through Analysis and Synthesis	1	
	13	Inquiry-driven Analysis and Synthesis for Evidence-based Reasoning	2	
	14	Evidence-based Assessment, Believability Assessment	3	
III	**Ontologies**		**11**	**20**
	15	What Is an Ontology? Concepts and Instances, Generalization Hierarchies	2	
	16	Object Features, Defining Features, Defining Features, Representation of N-ary Features	2	
	17	Transitivity, Inheritance, Ontology Matching	3	
	18	Ontology Design and Development Methodology- Steps in Ontology Development, Domain Understanding and Concept Elicitation, Modeling-based Ontology Specification	4	
IV	**Reasoning with Ontologies and Rules**		**10**	**15**
	19	Production System Architecture	1	
	20	Complex Ontology-based Concepts	1	
	21	Reduction and Synthesis Rules and the Inference Engine, Evidence-based Hypotheses Analysis, Rule for Ontology Matching	4	
	22	Partially Learned Knowledge, Reasoning with Partially Learned Knowledge	4	
V	**Open Ended Module- Learning for Knowledge-based Agents**		**12**	
	1	Generalization and Specialization Rules	4	
	2	Types of Generalizations and Specializations	4	

	3	Analogy-based Generalization	4	

References

- “Knowledge Engineering”, Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum
- "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
- "Knowledge Representation and Reasoning" by Ronald J. Brachman and Hector J. Levesque.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	1	-	-	1	1						
CO 2	3	-	-	-	1	1						
CO 3	1	3	1	1	2	3						
CO 4	1	-	1	1	2	3						
CO 5	1	-	-	-	2	3						
CO 6	1	2	1	1	3	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4	✓	✓	✓
CO 5	✓	✓	✓
CO 6	✓	✓	

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Programm	BSc IT				
Course Code	**ITY6EJ301(1)**				
Course Title	**Soft Computing**				
Type of Course	**Elective**				
Semester	VI				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Fundamental Mathematics Concepts: Set, Functions, Logic 2. CSC2CJ101 – Fundamentals of Programming				
Course Summary	This course explores implementations of linked list and array-based data structures, delving into the inner workings of basic data structures including lists, stacks, queues, trees, and graphs.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the foundational principles of soft computing and the historical factors influencing its development.	U	C	Instructor-created exams / Quiz
CO2	Analyze the properties of Fuzzy sets and Fuzzy relations	Ap, U	P	Assignment/ Seminar
CO3	Apply fuzzy logic concepts to solve real-world problems, showcasing proficiency in designing and implementing fuzzy systems.	Ap, U	C	Seminar Presentation / Quiz
CO4	Master the concepts of Genetic algorithms and their operations	U	C	Practical Assignment / Seminar
CO5	Design and implement solutions using fuzzy logic, neural networks, and genetic algorithms for diverse applications.	Ap	P	Practical Assignment/ Seminar
CO6	Evaluate and present real-world scenarios where soft computing techniques can be effectively applied	Ap	P	Case study/ Project
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to Soft Computing**	**7**
	1	Overview of Soft computing, Hard Computing, and Hybrid Computing	2
	2	Areas and Applications of Soft Computing	1
	3	Basic Tools of Soft Computing- Fuzzy Logic, Neural Networks and Evolutionary computing	2
	4	Introduction to Fuzzy logic, Neural Networks, Genetic Algorithm, and Hybrid systems (Concepts only)	2
II		**Introduction to Fuzzy Logic**	**14**
	6	Introduction to Fuzzy Logic	2
	7	Fuzzy sets and crisp sets	2
	8	Fuzzy relations and Crisp relations	2
	9	Tolerance and Equivalence Relations	2
	10	Fuzzy membership functions	3
	11	Fuzzification and Defuzzification	3
III		**Advanced Fuzzy Logic**	**14**
	12	Fuzzy Rules and Fuzzy Reasoning	3
	13	Fuzzy Inference Systems- Mamdani and Sugeno models	4
	14	Fuzzy Control Systems	3
	15	Fuzzy Clustering (Concepts only)	2
	16	Fuzzy Neural Networks (Concepts only)	2
IV		**Genetic Algorithm**	**13**
	17	Introduction to Genetic Algorithm	2
	18	Operators in genetic algorithm - coding - selection - cross over – mutation,	2
	19	Stopping condition for genetic algorithm flow.	2
	20	Constraints in Genetic Algorithm	2
	21	Classification of Genetic Algorithm	3
	22	Genetic Programming (Concepts)	2
V		**Open Ended Module**	**12**
		• Understand the different optimization techniques used. • Explore the real-life applications of soft computing techniques • Discuss hybrid soft computing techniques	

REFERENCES

1. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd
2. D.K. Pratihar, “Soft Computing: Fundamentals and Applications”, Alpha Science International Ltd

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	-	1	1						
CO 2	2	-	-	1	1	1						
CO 3	2	-	-	2	2	1						
CO 4	2	-	-	1	1	1						
CO 5	1	-	2	3	2	3						
CO 6	1	-	3	3	2	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	BSc IT				
Course Code	**ITY6EJ302(1)**				
Course Title	**Deep Learning**				
Type of Course	**Elective**				
Semester	VI				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	4. Introduction to Artificial Intelligence 5. Basic understanding of linear algebra, calculus, and probability. 6. Basics of Machine learning				
Course Summary	The theoretical groundwork for comprehending the fundamentals of deep learning is supplied by this course. Theoretical frameworks, optimisation techniques, and mathematical ideas that support deep neural network building and training will be examined by students.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Master key concepts of machine learning, understanding various layers of neural network.	U	C	Instructor-created exams / Quiz
CO2	Understand and implement the backpropagation algorithm for training neural networks, demonstrating the ability to compute gradients and update weights.	Ap, U	P	Assignment / Seminar presentations/ Exams
CO3	Analyze and compare different activation functions used in neural networks, explaining their role in the learning process.	U	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Design and implement feedforward neural networks for various applications, considering aspects such as model architecture, activation functions, and initialization methods.	Ap	C	Instructor-created exams / Home Assignments

CO5	Master the principles of convolutional neural networks, including convolutional layers, pooling layers, and their applications in computer vision. Master various regularization techniques, such as dropout, batch normalization, and weight regularization, to improve the generalization of neural networks	U	P	Writing assignments/ Exams/ Seminar Presentations
CO6	Apply deep learning concepts to solve real-world problems, demonstrating the ability to choose appropriate architectures and hyperparameters.	Ap	P	Case Study
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (48+12)	Marks (70)
I		**Machine Learning Basics**	**10**	**15**
	1	Learning Algorithms -Supervised learning- regression, classification, Unsupervised learning, Reinforcement learning (Introduction only)	2	
	2	Terms - Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance	2	
	3	Maximum Likelihood estimation, Bayesian statistics, Stochastic Gradient Descent	3	
	4	Building a Machine Learning Algorithm	1	
	5	Challenges Motivating Deep Learning	2	
II		**Optimisation and Neural Networks**	**15**	**20**
	6	Neural Networks –Perceptron, Gradient Descent solution for Perceptron, Multilayer perceptron	3	
	7	Activation Functions- Sigmoid, Softmax, Relu, LeakyRelu, ERELU	2	
	8	Chain rule, back propagation- Backpropagation Algorithm	3	
	9	Gradient based learning.	2	
	10	Introduction to optimization– Gradient based optimization, linear least squares. Stochastic gradient descent	2	
	11	Regularisation techniques- Drop out, Batch Normalisation, weight regularisation	3	
III		**Convolutional Neural Network**	**12**	**20**
	12	Convolutional Neural Networks – convolution operation, motivation	2	

	13	Pooling	2	
	14	Variants of convolution functions	2	
	15	Structured outputs, data types	2	
	16	CNN Architecture- Alexnet, VGG16	4	
IV	**Deep learning Architectures**		**11**	**15**
	17	Sequence Modeling: Recurrent and Recursive Nets- Basics of Recurrent Neural Networks	2	
	18	Encoder – Decoder Sequence to Sequence Architectures,	2	
	19	Deep Recurrent Networks, Recursive Neural Networks	2	
	20	The Long Short-Term Memory	2	
	21	GRU	2	
	22	Basics of transfer learning techniques (Concept only)	1	
V	**Open ended Module**		**12**	
	1	• Master students Basics of Mathematics required for Machine learning and deep learning- Linear Algebra (Scalars, Vectors, Matrices and Tensors, Eigen values, Eigen Vectors)- concepts only • Probability awareness- Why probability, random variable, probability distributions)- concepts only • Discuss advanced topics in deep learning, including transfer learning, autoencoders, adversarial training, and stay informed about recent developments in the field.)- concepts only		

References

- "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
- Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, “Dive into Deep Learning”, August 2019.
- Neural Networks and Deep Learning: A Textbook by Charu C. Aggarwal. Springer.1st edition, 2018.
- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	-	-	2	3						
CO 2	2	-	1	1	2	3						
CO 3	2	-	-	-	2	1						

CO 4	2	-	1	1	2	2						
CO 5	2	-	2	1	2	3						
CO 6	2	-	2	1	2	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4		✓	✓
CO 5		✓	✓
CO 6		✓	

Computer Networks									
1	ITY5EJ303(2)	Wireless Communication	5	60	4	4	30	70	100
2	ITY5EJ304(2)	Cryptography and Network Security	5	60	4	4	30	70	100
3	ITY6EJ303(2)	Storage Area Network	6	60	4	4	30	70	100
4	ITY6EJ304(2)	Internet of Things	6	60	4	4	30	70	100

Programme	BSc IT				
Course Code	**ITY5EJ303(2)**				
Course Title	Wireless Communication				
Type of Course	Elective				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic knowledge in IT 2. Familiarity with networking fundamentals and Digital Communication basics.				
Course Summary	The Wireless Communications course is designed for the students to gain a comprehensive understanding of wireless communication technologies and their applications. The course covers fundamental concepts, protocols, and technologies that form the basis of modern wireless networks. It explores the evolution from 2G to 5G and beyond, as well as emerging trends such as Internet of Things (IoT) and 6G. Students will also delve into security and privacy considerations in wireless communications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define the fundamental concepts of wireless communication technologies.	R	F	Practical Assignment / Instructor-created exams / Quiz
CO2	Explain the evolution and standards of wireless networks.	U	C	Practical Assignment /

				Instructor-created exams / Quiz
CO3	Apply knowledge of wireless protocols to design and configure wireless networks.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	Analyze the security threats in wireless communication systems and propose countermeasures.	An	M	Practical Assignment / Instructor-created exams / Quiz
CO5	Evaluate the impact of emerging trends in wireless communications on industry demands and ethical considerations.	E	P	Practical Assignment / Instructor-created exams / Quiz
CO6	Design and develop innovative solutions for challenges in the field of wireless communications.	C	P	Practical Assignment / Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Marks
I	**Introduction to Wireless Transmission**		**13**	**18**
	1	Applications of wireless networks	1	
	2	History of wireless communication	2	
	3	Simplified Reference Model	2	
	4	Frequencies for radio transmission, signals, Antennas	3	
	5	Signal propagation and Multiplexing	2	
	6	Modulation, Spread Spectrum, Cellular systems	3	
II	**Medium Access Control & Telecommunications Systems**		**12**	**17**
	7	Motivation for specialized MAC	2	
	8	SDMA, FDMA	2	
	9	TDMA, CDMA	3	
	10	GSM-Mobile Services, Architecture, Protocols	3	
	11	DECT-System & Protocol Architecture	2	
III	**Satellite Systems & Wireless LANs**		**12**	**18**
	12	Satellite systems, Basics- GEO, LEO, MEO	2	
	13	Routing, Localization & Handover	2	
	14	Infra-red vs radio transmission	2	
	15	Infrastructure and ad-hoc network	2	
	16	IEEE 802.11	2	
	17	Bluetooth	2	
IV	**Mobile Network & Transport Layer**		**11**	**17**
	18	Mobile IP, DHCP	3	

	19	Mobile Ad-hoc networks	2	
	20	Traditional TCP	3	
	21	Classical TCP Improvements	2	
	22	TCP over 2.5/3G wireless networks	1	
V	**Open Ended Module – Support for Mobility**		**12**	
		• Various file systems such as NFS, AFS, Coda, Little Work, Ficus, Mio-NFS, Rover, etc. • World Wide Web- Problems and solutions when used in mobile and wireless environment. • Wireless Application Protocols, architecture, Wireless Transaction Protocols, Markup language, Session Protocol, etc. • 4G, 5G, 6G and beyond: Future wireless Technologies • IOT, Green Wireless Communications, Machine-to-Machine (M2M) communications.	12	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	-	-	-	1						
CO 2	1	2	-	-	-	1						
CO 3	2	3	3	2	2	2						
CO 4	2	3	3	-	2	2						
CO 5	3	2	2	-	3	3						
CO 6	2	3	3	1	3	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. "Mobile Communications" by Jochen H. Schiller, 2/e, Pearson Education, 2012.

2. "Wireless Communications: Principles and Practice" by Theodore S. Rappaport.

3. "Wireless Communications and Networks" by William Stallings.

4. “Wireless Communications” by Andrea Goldsmith, Cambridge University Press, 2005.

5. "5G NR: The Next Generation Wireless Access Technology" by Erik Dahlman, Stefan Parkvall, and Johan Skold.

Programme	BSc IT				
Course Code	**ITY5EJ304(2)**				
Course Title	Cryptography and Network Security				
Type of Course	Elective				
Semester	V				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Basic understanding of computer networks, cryptography, and programming concepts. Familiarity with OSI model, encryption algorithms, and network security mechanisms recommended.				
Course Summary	Cryptography and Network Security course provides a comprehensive overview of security principles and encryption techniques essential for securing computer networks. Upon completion, students will possess the knowledge and skills to analyse, implement, and maintain secure network environments, addressing contemporary security challenges effectively.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental principles of cryptography	U	F	Quizzes, Assignments/Instructor-created exams
CO2	Analyse security vulnerabilities in network systems	An	C	Case studies, Projects, Instructor-created exams
CO3	Design and implement secure communication protocols	Ap	P	Coding exercises, Projects
CO4	Evaluate cryptographic techniques for different applications	E	C	Research papers, Critical reviews, Instructor-created exams/Quizzes
CO5	Apply cryptographic principles to real-world scenarios	Ap	P	Simulations, Scenario-based assessments, Presentations, Quizzes
CO6	Critically assess emerging trends and technologies in cryptography and network security	E	C	Projects, Industry Internships, Instructor-created exams/Quizzes

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Mark
I	**Introduction To Security and Traditional Symmetric Key Encryption Techniques**		**11**	**15**
	1	**Introduction To Security:** The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Cryptology, A Model for Network Security.	3	
	2	**Symmetric Cipher Model-** Cryptography, Cryptanalysis and Brute-Force Attacks	2	
	3	**Substitution Techniques -** Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One Time Pad Cipher.	3	
	4	**Transposition Techniques –** Rail Fence	1	
	5	**Rotor Machines-** Basic Principle and Working	1	
	6	**Steganography-** Purpose, Techniques	1	
II	**Modern Symmetric Key Encryption Techniques**		**15**	**15**
	7	**Stream Ciphers and Block Ciphers-** Definitions, Difference, Block Cipher Structure - Feistel Cipher - Structure, Encryption and Decryption.	3	
	8	**Data Encryption Standard (DES) –** Encryption, Decryption, Example, Strength Of DES	3	
	9	**Advanced Encryption Standard (AES) –** Encryption and Decryption, Transformation functions, Key Expansion, Example	2	
	10	**Block Cipher Modes of Operations-** Electronic Code Mode, Book Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode	3	
	11	**Stream Cipher –** Structure, RC4	4	
III	**Asymmetric Cipher and Cryptographic Data Integrity Algorithms**		**11**	**20**
	12	**Public Key Cryptography (Asymmetric Cryptography) –** Encryption and Decryption	2	
	13	**RSA Algorithm –** Introduction, Encryption and Decryption, Example, Advantage and Disadvantage	2	
	14	**Cryptographic Hash Functions –** Concept, Applications	2	
	15	**Secure Hash Algorithm-** SHA 512	1	
	16	**Message Authentication Code –** Concept, Requirements, Security	1	
	17	**MACs based on Hash Functions-** HMAC	3	
IV	**Network and Internet Security**		**11**	**20**
	18	**Web Security Considerations-** Web Security Threats Web Traffic Security Approaches	1	
	19	**Secure Socket Layer and Transport Layer Security-** Concept, Working of SSL and TLS, Difference between SSL and TLS	3	

	20	**HTTPS -** Concept**,** Connection Initiation Connection Closure	1	
	21	**SSH-** Concept, Transport Layer Protocol User Authentication Protocol Connection Protocol	2	
	22	**Electronic Mail Security –** PGP, S/MIME	4	
V	**Open Ended Module- System Security**		**12**	
		• Intruders • Malicious Software • Firewalls		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	2	-	1	-						
CO2	1	1	2	3	-	-						
CO3	-	2	3	3	-	1						
CO4	-	-	1	2	2	2						
CO5	-	2	-	-	1	1						
CO6	-	2	-	2	-	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO1	✓	✓	✓	✓
CO2	✓	✓	✓	✓
CO3		✓	✓	✓
CO4		✓		✓
CO5	✓	✓	✓	✓
CO6	✓	✓	✓	✓

References:

1. Cryptography And Network Security Principles and Practice, William Stallings, Pearson Education- Fifth Edition
2. Cryptography and Network Security, Behrouz A. Forouzan Tata, McGraw-Hill.
3. Cryptography and Network Security, Atul Kahate, Tata McGraw Hill,2019.
4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

Programme	BSc IT				
Course Code	**ITY6EJ303(2)**				
Course Title	Storage Area Network				
Type of Course	Elective				
Semester	VI				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic understanding of computer networks 2. Familiarity with operating systems and file systems				
Course Summary	This course provides an in-depth understanding of Storage Area Networks (SANs) and their role in modern computing environments. Students will explore the fundamental concepts, architectures, protocols, and implementation strategies of SANs. Practical aspects of designing, managing, and troubleshooting SANs will also be covered.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Define the fundamental concepts and components of Storage Area Networks (SANs), describe the evolution of storage architectures and the role of SANs in modern computing environments.	U	C	Practical Assignment / Instructor-created exams / Quiz
CO2	Design a basic Storage Area Network (SAN) architecture, considering storage devices, Fibre Channel technology, and SAN fabric components, implement zoning and LUN masking for secure and efficient data access in a SAN.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO3	Evaluate and compare different SAN protocols, including Fibre Channel Protocol (FCP), iSCSI, FCIP, and FCoE, analyze and troubleshoot common issues in SANs, applying knowledge of SAN components and protocols.	An	P	Practical Assignment / Instructor-created exams / Quiz
CO4	Devise strategies for RAID configurations and data migration in a SAN, develop a comprehensive SAN	R	P	Practical Assignment / Instructor-

	security plan, integrating authentication, access control, and encryption.			created exams / Quiz
CO5	Assess the performance of a Storage Area Network, identifying bottlenecks and implementing optimization techniques, critically evaluate emerging trends in SANs, such as basic, advanced and Backup software.	E	F	Practical Assignment / Instructor-created exams / Quiz
CO6	Demonstrate practical skills in designing, managing, and troubleshooting a Storage Area Network through hands-on projects, communicate effectively about SAN concepts, protocols, and best practices in both written and oral formats.	C	P	Practical Assignment / Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Marks
I		**Networking and Storage Concepts**	**10**	**15**
	1	OSI reference model	1	
	2	Common network devices, Network Topologies	3	
	3	MAC standards	2	
	4	Need for Storage Networks, Storage Devices and Techniques	2	
	5	SAN Components and Building Blocks	2	
II		**Fibre Channel and SAN Fundamentals**	**12**	**20**
	6	Fibre Channel Topologies, Fibre Channel Layers	3	
	7	Classes of Services, SAN topologies	3	
	8	SAN Operating Systems, software and hardware	2	
	9	Types of SAN technology	2	
	10	SAN Protocols- FCP, iSCSI, FCIP, FCoE	2	
III		**Storage networking architecture**	**13**	**20**
	11	Storage in storage Networking- challenges, cost, performance	1	
	12	Keeping SAN storage Up & working	2	
	13	Network in storage Networking	2	
	14	Emerging SAN interconnect Technologies	2	
	15	Basic software for Storage Networking	3	
	16	File systems and Application Performances	3	
IV		**Advanced and Backup softwares for SAN**	**13**	**15**
	17	Advanced software for storage Networking- Data Replication	3	
	18	Synchronous & Asynchronous Replication	2	
	19	Cluster Data Models	2	

	20	Enterprise Backup Software for SAN	2	
	21	Enterprise Backup Architecture and Policies	3	
	22	Minimizing the Impact of Backup	1	
V	**Open Ended Module – Design and Building a SAN**		**12**	
	1	• Design considerations and business requirements • Physical layout, placement, storage, pooling • Data availability, connectivity, scalability, migration, manageability • Fault Tolerance and resilience, Prevention of Congestion • SAN security- basic security guidelines, future of SANS.	12	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	2	1	-	3	-						
CO 2	1	2	1	-	3	-						
CO 3	3	1	1	-	3	-						
CO 4	3	1	1	-	3	-						
CO 5	3	-	1	1	3	-						
CO 6	3	-	1	1	3	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓

CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Meeta Gupta, Storage Area Network Fundamentals, Cisco Press.

2. Richard Barker and Paul Massiglia, Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs, Wiley India Pvt Ltd.

3. John R. Vacca, The Essential Guide to Storage Area Networks, 1st Edition, Prentice Hall.

4. Christopher Poelke and Alex Nikitin, Storage Area Networks for Dummies, 2nd Edition.

5. Tom Clark, Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, 2nd Edition, Addison Wesley Professional.

6. Robert Spalding, Storage Networks: The Complete Reference, 1st Edition, Tata McGraw-Hill Education.

Programme	BSc IT				
Course Code	**ITY6EJ304(2)**				
Course Title	Internet of Things				
Type of Course	Elective				
Semester	VI				
Academic Level	300-399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic understanding of information technology concepts. 2. Familiarity with networking fundamentals. 3. Proficiency in a programming language (e.g., Python, Java).				
Course Summary	A course on the Internet of Things (IoT) typically covers a range of topics to provide students with a comprehensive understanding of this interdisciplinary field like Basic concepts and Components of an IoT system, IOT Architecture and communication protocols, IOT devices and Sensors, IOT security, Data management and Applications				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things.	U	P	Assignment / Instructor-created exams / Quiz
CO2	Define and articulate the fundamental concepts and principles of the Internet of Things.	R	P	Assignment / Instructor-created exams / Quiz
CO3	Understand the role of edge computing and fog computing in IoT architectures.	U	P	Assignment / Instructor-created exams / Quiz
CO4	Identify and address security challenges in IoT systems.	An	P	Assignment / Instructor-created exams / Quiz
CO5	Manage data generated by IoT devices, including collection, storage, and processing.	Ap	P	Assignment / Instructor-created exams / Quiz
CO6	Identify and analyse industry-specific	An	P	Assignment /

	applications of IoT in areas such as healthcare, smart cities, agriculture, and manufacturing			Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (48+12)	Marks
I	**Introduction to IoT**		**10**	**12**
	1	Definition and characteristics of IoT	2	
	2	Components of IoT	2	
	3	Embedded Systems	3	
	4	Basics of IoT Networking	3	
II	**IoT protocols**		**12**	**18**
	5	Protocol Standardization for IoT	3	
	6	SCADA and RFID Protocols	3	
	7	M2M and WSN Protocols	2	
	8	Issues with IoT Standardization	2	
	9	IOT security and Liability	2	
III	**IoT Architecture**		**13**	**20**
	10	Components of IOT architecture	1	
	11	Stages of IOT solutions Architecture	2	
	12	Layers of IOT Architecture	2	
	13	IoT Open-source architecture (OIC)	2	
	14	OIC Architecture & Design principles	3	
	15	IoT Devices and deployment models	3	
IV	**IoT Data Management**		**13**	**20**
	16	Data collection, storage, and processing in IoT	1	
	17	Data analytics techniques for IoT data.	2	
	18	Ethical considerations in IoT design and deployment.	1	
	19	Cloud Computing for IoT	2	
	20	Overview of cloud platforms for IoT solutions	3	
	21	IoT data management and analytics in the cloud.	1	
	22	Existing IoT platforms /middleware, IoT- A, Hydra etc	3	
V	**Capstone Project: Case studies based on IOT APPLICATIONS**		**12**	
		▪ IoT applications for industry, Environment, Marketing ▪ Healthcare, smart cities, agriculture, and manufacturing.	12	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	1	-	3	-						

CO 2	1	-	1	-	3	-						
CO 3	3	-	1	-	3	-						
CO 4	3	-	1	-	3	-						
CO 5	3	-	1	-	3	-						
CO 6	3	-	1	-	3	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,2012.

2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.

3. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.

4. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

5. David Hanes, Gonzalo Salgueiro, Patrick Grossetete “IOT Fundamentals: Networking Technologies, protocols and use cases for the internet of Things”

6. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”,1st Edition, VPT, 2014
7. Adrian McEwen and Kakim Cassimally, “Designing the Internet of Things”

ELECTIVE COURSES IN INFORMATIOM TECHNOLOGY WITH NO SPECIALISATION

Sl. No.	Course Code	Title	Semester	Total Hrs	Hrs/ Week	Credits	Marks		
							Internal	External	Total
1	ITY8EJ401	Microprocessor and its Applications	8	60	4	4	30	70	100
2	ITY8EJ402	System Software	8	60	4	4	30	70	100
3	ITY8EJ403	Client Server Architecture	8	60	4	4	30	70	100
4	ITY8EJ404	Digital and Mobile Forensics	8	60	4	4	30	70	100
5	ITY8EJ405	Social Networks Analysis	8	60	4	4	30	70	100
6	ITY8EJ406	Parallel Computing	8	60	4	4	30	70	100

Programme	BSc IT				
Course Code	**ITY8EJ401**				
Course Title	**Microprocessor and its Applications**				
Type of Course	**Elective**				
Semester	VIII				
Academic Level	400-499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	-				
Course summary	This course provides a comprehensive understanding of microprocessors with a specific focus on Intel's 8085 & 8086 architectures. The course delves into the key principles, features, and programming techniques associated with 8086. The feature comparison of advanced processors gives an overview of developments in Microprocessor technology				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Recognise the purpose, characteristics, and architecture of the 8085 and 8086.	U	C	Instructor-created exams / Quiz

CO2	Identify the addressing modes and comprehend how the 8086 instructions work.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Illustrate simple assembly language programs.	Ap	P	Programming Assignment / Observation of Practical Skills
CO4	Indentify the functions of peripheral integrated circuits (ICs) and how interrupts are handled in the 8086.	U	C	Instructor-created exams / Seminars
CO5	Describe the characteristics of advanced microprocessors.	U	C	Instructor-created exams / Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (48+12)	Marks (70)
I	**Introduction to Microprocessors**		**8**	**15**
	1	Basic Architecture of a Computer System	1	
	2	Advances in Semiconductor Technology, Evolution of Microprocessors	2	
	3	Overview of Microprocessors vs Microcontrollers, Computer Languages: High Level, Machine Language, Assembly Language	1	
	4	8085 Microprocessor (Architecture and Pin diagram)	4	
II	**Basics of 8086 Architecture**		**9**	**20**
	5	Features of an n-bit microprocessor, 8086 Architecture (Block diagram, Register Configuration, Address Translation)	5	
	6	8086 Pin Configuration	2	
	7	Minimum and Maximum Mode Configuration	2	
III	**8086 Programming**		**23**	**20**
	8	8086 Addressing Modes	2	
	9	8086 Instruction Set: Data Transfer and Arithmetic Instruction	4	
	10	8086 Instruction Set: Branch and Loop Instructions	3	
	11	8086 Instruction Set: Sting Instructions	2	
	12	8086 Instruction Set: Processor Control Instructions	1	
	13	Assembler Directives	1	
	14	Sample Programs: 1) Assembly Program to find the sum of n numbers given 2) Assembly Program to perform division using repeated subtraction 3) Assembly Program to multiply two 16 bit numbers 4) Assembly Program to find the largest of n numbers given 5) Assembly Program to perform linear search in a set of numbers given. Also find the number occurrence of the searching element. 6) Assembly Program to perform comparison of two strings.	6	

	15	8086 Interrupts and Interrupt Service Routines	2	
	16	Procedures and Macros	2	
IV	**Advanced Microprocessors** *(Study of Architecture and Pin diagram not needed)*		**8**	**15**
	17	Features of Intel 80186 & 80286	2	
	18	Features of Intel 80386 & 80486	2	
	19	Features of Pentium Processors	1	
	20	Features of Multi Core Processors	1	
	21	Features of i series Processors	1	
	22	Features of Mobile Processors	1	
V	**Open Ended Module: 8086 Interfacing**		**12**	
	1	**Introduction to peripheral Interfacing** **Include Case studies of any 3 interfacing ICs like:** 1. Programmable Peripheral Interface (8255) 2. Programmable DMA Controller (8257) 3. Programmable Interrupt Controller (8259) 4. Programmable Interval Timer (8253) 5. Interfacing output displays (8212) 6. Programmable communication interface (8251A)	12	

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	3	-	-	-	-						
CO 2	2	2	-	1	-	-						
CO 3	-	-	-	2	-	-						
CO 4	2	2	-	-	-	-						
CO 5	1	1	-	-	-	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment/Seminar	Programming Assignments	End Semester Examinations
CO 1	✓			✓
CO 2	✓		✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓		
CO 5		✓		✓

Programme	BSc IT				
Course Code	**ITY8EJ402**				
Course Title	**System Software**				
Type of Course	Elective				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	13. Introduction to IT 14. Data Structures and Algorithms 15. Computer Organization and Architecture				
Course Summary	With an emphasis on the creation and use of system software, this course examines the ideas and methods of system programming. Compiler design, system calls, loaders and linkers, and debugging methods are among the topics covered.				

CO	**CO Statement**	**Cognitive Level***	**Knowledge Category#**	**Evaluation Tools used**
CO1	Define the key concepts in system programming, such as compilers, assemblers, linkers, and loaders. Identify the various stages in the compilation process and understand the purpose of each stage.	U	C	Instructor- created exams / Quiz
CO2	Master different types of system calls and their role in system programming. Master the principles of lexical and syntax analysis in the context of compiler design. Master various linking and loading schemes	Ap	P	Assignment / Seminar presentations/ Exams
CO3	Interpret and understand the process of debugging, including the use of debugging tools and techniques.	Ap	P	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Analyze the impact of different optimization techniques in the compilation process. Evaluate advantages and disadvantages of various linking and loading schemes.	U	C	Instructor- created exams / Home Assignments
CO5	Implement programs using system calls to perform various system-	Ap	P	Writing assignments
	level tasks, such as file operations and process management			

CO6	Apply principles of compiler design to write a simple compiler using a programming language.	Ap	P	Case Study

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) #
- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)
Metacognitive Knowledge (M)

Course Outcomes (CO):

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Introduction to System Programming & Assemblers**	**14**
	1	Introduction to System Programming- Goals of System Software, System Programs and Systems Programming	3
	2	Language Processors- Overview, Kinds of Language processors, language processing activities, program execution	4
	3	System Tables	1
	4	Assemblers- Elements of Assembly Language Programming	2
	5	Design of two pass assembler	4
II		**Macros and Macro Processors**	**10**
	6	Introduction to macros and macro processors- macro definition and call, macro expression	4
	7	Nested macro calls	2
	8	Design of macro processor	4
III		**Linkers and Loaders, Scanning and Parsing**	**10**
	9	Relocation and linking concepts	2
	10	Design of linkers	2
	11	Self locating program	2
	12	Loaders- absolute loader, relocating loader	4
IV		**Compilers, System calls and libraries**	**14**
	13	Data structures used in compilers	1
	14	Phases of a compiler – Introduction	1
	15	Lexical Analysis (Scanning)	2
	16	Syntax Analysis (Parsing)	2
	17	Semantic Analysis	1
	18	Intermediate code generation	1
	19	Code optimisation- optimisation transformation, local optimisation, global optimisation, Code Generation	2
	20	Passes of Compiler	1
	21	System calls and their implementation	1
	22	Standard C library functions for system calls	2
V		**Open Ended Module: Case Studies**	**12**
	1	• Case studies of lexical and syntax analyzers: LEX and YAAC. • System programs using system calls	

References

- D.M. Dhamdhere, Systems Programming and Operating Systems
- John J Donovan, Systems programming
- Jim Welsh and R M Mckeag, Structured System Programming, Prentice Hall.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	1	-	1	-	-						
CO 2	2	3	-	1	-	-						
CO 3	1	-	1	1	1	-						
CO 4	2	2	1	1	-	-						
CO 5	2	3	1	-	-	-						
CO 6	2	3	1	-	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)

- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓		✓
CO 2	✓		✓
CO 3	✓		✓
CO 4		✓	✓
CO 5		✓	✓
CO 6		✓	

Programme	BSc IT				
Course Code	ITY8EJ403				
Course Title	CLIENT SERVER ARCHITECTURE				
Type of Course	Major				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge in Fundamentals of Network and Operating System				
Course Summary	The syllabus is prepared with the view of preparing the BSc Computer Science Graduates to build effective Client/Server applications. This course aims at providing a foundation in decentralized computer systems, using the client/server model. The course content is decided to cover the essential fundamentals which can be taught within the given slots in the curriculum.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	aluation Tools used
CO1	Understand the basics of client/server systems and the driving force behind the development of client/server systems.	U	C	Instructor-created exams / Quiz
CO2	Outline the architecture and classifications of client/server systems	U	C	Instructor-created exams / Quiz
CO3	Choose the appropriate client/server network services for a typical application	U	P	Instructor-created exams / Quiz
CO4	Describe management services	U	C	Instructor-created exams / Case studies
CO5	Describe issues in network	U	P	Instructor-created exams / Quiz Case studies

CO6	Apply various services and support	U	P	Instructor-created exams / Quiz / Case studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Introduction to Client/Server computing**	**12**	**15**
	1	Introduction to Client/Server computing - Driving forces behind Client/ Server, Client/ Server development tools	2	
	2	Development of client/server systems, Client/Server security	2	
	3	Organizational Expectations, Improving performance of client/server applications	2	
	4	Single system image, Downsizing and Rightsizing	3	
	5	Advantages of client server computing, Applications of Client/Server	3	
II		**Client/Server Application Components**	**12**	**15**
	6	Classification of Client/Server Systems- Two-Tier Computing, Middleware, Three-Tier Computing	2	
	7	Model View Controller (MVC)	1	
	8	Principles behind Client/Server Systems	3	
	9	Client/Server Topologies	3	
	10	Existing Client/Server Architecture.	1	
	11	Architecture for Business Information System	2	
III		**Client/ Server Systems Development**	**12**	**20**
	12	Client- Services, Request for services, RPC, Windows services, Print services, Remote boot services, other remote services, Utility Services.	2	
	13	Dynamic Data Exchange (DDE).	2	
	14	Object Linking and Embedding (OLE).	2	
	15	Common Object Request Broker Architecture (CORBA).	2	
	16	Server- Detailed server functionality	2	
	17	Network operating system, Available platforms, Server operating system.	2	
IV		**Client/ Server Systems Development**	**12**	**20**
	18	Services and Support- System administration, Availability, Reliability, Scalability, Observability, Agility, Serviceability.	2	
	19	Software Distribution, Performance, Network management.	2	
	20	Remote Systems Management- RDP, Telnet, SSH, Security.	3	
	21	LAN and Network Management issues, Training, Connectivity,	2	
	22	Communication interface technology, Inter process communication,	3	

V	**Open Ended Module**	**12**	
	CASE STUDY: Client Server Architecture Generic Client/Server Classes Client/Server Communication via Sockets The Server Protocol The Client Protocol A Two-Way Stream Connection		

Reference Books:

1. Patrick Smith & Steave Guengerich, "Client / Server Computing", PHI
2. Dawna Travis Dewire, "Client/Server Computing", TMH
3. Jeffrey D.Schank, "Novell's Guide to Client-Server Application & Architecture" Novell Press
4. Robert Orfali, Dan Harkey, Jeri Edwards, Client/Server Survival Guide, Wiley-India Edition, Third Edition

Note: The syllabus has five modules. There should be a total of 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 48 instructional hours for the first four modules and 12 hrs for the final one. Module V is open ended module.

Mapping of COs with PSOs and POs :

	PSO1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	2	-	-	-	-						
CO 2	-	3	-	-	-	-						
CO 3	-	2	1	-	-	-						
CO 4	-	2	1	1	1	1						

CO 5	-	2	1	-	-	-						
CO 6	-	2	1	-	1	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	BSc IT				
Course Code	**ITY8EJ404**				
Course Title	Digital and Mobile Forensics				
Type of Course	**Elective**				
Semester	VIII				
Academic Level	400 – 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1.Understanding concept Computer Hardware, Operating System 2.Knowledge of information security concepts, including confidentiality, integrity, and availability 3.Knowledge of legal and ethical issues surrounding digital evidence collection, preservation, and analysis is crucial for conducting forensic investigations in compliance with applicable laws and regulations.				
Course Summary	This course provides an overview of digital forensics and cyber laws, focusing on the principles, techniques, and legal considerations involved in investigating cyber crimes				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamental concepts of digital forensics, including the importance of digital evidence and its role in investigations	Ap	P	Instructor-created exams/ Home Assignments
CO2	Demonstrate proficiency in the digital forensic process, from identification and collection to examination, analysis, and presentation of evidence	Ap	P	Instructor-created exams/ Home Assignments
CO3	Gain knowledge of international cooperation mechanisms for collecting digital evidence and the legal frameworks and standards governing digital forensic investigations	U	C	Instructor-created exams / Quiz
CO4	Develop skills in conducting investigations specific to iOS and Android platforms, including knowledge of operating system fundamentals, file systems,	U	C	Instructor-created exams /Quiz

	security measures, and forensic tools			
CO5	Assess and implement enterprise-level digital forensic readiness strategies to prepare organizations for potential cyber incidents and enhance their ability to respond to security breaches effectively	U	C	Instructor-created exams /Quiz
CO6	Analyze real-world cyber crime case studies within the Indian legal context, applying cyber laws and investigative methodologies to solve digital crimes effectively	U	C	Instructor-created exams /Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**Introduction to digital forensic process**		**10**
	1	Introduction to Digital Forensics – Forensic Science, Digital Forensics, Digital Evidence	2
	2	Digital Forensic process	1
	3	The identification phase	1
	4	The collection phase	2
	5	The examination phase	2
	6	The analysis phase	2
	7	The presentation phases	
II	**Digital Crime and Investigation & Digital Forensic Readiness**		**10**
	8	Digital Crime- Substantive criminal law	3
	9	Investigation methods of Collecting Digital evidence	2
	10	International cooperation in order to collect digital evidence	1
	11	Digital Forensic readiness – the rationale, Frameworks, standards and methodologies, Enterprise digital forensic readiness	4
III	**Mobile Forensics : iOS Forensics**		**16**
	12	Introduction to mobile forensics - What is mobile forensics, its need, Challenges and evidence extraction	3
	13	Practical mobile forensic approaches - overview of mobile operating systems, mobile forensic tool levelling system, data acquisition methods	1
	14	Evidences: Potential evidences stored on mobile phones, examination and analysis and rules of evidence, good forensic practices	2
	15	Overview iOS devices -iPhone, iPad and Applewatch models and hardware, file system, disk layout, iOS architecture and security	3
	16	Data Acquisition form iOS Devices and backups	3
	17	iOS Data analysis and recovery	2
	18	iOS Forensic tools	2
IV	**Android Forensics**		**12**
	19	Understanding android- Android model, Security, file hierarchy, file system	3

	20	Android Forensic setup and Pre-Data Extraction techniques-	3
	21	Android Data Extraction Techniques	3
	22	Android Data Analysis and Recovery	3
V	**Cyber Forensics in the Indian Context**		**12**
		Cyberlaws in India Cybercrime case studies	

Note: The course is divided into five modules, with four having total 22 fixed units and one open-ended module with a variable number of units. There are total 48 instructional hours for the fixed modules and 12 hours for the open-ended one. Internal assessments (30 marks) are split between the open-ended module (10 marks) and the fixed modules (20 marks). The final exam, however, covers only the 22 units from the fixed modules.

References

- "Digital Forensics", edited by Andre Arnes, Published by John Wiley and Sons
- "Practical Mobile Forensics", Rohit Tamma, Oleg Skulkin, Heather Mahalik, Satish Bommisetty
- "An In-Depth Guide to Mobile Device Forensics" Chuck Easttom

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	-	-	-	-						
CO 2	3	3	2	-	-	-						
CO 3	2	3	-	-	-	-						
CO 4	2	3	-	-	-	-						
CO 5	2	3	-	-	-	-						
CO 6	1	3	-	-	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	End Semester Examinations
CO 1	✓	✓	✓
CO 2	✓	✓	✓
CO 3	✓	✓	✓
CO 4	✓		✓
CO 5	✓		✓
CO 6	✓		✓

Programme	BSc IT				
Course Code	**ITY8EJ405**				
Course Title	**Social Networks Analysis**				
Type of Course	Elective				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lectureper week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge in Fundamentals of Data Mining				
Course Summary	The syllabus is prepared with the view of preparing the BSc IT Graduates to build a basic understanding of what social networkanalysis is and how it can be applied. Topics covered include network structure and methods for social network analysis, link analysis and network community detection, information propagation on the web and some applications				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic notation and terminology used in social network analysis.	U	C	Instructor-created exams / Quiz
CO2	Compare and interpret social network structure, size and its connectivity pattern.	U	C	Instructor-created exams / Quiz
CO3	Discover community structure in complex network using statistical techniques	U	P	Instructor-created exams / Quiz
CO4	Apply link prediction techniques to discover new links in the social network	U	C	Instructor-created exams / Case studies
CO5	Describe influence in social media, perform recommendations	U	P	Instructor-created exams / Quiz Case studies
CO6	Perform Social Influence Analysis	U	P	Instructor-created exams / Quiz / Case studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Introduction to Social Network Data Analytics**	**12**	**15**
	1	Introduction to Social Network Analysis	2	
	2	Online social networks Research Issues and Topics	2	
	3	Statistical properties of social networks: Preliminaries	2	
	4	Static properties, Dynamic properties	3	
	5	Challenges of Social Network Streams	3	
II		**Random Walks in Social Networks**	**12**	**15**
	6	Random walks on Graphics, Walks based on proximity measures	2	
	7	Other graph based proximity measures	1	
	8	Graph theoretic measures for semi supervised learning	3	
	9	Clustering with random walk based measures	3	
	10	Applications in computer vision Text Analysis, Evaluation and datasets	1	
	11	Link prediction and data sources	2	
III		**Community Discovery in Social Networks**	**12**	**20**
	12	Communities in Context	2	
	13	Core Methods – KL Algorithm, Special algorithms	2	
	14	Markov Clustering, other approaches	2	
	15	Emerging Fields and problems : Community Discovery in dynamic networks	2	
	16	Heterogeneous networks, Directed networks,	2	
	17	Coupling content and relationship information for community discovery	2	
IV		**Link Prediction in Social Networks**	**12**	**20**
	18	Background, Feature based Link Prediction, Bayesian Probabilistic Models	3	
	19	Probabilistic Relational Models	2	
	20	Linear Algebraic Methods	2	
	21	Link Predictions: The Katz Score, Hitting & Commute Time	2	
	22	Rooted PageRank, SimRank	3	
V		**Open Ended Module**	**12**	

	CASE STUDY: Social Influence Analysis Influence Related Statistics, Social Similarity and Influence, Influence Maximization in Viral Marketing,	

Reference Books:

1. Charu.C. Aggarwal, Social Network Data Analytics, Springer Science+Business Media, LLC2011.
2. R. Zafarani, M. A. Abbasi, and H. Liu, Social Media Mining: An Introduction, CambridgeUniversity Press, 2014.
3. Krishna Raj P M, Ankith Mohan, K G Srinivasa ,Practical Social Network Analysis withPython , Springer Liu, Bing. Web data mining. Springer-Verlag Berlin Heidelberg, 2007.
4. Chakrabarti, Soumen. Mining the Web: Discovering knowledge from hypertext data. MorganKaufmann, 2003.
5. Scime, Anthony, ed. Web mining: applications and techniques. IGI Global, 2005

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	2	-	1	1	3						
CO2	-	3	-	1	1	2						
CO3	1	3	-	1	1	1						
CO4	1	2	-	-	1	1						
CO5	-	1	1	-	1	1						
CO6	-	1	1	-	1	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Programme	BSc IT				
Course Code	**ITY8EJ406**				
Course Title	**Parallel Computing**				
Type of Course	Elective				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	Knowledge in Fundamentals of COA and Operating System				
Course Summary	The syllabus is prepared with the view of preparing the BSc IT Graduates to understand basic and advanced concepts of parallel computing. It covers Principles of Parallel Algorithm Design, Communication operations, Programming Using the Message Passing Paradigm, Programming Shared Address Space Platforms, Thread Basics,				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Toolsused
CO1	Summarize the key parallel computational models	U	C	Instructor-created exams / Quiz
CO2	Appreciate and apply parallel and distributed algorithms in problem Solving	U	C	Instructor-created exams / Quiz
CO3	Appreciate the communication models for parallel algorithm development	U	P	Instructor-created exams / Quiz
CO4	Develop parallel algorithms using message passing paradigm	U	C	Instructor-created exams / Case studies
CO5	Formulate parallel algorithms for shared memory architectures	U	P	Instructor-created exams / Quiz Case studies
CO6	Understand thread management	U	P	Instructor-created exams / Quiz /Case studies

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Principles of Parallel Algorithm Design**	**12**	**15**
	1	Parallel Processing platforms. Preliminaries, Decomposition Techniques,	2	

	2	Characteristics of Tasks and Interactions	2	
	3	Mapping Techniques for Load Balancing	2	
	4	Methods for Containing Interaction Overheads	3	
	5	Parallel Algorithm Models.	3	
II	**Communication Operations**		**12**	**15**
	6	Basic Communication Operations - One-to-All Broadcast and All-to-One Reduction	2	
	7	All-to-All Broadcast and Reduction	1	
	8	All-Reduce and Prefix-Sum Operations	3	
	9	Scatter and Gather	3	
	10	All-to-All Personalized Communication, Circular Shift	1	
	11	Improving the Speed of Some Communication Operation	2	
III	**Programming Using the Message Passing Paradigm**		**12**	**20**
	12	Principles of Message-Passing Programming, The Building Blocks: Send Operations	2	
	13	Receive Operations	2	
	14	MPI: The Message Passing Interface	2	
	15	Overlapping Communication with Computation	2	
	16	Collective Communication and Computation Operations	2	
	17	Groups and Communicators	2	
IV	**Programming Shared Address Space Platforms Thread Basics**		**12**	**20**
	18	Thread Basics, Why Threads? The POSIX Thread Application Programme Interface, Synchronization Primitives in POSIX, Controlling Thread and Synchronization Attributes	2	
	19	Thread Cancellation, Composite Synchronization Constructs	2	
	20	OpenMP: a Standard for Directive Based Parallel Programming, Specifying Concurrent Tasks in OpenMP	3	
	21	Synchronization Constructs in OpenMP	2	
	22	OpenMP Applications: Parallel algorithm development for Matrix multiplication	3	
V	**Open Ended Module**		**12**	
	CASE STUDY: PARALLEL COMPUTING Heterogeneous Parallel Computing Data parallel computing Device Global Memory and Data Transfer Kernel Functions and Threading			

Reference Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, 2nd Ed, Addison-Wesley, 2003
2. David B. Kirk, Wen-mei W. Hwu, Programming Massively

Parallel Processors: A Hands- on Approach, 3rd Ed., Morgan Kaufman, 2016. References

3. Steven Brawer, Introduction to Parallel Computing, Academic Press, (1989)

4. Barbara Chapman, Gabriele Jost, Ruud van der Pas, Using OpenMP: Portable Shared Memory Parallel Programming , MIT Press, 2008.

5. William Gropp, Ewing Lusk, Anthony Skjellum Using MPI: Portable Parallel Programming with the Message-Passing Interface, 3rd Ed, MIT Press, 2014.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	2	-	-	-	-						
CO2	-	2	1	-	-	-						
CO3	-	2	1	-	1	1						
CO4	-	2	1	1	1	2						
CO5	-	3	1	1	-	2						
CO6	-	2	-	-	-	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Minor Courses

Detailed Syllabus of Minor Courses

Programme	BSc IT				
Course Code	ITY1MN102				
Course Title	Data analysis using Spread sheet				
Type of Course	**Minor**				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic mathematics knowledge 2. Basic computer knowledge				
Course Summary	This syllabus aims to cover a broad spectrum of Excel skills, catering to participants with varying levels of expertise.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate the ability to enter data accurately and efficiently into Excel worksheets	Ap	P	Instructor-created exams / Quiz
CO2	Use of Excel formulas, including basic arithmetic operations, application of common functions calculations in spreadsheets.	Ap	C	Problem-solving assessments
CO3	Use Excel for data analysis, including	Ap	P	Instructor-created exams / Quiz

	sorting, filtering, and the creation of Tables.			
CO4	Demonstrate proficiency in utilizing advanced Excel functions	Ap	P	Instructor-created exams / Quiz
CO5	Demonstrate collaboration skills and the ability represent real world data and create reports	Ap	P	Modelling Assignments/ / Case studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I	**Introduction to Spreadsheets**		**12**	**18**
	1	Overview - Overview of spreadsheet software (Microsoft Excel, Google Sheets) and their application	2	
	2	Excel Interface and Navigation-Ribbon,Row ,Column, Cell Worksheet,Workbook,Cell Address,Data range,Formula, Chart)	2	
	3	Basic navigation techniques within the workbook	2	
	4	Creating and Saving Workbooks - Creating a new workbook and saving it , Different file formats and when to use them	2	
	5	Inserting or deleting rows or columns	2	

	6	Basic Cell Formatting - Formatting text, numbers, and dates,	2	
II	Data Management		**11**	**18**
	7	Find and select -Find,Replace,Go To,Go To Special	2	
	8	Cell Referencing-Relative, Absolute and Mixed	1	
	9	Sorting data-Quick Sorting,Sorting by Multiple Criteria	2	
	10	Filtering data-Quick Filtering, Filtering by Multiple Criteria , Performing Calculations on Filtered Data	2	
	11	AutoFill and Flash Fill	1	
	12	Remove Duplicates	1	
	13	Get External Data - From web,from text and from other sources	2	
III	Excel Functions and formulas		**10**	**18**
	14	Mathematical and Statistical functions(-SUM, AVERAGE, MAX, MIN, ROUND, ABS, SQRT, MOD.,COUNT, COUNTIF, SUMIF, AVERAGEIF, MEDIAN, STDEV, VAR)	2	
	15	Logical Functions(IF, AND, OR, NOT, XOR, IFERROR, IFNA, SWITCH.)	2	
	16	Text Functions (CONCATENATE, LEFT, RIGHT, MID, LEN, SUBSTITUTE, FIND, SEARCH.)	2	
	17	Date & Time Functions-(TODAY, DATE, DAY, MONTH, YEAR, HOUR, MINUTE, SECOND.)	2	
	18	Using formula :Witing a formula ,Cell reference	2	
1V	Data Analysis and Manipulation		**12**	**16**
	19	Introduction to Tables and Data Organization - Creating and formatting tables for effective data management, Sorting and filtering data within tables	3	
	20	Data Analysis Techniques - Advanced functions (VLOOKUP, HLOOKUP, INDEX, MATCH)	3	

	21	PivotTables and PivotCharts - Understanding PivotTables for data analysis, Creating PivotCharts for visual representation	3	
	22	Data Visualization: Creating and customizing various chart types, Effective use of charts for data presentations	3	
V	**Project and Practical Applications**		**30**	
	1	Practical session on real-world applications (Eg: Use advanced functions relevant to field of study, Tabulation of Lab experiments data for better analysis and visualisation)	15	
	2	Course Project: Creating a comprehensive project using Excel features.	15	

References

1. "Microsoft Excel 2019 Step by Step" by Curtis Frye
2. "Excel 2019 Bible" by Michael Alexander and Richard Kusleika
3. "Microsoft Excel 2019 Data Analysis and Business Modeling" by Wayne Winston

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	2	1						
CO2	-	-	2	-	2	1						
CO3	-	-	2	-	2	1						
CO	-	-	2	-	2	1						

4												
CO 5	-	-	3	-	2	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2	✓	✓		✓
CO 3		✓		✓
CO 4	✓			✓
CO 5	✓		✓	✓
CO 6	✓		✓	✓

Programme	BSc IT				
Course Code	ITY2MN102				
Course Title	**Fundamentals of SPSS and R programming**				
Type of Course	**Minor**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic computer knowledge 2. Spreadsheet essentials				
Course Summary	This course offers SPSS basics including data management, transformation, visualization and statistical analysis techniques. Also introduces fundamentals of R environment, focusing on data manipulation and visualization.				

Course Outcomes (CO):

CO	**CO Statement**	**Cognitive Level***	**Knowledge Category#**	**Evaluation Tools used**
CO1	Perform essential data input and manipulation activities within SPSS.	U	C	Instructor-created exams / Seminar Presentation/ Instructor-created exams/ Quiz
CO2	Implement Data analysis using SPSS	C	C	Assignment / Instructor-created exams
CO3	Compute descriptive statistics and conduct parametric and nonparametric tests in SPSS	C	P	Assignment / Instructor-created exams

CO4	Conduct hypothesis testing and regression analysis in R	Ap	P	Hands-on practical sessions
CO5	Create effective visualizations using SPSS and R.	C	P	

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**	**Marks**
I	**Introduction to SPSS**		**12**	**19**
	1	Features – Data View – Variable View – Output Viewer Window – Syntax Editor Window -	1	
	2	Open data file , Save , import from other data source ,data entry , labelling for dummy numbers	2	
	3	Recode in to same variable, Recode in to different variable, Transpose of data, Insert variables and cases	2	
	4	Merge variables and cases, Split, Select cases, Compute total scores	2	
	5	Table looks – Changing column - font style and sizes	2	
	6	Diagrammatic representation	2	
II	**Data Analysis Using SPSS**		**10**	**18**
	7	Estimation of mean, median and mode- Standard deviation and coefficient of variation.	2	

	8	Descriptive statistics, Parametric tests t-test (paired or unpaired), ANOVA (one-way- two way)	2	
	9	Pearson rank correlation, Linear regression	3	
	10	Non parametric tests: Mann Whitney U test, Wilcoxon signed rank test .	2	
	11	Kruskall Wallis test ,Chi- Square test	1	
III	**Overview of R Environment**		**11**	**18**
	12	R editor, Workspace	2	
	13	Data type – Importing and Exporting Data	2	
	14	Basic Computational Ideas – Merges in R. Matrix Determinant – Inverse – Transpose, Trace)	3	
	15	Eigen Values and Eigen Vectors	2	
	16	Construction of Bar, Pie, Histogram, Line Chart, Box Plot, Scatter Plot	2	
IV	**Parametric and Non Parametric testing of Statistical Hypothesis**		**12**	**15**
	17	One Sample t test, Two group t tests, Paired t test, one way ANOVA, two way ANOVA	3	
	18	Wilcoxon, Mann Witney, Kruskal Wallis Simple Correlation	3	
	19	Linear Regression, Multiple Linear Regression, Testing for overall	2	

		significance of Model Coefficients – Testing for Individual Regression Coefficients.		
	20	Outliers Detection Control Charts, Variable Control Chart, x, R, S.	2	
	21	Attribute Control Chart - p, np, c, u. CUSUM Control Chart, EWMA Control Chart.	2	
	22	Process Capability Analysis, Process Capability Analysis		
V	**Hands-on Word Processor and Presentation Tool:** **Practical Applications, Case Study and Course Project**		**30**	
		SPSS 1. Descriptive Statistics 2. Paired –Samples T Test 3. One-Way ANOVA 4. Correlation & Linear Regression 5. Chi- Square Test **R PROGRAMMING** 6. Simple Correlation 7. Linear Regression 8. One- Way ANOVA 9. Paired T test 10. Plotting Bar Chart	20	
		Case study(Example): **SPSS and R** 1. **Case Study: Customer Satisfaction Analysis** Analyze factors influencing customer satisfaction using survey data. Employ SPSS for regression analysis to identify significant predictors	10	

		such as product quality, pricing, and customer service. Use R programming to analyse data and make predictions.		

Reference Books:

1. Michael S. Louis – Beck (1995). Data analysis an introduction, Series: quantitative applications in the social sciences. Sage, Publications. London
2. Jeremy J. Foster (2001). Data analysis using SPSS for windows. New edition. Versions 8-10. Sage publications. London.
3. Sprankle , M., Problem Solving & Programming Concepts, Pearson India
4. Learning Statistics using R By Rndall E.Schumacker, Sage Publication
5. R for Everyone By Jared P.Lander, Pearson Education

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO 6	PO 1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	2	-	2	3						
CO 2	-	-	2	-	2	3						
CO 3	-	-	3	2	3	3						
CO 4	-	-	3	-	3	3						
CO 5	-	-	3	-	3	3						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low

2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓

Programme	BSc IT				
Course Code	ITY3MN202				
Course Title	Data Visualisation using Python				
Type of Course	**Minor**				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Have an understanding about algorithms and flowchart				
Course Summary	This course explores the versatility of Python language in programming and teaches the application of various data structures using Python.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge	Evaluation Tools used
CO1	Understand the basic concepts of Python programming	U	C	Instructor- created exams / Quiz
CO2	Apply problem-solving skills using different control structures and loops	Ap	P	Coding Assignments/ Code reading and review
CO3	Design simple Python programs to solve basic computational problems and acquire knowledge of Python's error handling mechanisms to effectively debug programs	Ap	P	Coding Assignments/ exams

CO4	Analyze the various data structures and operations on it using Python	An	P	Instructor-created exams / Case studies
CO5	Apply modular programming using functions	U	C	Instructor- created exams / Quiz
CO6	Identify the necessary Python packages in the domain and create simple programs with it	U, Ap	C, P	Coding
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I	**Introduction to Python**		**12**	18
	1	Features of Python, Different methods to run Python, Python IDE	2	
	2	Comments, Indentation, Identifiers, Keywords, Variables	2	
	3	Standard Data Types	2	
	4	Input Output Functions, Import Functions, range function	1	
	5	Operators and Operands, Precedence of Operators, Associativity	2	
	6	Type Conversion, Multiple Assignment	1	
	7	Expressions and Statements, Evaluation of Expressions	1	
	8	Boolean Expressions	1	
	Control Structures		**12**	19
	9	Decision Making- if statement, if…else statement, if…elif…else statement, Nested if statement	5	

II	10	Loops - for loop, for loop with else, while loop, while loop with else, Nested Loops	5	
	11	Using indentation in Python to define code blocks	1	
	12	Control Statements- break, continue, pass	1	
III	**Data Structures in Python**		**12**	19
	13	Working with strings and string manipulation	3	
	14	List - creating list, accessing, updating and deleting elements from a list	2	
	15	Basic list operations	1	
	16	Tuple- creating and accessing tuples in python	2	
	17	Basic tuple operations	1	
	18	Dictionary, built in methods to create, access, and modify key-value pairs	2	
	19	Set and basic operations on a set	1	
	Functions		**9**	18
IV	20	Built-in functions - mathematical functions, date time functions, random numbers	1	
	21	Writing user defined functions - function definition, function call, flow of execution, parameters and arguments, return statement	6	
	22	Recursion. Introduction to basic Python libraries (e.g., math, random)	2	
	Hands-on Data Structures: **Practical Applications, Case Study and Course Project**		**30**	
Design programs from the concepts listed below. Select the topics and programs suited for your domain				

V	1	• Read input, include casting that input to the appropriate type • Select from one of several alternatives by using an if-elif or if-elif-else statement • Use the range() function in a form loop • Call and use functions residing in the math module		
		Case study: ● Design a basic calculator application in Python that can perform addition, subtraction, multiplication, and division. ● Create a Python program that retrieves weather data from an API (e.g., OpenWeatherMap) and displays it.		

	4	**Data Structures in Python** • String - Create a string , Indexing / Looping / Slicing • Lists - Create a list , Indexing /Looping / Slicing , Adding items / Modifying items / Removing items • Tuples - Create a tuple , Indexing / Looping / Slicing / Adding items to a tuple • Dictionary - Create a dictionary and access values with key / Adding a key- value pair / Adding to an empty dictionary /Modifying values in a dictionary / Removing key-value pair		

	5	**Function** • Call functions residing in the math module • Define a function for later use • Pass one or more values into a function • Return one or more results from a function • Call a function that you have defined previously		

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PO 1	PO2	PO3	PO4	PO5	PO6
CO 1	-	1	2	3	1	1						
CO 2	-	1	2	3	1	1						
CO 3	-	2	2	3	1	1						
CO 4	1	1	-	-	1	-						
CO 5	1	1	2	2	1	-						
CO 6	-	1	2	2	2	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)

- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓	✓	✓
CO 3	✓		✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓			✓
CO 6	✓			✓

Reference Books:

1. Jose, Jeeva. Taming Python By Programming. Khanna Book Publishing, 2017. Print.
2. Downey, Allen. Think Python. Green Tea Press, 2nd ed. 2009

Programme	BSc IT				
Course Code	ITY1MN103				
Course Title	Computer Essentials with Word Processing & Presentation				
Type of Course	**Minor**				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Mathematics Concepts: Number System				
Course Summary	This course serves as an introductory exploration into the foundational concepts of computing. Through a combination of lectures, hands-on exercises, and practical assignments, participants develop a holistic understanding of computer fundamentals. Ultimately, this course serves as a cornerstone for further studies in computer science, information technology, and related disciplines, empowering learners to navigate and contribute to the ever-evolving landscape of computing.				

Course Outcomes (CO):

CO	**CO Statement**	**Cognitive Level***	**Knowledge Category#**	**Evaluation Tools used**
CO1	Gain proficiency in understanding and representing data in various forms, including binary, decimal, hexadecimal, and character encodings.	Ap	F	Instructor-created exams / Quiz
CO2	Understand the basic principles of computer architecture and organization	U	C	Assignment / Demonstrations
CO3	Understand the concept of software and its significance in	U	C	Seminar Presentation /

	computing and be familiar with various types of software, including system software, application software, and utility software.			Group Tutorial Work
CO4	Understand the basic principles of document design and layout for enhanced readability and visual appeal	Ap	P	Hands-on practical sessions
CO5	Understand the importance of effective communication and visual aids in presentations.	Ap	P	Hands-on practical sessions
CO6	Acquire practical skills through hands-on exercises and projects, preparing participants to apply their knowledge in academic, professional, and personal contexts.	Ap	P	Hands-on practical sessions
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I	**Introduction to Computer Science and data representation**		**10**	**20**
	1	Introduction to Computers: Generation, Classification, Characteristics of Computers, Significance	2	
	2	Number Systems :Binary, Decimal, Octal, Hexadecimal.	2	
	3	Conversion from one base to another	3	
	4	Computer Codes: BCD Code, Excess 3 Code, ASCII Code, Unicode, Gray Code	3	
II	**Basic Computer Organization**		**10**	**20**

	5	CPU organisation :Arithmetic and Logic Unit, Control Unit	1	
	6	Memory hierarchy: Registers, Cache, Primary Memory, Secondary Memory	2	
	7	Primary Storage: RAM(SRAM, DRAM), ROM**(Masked ROM,** PROM,EPROM,EEPROM)	2	
	8	Secondary storage: SSD,HDD, Magnetic tapes, Disk Storage	2	
	9	Input/Output Unit:- Input Device: Keyboard, MouseTouchpad, Trackball, Scanner, Graphics Tablet, Microphone, Webcam, Joystick/Gamepad, Biometric Input Devices Output Devices: Monitor/Display, Printer,Projector, Speakers, Headphones, Plotter	3	
III	**Understanding Softwares**		**10**	**20**
	10	**Introduction to Software** (Definition and Importance of Software, Types of Software-System software, Application Software, Prop oratory vs Open source)	2	
	11	**Operating Systems** (Introduction to Operating Systems , Common Operating Systems,User Interfaces)	2	
	12	**Device Drivers and Utilities (Device Drivers** , **System Utilities** ,**Productivity Software** ,**Multimedia Software)**	2	
	13	Computer languages(Machine, Assembly and HighLevel), Language Translator- Assembler, Compiler, Interpreter	2	
	14	**Security Software and Best Practices(Antivirus Programs** ,F**irewalls and Security Suites**,**Best Practices for Software Security)**	2	
IV	**Introduction to Word Processing & Presentation**		**15**	**10**
	15	**Basics of Word Processing**: Creating, Opening, Saving, and Closing Documents, Text Entry and Formatting (Font, Size, Color),Paragraph Formatting (Alignment, Spacing),Copying, Cutting, and Pasting Text,Spell Check and Grammar Check)	2	
	16	**Advanced Word Processing Techniques**(Styles and Templates,Tables and Graphics (Inserting, Formatting),Headers and Footers,Page Layout (Margins, Orientation),Document Views (Print Layout, Draft, Outline	2	
	17	Advanced Graphics and Multimedia(SmartArt and Shapes ,	2	

		Customizing SmartArt and shapes,Embedding and Linking Media,Advanced techniques for embedding and linking images, audio, and video)		
	18	Document Collaboration (Track Changes, Comments),Mail Merge for Personalized Documents)	1	
	19	**Introduction to Presentation Software(**Creating a New Presentation, Slide Basics (Adding, Deleting, Rearranging), Slide Layouts and Choosing Templates,Text Entry and Formatting Inserting and Formatting Images and Shapes)	2	
	20	**Enhancing Presentations with Multimedia**(Inserting and Formatting Media (Audio, Video),Transitions Between Slides,Master Slides for Consistent Formatting,Design and Themes for Visual Appeal)	3	
	21	**Animations for Text and Objects (**Slide Show Setup (Timings, Rehearsal)	2	
	22	**Effective Presentation Delivery (**Tips for Engaging Presentations, Presenter View and Speaker Notes, Handling Q&A Sessions, Dealing with Technical Issues, Customizing Presentations for Different Audiences, Printing and Exporting Slides	1	
V	**Hands-on Word Processor and Presentation Tool:** **Practical Applications, Case Study and Course Project**		**30**	
		Identification and familiarization of Hardware Components (Processor, RAM,ROM, Peripheral devices, SSD, HDD, SMPS, Motherboard, Ports)	5	
		Microsoft Word: 1. Document Formatting: • Create a new document, set margins to 1 inch, and change the page orientation to landscape. • Apply a consistent font style, size, and color to the entire document. 2. Paragraph Formatting: • Create a bulleted or numbered list with at least three items.	20	

		• Adjust the indentation and line spacing for a specific paragraph. 3. Headers and Footers: • Insert a header with the document title and page number on the right. • Add a footer with the date aligned to the center. 4. Tables and Graphics: • Create a table with four columns and three rows. • Insert an image into the document and adjust its position. 5. Styles and Themes: • Apply a heading style to a section of text. • Change the document theme to give it a different look. **Microsoft PowerPoint:** 6. Slide Creation: • Create a new PowerPoint presentation and add five slides. • Apply different slide layouts to each slide. 7. Text and Object Formatting: • Add a title to the first slide and format it with a unique font and color. • Insert a shape and customize its fill and outline colors. 8. Transitions and Animations: • Apply a slide transition between the first and second slides. • Add an entrance animation to a text box on the third slide. 9. Master Slides: • Customize the master slide with a background color or image. • Add a placeholder for slide numbers in the master slide. 10. Delivery and Export: • Set up presenter view for a slideshow. Export the presentation as a PDF document		
		Case Study: Exploring feature of PowerPoint to enhance presentation skill	5	

Reference Books:

1. Tanenbaum, Andrew S. and Herbert Bos. Modern Operating Systems. 4th ed., Pearson, 2014.
2. Brookshear, J. Glenn. Computer Science: An Overview. 13th ed., Pearson, 2014.

3. Norton, Peter. Introduction to Computers. 7th ed., McGraw-Hill, 2016.

4. Patterson, David A. and John L. Hennessy. Computer Organization and Design: The Hardware/Software Interface. 5th ed., Morgan Kaufmann, 2013.

5. Stallings, William. Computer Organization and Architecture: Designing for Performance. 10th ed., Pearson, 2016.

6. Hennessey, John L. and David A. Patterson. Computer Architecture: A Quantitative Approach. 6th ed., Morgan Kaufmann, 2017.

7. Harel, David. Algorithmics: The Spirit of Computing. 3rd ed., Addison-Wesley, 2004.

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	1	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-		-	3	-	-						
CO 6	-	-	-	3	-	-						

Correlation Levels:

Level	**Correlation**
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4			✓	✓
CO 5			✓	✓
CO 6			✓	

Programme	BSc IT				
Course Code	ITY2MN103				
Course Title	Web Design Trends and Techniques				
Type of Course	**Minor**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Knowledge in Computers. 2. Basic knowledge in Internet and Basic knowledge Computers and Internet				
Course Summary	The aim of this course is to provide students with an understanding of the basic concepts in web browser and to achieve the basic web designing skills				

Course Outcomes (CO):

CO	**CO Statement**	**Cognitive Level***	**Knowledge Category#**	**Evaluation Tools used**
CO1	To get general introduction to internet	U	C	
CO2	To identify and analyse the current trends in web designing	Ap	P	
CO3	To understand basic knowledge in HTML5 and CSS3 for responsive web design	Ap	P	

CO4	To learn how to design a simple web applications	Ap	P	
CO5	To incorporate user experience principle in web design	Ap	P	
CO6	To Enable student to become proficient in web designing through current technologies	Ap	P	

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	**Unit**	**Content**	**Hrs**
I	**Introduction to Web Design**		**09**
	1	Overview of Internet	1
	2	Over view of Internet Security	1
	3	Client Server System	1
	5	Websites and Digital Communication Tools	1
	6	Collaboration for Website Development	1
	7	Understanding the evolution of web design	2
	8	Exploring current design trends	1
	9	Overview of innovative websites	1
II	**HTML – Building the Foundation**		**12**
	10	Understanding the basic structure of web pages(Role of HTML, basic concept of webpage, html document structure <!DOCTYPE>,<html>,<head>,<body>).	2
	11	Exploring tags, attributes, and their significance (font type, text formatting tag, otrher text related tag, heading, paragraphs, list, link, image, common attributes like class,	2

		id, src, alt, href).	
	12	Creating interactive forms to collect user data(form element tag like <form>,<input>,<textarea>,<select>,<button>,various form controls like text input, button, drodwonbox).	3
	13	Designing and structuring tabular data.(Basic table structure tag, colspan, rowspan)	2
	14	Enhancing the meaning and structure of your content(understanding semantic elements, benefit of semantic HTML).	3
III	**CSS – Styling Your Web Pages**		**12**
	15	Introduction to CSS(understanding the concept of styling, presentation, basic syntax electors, properties and values, inline, internal and external style, different types of selectors)	3
	16	Introduction to common CSS properties(color,font,text,margin, padding, border, background), CSS box model(margin, border, padding and content), positioning elements (static, relative, absolute, fixed, z-index)	3
	17	Introduction to layouts in web designing, The role of responsive layouts, Flexbox layout model, creating Grid, Media queries and breakpoints	3
	18	Transition properties(duration, timing function, property), CSS Animation, Adding interactive hover effect. Overview of CSS frameworks and their benefits. Introduction to Bootstrap and its features.	3
IV	**JavaScript Essentials**		**12**
	19	Overview of Javascript, declaring the variables and understanding data types. Object in Javascript, basic operations and control flow in Javascript	3
	20	Understanding the Document Object Model (DOM).Using selectors to target HTML elements. Modifying content, attributes, and styles dynamically. Using selector, content, attributes and styles dynamically.	3

		Creating and Deleting elements. Navigating through the DOM hierarchy.	
	21	Understanding events triggered, common events, writing event handlers, Bubbling and capturing phases of event propagation, controlling event flow, accessing event object	3
	22	Overview of JavaScript libraries and their benefits. Selecting elements, manipulating the DOM, and handling events with jQuery.Applying visual effects and animations with jQuery. Fade, slide, show/hide, and custom animations. Making asynchronous requests with jQuery.ajax(). Handling JSON data and updating the DOM dynamically.	3
V	**Hands-on Programming in Java(Using VSCode, Atom, Aptana Studio):**		**30**
	Practical Applications, Case Study and Course Project		
	1	Implement the following:	
		1. Program for implementing html tags	20
		2. Write program for implementing Style a paragraph (<p>) to have a red color, a font size of 16px, and a bold font weight	
		3. Write a program to implement CSS Box Model	
		4. Create a simple layout using Flexbox, with three div elements aligned horizontally.	
		5. Implement a media query that changes the background color of a webpage when the screen width is less than 600 pixels.	
		6. Write a JavaScript function that changes the text content of an HTML element with the id "demo" to "Hello, World!" when a button is clicked.	
		7. Declare a variable in JavaScript and assign it a string value. Also, mention the data type of the variable.	
		8. Write a JavaScript program for attaching a click event to a button.	

		9. Use JavaScript to make an asynchronous request to a JSON file and display the data on the webpage. 10. Use JavaScript to perform AJAX operation	
	2	Case Study	2
	3	**Project:** Build a web application for perform responsive web application.	8

Text Book :

1. HTML5 Black Book, Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP And JQuery (Second Edition), Dreamtech Press,ISBN: 9789351199076

References :

1. Internet and World Wide Web, H.M.Dietel, Pearson.
2. Mastering HTML, CSS & Javascript Web Publishing (English, Paperback, Lemay Laura)
3. Web Designing (English, Paperback, Hirdesh Bhardwaj)

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	3	3	-	-						
CO 2	1	-	3	3	-	-						
CO 3	-	-	3	3	2	3						
CO 4	-	-	2	3	-	-						
CO 5	-	-	3	3	2	3						
CO			3	3	3							

6												

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓

Programme	BSc IT				
Course Code	ITY3MN203				
Course Title	Exploring Cybersecurity in social media				
Type of Course	**Minor**				
Semester	III				
Academic Level	200-299.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of Computers				
Course Summary	Students can investigate the complex interplay between social media and cybersecurity with this minor programme. The course will explore the different risks, vulnerabilities, and dangers related to social media platforms, providing participants with valuable knowledge on how to safeguard both individuals and organisations. Students will get a thorough grasp of cybersecurity principles as they relate to social media through a combination of academic study, hands-on activities, and case analysis.				

Course Outcomes (CO): .

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the idea of cyber security as well as the problems and difficulties that surround it.	U	F	Instructor-created exams / Quiz
CO2	Understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures	U	C	Practical Assignment / Observation of Practical Skills
CO3	Understand the privacy and security issues associated with using online social media. They should also be aware of the best practices for using social media platforms, the legal ramifications, and how to report incorrect content.	U	F	Seminar Presentation / Group Tutorial Work/ Viva Voce
CO4	Understand ethical standards related to usage of social media and apply those ethical standards in their day today life usage.	U	C	Instructor-created exams / Home Assignments
CO5	Comprehend the fundamentals of computer and mobile security and	Ap	P	Writing assignments/

	will be able to safeguard their gadgets with simple tools and technology.			Instructor-created exams/ practicals
CO6	Develop a cybersecurity plan for a hypothetical social media.	Ap	P	Case Study/ mini Project/ practicals
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks (70)
I	**Introduction to Cyber security & History of Internet and social media**		**9**	**12**
	1	Historical overview of social media development	2	
	2	Impact of social media	1	
	3	Internet, World wide web, Introduction of the internet	2	
	4	Internet infrastructure for data transfer and governance	2	
	5	Terminologies like anti-virus, firewall, Wi-Fi network	2	
II	**Introduction Cyber Security & reporting of cyber crimes**		**12**	**15**
	6	Concept of cyber security, Issues and challenges of cyber security Terminologies: Cyber Security, Cyber Crime, Cyber Attack, Cyber Espionage, Cyber Warfare	2	
	7	Classification of cyber crimes : Financial crimes: Online fraud, phishing, identity theft (basic concepts only)	2	
	8	Cyber crime targeting computers and mobiles	2	
	9	Cyber crime against women and children, social engineering attacks, malware and ransomware attacks	2	
	10	Reporting of cyber crimes,	2	
	11	Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences	2	
III	**Introduction to Social Media**		**12**	**15**
	12	Introduction to Social networks. Types of Social media, Social media platforms	2	
	13	Social media monitoring, Hashtag, Viral content	3	
	14	Social media marketing	2	
	15	Social media privacy, Challenges, opportunities and pitfalls in online social network	2	
	16	Security issues related to social media: Phishing Attacks, Account take over, Data breeches, Fake Accounts and Impersonation, Credential Stuffing, Doxing (concepts only)	3	
IV		**Cyber Security in social media**	**12**	**20**
	17	End Point device and Mobile phone security, Password policy	1	

	18	Data backup, Downloading and management of third party software	2	
	19	Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus,	2	
	20	Wi-Fi security, Configuration of basic security policy and permissions.	1	
	21	Terminologies like- strong password, Two-Factor Authentication, Login Activity Monitoring, Authorized Devices	3	
	22	Ethical dilemmas in social media usage: Privacy vs. Transparency, Authenticity vs. Self-Presentation, Misinformation vs. Truthfulness, Cyberbullying and Online Harassment, Data Privacy and User Consent, Influence and Manipulation, Addiction & Mental Health	3	
V	**Practical Implementations of Cyber security in social media**		**30**	**20**
	1	• Setting, configuring and managing three password policy in the computer (BIOS, Administrator and Standard User). • Setting and configuring two factor authentication in the Mobile phone. • Security patch management and updates in Computer and Mobiles. • Managing Application permissions in Mobile phone. • Installation and configuration of computer Anti-virus. • Installation and configuration of Computer Host Firewall. • Wi-Fi security management in computer and mobile. • Hands-on exercises with social media monitoring tools	20	
	2	Develop a cybersecurity plan for a hypothetical social media scenario (Capstone) Organisations dealing with Cyber crime and Cyber security in India, Case studies.	10	

References

- "Social Media Security: Leveraging Social Networking While Mitigating Risk" by Michael Cross
- "The Social Media Security Playbook: Your Guide to Stopping Threats, Plugging Gaps, and Responding to Emergencies" by Christopher Hadnagy and Michele Fincher

- Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
- Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
- Fundamentals of Network Security by E. Maiwald, McGraw Hill.

Note: The syllabus has five modules. There should be total 22 units in the first four modules composed of the theory topics. The number of units in the last module can vary. There are 45 instructional hours for the first four modules and 30 hrs for the final one. Module V is designed to equip students with practical skills. The 20 marks for the evaluation of practical will be based on Module V. The end-semester examination for the theory part will be based on the 22 units in the first four modules.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	2	-	-	-	-						
CO 2	-	1	-	-	-	-						
CO 3	-	2	-	-	-	-						
CO 4	-	2	-	-	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	1	1	-	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓
CO 6	✓	✓	✓	

Programme	BSc IT				
Course Code	ITY1MN104				
Course Title	Fundamentals Of Scripting				
Type of Course	Minor				
Semester	I				
Academic Level	100 - 199.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic computer skills, Fundamental programming concepts, HTML and CSS knowledge, Problem-solving abilities, Basic database understanding, Familiarity with web development concepts, Text editing proficiency				
Course Summary	Aims to teach scripting languages, focusing on JavaScript for front-end and PHP for back-end development. Students will learn fundamental concepts and practical skills to build dynamic web applications using both languages.				

Course Outcomes (CO): .

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand scripting languages' role in web development.	U	C	Written assessments or quizzes, Class discussions or presentations
CO2	Master JavaScript basics, including modern features and DOM manipulation.	Ap	P	Practical coding exercises and assignments, Code reviews, and peer evaluations
CO3	Develop proficiency in PHP fundamentals, database interaction, and sessions.	Ap	P	Coding projects and assignments, Assessments
CO4	Apply knowledge to develop a dynamic web application using JavaScript and PHP.	C	P	Capstone project, Presentation, and demonstration
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45)	Marks (70)

I	**INTRODUCTION TO SCRIPTING LANGUAGES**		**11**	**15**
	1	OVERVIEW OF SCRIPTING LANGUAGES- Definition and characteristics, Comparison with compiled languages	2	
	2	Role of scripting languages in web development	1	
	3	CLIENT-SIDE VS. SERVER-SIDE SCRIPTING	1	
	4	JAVASCRIPT BASICS- Introduction to JavaScript, Syntax and data types, Variables, operators, and expressions	2	
	5	Control structures: conditionals and loops, Regular Expressions	3	
	6	JAVASCRIPT FUNCTIONS- Function declaration and invocation, *this* keyword, Callback functions	2	
II	**FRONT-END DEVELOPMENT WITH JAVASCRIPT**		**11**	**15**
	7	JAVASCRIPT OBJECTS- Properties & Methods, Constructors, Prototypes, Iterables	3	
	8	DOCUMENT OBJECT MODEL (DOM)- Understanding the DOM tree, Accessing and manipulating DOM elements, Event handling and propagation	2	
	9	ES6 AND MODERN JAVASCRIPT FEATURES- Overview of ECMAScript 6 (ES6) features, Modules, Arrow functions, Promises, Template literals, Let and const declarations, spread, and rest operators	2	
	10	ERROR HANDLING - Understanding JavaScript errors and exceptions, Using try-catch blocks for error handling	2	
	11	DEBUGGING- Debugging techniques and tools (console.log, browser developer tools)	2	
III	**BACK-END DEVELOPMENT WITH PHP**		**11**	**20**
	12	OVERVIEW OF PHP- How to Install Xampp & Wamp tools, Static and Dynamic web pages, How PHP works, Server-Side / Client-Side scripting, Role of Apache & MySQL Server, PHP capabilities & advantages, How to configure php.ini	2	
	13	BASIC PROGRAMMING IN PHP- PHP Scripting Blocks, How to embed in HTML, Data Types & Variable Declaration, Conditional Statements, Looping Constructs while, for etc	3	
	14	PHP FUNCTIONS- Why to create functions, defining functions, Variable scope, Passing parameters to functions, Returning values, Passing arguments by value and reference, The include, include_once and require statement, Difference between include and require, Built-in PHP functions	2	

	15	PHP ARRAY- What are Arrays?, Character & Numeric Indexing, Auto Indexing, Counting & Sorting Array Elements, Array Search, Array Functions, Sending Array from static Page	2	
	16	Handling HTML Form Data as an Array	2	
IV	**ADVANCED PHP**		**12**	**20**
	17	RECEIVING DATA FROM HTML FORMS- Form creation, Understanding method $_GET , $_POST and $_REQUEST, Receiving Data at Server, Sending Artificial data from HTML, Formated Response by PHP, Dynamic data manipulation, Handling Null Values, Generating Dynamic Web Page by HTML Input	2	
	18	WORKING WITH DATABASES AND FORMS- Introduction to PHPMyAdmin Panel, PHP Database Creation, Understanding table structure, Go through with SQL Queries, CRUD operation in MySQL	2	
	19	Handling multiple tables in PHP-MySQL, MySQL Joins and Views, Importing and Exporting data through SQL script, Connectivity to remote server	2	
	20	CONFIGURING AND USING MYSQL- Fetching MySQL data from PHP forms, Creating registration forms, Managing secure Login Screens, Receiving Character and numeric indexes, Learn PHP SQL Functions, Implementation of all crud operation, Search data in MySQL, PHP Paging script	2	
	21	WORKING WITH PHP SESSIONS- Session Overview, How Session works, Global Session Variables, Session and Array, Expiring Session, Session Storage	2	
	22	EXCEPTION HANDLING- Understanding PHP exceptions and error handling mechanisms, Using try-catch blocks for exception handling	2	
V	**Open Module Practical**		**30**	**30**
	1. Create a JavaScript program that prompts the user to enter their name and then displays a greeting message using alert(). 2. Write a JavaScript program that checks if a number entered by the user is even or odd, and then displays the result. 3. Write a JavaScript program that validates a user's email address using regular expressions. 4. Create a JavaScript function that calculates the factorial of a number entered by the user. 5. Write a JavaScript program that demonstrates the use of a callback function to perform asynchronous operations.		7	
	6. Write a JavaScript program that dynamically adds a new paragraph element to the HTML document when a button is clicked. 7. Write a JavaScript program that uses ES6 features such as arrow functions and template literals to create a simple greeting message. 8. Write a JavaScript program that demonstrates error handling		8	

	using try-catch blocks when parsing JSON data. 9. Write a JavaScript program that demonstrates debugging using console.log statements to print the values of variables and objects. 10. Write a JavaScript program that handles click events on a button to toggle the visibility of a paragraph element.		
	11. Demonstrate the installation of XAMPP or WAMP tools on a local development environment. Guide students through the installation process and verify that the Apache and MySQL servers are running correctly. 12. Write a PHP script that displays "Hello, World!" on a webpage. Embed the PHP script within HTML markup and save the file with a .php extension. Verify that the PHP script executes correctly when accessed through the local server. 13. Write a PHP program that defines a function to calculate the factorial of a given number. Test the function by passing different values and displaying the results. 14. Create an HTML form with input fields for name and email. Write a PHP script that receives the form data, validates it, and displays a confirmation message. 15. Write a PHP program that demonstrates various operations on arrays such as creating arrays, accessing array elements, adding and removing elements, and sorting arrays.	7	
	16. Create an HTML form for user registration with fields for name, email, and password. Write a PHP script to receive the form data using the $_POST method, validate it, and insert it into a MySQL database. 17. Use PHPMyAdmin to create a database and a table for storing user registration data. Write PHP scripts to perform CRUD operations (Create, Read, Update, Delete) on the database table, allowing users to add, view, edit, and delete records through a web interface. 18. Create multiple tables in the database to represent related data entities. Write PHP scripts to perform MySQL joins to retrieve data from multiple tables and display it in a meaningful way on a web page. 19. Create a login form with fields for username and password. Write PHP scripts to authenticate users against a MySQL database, validate their credentials, and redirect them to a dashboard page upon successful login. Implement secure password hashing and salting techniques for user authentication. 20. Implement PHP sessions to store and manage user authentication status and other user-specific data across multiple pages. Use try-catch blocks to handle exceptions and errors gracefully, providing informative error messages to users while preventing sensitive information leakage.	8	

.**Mapping of COs with PSOs and POs:**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6

CO 1	1	1	-	-	3	3						
CO 2	-	-	2	3	3	3						
CO 3	-	-	2	3	3	3						
CO 4	-	-	3	3	3	3						

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4		✓	✓	✓

References:

1. Duckett, Jon, et al. JavaScript and JQuery: Interactive Front-End Web Development. United Kingdom, Wiley, 2014.
2. Crockford, Douglas. JavaScript: The Good Parts. United States, O'Reilly Media, 2008.
3. Welling, Luke, and Thomson, Laura. PHP and MySQL Web Development. United States, Pearson Education, 2008.
4. Weisfeld, Matt. The Object-Oriented Thought Process. United Kingdom, Pearson Education, 2008.

Programme	BSc IT				
Course Code	ITY2MN 104				
Course Title	API Fundamentals: Developing RESTful APIs				
Type of Course	Minor				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic understanding of programming concepts and web development principles, as well as familiarity with HTTP protocol				
Course Summary	This course offers a comprehensive overview of RESTful API development, covering topics such as design principles, implementation techniques etc., and gain the skills needed to create, test, and deploy RESTful APIs effectively in modern web applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand API fundamentals, including design principles and communication strategies.	U	C	Conceptual quizzes or written assignments
CO2	Explore API protocols such as REST and SOAP, analyzing their architectures and components.	An	P	Practical Assignment / Observation of Practical Skills
CO3	Learn about API layers and supporting services, enhancing understanding of API architecture.	U	C	Conceptual quizzes, written assessments
CO4	Gain knowledge of API development tools and techniques for building and testing RESTful APIs.	U	P	Practical assignments/ reviewing and testing
CO5	Apply theoretical knowledge to analyze and evaluate API use cases in diverse scenarios.	Ap	C	Case studies/ written reports, presentations, or peer discussions

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (48)	Marks (70)
I	**Introduction to APIs**		**9**	**14**
	1	Understanding APIs; Key Concepts & Principles: Design, Communication, Testing and Monitoring	2	
	2	Types of APIs : By Availability, By Use cases, By Audience, By Architecture	2	
	3	API Protocols: SOAP (Simple Objects Access Protocol), REST (Representational State Transfer), GraphQL, gRPC (Google Remote Procedural Call), RPC (Remote Procedural Call), Apache Thrift	3	
	4	Benefits of APIs : APIs Vs Web Appications, Innovation with APIs, Real-time examples	2	
II	**API Architecture**		9	**14**
	5	Elements of API Architecture: Endpoints, Requests and Responses, Http Methods, Data Formats, Security, Versioning, Error Handling	2	
	6	Defining Goals, Selecting Technology Stack, Planning Data Model	2	
	7	Designing Data Access Layer, Creating Endpoints, Testing and Deployment		
	8	Layers : Presentation Layer, Business Logic Layer, Data Access Layer, Database Layer, Security Layer	2	
	9	Supporting Services : Management Services, Security Services, Developer Services, Analytics Services	3	
III	**Exploring REST and SOAP**		**11**	**18**
	10	Definition, Design Principles	1	
	11	Architectural Components: Data Model and Endpoints Design	2	
	12	Authentication and Authorization Mechanisms	1	
	13	Utilizing Software Development Kits (SDKs)	2	
	14	Versioning Strategies for APIs	1	
	15	Analytics and Monitoring Implementation	2	
	16	REST Vs SOAP	2	
IV	**Developing RESTful APIs**		**16**	**24**
	17	REST API Tools : Understanding API Building Blocks	3	
	18	Design Principles for RESTful APIs	3	
	19	Implementation Techniques for RESTful APIs	2	
	20	Testing APIs using Postman	4	
	21	Authentication and Authorization in RESTful APIs	2	
	22	Handling Errors and Exceptional Cases, API Versioning	2	

		and Documentation Best Practices		
V	**Open Ended Module: Practicum Component**		**30**	
	1. Create a presentation discussing the importance of API design in facilitating integration between software systems. Include examples of well-designed APIs and explain how they contribute to developer productivity and system interoperability. 2. Analyse different types of APIs based on their availability. Discuss the advantages and challenges associated with public, private, and partner APIs, and provide real-world examples of each type. 3. Compare and contrast the SOAP and REST protocols, highlighting their key characteristics, advantages, and use cases. Evaluate which protocol is better suited for different scenarios, such as enterprise integration vs. web development. 4. Develop a whitepaper outlining the key elements of API architecture, including endpoints, HTTP methods, data formats, security mechanisms, versioning strategies, and error handling practices. Discuss how each element contributes to building robust and scalable APIs.		
	5. Use Postman to make GET, POST, PUT, and DELETE requests to a public API (e.g., JSONPlaceholder). Document the responses. 6. :Set up an Express server that listens on a port and responds with "Hello, World!" to a GET request. 7. Create a RESTful API with CRUD operations for a simple resource 8. Comprehensive RESTful API Project -Students will design and develop a complete RESTful API			

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	2	2	-	2	2	3
CO 2	-	3	-	3	3	3
CO 3	1	1	-	-	3	3
CO 4	-	-	3	3	3	3
CO 5	-	-	3	3	3	3

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓	✓	✓

References:

1. Richardson, Leonard, et al. RESTful Web APIs: Services for a Changing World. United States, O'Reilly Media, 2013.
2. Biehl, Matthias. RESTful API Design. United Kingdom, CreateSpace Independent Publishing Platform, 2016.
3. Masse, Mark. REST API Design Rulebook. Germany, O'Reilly Media, 2011.
4. Niedermair, Andreas. Mastering ServiceStack. United Kingdom, Packt Publishing, 2015.

Programme	BSc IT				
Course Code	ITY3MN204				
Course Title	UI/UX				
Type of Course	**Minor**				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Proficiency in using computers and common software applications. 2. Understanding of basic web concepts like websites and web browsers. 3. Creativity and Problem-Solving Skills. 4. Familiarity with HTML markup language and CSS for styling web content.				
Course Summary	Equip students with the knowledge and skills necessary to design intuitive and user-friendly web interfaces through effective UI/UX practices.				

Course Outcomes (CO): .

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the principles of user interface (UI) and user experience (UX) design.	U	C	Quizzes or assessments
CO2	Apply design thinking methodologies to create user-centered web interfaces	Ap	P	Seminar Presentation
CO3	Utilize industry-standard tools and techniques for UI/UX prototyping and wireframing	Ap	P	Practical exercises
CO4	Evaluate and improve web interface usability through user testing and feedback.	E	P	Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (Max 48)	Marks (70)
I	INTRODUCTION TO UI/UX DESIGN		9	**15**

	1	Overview of UI (User Interface) and UX (User Experience), Differentiating between UI and UX design principles, Importance of UI/UX in web development	1	
	2	Understanding user-centered design (UCD) process - Usability testing and user feedback, Iterative design and prototyping, User research techniques: surveys, interviews, and personas	2	
	3	Wireframing tools and techniques	2	
	4	Information Architecture - Organizing and structuring website content, Creating user flows and navigation patterns	3	
	5	Introduction to design thinking and its application in UI/UX design	1	
II	VISUAL DESIGN PRINCIPLES FOR WEB UI		**15**	**25**
	6	Fundamentals of visual design: Color theory, Typography - Selecting appropriate typefaces and fonts for web design, Understanding the psychology of color in design, Creating Visually appealing and harmonious color schemes	3	
	7	Layout and Grid Systems - Principles of Visual Hierarchy and Layout Composition, Grid systems and their application in Web design	2	
	8	Visual elements and UI components - Creating visually appealing buttons, forms, and icons, Using imagery and graphics effectively in web design, Consistency and branding in UI elements	2	
	9	Introduction to design systems and style guides	2	
	10	Responsive design principles for web interfaces	2	
	11	Accessibility considerations in UI design: WCAG guidelines and best practices	2	
	12	Tools and software for visual design: Adobe XD, Sketch, Figma, etc.	2	
III	INTERACTION DESIGN AND USER EXPERIENCE (UX)		**14**	**20**
	13	Principles of interaction design: feedback, affordance, and signifiers	2	
	14	Designing effective navigation systems and user flows	2	
	15	Gestalt principles and their application in UI/UX design	1	
	16	Introduction to micro-interactions and their role in enhancing user experience	1	
	17	Usability testing methods: heuristic evaluation, A/B testing, and usability testing sessions	3	
	18	Analyzing user behaviour using analytics tools like Google Analytics	2	
	19	Prototyping and user testing - Creating interactive prototypes for user testing, Conducting usability tests with prototypes, Analysing user feedback, and iterating	3	

		on designs, Advanced prototyping techniques: high-fidelity prototypes, animations, and transitions		
IV	ADVANCED TOPICS IN UI/UX FOR WEB DEVELOPMENT		**7**	**10**
	20	Designing for multiple devices and platforms: mobile-first design approach - Designing for different screen sizes and devices, Mobile-first design approach and techniques, Mobile usability and touch interactions	3	
	21	Integrating UI/UX design with front-end development workflows - Collaborating with front-end developers in implementing UI/UX designs, Translating designs into HTML, CSS, and JavaScript, Design handoff, and communication with developers.	2	
	22	Performance optimization and Loading Speed - Techniques for optimizing web page loading speed, Image optimization, lazy loading, Minification and code optimization, Cross-browser compatibility, and performance optimization considerations	2	
V	**Hands-on UI/UX: Practicum Components**		30	
	1. Analyse the differences between UI (User Interface) and UX (User Experience) design principles. Discuss their respective importance in web development, providing examples of websites or applications that excel in both UI and UX. 2. Research and present a case study on successfully implementing the user-centred design (UCD) process in a web development project. Describe the usability testing methods, user feedback collection techniques, and iterative design processes used to improve the user experience. 3. Explore various wireframing tools and techniques available for UI/UX designers. Compare and contrast at least three tools, evaluating their features, usability, and suitability for different design projects. 4. Create a presentation on the fundamentals of visual design, focusing on colour theory and typography. Discuss the psychological effects of different colours and fonts on user perception and mood, and provide examples of effective color schemes and typeface combinations in web design.			
	5. Design a wireframe and information architecture for a hypothetical website or application. Demonstrate how you would organize and structure the content, create user flows, and design navigation patterns to optimize user experience and accessibility. 6. Investigate the interaction design principles, including feedback, affordance, and signifiers. Analyse how these principles influence user interactions and interface design			

	decisions in popular websites or applications. 7. Develop a mobile-first design approach for a responsive website. Create wireframes and design mock ups that prioritize mobile user experience, considering touch interactions, screen sizes, and performance optimization techniques. 8. Perform a performance optimization audit on a website or web application. Identify areas for improvement in terms of loading speed, image optimization, code minification, and cross-browser compatibility. Develop a plan for optimizing the website's performance based on your findings		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	-	-	-	1	3	3						
CO 2	-	-	-	1	3	3						
CO 3	-	-	-	1	3	3						
CO 4	-	-	-	1	3	3						

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

References

1. Krug, Steve. Don't Make Me Think: A Common-Sense Approach to Web Usability. Ukraine, Pearson Education, 2009.
2. Norman, Don. The Design of Everyday Things: Revised and Expanded Edition. United States, Basic Books, 2013.
3. Tidwell, Jenifer. Designing interfaces. Germany, O'Reilly Media, Incorporated, 2006.
4. Wroblewski, Luke. Mobile First. United States, A Book Apart, 2011.

Vocational Minor Courses

Programme	BSc IT				
Course Code	ITY1VN101				
Course Title	Mathematics for Data Science				
Type of Course	Vocational Minor				
Semester	I				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic knowledge of Maths				
Course Summary	This mathematics course covers essential topics including vectors, matrices, linear equations, integration, and calculus. Students will learn fundamental concepts such as vector operations, matrix algebra, solving systems of linear equations, techniques of integration, and differentiation rules. Through problem-solving exercises and practical applications, students will develop a strong foundation in mathematics, preparing them for further study in fields such as engineering, physics, and computer science.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply Vector operations to solve computational problems.	Ap	P	Practical assignments\exam
CO2	Apply Matrix operations to solve computational problems.	Ap	P	Practical assignments\exams
CO3	Solve the system of linear equations to identify the unknowns	Ap	P	Practical assignments\exams
CO4	Evaluate the eigen values and eigen matrices to understand the data transformations	Ap	P	Practical assignments
CO5	Understand the concepts of derivatives and limits	U	C	Instructor-created exams / Assignment
CO6	Apply calculus to solve the real-world problems	Ap	P	Practical assignments\exams

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (Max 48)	Marks (Max 70)
I	**Fundamentals of Vector**		**5**	**10**
	1	Introduction to vectors, Properties of vectors		
	2	Vector Addition and Scalar Multiplication		
	3	Inner product		
	4	Norm, distance, angle and projection of vectors		
II	**Fundamentals of Matrices**		**10**	**15**
	5	Introduction to matrices		
	6	Matrix Addition and Scalar Multiplication		
	7	Matrix Multiplication		
	8	Transpose of a matrix, Square matrix, Diagonal and Trace		
	9	Orthogonal, Symmetric and Normal Matrices		
	10	Invertible Matrices, determinants of matrices		
III	**System of Linear Equations**		**14**	**20**
	11	Linear Equations and System of Linear Equations		
	12	Coefficient and Augmented matrix		
	13	Systems in triangular and echelon forms		
	14	Solving Linear equations using matrix inversion		
	15	Solving Linear equations using Gaussian elimination		
	16	Eigenvalues and eigen vectors of matrix		
IV	**Introduction to calculus**		**16**	**25**
	17	Overview of calculus and its importance in machine learning and data science.		
	18	Functions- Definition and types of functions, Graphical representation of functions, Operations on functions.		
	19	Limits -Understanding the concept of limits and evaluating limits algebraically and graphically		
	20	Introduction to derivatives: definition and interpretation Derivatives of common functions: constant, linear, quadratic,		
	21	cubic, inverse, trigonometric, exponential, logarithmic, and power functions		
	22	Integration rules: power rule, substitution, and integration by parts.		
V	**Practical Applications**		**30**	**30**
	1	Write Python programs for 1. Perform vector arithmetic. 2. Perform matrix multiplication. 3. Find the determinant of a square matrix. 4. Solve a system of linear equations using		

		Gaussian elimination. 5. Find the eigenvalues and eigenvectors of a square matrix. 6. Calculate Frobenius norm of a matrix 7. Find the inverse of a square matrix. 8. Check if a given matrix is orthogonal. 9. Calculate the trace of a square matrix. 10. Calculate the nth-order derivative of a function. 11. Find the definite integral of a function using numerical methods 12. Find the minimum or maximum value of a function using optimization techniques (e.g., gradient descent)		

References

1. Gilbert Strang. Introduction to Linear Algebra. 5th ed. Wellesley-Cambridge Press, 2016.
2. Jason Brownlee, Basics of Linear Algebra for Machine Learning, First Edition, Machine Learning Mastery, 2018
3. Markin, Marat V. Integration For Calculus, Analysis, And Differential Equations: Techniques, Examples, And Exercises. Singapore, World Scientific Publishing Company, 2018.
4. Text Book of Integral Calculus. India, Discovery Publishing House Pvt. Limited, 2005.

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	-	1	1	1						
CO 2	1	3	-	-	1	-						
CO 3	1	3	-	-	2	2						
CO 4	1	3	-	-	2	2						
CO 5	2	1	-	1	1	-						
CO 6	2	1	1	2	2	1						

Correlation Levels:

Level	Correlation
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓	✓	✓

Programme	BSc IT				
Course Code	ITY1VN102				
Course Title	Statistics for Data Science				
Type of Course	Vocational Minor				
Semester	I				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. A strong foundation in algebra 2. Fundamentals of Set theory and logic				
Course Summary	The course on probability and statistics covers fundamental topics including descriptive statistics (measures of central tendency and dispersion), probability theory (events, sample spaces, probability laws, random variables, and distributions), inferential statistics (regression analysis), and applications in various fields such as science, engineering, economics, and social sciences, emphasizing critical thinking, data analysis, and problem-solving skills.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply fundamental statistics concepts	Ap	C	Quizzes, Homework, Exams
CO2	Analyze data using descriptive statistics	An	P	Projects, Midterm, Exams
CO3	Perform regression analysis	An	P	Projects, Exams
CO4	Apply probability and statistics in real-world situations	Ap	C	Projects, Exams
CO5	Develop critical thinking and problem-solving skills	E	M	Homework, Projects
CO6	Communicate statistical findings effectively	E	M	Presentations, Reports

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Mark
I		**DESCRIPTIVE STATISTICS**	**09**	**15**
	1	Concept of primary and secondary data, Methods of collection	1	
	2	Measures of central tendencies (Mean, Median, Mode, GM and HM)	4	
	3	Measures of dispersion, Relative Measures and Absolute Measures	2	
	4	Range, Quartile deviation, Mean deviation, standard deviation, Variance	2	
II		**CORRELATION AND REGRESSION ANALYSIS**	**10**	**15**
	5	Principles of Least Squares and Exploratory data analysis (EDA) techniques: histograms, box plots, scatter plots.	3	
	6	Pearson's Coefficient of Correlation	2	
	7	Rank Correlation	2	
	8	Simple linear regression and multiple linear regression. Logistic regression for classification problems.	3	
III		**PROBABILITY THEORY**	**11**	**20**
	9	Random experiment, Sample point, Sample Space	1	
	10	Events, Operation of events (Union, Intersection, Complement of Events)	2	
	11	Exclusive and exhaustive events, equally likely events with examples	1	
	12	Classical approach to probability, Axiomatic definitions of probability, simple problems	2	
	13	Theorems of probability - Addition Theorem - Multiplication Theorem	2	
	14	Conditional probability	1	
	15	Inverse probability	1	
	16	Baye's Theorem	1	
IV		**THEORETICAL DISTRIBUTION**	**16**	**20**
	17	Discrete and continuous random variables and probability distribution and Expectation	3	
	18	Binomial distribution: Definition, Expectation, Variance, Moment Generating Function and Problems	2	
	19	Poisson distribution: Definition, Expectation, Variance, Moment Generating Function and Problems	2	
	20	Normal distribution - Features and properties- Standard normal curve	3	

	21	Normal distribution: Definition, Expectation, Variance, Moment Generating Function, Standard normal curve and Problems	3	
	22	Type of Testing: T-Test, ANOVA-Test, Chi-square test, Z-Test (Concept Only)	2	
V	**Lab Activities (Use Sci Lab)**		**30**	
	1	Implements mean, median and mode hight of then students	20	
		Determine the standard deviation and variance		
		Plot a histogram to visualize the distribution		
		Create a variable ‘x’ and assign it the value 10. Display the value of ‘x’.		
		You have a dataset containing the number of hours students spent studying and their corresponding scores in an exam. Perform linear regression to predict the exam scores based on the number of hours studied.		
		You are given two arrays representing the scores of students in two subjects, Math and Science. Calculate the correlation coefficient between the scores in Math and Science.		
		Perform simple linear regression and using the principles of least squares in SciLab.		
		Suppose you toss a fair coin 10 times. Simulate the experiment and calculate the probability of getting exactly 5 heads.		
		Create a SciLab function to simulate random experiments and calculate probabilities of events		
		Compute the expectation, variance distributions for given parameters (Binomial and Poisson).		
	2	Case Study	2	
	3	Develop a predictive model using statistical techniques and tools for identifying a real-world problem in data science.		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	-	1	1	1						
CO 2	1	3	-	-	1	-						
CO 3	1	3	-	-	2	2						
CO 4	1	3	-	-	2	2						

CO 5	2	1	-	1	1	-						
CO 6	2	1	1	2	2	1						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Introduction to Mathematical Statistics, Hogg R V Craig A T, Macmillan

2. Mathematical Statistics, Freund J E, Waple R E, Prentice Hall of India.
3. Probability and Statistics for Engineers, Miller I Freund J E, Prentice Hall of India.
4. Statistics for Management, Levin R I, Prentice Hall of India
5. Introduction to Mathematical Statistics, Hogg R V Craig A T, Macmillan
6. Mathematical Statistics, Freund J E, Waple R E, Prentice Hall of India.
7. Probability and Statistics for Engineers, Miller I Freund J E, Prentice Hall of India.
8. Gupta, S.P. Statistical Methods. Sultan Chand and Sons: New Delhi.
9. Mood, A.M., Graybill, F.A and Boes, D.C. Introduction to Theory of Statistics. 3rd EditionPaperback – International Edition.
10. Mukhopadhyay, P. Mathematical Statistics. New central Book Agency (P) Ltd: Calcutta
11. Probability and Statistics for Computer Scientists by Michael Baron

Programme	BSc IT				
Course Code	ITY2VN103				
Course Title	Discrete Structures for Data Science				
Type of Course	Vocational Minor				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	No pre-requisites required				
Course Summary	This course provides a foundational understanding of essential concepts that are fundamental to computer science and various branches of mathematics. The course explores topic related to Propositional Logic, Sets and Relations, Graphs and Trees. This helps the students to equip with the analytical and problem-solving skills necessary for applications in computer science and algorithm design.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Acquire a comprehensive understanding of propositional logic and its applications, with a focus on constructing and interpreting truth tables.	U	C	Instructor- created exams / Quiz/Assignment/ Seminar
CO2	Able to proficiently define and manipulate sets, analyse relations and functions and their representation by Venn diagrams	U	C	Instructor-created exams/ Quiz/Assignment/ Seminar
CO3	Acquire a basic understanding of graph theory including representations, types of graphs, their properties such as connectivity, cycles, paths and degrees.	U	C	Instructor-created exams/ Quiz/Assignment/ Seminar
CO4	Able to demonstrate a deep understanding of advanced graph theory concepts, focusing on Euler's graph, Hamiltonian graphs, Isomorphism and Homeomorphism.	U	C	Instructor-created exams/ Quiz/Assignment/ Seminar
CO5	Able to proficiently understand the tree data structures, spanning trees and associated algorithms for solving problems such as Prim's and Kruskal.	U	C	Instructor-created exams/ Quiz/Assignment/ Seminar

CO6	Represent various mathematical problems using algorithmic approaches and enhance problem-solving skills by visualizing solutions through the utilization of software tools.	U, Ap	C, P	Practical Assignment / Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Contents	Hrs (45+30)	Mark
I		**Mathematical Logic**	**09**	**17**
	1	Propositional Logic: Definition, Logical Operators (Negation, Disjunction, Conjunction, Implication, Biconditional), Truth Table	2	
	2	Law of Logic: Tautology, Contradiction, Contingency, Logical equivalence	2	
	3	Algebra of Propositions, Solving logic with and without truth table	2	
	4	Validity of Arguments, Logical implication	2	
	5	Quantifiers: Universal and Existential	1	
II		**Set Theory and Relations**	**10**	**17**
	6	Set Theory: Definition, Concept of Set Theory, Cardinality, Types of sets	1	
	7	Properties of Set: Subsets, Power set, Venn Diagrams, Set operations, Partition	2	
	8	Relation: Definition and Examples, Type of Relations with example,	2	
	9	Equivalence relation, Equivalence Class and Di-Graph and problems	3	
	10	Functions: Introduction, type of function, Composition function	1	
	11	One-to-one function, onto function, One-to-one correspondence	1	
III		**Introduction to Graphs**	**15**	**20**
	12	Graph: Definition, Properties of Graph, Simple Graph, Regular Graph, Null Graph, Subgraph and Isomorphism	2	
	13	Walk, Path, Trail, Circuit, Cycle, Complete Graph, Hand-Shaking Theorem	2	

	14	Connected Graph, Complete Graph, Euler Graph, Hamiltonian graph, Travelling Sales Man Problem, Operations on Graph, Homeomorphism	3	
	15	Planar Graph, Kuratowski's two graph, Matrix Representation of Graph,	3	
	16	Bi-Partite Graph, Graph colouring, Chromatic number	2	
	17	Basic theorems on Graph: Hand-Shaking Theorem	3	
IV	**Trees and Applications**		**11**	**16**
	18	Tress: Definition, Properties, Pendant vertex, Distance, Eccentricity and Center of Tress	2	
	19	Rooted Tress, Binary Tress and Its Properties	2	
	20	Basic Theorems on Tress	3	
	21	Minimum Spanning Tree: Definition, Prim's Algorithm and Kurskal's Algorithm (Algorithm and Problem Based)	2	
	22	Cut-Set and Cut-Vertices, Connectivity of Graph and Weighted Graph	2	
V	**Lab Activities (Use Sci Lab or any other Alternative tools)**		**30**	**30**
	1	Define logical operators and truth tables to evaluate the truth values of the formulas		
		Implement a function to determine whether a given logical expression is a tautology, contradiction, or contingency.		
		Define predicates, quantifiers, and rules of inference, then perform inference steps.		
		Develop a SciLab script to perform set operations such as union, intersection, and complement for two given sets.		
		Create a SciLab program to determine if a given relation is reflexive, symmetric, transitive, or an equivalence relation.		
		Define matrices or lists to represent graphs		
		Write a SciLab function to verify the Hand-Shaking Theorem for a given graph.		
		Implement algorithms to color graphs with the minimum number of colors (e.g., greedy coloring).		
		Implement Prim's algorithm to find minimum spanning trees of given graphs.		

		Implement Kruskal's algorithm to find minimum spanning trees of given graphs.		
	2	Case Study		
	3	Demonstrate Practical application theory in various domain of Computer Science from social networks and web search to network security and bioinformatics. They challenge students to apply their knowledge of graph theory to solve complex, real-world problems and to gain a deeper understanding of its relevance in modern computing environments.		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	1	1	-	-						
CO 2	2	-	2	2	-	-						
CO 3	2	-	2	2	-	-						
CO 4	2	-	2	2	-	-						
CO 5	2	-	2	2	-	-						
CO 6	2	-	2	2	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓	✓	✓

Programme	BSc IT				
Course Code	ITY2VN104				
Course Title	Introduction to Data Science				
Type of Course	Vocational Minor				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic understanding of computer science concepts. 2. Familiarity with data handling. 3. simple mathematical analysis.				
Course Summary	Data science is the domain of study that deals with vast volumes of data using modern tools and techniques to find unseen patterns, derive meaningful information, and make business decisions.				

Course Outcomes (CO): .

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Proficiency in Excel Basics and Data Handling	U	C	Instructor-created exams / Quiz
CO2	Data Visualization Skills	U	C	Instructor-created exams
CO3	Understanding of Data Analytical Techniques	U	P	Seminar Presentation / Group Tutorial Work
CO4	Data Cleaning and Formatting Proficiency	Ap	P	Viva Voce
CO5	Advanced Excel Operations and Analysis	An	C	Instructor-created exams/Assignments
CO6	Application of Data Analytics in Practical Scenarios	U	C	Instructor-created exams / Home Assignments
CO7	Effective Report Generation and Presentation Skills	C	P	Practical Assignment / Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)				

Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (45+30)	Marks (70)
I	**INTRODUCTION TO DATA ANALYTICS & EXCEL**		**10**	**15**
	1	Application of data modelling in business.	2	
	2	Databases and types of Data variables.	2	
	3	Data analytical techniques, Need of Data Analytics.	2	
	4	Introduction to Excel, Understanding Worksheet Basics.	2	
	5	Perform Functions with Shortcut Keys, Formulas and Functions.	2	
II	**DATA VISUALIZATION**		**15**	**20**
	6	Introduction to Data visualization.	1	
	7	Chart types – Gantt & Milestone Chart.	2	
	8	Smart art & Organization chart.	2	
	9	Get creative with Icons.	2	
	10	3D models.	2	
	11	Digital Inking.	2	
	12	Putting Data in perspective with Pivots.	4	
III	**DATA-DRIVEN TECHNIQUES**		**10**	**20**
	13	Summarize Marketing Data: Slicing and Dicing Marketing Data with PivotTables.	2	
	14	Using Excel Charts to Summarize Marketing Data - Using Excel Functions to Summarize Marketing Data.	1	
	15	Simple Linear Regression and Correlation.	2	
	16	Using Multiple Regression to Forecast Sales.	2	
	17	Copernican Principle to Predict Duration of Future Sales Viral Marketing, Text Mining.	3	
IV	**FORECASTING IN EXCEL**		**10**	**15**
	23	Forecast Sheet, One-click forecasting.	2	

	24	Create Forecast Worksheet.	2	
	25	Customize Forecast using Options.	2	
	26	FORECAST Functions, FORECAST.ETS, FORECAST.ETS.CONFINT, FORECAST.ETS.STAT	2	
	27	What-if Analysis Tools, Scenario Manager, Goal Seek, Data Table, Solver Add-In.	2	
V	**Practical Applications using Excel**		**30**	
		Implement the following: 1. Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions. 2. Working with Data : Importing data, Data Entry & Manipulation, Sorting & Filtering. 3. Working with Data: Data Validation, Pivot Tables & Pivot Charts. 4. Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs. 5. Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate. 6. Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions. 7. Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis. 8. Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.	30	

		9. Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data. 10. Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data. Template for Practical Course and if AEC is a practical Course Annexure-V 11. Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts. 12. Generation of report & presentation using Autofilter &macro.		

References

1. Manisha Nigam, "Advanced Analytics with Excel 2019", BPB 2019. REFERENCE BOOKS
2. Wanyne. L. Winston, 2014 "Market Analytics Data Driven Technique with Microsoft Excel"
3. David Whigham, 2019, "Business Data Analysis Using Excel", Oxford Publications.

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	-	-	-	-	-						
CO 2	-	2	-	-	-	-						

CO 3	-	3	-	1	-	-						
CO 4	-	2	2	-	-	-						
CO 5	-	3	-	-	-	-						
CO 6	-	3	-	-	-	-						
CO7	-	-	2	2	-	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5	✓			✓
CO 6	✓			✓
CO7			✓	

Programme	BSc IT				
Course Code	ITY3VN201				
Course Title	Tools and Methodologies for Data Science				
Type of Course	Vocational Minor				
Semester	III				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	• Basic knowledge of Computer Science				
Course Summary	This course offers essential software and techniques necessary for modern data analysis and collaboration. It begins with an exploration of open-source software and Python IDEs, followed by a deep dive into Python packages tailored for data science tasks. Students learn to leverage Jupyter Notebooks for interactive analysis and explore cloud-based alternatives for remote collaboration. The course also delves into Extract, Transform, Load (ETL) processes and the significance of APIs in data retrieval and integration. Finally, students gain practical skills in version control using Git and collaborative development on GitHub, essential for managing data science projects efficiently.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Utilize open-source software effectively for data analysis and visualization	Ap	P	Demonstration of practical assignments
CO2	Apply Python packages proficiently to manipulate, analyse, and visualize data	Ap	P	Demonstration of practical assignments
CO3	Create, execute, and publish Jupyter Notebooks for interactive data exploration and presentation	Ap	P	Demonstration of practical assignments
CO4	Implement Extract, Transform, Load (ETL) processes and integrate data using available tools efficiently.	Ap	P	Demonstration of practical assignments
CO5	Utilize Git for version control, tracking changes, and collaborating on data science projects.	Ap	P	Demonstration of practical assignments
CO6	Manage GitHub repositories effectively for collaborative data science development.	Ap	P	Demonstration of practical assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (Max 48)	Marks (Max 70)
I	**Tools for Data Science**		**10**	**15**
	1	Open-Source Software	1	
	2	Open-source Data Science Tools	1	
	3	Python IDE	2	
	4	Python packages for Data Science	2	
	5	Familiarization with Jupyter notebook - setting up, using and publishing notebook, Installation of Jupyter notebooks	2	
	6	Other Cloud-based notebooks for data science	2	
	7	Languages for Data Science	2	
II	**ETL Tools**		**10**	**15**
	8	Introduction to ETL	2	
	9	Significance of ETL in data science	3	
	10	Available Tools for ETL, Types of ETL tools	3	
	11	API for Data Science, Necessity of APIs in Data Science	2	
III	**Introduction to Git and GitHub for collaborative data science projects**		**10**	**15**
	12	Introduction to Git and its advantages, Importance of Git for a Data Scientist	3	
	13	Installing Git and setting up a Git environment	2	
	14	Introduction to GitHub and its role in hosting Git repositories	2	
	15	Initializing a Git repository, configuring git	3	
IV	**Basic Operations on GitHub**		**15**	**25**
	16	Adding files to the staging area	2	
	17	Committing changes to the repository, Viewing the history of commits	2	
	18	Undoing changes using reset and revert	2	
	19	Using Gitignore to ignore files and directories	2	
	20	Working with remote repositories: cloning, pushing, and pulling	2	
	21	Git branch, checkout, status, merge	2	
	22	Creating repositories on GitHub and pushing local repositories to GitHub	3	
V	**Hands-on: Practical Applications, Case Study and Course Project**		**30**	**30**

	1	Installation of Python and execution of small programs using Python		
	2	Installation of Jupyter and execution of small programs using Jupyter		
	3	Cleaning of any publicly available dataset		
	4	Create a dashboard using Jupyter Notebooks		
	5	Install Git on your computer and configure a Git environment suitable for data science projects. Simulate a typical Git workflow by creating a sample project repository. Practice basic Git operations such as adding files, committing changes, and viewing commit history.		
	6	Practice creating and merging branches in Git using a sample project repository. Create multiple branches to work on different features or fixes, then merge them back into the main branch. Resolve any conflicts that arise during the merging process and document your approach.		
	7	Demonstration of collaborative projects using GitHub. Form teams and create GitHub repositories for collaborative projects. Assign roles within each team (e.g., project manager, developer, tester) and establish guidelines for collaboration, including branch management, code review processes, and issue tracking. Document the repository setup and collaboration guidelines		

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

References

1. https://docs.python.org/3/using/index.html
2. https://datasciencenotebook.org/
3. https://docs.jupyter.org/en/latest/
4. https://www.dremio.com/resources/guides/adv-types-etl-tools/
5. https://www.domo.com/glossary/what-is-a-data-science-platform-apis
6. https://www.knowledgehut.com/blog/data-science/github-for-data-science
7. Tsitoara, Mariot. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer. Germany, Apress, 2019.

Programme	BSc IT				
Course Code	ITY3VN202				
Course Title	Data Analysis and Visualisation Using Spreadsheets				
Type of Course	**Vocational Minor**				
Semester	III				
Academic Level	200-299.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	• Basic understanding of computers • Familiarity with basic mathematical operations				
Course Summary	This course provides a comprehensive introduction to Spreadsheets, focusing on understanding formulas, functions, data organization, analysis techniques, and data visualization. Participants will gain skills in spreadsheet management, data cleansing, analysis, and visualization using Excel's various tools and features.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Students will demonstrate proficiency in managing spreadsheets, including creating, formatting, and manipulating data within Excel workbooks. They will be able to effectively navigate Excel's interface and utilize toolbars.	U	P	Instructor-created exams / Quiz
CO2	Learners will understand the importance of data organization and cleansing in Excel. They will be able to import, export, filter, sort, validate, and remove duplicates from datasets. Students will develop skills to ensure data integrity and consistency, enhancing their ability to work with clean and organized data sets.	U	P	Instructor-created exams/ Home Assignments
CO3	Participants will acquire advanced data analysis skills like pivot tables, what-if analysis, and goal seek. They will be able to apply various Excel functions and tools to perform complex calculations, analyze trends, and make informed decisions based on data analysis.	Ap	P	Instructor-created exams
CO4	Students will gain proficiency in data visualization techniques using Excel. They will be able to create a variety of	Ap	P	Instructor-created exams

	charts, design pivot charts, dashboards for effective data analysis. Additionally, learners will be able to implement form controls for interactive data manipulation in their visualizations.			
CO5	Learners will develop skills in advanced features of Excel like macros, protect data sheets and workbooks, utilize split, freeze, and hide options effectively, incorporate add-ins for extended functionalities, and manage printing options in Excel for professional presentation of data.	Ap	P	Instructor-created exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45)	Marks (70)
I	**Introduction to Excel & Understanding Formulas, Functions**		**10**	**15**
	1	Features of Spreadsheet	1	
	2	Parts of Excel Window, Toolbars, Worksheet and Workbook, Insertion and Deletion of cells, columns, rows	2	
	3	Formatting in Excel (Merge, Warp, Font Formatting, Number Formatting, Borders and Shading, Colouring)	2	
	4	Range, Autofill, Autosum, Relative, Absolute and Mixed Referencing in Excel, Linking data between worksheets	2	
	5	Formulas and Functions in Excel: Use of Formula Bar, Functions: SUM, ROUND, CEIL, FLOOR, IF, AND, OR, AVERAGE, MIN, MAX ,COUNT, COUNTIF, SUMIF, VLOOKUP,HLOOKUP	3	
II	**Cleansing and Organising Data in Excel**		**10**	**10**
	6	Importance of Data Cleansing and Organisation	1	
	7	Data Import and Export	2	
	8	Filtering and Sorting	2	
	9	Data Validation and removal of duplicates	2	
	10	Group, Ungroup, Subtotal	2	
	11	Conditional Formatting – Highlight Cell Rules, Top/Bottom Rules	1	
III	**Advanced Techniques for Data Analysis**		**14**	**10**
	12	Features of Pivot table	1	
	13	Pivot Table creation	2	
	14	Fitting Linear regression in Excel	3	
	15	Linear regression using Excel formulas	3	
	16	Interpreting regression results	2	
IV	**Data Visualisation Techniques**		**14**	**15**

	17	Creating Charts, Different types of charts	2	
	18	Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table	2	
	19	Creating charts from regression	2	
	20	Pivot Chart	2	
	21	Dashboards	2	
	22	Form Controls	4	
V	**Hands-on Spreadsheets**		**30**	**30**
	Spreadsheet Basics: 1. Create a new workbook in Excel. 2. Identify and label different parts of the Excel window, such as the Ribbon, Formula Bar, Name Box, and Worksheet Tabs. **3.** Insert and delete cells, columns, and rows within a worksheet.			
	Formatting: 4. Merge cells and wrap text within merged cells. 5. Experiment with different font styles, sizes, and colours for text formatting. 6. Apply various number formatting options (e.g., currency, percentage, date) to cells. **7.** Add borders and shading to cells or ranges.			
	Range Operations: 8. Use Autofill to quickly populate a series of cells with data (e.g., numbers, dates, text). 9. Utilize Autosum to calculate the sum of a range of numbers automatically. 10. Practice relative, absolute, and mixed referencing in formulas to understand their impact on cell references. **11.** Link data between different worksheets within the same workbook.			
	Formulas and Functions: 12. Experiment with different mathematical formulas (e.g., addition, subtraction, multiplication, division) using the Formula Bar. 13. Apply common functions such as SUM, ROUND, CEIL, FLOOR, IF, AND, OR, AVERAGE, MIN, MAX, COUNT, COUNTIF, SUMIF, VLOOKUP, and HLOOKUP to solve specific problems or analyse data sets. **14.** Combine functions within formulas to perform more complex calculations.			
	Data Import and Export: 15. Import external data from sources such as CSV files, text files, or databases into Excel. **16.** Export Excel data to different formats (e.g., CSV, PDF) for sharing or further analysis.			
	Filtering and Sorting: 17. Filter data to display specific records based on criteria (e.g., dates, categories, numerical ranges). **18.** Sort data alphabetically, numerically, or chronologically to analyse trends or identify patterns.			

	Data Validation and Removal of Duplicates: 19. Implement data validation rules to restrict input values within specified criteria (e.g., date ranges, numerical limits, list selections). **20.** Identify and remove duplicate records from a dataset while preserving unique data entries.		
	Grouping, Ungrouping, and Subtotal: 21. Group related rows or columns together to organize data hierarchically. **22.** Perform subtotal calculations within grouped data to summarize information at different levels of detail.		
	Conditional Formatting: 23. Apply conditional formatting using highlight cell rules to visually identify data outliers, trends, or exceptions. **24.** Utilize top/bottom rules to highlight top or bottom values within a dataset for quick analysis.		
	Pivot Table Creation: 25. Import a dataset into Excel and create a pivot table summarizing key metrics (e.g., sales revenue, product quantities) by different dimensions (e.g., region, product category). **26.** Experiment with different pivot table configurations (e.g., adding calculated fields, grouping data, creating hierarchical rows/columns) to gain insights into the dataset.		
	Fitting Linear Regression in Excel: 27. Import a dataset containing variables for linear regression analysis (e.g., independent and dependent variables). **28.** Use Excel's built-in regression analysis tool to fit a linear regression model to the data and calculate coefficients, standard errors, and goodness-of-fit measures.		
	Creating Charts from Regression Analysis: 29. Perform linear regression analysis on a dataset containing independent and dependent variables. **30.** Create a scatter plot chart to visualize the relationship between the variables, including the regression line and confidence intervals.		
	Pivot Chart: 31. Create a pivot chart based on a pivot table summarizing key metrics from a dataset. **32.** Customize the pivot chart to display data trends and patterns dynamically as the underlying pivot table data is updated.		
	Dashboards: 33. Design a dashboard incorporating multiple charts and pivot tables to provide a comprehensive overview of business metrics or performance indicators. **34.** Use interactive features such as slicers and timeline controls to enable users to filter and analyse data dynamically.		
	Form Controls: 35. Add form controls such as checkboxes, dropdown lists, and option buttons to interact with charts and pivot tables. **36.** Create interactive features allowing users to customize chart views or update data dynamically based on user inputs.		

References

1. "Excel 2019 Bible" by Michael Alexander and Richard Kusleika
2. "Excel Formulas & Functions For Dummies" by Ken Bluttman and Peter Aitken
3. “Excel with Microsoft Excel: Comprehensive & Easy Guide to Learn Advanced MS Excel” by Naveen Mishra

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Final Exam

Programme	BSc IT				
Course Code	ITY8VN401				
Course Title	Data Science Programming using R				
Type of Course	Vocational Minor				
Semester	VIII				
Academic Level	400 - 499				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1.Basic knowledge about Data Science 2. Basic knowledge about Programming languages				
Course Summary	The R programming course offers a comprehensive overview of the R language, encompassing fundamental principles and practical abilities essential for data analysis and statistical computing.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate how to install and configure RStudio	U	C	Instructor-created exams / Quiz
CO2	Apply OOP concepts in R programming	U	C	Practical Assignment / Group Tutorial Work
CO3	Explain the use of data structure and loop functions	U	C	Practical Assignment / Group Tutorial Work
CO4	Understand the concept of data frames	U	C	Instructor-created exams / Home Assignments

CO5	Implement the DPLYR package and Data Visualization	Ap	P	Practical assignments and practical tests
CO6	Implementation of R Programming concepts	Ap	M	Practical assignments and practical tests

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs (45+30)	Marks
I		**Fundamentals Of R**	**10**	**10**
	1	Installation of R & R Studio	2	
	2	Features of R,Variables ,Constants	2	
	3	Operators	2	
	4	Datatypes and R Objects	2	
	5	Accepting Input from keyboard, Important Built-in functions	2	
II		**Vectors, Matrices and Lists**	**15**	**20**
	6	Vectors-Accessing elements of a Vector, Operations on Vectors	3	
	7	Vector Arithmetic	2	
	8	Matrices-Accessing elements of a Matrix	2	

	9	Operations on Matrices, Matrix transpose	3	
	10	Creating lists, manipulating list elements, Merging lists	3	
	11	Converting lists to vectors	2	
III	**Control Statements , Functions And Arrays In R**		**10**	**20**
	12	If statement, if…else statement, if else () function, switch () function	1	
	13	repeat loop, while loop, for loop, break statement, next statement	2	
	14	Formal and Actual arguments, Named arguments	1	
	15	Global and local variables, Argument and lazy evaluation of functions	2	
	16	Recursive functions, String and string functions	2	
	17	Creating arrays, Accessing array elements, Calculations across array elements	2	
IV	**Data Manipulation -Dplyr Package And Data Visualization In R**		**10**	**20**
	18	R factors and Data Frames, Load data into data frame	2	
	19	Viewing the data Selecting columns, selecting rows, Reordering the rows	2	
	20	Pipe operator, Group operations	2	
	21	Data Visualization-Bar plot, Plotting categorical data, Stacked bar plot, Histogram	2	
	22	Plot () function and line plot, pie chart / 3D pie chart, Scatter plot, Box plot	2	

V	**Practical Applications**	**30**	
	Implement the following: Implementation of Vectors, Matrices and Lists Implementation of Control statements, functions and Arrays Usage of DPLYR package and data Visualization Case Study with any Data Set (MNIST/IRIS)	30	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	1	-	-	-	-						
CO 2	1	2	1	-	-	-						
CO 3	2	2	2	2	-	1						
CO 4	2	2	2	2	1	2						
CO 5	3	3	2	2	2	2						
CO6	3	3	3	3	3	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5			✓	
CO6			✓	

References:

1. “The Book of R” by Tilman M. Davies, no starch press(San Francisco)

2. “The Art of R programming” by Norman Matloff, no starch press(San Francisco)

Programme	BSc IT				
Course Code	ITY8VN402				
Course Title	Predictive Modelling				
Type of Course	Vocational Minor				
Semester	VIII				
Academic Level	400-499.				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. Basic Mathematical Concepts 2. Basic Statistics				
Course Summary	Predictive Modeling gives undergraduate students a solid foundation in predictive analytics techniques essential for data-driven decision-making. The course covers key topics such as correlation, covariance, linear regression, multiple regression, polynomial regression, logistic regression, and time series analysis and forecasting.				

Course Outcomes (CO): .

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply correlation and covariance analysis to assess relationships between variables.	Ap	P	Problems/ Projects
CO2	Implement linear, multiple, and polynomial regression models to predict outcomes from numerical data.	Ap	P	Problems/ Projects
CO3	Employ time series analysis techniques to identify trends, and seasonal patterns, and make accurate forecasts.	An	P	Problems/ Projects
CO4	Evaluate model performance and interpret results to inform business decisions.	An	P	Analysis of reports and case studies
CO5	Utilize logistic regression to classify categorical outcomes and make data-driven decisions.	Ap	P	Projects
CO6	Acquire proficiency in building predictive models using real-world datasets	U	C	Assignments/ Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)				

Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (48)	Marks (70)
I	**Correlation & Covariance**		**8**	**12**
	1	Data types or levels of measurement- Nominal, ordinal, interval and ratio	2	
	2	Covariance sample and population, sign and magnitude of covariance,	1	
	3	The covariance matrix, Covariance vs Correlation	2	
	4	Measures of Correlation, Simple correlation	1	
	5	Partial correlation and Multiple correlations	2	
II	**Regression Techniques**		**12**	**16**
	6	Simple linear regression	2	
	7	Basics of fitting and residual analysis	2	
	8	Multiple linear regression	2	
	9	Gauss Markov theorem	2	
	10	Least Squares Method, ordinary least squares, weighted least squares	2	
	11	Polynomial regression	2	
III	**Logistics Regression**		**11**	**14**
	12	Basics of Logistic regression	2	
	13	Logistic regression with binary predictor	2	
	14	Odds ratio, z-statistic, p-values	3	
	15	Confidence intervals	2	
	16	Logistic regression with categorical predictors	2	
IV	**Time Series analysis and forecasting**		**16**	**28**
	17	Components of time-series, additive and multiplicative models	3	
	18	Methods for measurement of trends	2	
	19	Methods for measurement of seasonal fluctuations	3	
	20	Forecasting, Autocorrelation	2	
	21	ARIMA Model	3	
	22	ARMA Model	3	
V	**Open Ended Module: Assignments, Case study**		**12**	
	1. Provide real-world examples to understand the relationships between variables in data analysis using covariance, correlation 2. Using real examples, understand the difference between different types of correlation. 3. Provide examples for nominal, ordinal, interval, and ratio data types 4. Provide examples of how linear regression is used in various fields such as economics, finance, healthcare, and engineering to analyse relationships between variables and make predictions.		4	
	5. Analyse the relationship between different variables using multiple linear regression. Eg: Health Care analytics: patients'		8	

	demographics, lifestyle factors, and medical history using multiple linear regression. 6. Analyse the relationship between different variables using logistic regression. Eg: Predict the risk of developing a certain disease (e.g., diabetes, cancer) using logistic regression with binary predictors such as genetic markers, lifestyle factors, and medical history. 7. Analyse the time series model using ARIMA/ ARMA model		

Mapping of COs with PSOs and POs:

	PSO1	PSO 2	PSO 3	PSO4	PSO 5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	3	-	-	-						
CO 2	3	-	3	2	-	2						
CO 3	3	-	3	2	-	2						
CO 4	-	-	2	-	-	2						
CO 5	3	-	3	2	-	2						
CO 6	-	-	2	-	-	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓	✓	✓
CO 2	✓	✓	✓	✓
CO 3	✓	✓	✓	✓

CO 4	✓		✓	✓
CO 5	✓			✓
CO 6	✓			✓

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Final Exam

References:

1. Fan, Jianqing, et al. Statistical Foundations of Data Science. United States, CRC Press, 2020.
2. Hilbe, Joseph M. Practical Guide to Logistic Regression. United States, CRC Press, 2016.
3. Nielsen, Aileen. Practical Time Series Analysis: Prediction with Statistics and Machine Learning. United States, O'Reilly Media, 2019.
4. Fundamentals of Mathematical Statistics. United Kingdom, Sultan Chand & Sons, 2020.

General Foundation Courses

General Foundation Papers

Programme	BSc IT				
Course Code	ITY1FM105				
Course Title	Introduction to Computers and Office Automation.				
Type of Course	MDC				
Semester	I				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic knowledge of computers & Internet.				
Course Summary	This course focuses on the use of computer technology and software applications to automate routine office tasks and streamline business processes. Students will be able to use computer technology to enhance communication and data management.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the fundamentals of computer Hardware and Software and Computer Networks.	U	C	Instructor-created exams / Quiz/ Assignment/ Seminar
CO2	Understand the fundamentals of word processing and its importance in office automation. Demonstrate proficiency in creating, editing, and formatting documents using word processing software. Explore advanced formatting options and features	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO3	Understand the fundamentals of electronic spreadsheets and their role in data analysis, manipulation, and presentation. Demonstrate proficiency in creating, saving, and editing workbooks and worksheets within electronic spreadsheet software. Utilize various data entry techniques. Handle operators in formulas and utilize a wide range of functions.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	Demonstrate proficiency in creating, manipulating, and enhancing slides within presentation software, including adding text, images, shapes, and multimedia elements. Expertise	Ap	P	Practical Assignment / Instructor-created exams / Quiz

	in utilizing organizational charts and various chart types to represent hierarchical structures and data trends effectively. Explore drawing tools to create custom shapes, diagrams, and illustrations.			
CO5	To empower students to design and implement automation solutions in real- world scenarios.	Ap	P	Case study/ Project
CO6	Gaining a deep understanding of emerging trends and technologies in the field of automation.	U, Ap	P	Assignment/ Seminar
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (36+9)	Marks
I		**Introduction To Computers**	**8**	**14**
	1	Types of Computers	1	
	2	Hardware: CPU, Input/Output Devices. Storage Devices, memory hierarchy, RAM, ROM, Secondary Memory,and Registers.	3	
	3	Software: Types of Software, computer languages, language translators, and Operating Systems.	2	
	4	Computer Networks: LAN, WAN, MAN, Client -Server	2	
II		**Documentation Using a Word Processor (OpenOffice Writer / M.S. Word)**	**8**	**12**
	5	Introduction to Office Automation, Word Processing Concepts - creating and editing documents, Formatting documents.	3	
	6	Finding and Replacing Text, Printing documents, Auto-text, Autocorrect, Spelling and Grammar Tools.	2	
	7	Document Dictionary, Graphics, Tables, Charts, Columns, Page Borders, Bookmark.	1	
	8	Advanced Features- Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding objects, Template.	2	
III		**Electronic Spread Sheet (Open Office Calc/MS- Excel)**	**10**	**12**
	9	Introduction to Spread Sheet, Spreadsheet Concepts, Creating, Saving, and Editing a Workbook.	2	
	10	Inserting, deleting worksheets, entering data in a Cell/Formula, Copying and moving data from selected Cells.	1	
	11	Handling Operators in Formula. Functions: Mathematical, Logical, Statistical, Text, Financial, Date and Time, Function Wizard.	1	
	12	Formatting a Worksheet, Formatting Cells, and Changing Data alignments. Changing date, Character, Number, Currency format,	2	

		Changing font.		
	13	Adding borders and colors, Printing Worksheets, Charts and graphs, creating previewing and modifying charts, Conditional Formatting, and Filters.	3	
	14	Advanced features – Pivot table & Pivot Chart, Linking and Consolidation	1	
IV	**Presentation using (OpenOffice Impress/MS- Power Point)**		**10**	**12**
	15	Presentations, Creating, Manipulating & Enhancing Slides.	2	
	16	Organizational Charts, Charts, Drawing objects, clip arts, Word Art, Layering art Objects.	4	
	17	Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.	4	
V	**Open Ended Module**		**9**	
	1	• Design and Implement Automation Solutions in real-world scenarios • Understand Future Trends in Automation	9	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	3	-	-	-	-						
CO 2	3	2	-	-	3	-						
CO 3	3	2	-	-	3	-						
CO 4	3	2	-	-	3	-						
CO 5	3	1	-	-	3	-						
CO 6	3	1	-	-	3	3						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. P. K. Sinha and P. Sinha, “Foundations of Computing”. BPB Publicaiion.
2. Russell A. Stultz, Learn Microsoft Office, BPB Publication.
3. S. Sagman. “Microsoft Office 2000 for Windows”. Pearson Education.
4. Turban, Mclean and Wetherbe. “Information Technology and Management John Weily and Sons.

Programme	BSc IT				
Course Code	ITY2FM106				
Course Title	Digital Empowerment through Ethical Standards				
Type of Course	**MDC**				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic understanding of computers				
Course Summary	This course explores the evolution from pre-digital challenges to the current digital landscape, covering historical milestones, key technologies, and the vision of Digital India. It emphasizes the benefits and importance of digital revolution while addressing ethical and security considerations. Participants engage with digital tools for personal and professional growth and examine case studies on digital infrastructure, missions, and services to understand real-world applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Students will be able to analyse the challenges of the pre-digital age and comprehend the importance and benefits of digital revolution, facilitating a deeper understanding of technological evolution.	An	F	Instructor-created exams / Quiz
CO2	Participants will gain familiarity with key digital technologies like Cloud Computing, IoT, AI, and Blockchain, equipping them with the knowledge to identify their applications and potential benefits in different sectors.	U	C	Instructor-created exams/ Home Assignments
CO3	Students will develop insights into Digital India initiatives and emergence of Kerala as Digital Society	U	C	Instructor-created exams
CO4	Through exploration of digital tools	Ap	P	Instructor-

	for personal and professional growth, students will enhance their digital literacy and ability in utilizing tools for data sharing, online learning, networking, and content creation, empowering them to thrive in the digital age.			created exams
CO5	Learners will become aware of ethical and security considerations in the digital age, including privacy concerns, Intellectual Property Rights, key terminologies related to cyber security, and an introduction to cyber laws in India, fostering responsible digital citizenship.	U	C	Instructor-created exams
CO6	Students will analyse real-world case studies of digital infrastructure projects, digital missions, and digital services to demonstrate a comprehensive understanding of the practical applications and implications of digital technologies in various contexts, fostering critical thinking and strategic decision-making skills in digital transformation initiatives.	An	C	Instructor-created exams
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs 36+9	Marks (50)
I	**Transition to Digital World**		**7**	**8**
	1	Challenges of Pre-Digital Age	1	
	2	Importance and Benefits of Digital Revolution	2	
	3	Key concepts: digitization, digitalization, digital transformation	1	
	4	Introduction to Key Digital Technologies: Cloud Computing, IoT, AI, Block Chain	3	

II	**Perspective of Digital India & Digital Innovations in Kerala**		**11**	**15**
	5	Understanding Digital India: Concept, Objectives, and Evolution	1	
	6	Overview of Digital Infrastructure: Broadband Connectivity, Digital Literacy, and Access to Information	2	
	7	Vision of Digital India: DigiLocker, E-Hospitals, e-Pathshala, BHIM, , e-Health Campaigns	3	
	8	Kerala-Emergence as Digital Society : Internet & Mobile Penetration in Kerala, 4 Pillars of Digital Emergence in Kerala (Akshaya Project, IT@School Project, Digital Infrastructure Availability, State Data Centre & allied Applications),	2	
	9	Role of K-DISC in Digital Empowerment	1	
	10	Kerala State IT Mission: Core IT Infrastructure, e-Governance Applications, Service Delivery Platforms,	2	
III	**Digital Tools for Personal and Professional Growth**		**9**	**12**
	11	Digital Tools for Data Sharing: Google Drive, Google Sheets	2	
	12	Digital Tools for Data Sharing: Google Docs, Google Classroom	3	
	13	Online learning platforms and resources (e.g., Coursera, Khan Academy, MOOCs, Duolingo)	2	
	14	Networking Tools: LinkedIn	1	
	15	Content Creation and Management: Canva	1	
IV	**Ethical and Security Considerations in the Digital Age**		**9**	**15**
	16	Understanding privacy in the digital age	1	
	17	Legal and ethical considerations in data collection and processing: Intellectual Property Rights (IPR)	2	
	18	Key Terminologies: Cyber Security, Cyber Crime, Cyber Attack, Cyber Espionage, Cyber Warfare	2	
	19	Authentication, Authorisation	1	
	20	Cyber Crimes and Classification	2	
	21	Introduction to Cyber Laws in India	1	
V	**Open Ended Module: Case Study (One from each set)**		**9**	
	1	Case Study on Digital Infrastructure Projects: (Bharat Broadband Network (BBNL) , Submarine Cable Project, Google Data Center)	3	
	2	Case Study on Digital Mission:	3	

		(Digital Literacy Missions in Kerala, SmartDubai Project, China's Digital Silk Road)		
	3	Case Study on Digital Services: (MyGov.in , Moodle LMS, Digital Payment Services)	3	

References

1. "Digital India Importance Needs and Values" by S K Kaushal
2. "Cyber Security in India: Government, Law Enforcement and Corporate Sector" by Vipin M. Chaturvedi and Shivani Kapoor
3. "Information Security: Principles and Practices in Indian Context" by R.S. Pressman, G. Sharma, and G. Sridhar
4. "Introduction to Computer Security" by Michael Goodrich and Roberto Tamassia
5. https://kdisc.kerala.gov.in/
6. https://itmission.kerala.gov.in/

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Final Exam

Programme	BSc IT				
Course Code	ITY3FV108				
Course Title	Professional Skill Development for IT Career Excellence				
Type of Course	VAC				
Semester	III				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	1. Basic Mathematics 2. Basic English reading and Writing Skills				
Course Summary	The course provides a comprehensive overview of essential skills and knowledge relevant to success in information technology. It covers various topics, including personal development, communication, quantitative reasoning, programming, software development, and web technologies.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Students will demonstrate effective communication skills, including verbal and written communication, and adhere to professional etiquette standards in various contexts, including digital communication.	Ap	C	Assignment / Instructor-created exams / Quiz
CO2	Students will develop job readiness skills, including resume writing, job application preparation, and interview techniques, to enhance their employability and succeed in job interviews.	E	C	Assignment / Instructor-created exams / Quiz
CO3	Students will collaborate effectively in group discussions and presentations, demonstrating teamwork, leadership, and critical thinking skills in diverse group settings.	Ap	C	Assignment / Instructor-created exams / Quiz
CO4	Students will apply quantitative and logical reasoning skills to solve mathematical problems, analyse data, and make informed decisions in various contexts, including financial and analytical reasoning.	Ap	C	Assignment / Instructor-created exams / Quiz
CO5	Students will understand fundamental programming concepts, data structures, and database principles, and apply them to solve	Ap	C	Assignment / Instructor-created exams / Quiz

	computational problems and develop software applications.			
CO6	The student will be able to learn areas and skills essential for success in the IT industry, including communication, problem-solving, programming, and technology integration.	Ap	C	Assignment / Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs (36+9)	Marks
I		**Introduction to Soft Skills and Academic Skills**	**10**	**15**
	1	Personality Development: Knowing Yourself, Positive Thinking, Communication Skills, Professional Etiquette	2	
	2	Employment Communication: Introduction, Resume, Curriculum Vitae, Developing an Impressive Resume, Job Application or Cover Letter	2	
	3	Job Interviews: Definition of Interview, Types of Interviews, Preparatory Steps for Job Interviews, Interview Skill Tips	2	
	4	Group Discussion: Importance of Group Discussions, Difference between Group Discussion, Panel Discussion and Debate, Preparing the Presentation, Delivering the Presentation	2	
	5	HR round: Self Introduction, Strength and Weakness Analysis, Scenario-Based Tasks, Body Language, Positive Attitude	2	
II		**Basic Aptitude Skills**	**9**	**15**
	6	Number System: HCF and LCM, Decimal Fraction, Problems on Age	2	
	7	Square Root, Cube Root, Problems on Numbers,	1	
	8	Problems on Speed, Time and Distance, Percentage, Problems on Trains	2	
	9	Profit and Loss, Ratio and Proportion, Partnership	2	
	10	Simple Interest, Compound Interest, Chain Rule, Problems on Callender and Clock	2	
III		**Reasoning Skills Development**	**9**	**10**
	11	Verbal Reasoning: Antonym and Synonym, Verbal Analogies, Spotting Errors, Ordering Words, Sentence correction, Fill in blanks, Replace the word, Idioms and	3	

		Phrases		
	12	Logical Reasoning Aptitude: Series: Missing Numbers, Odd One Out, Assumptions and Conclusions, Alpha-Numeric Sequence Puzzle, Number, Ranking & Time Sequence Test	3	
	13	Non-Verbal Reasoning: Choosing the Missing Figure in a Series, Choosing the Set of Similarly Related Figures, Dot Situation, Basic Analytical Reasoning	3	
IV	**Technical Skills and Programming Skills**		**8**	**10**
	14	Concept of Procedure-Oriented Programming and Object-Oriented Programming, Basic structure of C Programming	2	
	15	Data Structures: Array, Linked list, Stack, Queue, Tree and Graphs (Concept Only)	2	
	16	Database Concept: ER Model, Normalisation, ACID Property, DML and DDL	2	
	17	Basic Concept of SDLC, Agile Model(Concept Only), Blackbox and Whitebox Testing(Concept)	2	
V	**Open Ended Module- Application Level**		**9**	
		Assign the tasks from the following • Writing an impressive resume • Active listening and feedback mechanisms • Conduct Ice breaking Session • Assign students to participate in a group discussion on a given topic and write a reflective analysis of their experience, including observations on communication dynamics, collaboration, and leadership. • Pair students and assign roles (interviewer and interviewee) to conduct mock interviews based on various scenarios, such as behavioural questions, technical challenges, or situational inquiries. • Task students with designing and delivering a professional presentation on a topic related to their field of study or interest, incorporating effective visual aids, storytelling techniques, and audience engagement strategies. • Conduct low-level Aptitude tests, including Verbal and Non-Verbal Reasoning. • Conduct high-level Aptitude tests, including Verbal and Non-Verbal Reasoning. • Writing Simple programming in any language.		

		• Assign students to research and analyse a real-world software development project, applying concepts of the Software Development Life Cycle (SDLC)		

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	2	1	-	-						
CO 2	1	1	2	1	-	-						
CO 3	-	3	1	1	-	-						
CO 4	-	3	3	2	-	-						
CO 5	-	1	3	3	1	-						
CO 6	-	1	3	3	1	-						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓

CO 5	✓	✓		✓
CO 6	✓	✓		✓

Reference:

1. Chauhan, G. S., & Sharma, S. (2016). Soft Skills: An Integrated Approach to Maximise Personality. Wiley India.
2. Sonmez, J. (2015). Soft Skills: The Software Developer's Life Manual. Manning Publications.
3. Mitra, B. K. (2011). Personality Development and Soft Skills. Oxford University Press.
4. Aggarwal, R. S. (2017). Quantitative Aptitude for Competitive Examinations. S. Chand Publishing.
5. Verma, R. (2018). Fast Track Objective Arithmetic. Arihant Publications.
6. Aggarwal, R. S. (2018). A Modern Approach to Verbal and Non-Verbal Reasoning. S. Chand Publishing.
7. Rizvi, M. A. (2005). Effective Technical Communication. Tata McGraw-Hill Publishing.

Programme	BSc IT				
Course Code	ITY4FV110				
Course Title	Introduction to Cyber laws				
Type of Course	VAC				
Semester	IV				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	3	45
Pre-requisites	1. Basic Computer Literacy 2. Familiarity with Online Platforms 3. Willingness to Learn				
Course Summary	Introduction to Cyber laws provides students with a foundational understanding of various concepts Cyber Crimes and Cyber laws against them.				

Course Code		Course Title Introduction to Cyber Laws		
Credit 3		Duration 45 hrs		
Sl. NO:	Course Outcome	Cognitive level *	Knowledge category #	Evaluation Tools used
CO1	To understand the concept of Cyber Space ,Cyber Crimes and cyber laws	U	C	Instructor-Create Exams or Quiz
CO2	To understand details of cyber crimes and criminals	A	P	Discussions and Quizzes
CO3	To examine various provisions in IT Act 2000	U	F	Instructor created exams or Home assignments
CO4	To Identify Intellectual Property right and E-commerce related issues.	A ,E	P	Discussions, Quizzes
CO5	To get overall idea of cyber laws and its	Ap	P	Viva Voce

	enforcement mechanisms in India			Observation of practical skills
CO6	To get to know about Penalties and legal implications associated with cyber crimes under Indian law	U	M	Instructor Created - Exams, Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Module	Unit	Content	Hrs	Marks
I		Introduction to cyber space	**9**	**12**
	1	Cyber Space- Fundamental definitions	2	
	2	Jurisprudence and-Jurisdiction in Cyber Space	2	
	3	Need for IT act - Enforcement agencies	3	
	4	Introduction to cyber law and its relevance in the Indian context	2	
II		**Cyber Crimes and Criminals**	**9**	**12**
	5	Cyber crimes	2	
	6	Cyber Criminals and their Objectives	2	
	7	Cyber stalking; cyber pornography	2	
	8	Forgery and fraud; crime related to IPRs;	2	
	9	Phishing and Identity Theft	1	
III		**Indian Cyber law**	**9**	**14**
	10	Introduction to Indian Cyber Law	2	
	11	Cyber Crime vs Conventional Crime	2	
	12	Electronic Commerce and related issues	2	
	13	Overview of Intellectual Property rights	2	
	14	Computer Software and related IPR Issues	1	
IV		**Basics of IT law and its regulatory mechanisms**	**9**	**12**
	13	Key provisions of the Information Technology Act, 2000 related to cyber crimes and offenses	2	
	14	Regulatory Mechanisms and Enforcement	2	
	15	Overview of the Cyber Crime Investigation Cell (CCIC)	2	
	16	Understanding the process of reporting cyber crimes	2	
	17	Penalties and legal implications associated with cyber crimes under Indian law (basics only)	1	
V		**Hands-on :** **Practical Applications, Case Study and Course Project**	**9**	
	1	Social Media based Cyber crimes	2	
	2	Discussion on Emerging issues	2	
	3	Recent trends in digital marketing	3	
	4	Demonstrate how to use google web masters Indexing Using API	2	

References:

1. Cyber law –The Indian perspective by Pavan Duggal
2. Justice Yatindra Singh: Cyber Laws, Universal Law Publishing Co., New Delhi
3. Farouq Ahmed, Cyber Law in India, New Era publications, New Delhi

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5		✓		✓
CO6				✓

Programme	BSc IT				
Course Code	ITY5FS112				
Course Title	Introduction to Digital Marketing				
Type of Course	SEC				
Semester	V				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	3	45
Pre-requisites	1. Basic Computer Literacy 2. Familiarity with Online Platforms 3. Willingness to Learn				
Course Summary	Introduction to Digital Marketing" provides students with a foundational understanding of key concepts and techniques in the rapidly evolving field of digital marketing. Through engaging lectures. Students will explore various digital marketing channels, including search engine optimization (SEO), social media marketing, email marketing, and content marketing				

Course Code		Course Title Introduction to Digital Marketing		
Credit 3		Duration 45 hrs		
Sl. NO:	Course Outcome	Cognitive level *	Knowledge category #	Evaluation Tools used
CO1	To understand the concept of digital marketing and its integration with traditional marketing	U	C	Instructor-Create Exams or Quiz
CO2	To understand customer value journey in digital context and behaviour of online consumers	A	P	Discussions and Quizzes

CO3	To examine various tactics for enhancing a website's position and ranking with search engines	U	F	Instructor created exams or Home assignments
CO4	To Identify and differentiate between various digital marketing channels, including SEO, social media, email, and content marketing.	A ,E	P	Discussions, Quizzes
CO5	To get overall idea in implementing basic digital marketing strategies to enhance online visibility and engagement.	Ap	P	Viva Voce Observation of practical skills
CO6	To get to know about ethical considerations and best practices in digital marketing, including privacy, data protection, and consumer trust	U	M	Instructor Created - Exams, Assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus

Module	Unit	Content	Hrs	Marks
I		Digital Marketing Basics	**9**	**12**
	1	Overview of digital marketing	2	
	2	Importance of digital marketing for businesses	2	
	3	Introduction to key digital marketing channels (SEO, social media, email marketing)	3	
	4	Basics of creating a digital marketing strategy	2	
II		**Content Marketing & Social Media**	**9**	**12**
	5	Content Marketing Fundamentals	2	
	6	Content Strategy Development	2	
	7	Content Creation for Different Platforms	2	
	8	Introduction to Social Media Marketing & keyword Optimization	2	
	9	Social Media Strategy & Community Management	1	
III		**Search Engine Optimization (SEO) & Paid Advertising**	**9**	**14**
	10	Introduction to Search Engine Optimization	2	

	11	On-page and Off-page SEO Techniques	2	
	12	Search Engine Marketing (SEM) Fundamentals	2	
	13	Pay-Per-Click (PPC) Advertising with Google Ads	2	
	14	Social Media Advertising Platforms	1	
IV	**Web Analytics & Emerging Trends**		**9**	**12**
	13	Introduction to Web Analytics & Key Metrics	2	
	14	Using Analytics Tools for Data-Driven Decision Making	2	
	15	Conversion Tracking & Optimization	2	
	16	Emerging Trends in Digital Marketing	2	
	17	The Future of Marketing	1	
V	**Hands-on : Practical Applications, Case Study and Course Project**		**9**	
	1	**S**ocial Media Marketing-Social media Channels	2	
	2	Leveraging social media for brand conversions and buzz	2	
	3	Recent trends in digital marketing	3	
	4	Demonstrate how to use google web masters Indexing Using API	2	

References:

1. Digital Marketing for Dummies by Ryan DeWald
2. MARKETING 4.0 Moving from Traditional to Digital PHILIP KOTLER HERMAWAN KARTAJAYA IWAN SETIAWAN
3. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited
4. Taxmanns - Digital Marketing - Satinder Kumar, Supereet Kaur
5. Social Media Marketing 2024 - Mastering New Trends & Strategies for Online Success - Robert Hill

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓	✓		✓
CO 3	✓			✓
CO 4	✓			✓
CO 5		✓		✓
CO6				✓