Bharati Vidyapeeth

(Deemed to be University)
Pune, India

College of Engineering, Pune

B.Tech. Computer Science and Business Systems

(2023 Course)

Program Curriculum

As Per NEP Guidelines

VISION OF UNIVERSITY:

Social Transformation through Dynamic Education

MISSION OF UNIVERSITY:

- To make available quality education in different areas of knowledge to the students as per their choice and inclination.
- To offer education to the students in a conducive ambiance created by enriched infrastructure! and academic facilities in its campuses.
- To bring education within the reach of rural, tribal and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities.
- To make available quality education to the students of rural, tribal and other deprived sections of the population

VISION OF THE INSTITUTE:

To be World Class Institute for Social Transformation Through Dynamic Education.

MISSION OF THE INSTITUTE:

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet needs of profession and society.
- To provide an environment conducive to innovation, creativity, research and entrepreneurial leadership.
- To practice and promote professional ethics, transparency and accountability for social community, economic and environmental conditions.

VISION OF THE DEPARTMENT

To syndicate industry and institute to impart high quality knowledge through scholarity, research and creative endeavour

MISSION OF THE DEPARTMENT

- To impart contemporary technology conforming to a dynamic curriculum.
- To engage in professional development and scholarly endeavour through knowledge of common business principles.
- To promote the awareness of business discipline and ethical responsibility through industry alliance

Program Educational Objectives (PEOs)

1. Prevail technical competency to concord the industry's engrossment.
2. Assimilate business management skills.
3. Instigate business level innovation with societal consideration.

Program Specific Outcomes (PSOs)

Students of B. Tech (CSBS) will be

PSO1: Able to solve business problems using creative thinking, practical ideas, and knowledge of finance and modern technologies.

PSO2: Able to choose effective business communication techniques in professional Institute/organization.

Program Outcomes (POs)

The students of B.Tech (Computer Science & Business Systems) will be able to

1. Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified to develop to the solution of complex engineering problems.
2. Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
3. Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
4. Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
5. Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
6. Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
7. Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
8. Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences .
10. Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one’s own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

A. DEFINITION OF CREDITS:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
1 Hour Practical (P) per week	0.5 credits
2 Hours Practical (Lab)/week	1 credit

B. COURSE CODE AND DEFINITION

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
TW	Term Work
O	Oral
SEE	Semester End Examination
MJ	Major (Core) Courses
MI	Minor Courses
GE	General Elective Courses
OE	Open Elective Courses
SE	Skill Enhancement Courses
AE	Ability Enhancement Courses
VE	Vocational Enhancement Courses
VS	Vocational Skill Courses
MAC	Mandatory Credit Course
VA	Value Added Courses
CC	Co-curricular Courses
EC	Extra-Curricular Courses
ID	Inter-disciplinary Courses

MD	Multidisciplinary Courses
RP	Research I Project Courses
PC	Practical Courses
BS	Basic Science
ES	Engineering Science
AC	Audit Course
EC	Extracurricular Activities
BM	Basic Mathematics
BP	Basic Physics
BC	Basic Chemistry
UH	Universal Human Values
ET	Electrical Technology

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester –I (NEP 2023 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	L	P	T	Total
1.	MJ	MJ1106101	Discrete Mathematics	3	2	-	60	40	25	-	-	125	3	1	-	4
2.	BM	BM1106102	Introductory Topics in Statistics, Probability and Calculus	4	-	-	60	40	-	-	-	100	4	-	-	4
3.	MJ	MJ1106103	Fundamentals of Computer Science	4	2	-	60	40	25	25	-	150	4	1	-	5
4.	ET	ET1106104	Principles of Electrical Engineering	3	2	-	60	40	25	-	-	125	3	1	-	4
5.	BP	BP1106105	Physics for Computing Science	3	2	-	60	40	50	-	-	150	3	1	-	4
6.	AE	AE1106106	Business Communication & Value Science- I	2	2	-	-	-	25	-	25	50	2	1	-	3
7.	SE	SE1106107	Skill Based Course I- (Computer Aided Drawing and Design)	-	2	-	-	-	25	25	-	50	-	1	-	1
			Total	**19**	**12**	**0**	**300**	**200**	**175**	**50**	**25**	**750**	**19**	**6**	**0**	**25**
8.	BS	BS1106108	Induction Program (Non-Credit)	-	-	-	-	-	-	-	-	-	-	-	-	-

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – II (NEP 2023 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	L	P	T	Total
1	BS	BS1106201	Linear Algebra	3	2	-	60	40	25	-	-	125	3	1	-	4
2	BS	BS1106202	Statistical Methods & Modelling	4	2	-	60	40	25	-	-	125	4	1	0	5
3	MJ	MJ1106203	Data Structure and Algorithms	4	2	-	60	40	25	25	-	150	4	1	0	5
4	ES	ES1106204	Principles of Electronics	3	2	-	60	40	25	-	25	150	3	1	0	4
5	MJ	MJ1106205	Fundamental of Economics	3	-	-	60	40	-	-	-	100	3	-	-	3
6	MJ	MJ1106206	Business Communications & Value Science - II	2	2	-	-	-	25	-	25	50	2	1	-	3
7	SE	SE1106207	Skill Based Course II- (Computer Workshop Technology)	-	2	-	-	-	25	25	-	50	-	1	-	1
			Total	**19**	**12**	**0**	**300**	**200**	**150**	**50**	**50**	**750**	**19**	**6**	**0**	**25**
8	BS	BS1106208	Environmental Sciences (Non-Credit)	-	-	-	-	-	-	-	-	-	-	-	-	-

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – III (NEP 2023 COURSE)

Sr. No.	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	MJ	MJ1106301	Formal Language and Automata Theory	3	-	1	60	40	25	-	-	125	3	-	1	4
2.	ID	ID1106302	Computer Organization and Architecture	3	2	-	60	40	25	-	-	125	3	1	-	4
3.	MJ	MJ1106303	Software Engineering	3	2	-	60	40	25	25	-	150	3	1	-	4
4.	MJ	MJ1106304	Computational Statistics	3	-	-	60	40	-	-	-	100	3	-	-	3
5.	MJ	MJ1106305	Object Oriented Programming	3	2	-	60	40	25	-	25	150	3	1	-	4
6.	SE	SE1106306	Skill Based Course III (Data Science with Python)	-	2	-	-	-	25	-	25	50	-	1	-	1
			Total	**15**	**8**	**1**	**300**	**200**	**125**	**25**	**50**	**700**	**15**	**4**	**1**	**20**
7.	AC	AC1106307	Indian Knowledge System	2	-	-	-	100	-	-	-	-	-	-	-	2
8.	VA	VA1106308	Value Added Course- I	2	-	-	-	100	-	-	-	-	-	-	-	2

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – IV (NEP 2023 COURSE)

Sr. No.	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ES E	IA	TW	OR	PR	Total	L	P	T	Total
1.	MJ	MJ1106401	Operating Systems	3	2	-	60	40	25	25	-	150	3	1	-	4
2.	MJ	MJ1106402	Database Management Systems	3	2	-	60	40	25	-	25	150	3	1	-	4
3.	ID	ID1106403	Introduction to Innovative IP Management & Entrepreneurship	2	-	-	60	40	-	-	-	100	2	-	-	2
4.	MJ	MJ1106404	Design Thinking	3	2	-	60	40	25	-	-	125	3	1	-	4
5.	MJ	MJ1106405	Operation Research	3	2	-	60	40	25	-	-	125	3	1	-	4
6.	SE	SE1106406	Skill Based Course IV (Software Design with UML)	-	2	1	-	-	25	-	25	50	-	1	1	2
			Total	**14**	**10**	**1**	**300**	**200**	**125**	**25**	**50**	**700**	**14**	**5**	**1**	**20**
7.	AE	AE1106407	**MOOC - I	-	-	-	-	-	-	-	-	-	-	-	-	2
8.	EC	EC1106408	**Social Activity	-	-	-	-	-	-	-	-	-	-	-	-	2

**** Indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – V (NEP 2023 COURSE)

Sr. No.	Category	Subject Code	Name of Subject	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1	MJ	MJ1106501	Design and Analysis of Algorithms	3	2	-	60	40	25	-	25	150	3	1	-	4
2	MJ	MJ1106502	Computer Network	3	2	-	60	40	25	-	25	150	3	1	-	4
3	MJ	MJ1106503	Business Strategy	2	-	-	60	40	-	-	-	100	2	-	-	2
4	MJ	MJ1106504	Artificial Intelligence	3	2	-	60	40	25	25	-	150	3	1	-	4
5	PE	PE1106505	Program Elective Course I	3	2	-	60	40	25	25	-	150	3	1	-	4
6	SE	SE1106506	Skill-Based Course V (Java Programming)	-	4	-	-	-	25	-	25	50	-	2	-	2
			Total	**14**	**12**	**0**	**300**	**200**	**125**	**50**	**75**	**750**	**14**	**6**	**0**	**20**
7	VA	VA1106507	**Value Added Course- II	2	-	-	-	40	-	-	-	-	2	-	-	2
8	AE	AE1106508	**MOOC - II	-	-	-	-	-	-	-	-	-	-	-	-	2

**** Indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

Sr. No	Program Elective Course (PEC) I
1	Image Processing
2	Data Mining and Analytics
3	Compiler Design

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – VI (NEP 2023 COURSE)

Sr. No.	Category	Subject Code	Name of Subject	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1	MJ	MJ1106601	Cloud, Microservices, and Application	3	2	-	60	40	25	25	-	150	3	1	-	4
2	MJ	MJ1106602	Finance and Cost Accounting	3	-	-	60	40	-	-	-	100	3	-	-	3
3	MJ	MJ1106603	Machine Learning	3	2	-	60	40	25	-	25	150	3	1	-	4
4	MJ	MJ1106604	Natural Language Processing	3	-	-	60	40	-	-	-	100	3	-	-	3
5	PS	PS1106605	Professional Skills	-	2	-	-	-	25	-	-	25	-	1	-	1
6	PE	PE1106606	Program Elective Course II	3	2	-	60	40	25	25	-	150	3	1	-	4
7	SE	SE1106607	Skill-Based Course V (Gen - AI)	-	2	-	-	-	25	-	25	50	-	1	-	1
8	AC	AC1106608	Environmental Studies	4	-	-	60	40	-	-	-	100	4	-	-	4
			Total	**19**	**10**	**0**	**300**	**300**	**125**	**50**	**50**	**825**	**19**	**5**	**0**	**24**

Sr. No	Program Elective Course (PEC) II
1	Introduction to IoT
2	Embedded System
3	Machine Organization & Microprocessor

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE

TRACK- I

B.Tech.(Computer Science and Business Systems): Semester–VII (2023 CBCS COURSE)

Sr. No.	Category	Subject Code	Subject	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	MJ	MJ1106701	IT Project Management	3	2	-	60	40	25	25	-	150	3	1	-	4
2.	MJ	MJ1106702	Marketing Research and Marketing Strategy	3	-	1	60	40	25	-	-	125	3	-	1	4
3.	PE	PE1106703	Program Elective Course III	3	2	-	60	40	25	-	25	150	3	1	-	4
4.	PE	PE1106704	Program Elective Course IV	3	2	-	60	40	25	25	-	150	3	1	-	4
5.	RP	RP1106705	Major Project	-	16	-	-	-	100	50	-	150	-	8	-	8
		Total		**12**	**24**	**-**	**240**	**160**	**200**	**125**	**25**	**725**	**12**	**11**	**1**	**24**

Program Elective Course (PEC)

Program Elective Course -III	Program Elective Course -IV
Advanced Social, Text and Media Analytics	Financial Management
Mobile Computing	Cognitive Science & Analytics
Augmented & Virtual Reality	Information Retrieval
Quantum Computation & Quantum Information	Enterprise Systems

B.Tech.(Computer Science and Business Systems): Semester– VIII (2023 CBCS COURSE)

Sr. No.	Category	Subject Code	Subject	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	Pr/Or	T	Total
1	MJ	MJ1106801	Cyber and Information Security	3	2	-	60	40	25	25	-	150	3	1	-	4
2	PE	PE1106802	Program Elective Course - V	2	-	-	60	40	-	-	-	100	2	-	-	2
3	CC	CC1106803	Seminar	-	4	-	-	-	50	50	-	100	-	2	-	2
4	SE	SE1106804	Internship (Industry/In-house)	-	-	-	-	-	150	100	-	250	-	14	-	14
		Total		**5**	**6**	**-**	**120**	**80**	**225**	**175**	**-**	**600**	**5**	**17**	**-**	**22**

Program Elective Course (PEC)

Program Elective Course - V
Computational Finance & Modeling
Behavioral Economics
Industrial and Organizational Psychology
Services Science & Service Operational Management

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
TRACK – II
B.Tech.(Computer Science and Business Systems): Semester–VII (2023 CBCS COURSE)

Sr. No.	Category	Subject Code	Subject	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	Pr/Or	T	Total
1	MJ	MJ1106801	Cyber and Information Security	3	2	-	60	40	25	25	-	150	3	1	-	4
2	PE	PE1106802	Program Elective Course - V	2	-	-	60	40	-	-	-	100	2	-	-	2
3	CC	CC1106803	Seminar	-	4	-	-	-	50	50	-	100	-	2	-	2
4	SE	SE1106804	Internship (Industry/In-house)	-	-	-	-	-	150	100	-	250	-	14	-	14
		Total		**5**	**6**	**-**	**120**	**80**	**225**	**175**	**-**	**600**	**5**	**17**	**-**	**22**

Program Elective Course (PEC)

Program Elective Course - V
Computational Finance & Modeling
Behavioral Economics
Industrial and Organizational Psychology
Services Science & Service Operational Management

B.Tech.(Computer Science and Business Systems): Semester– VIII (2023 CBCS COURSE)

Sr. No.	Category	Subject Code	Subject	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	MJ	MJ1106701	IT Project Management	3	2	-	60	40	25	25	-	150	3	1	-	4
2.	MJ	MJ1106702	Marketing Research and Marketing Strategy	3	-	1	60	40	25	-	-	125	3	-	1	4
3.	PE	PE1106703	Program Elective Course III	3	2	-	60	40	25	-	25	150	3	1	-	4
4.	PE	PE1106704	Program Elective Course IV	3	2	-	60	40	25	25	-	150	3	1	-	4
5.	RP	RP1106705	Major Project	-	16	-	-	-	100	50	-	150	-	8	-	8
		Total		**12**	**24**	**-**	**240**	**160**	**200**	**125**	**25**	**725**	**12**	**11**	**1**	**24**

Program Elective Course (PEC) List

Program Elective Course -III	Program Elective Course -IV
Advanced Social, Text and Media Analytics	Financial Management
Mobile Computing	Cognitive Science & Analytics
Augmented & Virtual Reality	Information Retrieval
Quantum Computation & Quantum Information	Enterprise Systems

Instructions

1. Students shall be permitted to opt for either Track-1 or Track-2.
    A) If the student opts Track-1 then he/she must perform Major Project in Semester-VII and undergo Internship in Sester-VIII.
    B) If the student opts Track-2 then he/she must undergo Internship in Semester-VII and perform Major Project in Sester-VIII.

2. Seminar:

Objectives for the Seminar

The Seminar aims to:

- Develop **self-learning ability** and **research orientation**
- Enhance **technical understanding of emerging technologies**
- Improve **presentation and communication skills**

Scope of Topics

Students must select a topic from E**merging/Recent Technologies, Case Studies, Research-Oriented Topics, Interdisciplinary Topics**

What Students Are Expected to Do

Topic Selection
Literature Survey
Content Preparation
Report Writing
Presentation

3. Major Project:

Objectives of the Major Project

Students are expected to:

- Apply knowledge of Computer/IT engineering to solve **real-world problems**
- Develop **design, implementation, and testing skills**
- Work effectively in a **team environment**
- Demonstrate **innovation, problem-solving, and research aptitude**
- Learn **documentation, presentation, and communication skills**
- Get exposure to **research methodology and publication process**

Nature of Projects

Projects should be:

Application-oriented / Industry-based / Research-based / Interdisciplinary
Should **NOT be repetitive** of previous batches
Must include **significant development and/or research contribution**

Research Publication

To encourage the students to write research articles/paper and presenting/publishing the same in journal/conference/symposium, the guides will may give advantage of credits to the students, even if it is not mandatory.

4. Internship

Objectives of Internship

- To provide real-world exposure to professional environments
- To enhance technical, problem-solving, and teamwork skills
- To bridge the gap between academics and industry expectations
- To develop professional ethics, communication, and responsibility

Guidelines

1) The students who receive an internship in the industry (through institute or own efforts), will do it for one complete semester in the industry.

2) Those students who don not receive the internship in the industry will have to perform it in-house. The Department will prepare modules for in-house internships based on recent domains/technology. The Department faculty plus external experts from industry fir the selected domain will deliver the sessions. In this case, the entire internship of one complete semester will be held in the institute itself.

3) The projects and the required computational facilities for these projects are available at FAIR Lab. The students may use facilities in IDEA and Intel Unnati Lab for this purpose.

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

COLLEGE OF ENGINEERING, PUNE

B. Tech (CSBS) Semester- III/IV/V/VI/VII (NEP-2020 COURSE)

MINOR DEGREE: BUSINESS SYSTEMS DETAILS

Sr. No	Course Code	Name of Course	Teaching Scheme (Hrs./ Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	TH	PR/OR	Tut	Total
1	MI1106301	**Sem III** Business Strategy	3	2	-	60	40	25	25	-	150	3	1	-	**4**
2	MI1106401	**Sem IV** Introduction to Innovative IP Management & Entrepreneurship	3	2	-	60	40	25	25	-	150	3	1	-	**4**
3	MI1106501	**Sem V** Marketing Research and Marketing Management	3	2	-	60	40	25	25	-	150	3	1	-	**4**
4	MI1106601	**Sem VI** Financial and Cost Accounting	3	2	-	60	40	25	25	-	150	3	1	-	**4**
5	MI1106602	**Sem VI** Project	-	8	-	-	-	50	50	-	100	-	4	-	**4**
Total			**12**	**16**	**-**	**240**	**160**	**150**	**150**	**-**	**700**	**12**	**8**	**-**	**20**

B. Tech (Computer Science and Business Systems)

TRACK- I
COURSE SYLLABUS SEMESTER VII

IT PROJECT MANAGEMENT					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3Hrs/Week**	**University Examination:**	**60**		
Practical:	**2Hrs/Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Oral	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. **Understand the fundamentals of IT Project Management** including project life cycle, project management processes, and knowledge areas.
2. **Apply project planning techniques** such as scope management, scheduling (Gantt charts, PERT/CPM), and cost estimation for IT projects.
3. **Analyze project risks and develop mitigation strategies** to ensure successful project execution.

Prerequisite:

Knowledge of Software Engineering Principles.

Course Outcomes: On completion of the course, students will have the ability to:

1. To understand project management principles in IT domain.
2. To apply planning, estimation, and scheduling techniques.
3. To implement Agile and hybrid methodologies.
4. To manage project risks, quality, and cyber security concerns.
5. Apply project scheduling and cost estimation techniques.
6. Use modern project management tools and techniques for project execution, monitoring, stakeholder communication, and closure.

Unit I **6 Hours**

Fundamentals of IT Project Management: Project vs Operations,Characteristics of IT Projects,Project Life Cycle Models,Process Groups (Initiation to Closing),Role & Skills of Project Manager,Overview of Knowledge Areas,AI in Project Management.

Unit II **6 Hours**

Project Initiation & Scope Management: Project Selection Methods (NPV, ROI, Payback)Business Case Development,Project Charter,Scope Planning & Scope Statement,Software Effort Estimation Models,Scope Verification & Control

Unit III **6 Hours**

Agile, DevOps & Hybrid Methodologies: Waterfall Model,Agile Manifesto,Scrum Framework (Roles, Artifacts, Events),Kanban & Lean,Hybrid (Agile + Traditional) Models,SAFe (Scaled Agile Framework)

Unit IV **6 Hours**

Risk, Quality & Security Management: Risk Identification & Risk Register,Qualitative & Quantitative Risk Analysis,Risk Mitigation Planning,Quality Planning & Assurance,Software Quality Standards (ISO, CMMI),Cybersecurity Risk in IT Projects,Compliance & Governance

Unit V **6 Hours**

Project Scheduling, Cost Estimation and Performance Control: Activity Identification & Work Breakdown Structure (WBS),Concept and Construction of Gantt Chart,Three Time Estimates (Optimistic, Most Likely, Pessimistic),Expected Time Calculation,Cost Performance Index (CPI),Schedule Performance Index (SPI),Estimate at Completion (EAC)

Unit VI	**6 Hours**
Project Execution, Monitoring & Stakeholder Management: Team Building & Leadership,Communication Management, Stakeholder Analysis,Performance Metrics (EVM – Earned Value Management),Change Management,Project Closure & Documentation	
Textbooks	
1. PMBOK Guide – Project Management Institute	
Reference Books	
1. Kathy Schwalbe – *Information Technology Project Management*	
2. Jack Meredith & Samuel Mantel – *Project Management*	
List of Assignments	
1. Differentiate between Project and Operations with examples.	
2. Describe Project Life Cycle models (Waterfall, Iterative, Agile).	
3. Prepare a sample Business Case for an IT project.	
4. Study Software Effort Estimation Models (COCOMO basics).	
5. Describe Scrum framework (Roles, Artifacts, Events).	
6. Write short note on SAFe (Scaled Agile Framework).	
7. Discuss Software Quality Standards (ISO, CMMI).	
8. Prepare a Work Breakdown Structure (WBS) for an E-commerce Website.	
9. Write steps involved in Project Closure.	
10. Case Study on Agile implementation in IT project.	
List of Laboratory Exercises	
1. Project Charter Preparation	
2. WBS Design	
3. Gantt Chart using MS Project	
4. PERT/CPM Network Diagram	
5. Risk Register Preparation	
6. Earned Value Analysis	
7. Agile Sprint Planning (Scrum Simulation)	
8. Jira / Trello Tool Implementation	
9. Case Study Analysis	
10. Mini Project – Complete IT Project Plan Documentation	
Project Based Learning	
1. Earned Value Management Analysis of a Real or Simulated IT Project	
2. Case study of Communications IT Project management	
3. Development of a Project Plan for a Cloud-Based ERP System	
4. Agile Project Management Implementation for a Mobile App Development Project	
5. Project Planning & Cost Estimation for an E-Commerce Website	
6. Risk Management Framework for a Cybersecurity Implementation Project	
7. Hybrid (Waterfall + Agile) Project Model for a Smart City IT Project	
8. IT Infrastructure Migration to Cloud – Project Execution Plan	
9. DevOps-Based Software Deployment Project Plan	
10. AI-Based Predictive Analytics for Project Risk Forecasting	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

MARKETING RESEARCH AND MARKETING STRATEGY					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3 Hrs./Week**	**University Examination:**	**60**		
Practical:	**-**	**Internal Assessment:**	**40**	**Lecture**	**03**
Tutorial	**01 Hr/Week**	**Term Work**	**25**	**Practical**	**-**
		Oral	**-**	**Tutorial**	**01**
		Total	**125**	**Total**	**04**

Course Objective:

1. Understand core marketing principles and consumer behaviour.
2. Develop skills in marketing research methods.
3. Apply quantitative and data-driven decision-making techniques.
4. Learn strategic marketing management concepts.
5. Integrate technology with marketing practices.

Prerequisite:

Students should have basic knowledge about marketing skills.

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain **t**he fundamental concepts, functions, and principles of marketing.
2. Describe and illustrate the stages of the Product Life Cycle and the process of new product
3. Explain and apply the basic principles of pricing, promotion, and distribution strategies in different market scenarios.
4. Analyse the dynamics of marketing systems and evaluate how various marketing components interact in real-world business environments.
5. Apply **m**arketing concepts and tools to design effective Internet/Digital marketing strategies.
6. Interpret and apply basic statistical tools for data analysis in marketing research and decision-making.

Unit I: Introduction to Marketing Concepts — **06 Hours**

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social. Understanding the consumer: Determinants of consumer behaviour, Factors influencing consumer behaviour. Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning.

Unit II: Product Management — **06 Hours**

Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging.

Unit III: Pricing, Promotion and Distribution Strategy — **06 Hours**

Policies & Practices –Pricing Methods & Price determination Policies. Marketing Communication– The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.

Unit IV : Marketing Research and Data Analysis — **06 Hours**

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations, Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research Data Analysis: Use of various statistical tools – Descriptive &

Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis.	
Unit V: Internet Marketing	**06 Hours**
Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing.	
Unit VI: Business to Business Marketing	**06 Hours**
Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy.	
Textbooks	
1.Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler	
2.Fundamentals of Marketing – William J. Stanton & Others	
3.Marketing Research – Rajendra Nargundkar	
4. Marketing Management – V.S. Ramaswamy and S. Namakumari	
5. Market Research – G.C. Beri	
6. Market Research, Concepts, & Cases – Cooper Schindler	
Reference Books	
1. Marketing Management – Rajan Saxena	
2. Marketing Management – S.A. Sherlekar	
3.Service Marketing – S.M. Zha	
4.Journals – The IUP Journal of Marketing Management, Harvard Business Review	
5.Research for Marketing Decisions by Paul Green, Donald, Tull	
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication	
Project Based Learning 1. Market Feasibility Study for a New Tech Product 2. Customer Segmentation Using Data Analytics 3. Digital Marketing Strategy for a Startup 4. Consumer Behavior Analysis for Online Platforms 5. Brand Positioning Analysis of Competing Tech Companies 6. Marketing Research for AI-Based Healthcare Solutions 7. Impact of Social Media Marketing on Purchase Decisions 8. Pricing Strategy Analysis for Subscription-Based Software 9. Customer Satisfaction and Loyalty Study Using Surveys 10. Market Entry Strategy for an International Tech Brand in India 11. Product Life Cycle Analysis of a Technology Product 12. Effectiveness of Online Advertising Using Web Analytics 13. Voice of Customer (VoC) Analysis Using Text Mining 14. Marketing Strategy for Sustainable or Green Technologies 15. Competitor Analysis Using Market Intelligence Tools	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE III: ADVANCED SOCIAL, TEXT AND MEDIA ANALYTICS					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hrs./Week**	**University Examination:**	**60**		
Practical	**02 Hrs./Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Practical	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. To introduce fundamental concepts and techniques of text mining and natural language processing.
2. To develop understanding of predictive modeling and sentiment analysis for social and media data.
3. To familiarize students with web analytics, web crawling, indexing, and ranking mechanisms.

Prerequisite: Machine Learning, Database and Data mining

Course Outcomes: On completion of the course, students will have the ability to:

1. Apply text mining techniques for pattern discovery and information extraction.
2. Apply NLP and predictive modeling techniques for sentiment and topic analysis
3. Analyze and evaluate keyword extraction methods using performance metrics
4. Apply web analytics tools and analyze web crawling, indexing, and ranking methods
5. Analyze social network structures to identify key actors and clusters
6. Analyze the evolution of web communities using dynamic network models.

Unit I **06 Hours**

Text Mining: Introduction, Core text mining operations, Preprocessing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications.

Unit II **06 Hours**

Methods & Approaches: Content Analysis; Natural Language Processing; Clustering & Topic Detection; Simple Predictive Modeling; Sentiment Analysis; Sentiment Prediction

Unit III **06 Hours**

Text Extraction: Introduction, Rapid automatic keyword extraction: candidate keywords, keyword scores, adjoining keywords, extracted keywords, benchmark evaluation: precision and recall, efficiency, stop list, generation, Evaluation on new articles.

Unit IV **06 Hours**

Web Analytics: Web analytics tools, Clickstream analysis, A/B testing, onlinesurveys; Web search and retrieval, Search engine optimization, Web crawling and Indexing, Ranking algorithms, Web traffic models.

Unit V **06 Hours**

Social Media Analytics: Social network and web data and methods. Graphs and Matrices. Basic measures for individuals and networks. Information visualization; Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity; Social network analysis

Unit VI **06 Hours**

Extracting And Analyzing Web Social Networks: Extracting Evolution of Web Community from a Series of Web Archive, Temporal Analysis on Semantic Graphusing Three-Way Tensor, Decomposition, Analysis of Communities and Their Evolutions in Dynamic Networks.

Textbooks

1. GuandongXu,Yanchun Zhang, and Lin Li, “Web Mining and Social Networking Techniques andApplications”, Springer
2. Social Media Data Mining and Analytics by Gabor Szabo, Gungor Polatkan, P. Oscar Boykin & Antonios Chalkiopoulos

Reference Books

1. Text Mining and Analysis: Practical Methods, Examples, and Case Studies Using SAS® – Dr. Godfrey Liang, Mark Li, & Danny Zeng
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics – Marshall Sponder
   Explains metrics and analytics for social platforms
3. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer,2010.

List of Assignments

1. Explain and implement tokenization, stemming, lemmatization, and stop-word removal on a sample dataset.
2. Compare Naïve Bayes and SVM for sentiment classification.
3. Study and compare TF-IDF, RAKE, and TextRank methods.
4. Write a report on web crawling process and ranking algorithms (e.g., PageRank concept).
5. Implement Apriori algorithm on a sample transactional dataset and interpret rules.
6. Calculate degree, betweenness, and closeness centrality on a given network dataset.
7. Study clustering methods used in social networks and compare results.
8. Analyze evolution of a network over time and summarize findings.

List of Laboratory Exercises

1. Perform text preprocessing using Python (NLTK/spaCy).
2. Implement sentiment analysis on product review dataset.
3. Extract keywords from news articles and evaluate using precision & recall.
4. Perform topic modeling using LDA.
5. Simulate web crawling and indexing on sample webpages.
6. Analyze clickstream dataset and visualize traffic patterns.
7. Create and visualize social network graph using NetworkX/Gephi.
8. Compute centrality measures and identify influential nodes.
9. Perform community detection using clustering algorithms.
10. Analyze temporal network data and observe community evolution.

Project Based Learning

1. Perform sentiment analysis on Amazon / IMDb / Twitter reviews.
2. Develop a system to extract keywords from news articles.
3. Analyze website traffic dataset.
4. Visualize network graph using Gephi/NetworkX.
5. Compare Facebook, Instagram, and TikTok marketing strategies.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE III: MOBILE COMPUTING					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3Hrs/Week**	**University Examination:**	**60**		
Practical	**2Hrs/Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Practical	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. To understand fundamentals of mobile computing and wireless communication.
2. To design and develop mobile applications.
3. To apply mobile networking protocols and architectures.
4. To integrate cloud, IoT and AI with mobile platforms.
5. To implement security and privacy mechanisms in mobile systems.

Prerequisite:

Knowledge of Computer Networks, Operating Systems, Object-Oriented Programming (Java/Kotlin), and Database Management Systems.

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain architecture and components of mobile computing systems.
2. Analyze wireless communication technologies and mobile networks.
3. Design and develop mobile applications using modern frameworks.
4. Implement data storage, cloud integration, and APIs in mobile apps..
5. Apply mobile security, authentication, and privacy mechanisms.
6. Evaluate emerging trends such as 5G, Edge AI, and Mobile IoT.

Unit I : Introduction to Mobile Computing — **6 Hours**

Evolution of Mobile Computing, Mobile Computing Architecture, Mobile Communication Models, Mobile Hardware & Software Platforms, Comparison: Desktop vs Mobile Computing, Overview of Android & iOS architecture, Mobile OS features, Edge Computing basics

Unit II: Wireless Communication & Mobile Networks — **6 Hours**

Wireless Transmission Fundamentals, Cellular Systems (1G to 5G evolution),GSM, CDMA, LTE Architecture, Mobile IP, Mobile Ad hoc Networks (MANET),Wireless LAN (Wi-Fi), Bluetooth, NFC

Unit III: Mobile Application Development — **6 Hours**

Android Architecture, Activity Lifecycle, UI Design & Layouts, Intents and Services, Fragments, Data Storage (SQLite, Shared Preferences),RESTful API Integration, JSON Parsing.

Unit IV : Mobile Data Management & Cloud Integration — **6 Hours**

Mobile Databases, Firebase Integration, Cloud Storage & Sync, Web Services & API Integration, Location Based Services (GPS),Google Maps Integration, Edge AI on Mobile Devices

Unit V : Mobile Security & Privacy — **6 Hours**

Security Challenges in Mobile Computing, Mobile Malware, Authentication & Authorization, Secure Coding Practices, Data Encryption Techniques, Secure Communication (HTTPS, SSL/TLS),Biometric Authentication, Zero Trust Architecture

Unit VI : Advanced Topics & Emerging Trends — **6 Hours**

Mobile Commerce (M-Commerce), Mobile Payment Systems (UPI architecture overview),IoT and Mobile Integration, Augmented Reality in Mobile, Wearable Computing, AI & ML in Mobile Applications, Generative AI in Mobile Apps

Textbooks

1. Raj Kamal – Mobile Computing
2. Ashok Talukder – Mobile Computing Technology

Reference Books

1. **Jochen Schiller** – Mobile Communications

2. **William Stallings** – Wireless Communications and Networks	
List of Assignments	
1. Explain the architecture of a mobile computing system with neat diagram.	
2. Compare mobile computing and distributed computing.	
3. Explain GSM architecture with diagram.	
4. Describe MANET characteristics and challenges.	
5. Explain fragments and their advantages.	
6. Discuss advantages and limitations of cloud integration in mobile apps.	
7. Describe location-based services with architecture.	
8. Describe secure coding practices for mobile apps.	
9. Discuss security challenges in mobile computing.	
10. Discuss IoT and mobile integration architecture.	
List of Laboratory Exercises	
1. Install Android Studio and create basic UI app	
2. Activity lifecycle demonstration	
3. Intent and data passing between activities	
4. Simple Flutter cross-platform app	
5. REST API integration using Retrofit	
6. Firebase authentication	
7. Google Maps integration	
8. Location-based app development	
9. Push notifications implementation	
10. Secure login system implementation	
Project Based Learning	
1. AI-based Sales Prediction Mobile Dashboard	
2. Inventory & Supply Chain Tracking App (Cloud Integrated)	
3. Mobile CRM Application for SMEs	
4. Smart Expense & Budget Analyzer with Data Visualization	
5. Customer Feedback Sentiment Analysis Mobile App	
6. Digital Marketing Campaign Tracker App	
7. Face Recognition Attendance System (Mobile + Cloud)	
8. AI Chatbot Integration in Mobile App	
9. Plant Disease Detection using Mobile Camera	
10. Real-Time Object Detection App (TensorFlow Lite)	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE III: AUGMENTED AND VIRTUAL REALITY					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3 Hrs./Week**	**University Examination:**	**60**		
Practical:	**2 Hrs./Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Practical	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. To understand fundamentals of augmented and virtual reality
2. To describe various elements and components used in AR/VR Hardware and Software
3. To understand the methods used for representing and rendering the virtual world
4. To create Augmented Reality application that allows users to interact with the immersive 3D world

Prerequisite: Computer Graphics, solid Modelling and Drafting, basic concepts of Human-Computer Interaction (HCI)

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand the basics of Augmented and Virtual reality systems and list their application
2. Describe interface to the Virtual World with the help of input and output devices
3. Explain representation and rendering system in the context of Virtual Reality
4. Analyse manipulation, navigation and interaction of elements in the virtual world
5. Summarize the basic concepts and hardware of Augmented Reality system
6. Create Mobile Augmented Reality using Augmented Reality techniques and software

Unit I Introduction	**6 Hours**

Virtual Reality (VR): Definition and Scope, Key Elements of VR, Experience, History, Applications. Strong vs Weak AR, Challenges in AR, Applications of AR, the role of AI and machine learning in AR Augmented Reality (AR): Introduction, History, Key Aspects, and Applications.

Unit II Computer Graphics and Geometric Modelling	**6 Hours**

Computer graphics, Real-time computer graphics, The virtual world space, Positioning the virtual observer, Human vision, Stereo perspective projection, Colour theory, 2D to 3D conversion, 3D space curves, 3D boundary representation, Simple 3D modelling, Illumination models, Reflection models, Geometrical transformations: Introduction, Frames of reference, Modelling transformations, Rendering techniques for VR/AR (shading, textures, ray tracing).

Unit III Representing and Rendering the Virtual World	**6 Hours**

Representation of the Virtual World, Visual Rendering Systems: Methods, Types (Geometrically Based and Nongeometric based), Complex Visual Scenes. Computer Graphics System Requirements. Aural Rendering Systems: Visual Methods, Complex Sounds, Understanding GPU architecture, GPU's role in rendering and acceleration, GPU performance optimization techniques

Unit IV Interacting with the Virtual World and Virtual Reality Experience	**Hours**

Introduction to VR Interfaces: User Interface Metaphors in VR, Basic principles of interacting with virtual environments. Manipulating Virtual Objects: Picking, moving, rotating objects, Properties of manipulation (size, shape, behaviour), Common manipulation operations. Navigating the Virtual World: Finding your way in VR, Classes of travel methods, Smooth vs. discrete movement methods. Interaction with Others in VR. System Interaction and Immersion: Interacting with the VR system, Rules of the virtual world: physics, object behaviour.

Unit V Augmented Reality	**6 Hours**

Concepts: Computer Graphics, Dimensionality, Depth Cues, Registration and Latency, Working of Augmented Reality, Augmented Reality Hardware (Sensors, Processors, Displays), Ingredients of an AR Experience.

Unit VI Augmented Reality Software and Mobile Augmented Reality	**6 Hours**

Augmented Reality Systems, Software Components, Software Tools for Content Creation, Interaction in Augmented Reality, Augmented Reality Techniques: Marker-based and Markerless tracking, Mobile Augmented Reality.
Textbooks
1. Alan B Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann Publishers, ISBN:978-0240824086
2. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design", (The Morgan Kaufmann Series in Computer Graphics)", Morgan Kaufmann Publishers, San Francisco, CA, 2002
Reference Books
1. Sanni Siltanen, "Theory and applications of marker-based augmented reality", Julkaisija – Utgaard Publisher. 2012. ISBN 978-951-38-7449-0
2. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016
List of Assignments
1. Study and compare Augmented Reality, Virtual Reality, and Mixed Reality with real-world applications.
2. Design and implement a basic AR application using marker tracking.
3. Create a mobile AR application using plane detection and surface tracking.
4.Implement object selection, movement, rotation, and scaling in a VR scene.
5.Study visual, aural, and haptic representation techniques used in VR systems.
6.Design a VR system that supports multi-user interaction and shared experience.
List of Laboratory Exercises
1. Create an app using image tracking (like Vuforia or ARKit) to display interactive 3D models (e.g., a solar system or engine part) over a physical marker.
2. Develop a mobile application that uses face tracking to allow users to try on glasses, makeup, or accessories.
3. Build an app that overlays arrows and information on a phone screen to guide users through a building.
4. Create a furniture or product placement application that allows users to place virtual, to-scale items in their room
5. Develop a VR simulation for industrial safety training (e.g., operating a forklift or factory machine) using the XR Interaction Toolkit.
6. Design a 3D virtual environment (e.g., a modern apartment or museum) and enable navigation with interactive, clickable objects.
7. Create a simple first-person shooter or puzzle game, focusing on user interaction and controller mechanics in Unity, optimized for VR headsets.
8. Build an application that displays complex data sets in a 3D space, allowing the user to walk through the data.
Project Based Learning
1. Design a mobile AR application to guide users inside a building (e.g., college campus or mall) using markers or plane detection.
2. Develop a VR environment to showcase products (e.g., furniture, gadgets) where users can interact with and manipulate items.
3. Create a VR scene that allows multiple users to collaborate on a task (e.g., designing a room, drawing together).
4. Design an AR-based learning app that teaches a concept (e.g., human anatomy, solar system) with interactive 3D models.
5. Develop a VR training module for a real-world scenario (e.g., fire safety, machine operation, medical procedure).
6. Create a simple AR game (e.g., treasure hunt, object collection) that responds to real-world markers or surfaces.
7. Build a VR experience where users can interact with objects using haptic feedback to feel textures or forces.

8. Integrate AR and VR components in a single experience (e.g., start with AR in real world, then transition to VR environment).	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE III: QUANTUM COMPUTATION & QUANTUM INFORMATION					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hrs./Week**	**University Examination:**	**60**		
Practical:	**02 Hrs./Week**	**Internal Assessment:**	**40**	**Lecture**	**03**
		Term Work	**25**	**Practical**	**01**
		Practical	**25**		
		Total	**150**	**Total**	**04**

Course Objective:

1. Understand mathematical and physical principles underlying quantum computation.
2. Analyze quantum computational models and circuit-based representations.
3. Apply quantum algorithms to solve computational and cryptographic problems.
4. Evaluate the impact of quantum computing on modern cryptography.
5. Explore emerging quantum technologies including QKD, QTRNG, and PQC..

Prerequisite: Basic Linear Algebra, Probability, Analysis and Design of Algorithms.

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain postulates of quantum mechanics, Hilbert space formalism, and density matrices.
2. Model quantum systems using quantum gates and circuit representations.
3. Analyze and implement fundamental quantum algorithms such as Deutsch–Jozsa, Grover's, and Shor's algorithms.
4. Evaluate the implications of quantum algorithms on classical cryptographic schemes.
5. Analyze the working principles of Quantum Key Distribution protocols and Quantum Random Number Generators.
6. Compare post-quantum cryptographic approaches and assess their relevance in securing future communication systems.

Unit I Mathematical Foundations of Quantum Computing	**06 Hours**

Complex vector spaces and Hilbert spaces, Linear operators and matrices, Inner products, tensor products, Quantum states (pure states), Unitary evolution, Measurement postulates, Superposition and interference, Density operators and mixed states, Entanglement and correlation.

Unit II Quantum Information & Circuit Model	**06 Hours**

Qubits and Bloch sphere representation, multi-qubit systems, Quantum gates (Pauli, Hadamard, Phase, CNOT, Toffoli), Quantum circuits and universality, No-cloning theorem, Quantum teleportation, Superdense coding, CHSH game and non-locality

Unit III Quantum Algorithms & Complexity	**06 Hours**

Quantum parallelism, Deutsch–Jozsa algorithm, Simon's algorithm, Grover's search algorithm, Shor's factoring algorithm, Complexity comparison: Classical vs Quantum, Impact of Grover on symmetric cryptosystems, Impact of Shor on RSA & discrete logarithm-based cryptosystems

Unit IV Quantum Key Distribution (QKD) & Security	**06 Hours**

Principles of quantum cryptography, BB84 protocol, Ekert protocol, Semi-Quantum QKD, Entropic uncertainty relations, Device independence issues, Security proofs (conceptual), Commercial implementations.

Unit V Quantum True Random Number Generators (QTRNG)	**06 Hours**

Principles of quantum randomness, Measurement-based randomness, Design of QTRNG systems, Certification of randomness, Practical implementation challenges, Commercial QTRNG systems, Applications in cryptography & simulations.

Unit VI	**Post-Quantum Cryptography (PQC)**	**06 Hours**

(Refer to National Institute of Standards and Technology PQC Project)
Motivation for post-quantum cryptography, Lattice-based cryptography (e.g., CRYSTALS-Kyber – conceptual), Code-based cryptography, Hash-based signatures, Comparison with classical cryptography, Future directions in quantum-safe security.

Textbooks

1. "Quantum Computation and Quantum Information", M. A. Nielsen & I. L. Chuang, Cambridge University Press.
2. "Quantum Computer Science, N. David Mermin", Cambridge University Press.

Reference Books

1. "Introduction to Quantum Computing", P. Kaye, R. Laflamme, M. Mosca, Oxford University Press.
2. "Applied Cryptography", A. J. Menezes, P. C. van Oorschot, S. A. Vanstone, CRC Press.
3. Quantum Computer Science. N. David Mermin, Cambridge University Press.

List of Assignments

1. Prove that quantum evolution must be unitary.
2. Demonstrate Bloch sphere representation of a qubit.
3. Explain the No-Cloning theorem with a mathematical proof.
4. Design a quantum circuit for quantum teleportation.
5. Compare Grover's algorithm with classical search complexity.
6. Explain the working of Shor's algorithm with a flow diagram.
7. Discuss the impact of Shor's algorithm on RSA cryptosystem.
8. Analyze Simon's algorithm and its exponential speedup.
9. Compare BB84 and Ekert QKD protocols.
10. Explain entropic uncertainty principle in QKD security.
11. Study a commercial QTRNG and analyze its architecture.
12. Compare lattice-based and hash-based post-quantum cryptography.

Practical experiments:

The following practical exposure is strongly recommended using simulators like IBM Qiskit, Cirq, and Quantum simulators.

1. Implement and simulate single-qubit gates (X, Y, Z, Hadamard, Phase) and analyze state vector changes.
2. Demonstrate Bloch sphere visualisation of different qubit states.
3. Construct and simulate Bell states and verify quantum entanglement.
4. Implement multi-qubit quantum circuits using CNOT and Toffoli gates.
5. Simulate the quantum teleportation protocol and verify correctness through measurement.
6. Implement the Superdense Coding protocol and analyse the classical bit transmission efficiency.
7. Implement the Deutsch–Jozsa algorithm and compare with classical evaluation.
8. Implement Grover's Search Algorithm for a 2 or 3-qubit system and analyze probability amplification.
9. Simulate BB84 Quantum Key Distribution protocol and demonstrate detection of eavesdropping.
10. Implement a basic Quantum Random Number Generator circuit and statistically test randomness.
11. Analyze the effect of quantum noise models (bit-flip, phase-flip) on quantum states.
12. Compare classical brute-force search with Grover's algorithm using simulator-based experiments.

Project-Based Learning

1. Design and develop a modular quantum gate simulation library for educational use.
2. Comparative performance analysis of classical vs quantum search algorithms for small datasets.
3. Design a conceptual architecture of a practical Quantum Key Distribution (QKD) system.
4. Security analysis of BB84 and Ekert protocols under practical attack scenarios.
5. Implementation and analysis of Shor's algorithm (conceptual or partial simulation).
6. Study and compare selected Post-Quantum Cryptography algorithms from
7. National Institute of Standards and Technology PQC standardisation project.
8. Develop a mini research report on entropic uncertainty relations and their role in QKD security.
9. Simulation of noise-resilient quantum circuits and error mitigation techniques.
10. Design and simulate a small-scale quantum chemistry problem using quantum algorithms.
11. Study and evaluate commercial quantum computing platforms (IBM Quantum, Rigetti, IonQ) and compare hardware architectures.
12. Analyze the impact of Shor's algorithm on RSA-based systems and propose quantum-safe alternatives.
13. Develop a quantum-based secure communication prototype using simulation tools.

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE IV: FINANCIAL MANAGEMENT					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hrs./Week**	**University Examination:**	**60**		
Practical	**02 Hrs./Week**	**Internal Assessment:**	**40**	**Lecture**	**03**
		Term Work	**25**	**Practical**	**01**
		Oral	**25**		
		Total	**150**	**Total**	**04**

Course Objective:

1. To understand financial management principles and apply time value of money concepts in IT and digital project evaluation.
2. To analyse valuation of securities and evaluate risk–return relationships in technology-sector investments.
3. To examine operating and financial leverage and their impact on startup and IT firm financing decisions.
4. To evaluate investment proposals using cost of capital and capital budgeting techniques for digital transformation projects.
5. To apply working capital and cash management strategies for efficient fund utilization in IT and SaaS firms
6. To assess credit policies and receivables management techniques for improving liquidity and financial performance.

Prerequisite: Software Engineering, Fundamentals of Economics, Design Thinking

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain the goals of financial management and compute time value of money using interest and annuity concepts.
2. Analyse the valuation of securities and risk–return relationships using CAPM with reference to technology sector investments.
3. Evaluate leverage decisions in startup financing and digital business models.
4. Evaluate capital budgeting proposals (NPV, IRR, Payback) for digital transformation, cloud, or AI projects using structured financial analysis models.
5. Apply working capital estimation and cash management techniques to optimize liquidity in digital enterprises.
6. Develop analytical frameworks for credit policy evaluation and receivables management using structured financial metrics and risk assessment tools.

Unit I :Foundations of Financial Management in IT	**06 Hours**

Role of Financial Management in Digital Enterprises, Goals of the Firm in Technology-Driven Markets, Financial Environment & Digital Economy, **Time Value of Money:** Simple & Compound Interest, Annuities, Applications in IT project costing, Subscription-based revenue models.

Unit II :Valuation, Risk & Return in Technology Sector	**06 Hours**

Valuation of Securities: Bond Valuation**,** Preference & Equity Valuation**,** Yield & YTM**.** Risk & Return Concepts**,** Probability & Risk Measurement**,** Diversification in Tech Portfolios**,** Capital Asset Pricing Model (CAPM)**,** Risk Analysis in FinTech & Digital Investments.

Unit III: Leverage & Startup Financing	**06 Hours**

Operating Leverage in IT Services, Financial Leverage in Startups, Total Leverage & Business Risk, Indifference Analysis, Funding Sources for Tech Enterprises**:** Venture Capital, Angel Investment, Debt vs Equity in Digital Firms.

Unit IV: Cost of Capital & Capital Budgeting	**06 Hours**

Cost of Capital: Concepts, Cost of Equity, Preference, Debt, Weighted Average Cost of Capital

(WACC), Factors Affecting Cost of Capital in IT Firms, Capital Budgeting: Concepts, Estimation of After-Tax Cash Flows, Project Evaluation Techniques**:** NPV, IRR, Payback Period, Profitability Index.

Unit V :Working Capital & Cash Management | **06 Hours**

Working Capital Concepts, Financing Current Assets, Estimation of Working Capital, Cash Management**:** Motives for Holding Cash**,** Electronic Payments**,** Factoring**,** Outsourcing. Working Capital in SaaS & E-commerce Models.

Unit VI:Accounts Receivable & Credit Management | **06 Hours**

Credit & Collection Policies, Credit Risk Assessment, Digital Credit Scoring, Optimising Credit Period, Receivables Management in IT Services, Managing B2B vs B2C Credit

Textbooks

1. P. Chandra, Financial Management: Theory and Practice, 10th ed. New Delhi, India: McGraw-Hill Education, 2019.
2. E. F. Brigham and M. C. Ehrhardt, Financial Management: Theory & Practice, 16th ed. Boston, MA, USA: Cengage Learning, 2020.
3. J. C. Van Horne and J. M. Wachowicz Jr., Fundamentals of Financial Management, 13th ed. New Delhi, India: Pearson Education, 2009.

Reference Books

1. A. Damodaran, Applied Corporate Finance, 4th ed. Hoboken, NJ, USA: John Wiley & Sons, 2014.
2. S. A. Ross, R. W. Westerfield, and J. Jaffe, Corporate Finance, 11th ed. New York, NY, USA: McGraw-Hill Education, 2016.
3. P. Pignataro, Financial Modelling and Valuation: A Practical Guide to Investment Banking and Private Equity, Hoboken, NJ, USA: John Wiley & Sons, 2013.
4. F. Provost and T. Fawcett, Data Science for Business, Sebastopol, CA, USA: O'Reilly Media, 2013.

List of Lab Assignments

1. Analyse real-world scenarios (e.g., loan amortisation for an IT startup) using simple/compound interest, annuities, and multi-period computations. Calculate present/future values and discuss implications for project funding.
2. Evaluate bonds, preferred stocks, and common stocks for a tech company (e.g., TCS). Use probability distributions, CAPM, and diversification to assess risk-return trade-offs in a portfolio context.
3. Compute weighted average cost of capital (WACC) for equity/debt/preference shares in an IT firm. Estimate after-tax cash flows and apply techniques like NPV/IRR for project evaluation.
4. Examine short/long-term financing mixes for current assets in a software company. Analyse motives for holding cash, speeding receipts (e.g., via electronic commerce), and factoring to optimise balances.
5. Review credit/collection policies for a fintech business. Analyse credit applicants, references, and optimal credit periods to minimize bad debts
6. Choose an organisation (e.g., Reliance Jio) and perform a comprehensive analysis of its capital budgeting process, including proposal generation, cash flow estimation, and alternative evaluation methods.
7. Select a global tech firm (e.g., Google) and break down its investment proposals, incremental operating cash flows, and budgeting techniques to recommend improvements.
8. Apply the Capital Asset Pricing Model (CAPM) to analyze risk in a portfolio of IT stocks. Calculate beta, expected returns, and discuss attitudes toward risk/diversification.
9. Investigate policies in a retail/e-commerce company (e.g., Amazon India). Evaluate applicant analysis, credit references, and period optimization for effective receivables management.
10. Build a simulated investment portfolio (e.g., mixing tech stocks and bonds) for an individual. Incorporate yield to maturity (YTM), risk-return via CAPM, and leverage analysis to balance goals.

Project-Based Learning

Each task can be completed individually or in groups, utilising tools such as Excel or Python for

calculations and incorporating real-world data.

1. Analyse scenarios involving simple/compound interest, amortisation, and annuities (e.g., funding an IT project over time).
2. Evaluate bonds, stocks, YTM, and risk using probability distributions, CAPM, and diversification in a tech portfolio.
3. WACC, estimate cash flows, and apply NPV/IRR techniques for project evaluation.
4. Explore financing mixes, cash motives, electronic commerce, outsourcing, and factoring for maintaining balances.
5. Examine credit policies, applicant analysis, references, and optimal credit periods.
6. Choose an organisation of your choice and analyse it from the perspectives of capital budgeting: Select a firm and review its investment proposals, cash flows, and budgeting process.
7. Analysis of an organisation for capital budgeting: Break down proposals, incremental cash flows, techniques, and selection methods for a specific company.
8. Apply CAPM to assess beta, returns, and risk in a portfolio, discussing attitudes and diversification.
9. Credit and collection policies: Investigate policies, applicant evaluation, and credit optimisation in a business context.
10. Build and analyse a personal investment portfolio incorporating valuation, risk-return, and leverage.

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE IV: COGNITIVE SCIENCE AND ANALYTIC					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**03 Hrs./Week**	**University Examination:**	**60**		
Practical:	**02 Hrs./Week**	**Internal Assessment:**	**40**	**Lecture**	**03**
		Term Work	**25**	**Practical**	**01**
		Oral	**25**		
		Total	**150**		**04**

Course Objective:

1. Understand the fundamentals of cognitive science and explain how human cognition influences intelligent system design.
2. Differentiate between traditional computing and cognitive computing systems, including their architectures and working principles.
3. Apply Natural Language Processing (NLP) techniques in cognitive systems for language understanding and text analytics.
4. Analyze and interpret data using cognitive analytics techniques to derive meaningful insights and predictions.
5. Design and evaluate cognitive-based solutions for real-world applications in domains such as healthcare, finance, education, and business intelligence.

Prerequisite:

Students should have prior knowledge of programming, basic statistics and linear algebra, data structures, database concepts, and introductory artificial intelligence or machine learning fundamentals.

Course Outcomes: On completion of the course, students will have the ability to:

1. Apply cognitive computing and design principles.
2. Understand and differentiate between NLP and cognitive systems.
3. Analyze advanced analytics techniques applied in cognitive platforms.
4. Discuss business applications of cognitive computing.
5. Illustrate real-world uses of cognitive analytics
6. Apply cognitive computing and design principles.

Unit I: Foundations of Cognitive Computing	**6 Hours**

Introduction to cognitive computing, Difference between traditional computing and cognitive systems, Foundations of human cognition and machine interpretation, Design principles and system models for cognition.

Unit II : Natural Language Processing & Cognitive Computing	**6 Hours**

NLP fundamentals in cognitive systems, Role of language understanding in cognitive computing, Text analytics and semantic processing, Interfaces between NLP and cognitive models

Unit III: Data Analytics with Cognitive Systems	**6 Hours**

Data integration for cognitive insights, Big data and analytics in cognitive computing, Patterns, associations, and predictive insights, Analytics pipeline and modelling

Unit IV: Business Implications	**6 Hours**

Application of cognitive computing to business problems, Disruptive models and strategic insights, Knowledge meaning and business intelligence, Use cases in enterprise, healthcare, finance, and automation	
Unit V: Building Cognitive Applications	**6 Hours**
Lifecycle of cognitive solution design, Integration of NLP, analytics, and cognitive workflows, Challenges in implementation, Case studies and real-world cognitive solution.	
Unit VI : Ethics, Emerging Trends and Future Directions	**6 Hours**
Ethical issues in cognitive computing and analytics, Bias, fairness, transparency, and explainable AI (XAI),Data privacy and security in cognitive systems, Human–AI interaction and responsible AI design, Emerging trends in cognitive analytics (Generative AI, cognitive robotics, adaptive systems),Future research directions and interdisciplinary application	
Textbooks	
1. Cognitive Science, Computational Intelligence, and Data Analytics: Methods and Applications with Python	
Reference Books	
1. Artificial Intelligence: A Modern Approach	
2. Data Science and Predictive Analytics — Ivo D. Dinov	
3. Cognitively Inspired Natural Language Processing — Abhijit Mishra & Pushpak Bhattacharyya	
4. Advances in Cognitive Informatics and Cognitive Computing — Yingxu Wang et al. (eds.)	
List of Laboratory Exercise	
1. Compare a traditional "if-else" system with a machine learning model for data classification.	
2. Use NLP to perform Named Entity Recognition (NER) and dependency parsing on a text corpus.	
3. Develop a system to detect specific human emotions (joy, anger, fear) from text or speech.	
4. Apply K-Means clustering or Association Rules to find hidden trends in a big data elective.	
5. Design a recommendation engine using semantic similarity or knowledge graphs.	
6. Create a conversational agent that uses an NLP engine to handle complex user intents.	
7. Develop a live analytics interface to visualize cognitive data streams (e.g., live social feeds).	
Project Based Learning	
1. Cognitive Chatbot with Sentiment Awareness	
2. Emotion Recognition System	
3. Cognitive Recommender System	
4. Fake News Detection using Cognitive Analytics	
5. Healthcare Decision Support System	
6. Cognitive Learning Analytics Dashboard	
7. Voice-Based Virtual Assistant	
8. Customer Behavior Prediction using Cognitive Models	
9. Explainable AI (XAI) Model for Decision Transparency	
10. Cognitive Fraud Detection System	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE IV: INFORMATION RETRIEVAL					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3Hours/Week**	**University Examination:**	**60**		
Practical:	**2 Hours/Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Oral	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. To understand the fundamentals of Information Retrieval (IR) systems and their architecture.
2. To learn indexing, querying, and text processing techniques used in IR systems.
3. To analyze various retrieval models and ranking algorithms.
4. To explore web search, link analysis, and evaluation metrics.
5. To understand text mining and modern IR applications.

Prerequisite:Data Structures and Files, Database management systems

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain the architecture and components of an Information Retrieval system.
2. Apply text processing and indexing techniques for document representation.
3. Compare and implement different retrieval models and ranking methods
4. Apply the concepts of multimedia and distributed information retrieval.
5. Use appropriate tools in analyzing the web information
6. Simulate the working of a search engine and recommender system

Unit I Introduction to Information Retrieval	**6 Hours**

Basic Concepts of IR, Data Retrieval & Information Retrieval, Text mining and IR relation, IR system block diagram, Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighting, Probabilistic Indexing, Automatic Classification. Measures of Association, Different Matching Coefficients, Cluster Hypothesis, Clustering Techniques: Rocchio's Algorithm, Single pass algorithm, Single Link algorithm.

Unit II Indexing , Query Processing and Searching Techniques	**6 Hours**

Inverted Index Construction,Index Compression Techniques,Dictionary and Postings List,Query Processing and Optimization,Phrase Queries,Wildcard Queries,Spelling Correction (Edit Distance),Efficient Index Construction.Searching Techniques: Boolean Search, sequential search, Serial search, cluster-based retrieval, Query languages, Types of queries, Patterns matching, structural queries. IR Models: Basic concepts, Boolean Model, Vector Model, Probabilistic Model.

Unit III Retrieval Models	**6 Hours**

Vector Space Model,Term Frequency (TF), Inverse Document Frequency (IDF),Cosine Similarity,Probabilistic Retrieval Model,BM25 Model,Language Models for IR

Unit IV Distributed and Multimedia IR	**6 Hours**

Distributed IR: Introduction, Collection Partitioning, Source Selection, Query Processing, **Multimedia I**R: Introduction, Data Modeling, Query Language, Background-Spatial Access Method, A Generic Multimedia Indexing Approach, One Dimensional Time Series, Two-Dimensionalcolor Images, Automatic Feature Extraction, Trends and Research Iss**ue.**

Unit V Web Searching	**6 Hours**

Introduction, Challenges, Web Characteristics, Search Engines: Centralized Architecture, Distributed Architecture, User Interfaces, Ranking, Crawling the web, Indices, Browsing, Meta-searchers, Searching using Hyperlinks, Trends and Research Issues, Introduction to Web Scraping: Python for web scraping, Request, HTML parsing, Beautiful Soup.

Unit VI Advanced Information Retrieval	**6 Hours**

XML Retrieval: Basic XML concepts, Challenges in XML retrieval, Vector space model for XML retrieval, Evaluation of XML retrieval, Text-Centric vs. Data-Centric XML retrieval. Recommendation system: Collaborative Filtering and Content Based Recommendation of Documents and Products. Introduction to Semantic Web

Textbooks

1. Ricardo Baeza-Yates, Berthier Riberio–Neto, Modern Information Retrieval, Pearson Education, ISBN: 81- 297-0274-6.
2. C.J. Rijsbergen, Information Retrieval, (www.dcs.gla.ac.uk), Second Edition ISBN:978-408709293
3. Ryan Mitchell, Web Scraping with Python, O'reilly, second Edition, ISBN: 9781491985571.

Reference Books

1. ChabaneDjeraba, Multimedia mining: A highway to intelligent multimedia documents, Kulwer Academic Publisher, ISBN: 1-4020-7247-3.
2. V. S. Subrahamanian, Satish K. Tripathi, Multimedia information System, Kulwer Academic Publisher.
3. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, 2008. 4. Marek Kowalkiewicz, Maria E. Orlowska, Tomasz Kaczmarek, Witold Abramowicz, Web Information Extraction and Integration, Springer New York Publisher.

List of Lab Exercise

1. Implement a Conflation Algorithm (Stemming/Lemming) and Stop-word removal for a set of documents.
2. Build an Inverted Index for a small document collection and implement index compression.
3. Develop a Boolean Search engine to process AND, OR, and NOT queries.
4. Calculate Term Frequency (TF) and Inverse Document Frequency (IDF) for a set of text files.
5. Implement Cosine Similarity to find the rank of documents against a user query.
6. Implement the Single-Pass or Single-Link clustering algorithm for document grouping.

Project Based Learning

1. Design a basic search engine that:Indexes documents,Processes user queries.
2. Build a model to automatically classify documents into categories like: sports,Technology,Politics.
3. Create a tool that:Compares two or more documents,Displays similarity score.
4. Plagiarism Detection System Design a system that:Compares documents,Detects similarity percentage,Uses matching coefficients

Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE IV: ENTERPRISE SYSTEMS					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3Hrs/Week**	**University Examination:**	**60**		
Practical:	**2 Hrs/Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Oral	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. Understand enterprise-wide systems and integrated business processes
2. Analyze ERP implementation strategies and challenges
3. Explore CRM, SCM, BI integration
4. Evaluate cloud-based and AI-driven enterprise systems
5. Develop managerial and technical perspective for enterprise transformation

Prerequisite:

Knowledge of Database Management Systems, Software Engineering, Management Information Systems, and basic business process concepts to effectively understand and apply Enterprise Systems.

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain enterprise systems and business process integration
2. Analyze ERP architecture and implementation strategies
3. Evaluate CRM and SCM integration in organizations.
4. Apply analytics concepts for enterprise decision-making
5. Assess modern trends like cloud ERP, AI & RPA
6. Propose enterprise system solutions for real-world scenarios

Unit I: Enterprise Systems & Business Process Integration — **6 Hours**

Introduction to Enterprise Systems, Functional Silos vs Process-Oriented Organizations, Cross-functional Business Processes, Enterprise System Architecture (2-tier, 3-tier, SOA), Digital Transformation & Enterprise Integration, Evolution: Legacy Systems → ERP → Cloud ERP

Unit II : Enterprise Resource Planning (ERP) Systems — **6 Hours**

ERP Concepts & Characteristics, ERP Modules:Finance & Accounting, Human Resource Management, Production & Manufacturing, Sales & Distribution, Procurement & Inventory, ERP Vendors & Ecosystem, ERP Implementation Life Cycle

Unit III: Customer Relationship Management (CRM) & Supply Chain Management (SCM) — **6 Hours**

CRM-CRM Concepts & Objectives, Operational, Analytical & Collaborative CRM, Customer Data Platforms, Social CRM & Omnichannel Integration, SCM-Supply Chain Fundamentals, Demand Forecasting, Inventory Management, Logistics & Distribution, Integration of SCM with ERP

Unit IV: Business Intelligence, Analytics & Data in Enterprise Systems — **6 Hours**

Data Warehousing, OLAP & Reporting, KPIs & Dashboard Design, Predictive Analytics in ERP, AI & Machine Learning Integration, Data Governance & Data Quality

Unit V: Emerging Trends in Enterprise Systems — **6 Hours**

Cloud ERP & SaaS Models, Multi-cloud & Hybrid Architecture, Enterprise Mobility, Robotic Process Automation (RPA), Blockchain in Supply Chain, Cybersecurity in Enterprise Systems, ESG

Reporting & Sustainable Enterprise Systems, Industry 4.0 & Smart Enterprises	
Unit VI: Enterprise Solution Design and Digital Transformation Strategy	**6 Hours**
Designing integrated ERP–CRM–SCM solutions, multi-tier and cloud-based architecture design, Identifying business problems, Stakeholder analysis, Functional and non-functional requirements, Cloud migration roadmap, AI and analytics integration, Automation and RPA opportunities	
Textbooks	
1. Sharma & Sharma – Enterprise Resource Planning with SAP S/4HANA	
Reference Books	
1. Monk & Wagner – Concepts in Enterprise Resource Planning	
2. Leon – ERP Demystified	
3. Garg & Venkitakrishnan – Enterprise Resource Planning	
4. O'Brien & Marakas – Management Information Systems	
List of Laboratory Exercise:	
1. Use a modeling tool (like Lucidchart, Bizagi, or ARIS) to map a "Purchase-to-Pay" or "Order-to-Cash" process.	
2. Using an open-source ERP (like Odoo, ERPNext) or a trial version of SAP S/4HANA, create Master Data for a Product, Vendor, and Customer.	
3. Execute a complete procurement cycle: Create a Purchase Requisition → Purchase Order → Goods Receipt → Invoice Verification.	
4. Perform a standard sales cycle: Inquiry → Quotation → Sales Order → Delivery/Picking → Billing.	
5. Configure a Lead-to-Opportunity pipeline in a CRM tool (like Salesforce Trailhead or HubSpot).	
6. Use a dataset to perform demand forecasting using simple moving averages or exponential smoothing within an ERP or Excel-based tool.	
Project Based Learning	
1. Business Process Mapping Assignment	
2. ERP Vendor Comparative Study	
2. Case Study Analysis (ERP success/failure)	
3. CRM solution for banking sector	
4. Design a Cloud-based Enterprise Architecture	
5. Research Paper Review on AI in ERP	
6. CRM System Design for a Hospital	
7. SCM integration with ERP for manufacturing industry	
8. Cloud Migration Strategy for Legacy Enterprise Systems	
9. Business analytics solution for sales prediction	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

MAJOR PROJECT					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**- Hrs/Week**	**University Examination:**	**--**		
Practical:	**16 Hrs./Week**	**Internal Assessment:**	**--**	**Lecture**	**-**
		Term Work	**100**	**Practical**	**8**
		Oral	**50**		
		Total	**150**	**Total**	**8**

Course Objective:

1. To identify and analyze real-world problems through systematic literature review and gap analysis.
2. To design and architect innovative computing solutions by integrating core engineering principles with emerging technologies like AI and Cybersecurity.
3. To develop and implement a functional prototype or system using modern software development tools, platforms, and methodologies.
4. To validate and evaluate the system performance using empirical evidence, standard benchmarks, and rigorous testing.
5. To cultivate professional skills in technical documentation, research publication, and effective oral communication.

Prerequisite:

Basics of Software engineering, Software testing and knowledge of core computer subjects, Python, security & ML, knowledge of DevTools, Skill in handling datasets and reading IEEE/ACM papers, Basic Statistics to validate experimental results.

Course Outcomes: On completion of the course, students will have the ability to:

1. Analyze complex engineering problems and formulate a clear, measurable problem statement supported by a comprehensive literature survey.
2. Design a robust system architecture and methodology by selecting appropriate algorithms, data structures, and technological frameworks.
3. Build a functional software or hardware prototype using programming languages (e.g., Python), libraries, and specialized tools (e.g., LLMs, datasets).
4. Evaluate the developed solution using quantitative metrics and empirical data to demonstrate its effectiveness and accuracy.
5. Prepare a structured technical dissertation and present research findings effectively to an expert committee or through peer-reviewed publications.
6. Demonstrate the ability to work in a team, manage project timelines, and adhere to ethical standards regarding data privacy and intellectual property.

1. Problem Identification and Domain Research

- Identification of a real-world technical or business problem.
- Selection of a specific domain (e.g., Cybersecurity, Fintech, or AI).
- Formulation of a clear Problem Statement and set of measurable Research Objectives.

2. Literature Review and Feasibility Study

- Comprehensive survey of existing research papers, patents, and industry standards.
- Gap analysis to identify what current solutions are missing.
- Evaluation of technical feasibility, including required hardware (GPUs/TPUs), software libraries (Python, PyTorch, LangChain), and dataset availability.

3. System Design and Architecture

- Design of the high-level system architecture and data flow diagrams.

- Selection of algorithms or models (e.g., specific LLMs or Machine Learning classifiers).
- Planning the integration of different modules (e.g., Pre-processing, Analysis Core, and UI).

4. Implementation and Prototyping

- Data collection and cleaning (using datasets like EMBER or CIC IDS).
- Feature engineering and extraction.
- Development of the core logic, including prompt engineering strategies (Few-Shot/Chain-of-Thought) and model fine-tuning.
- Building a functional user interface for demonstration.

5. Testing, Validation, and Empirical Analysis

- Rigorous testing of the system against standard benchmarks.
- Collection of empirical evidence (Accuracy, Precision, Recall, and Latency).
- Comparative analysis of the proposed solution against existing state-of-the-art methods.

6. Documentation and Scientific Communication

- Maintenance of a project logbook or repository (e.g., GitHub).
- Preparation of a comprehensive Project Dissertation/Thesis following institutional formatting.
- Writing and submitting a research paper to a peer-reviewed journal or conference.
- Final technical presentation and viva-voce examination.

COURSE SYLLABUS SEMESTER VIII

CYBER AND INFORMATION SECURITY					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**3Hrs/Week**	**University Examination:**	**60**		
Practical:	**2 Hrs./Week**	**Internal Assessment:**	**40**	**Lecture**	**3**
		Term Work	**25**	**Practical**	**1**
		Oral	**25**		
		Total	**150**	**Total**	**4**

Course Objective:

1. To understand security parameters, cryptosystems, and access control models.
2. To identify and model various security threats including web and email threats.
3. To learn about digital forensics, incidence response, and enterprise security architecture.

Prerequisite:

Knowledge of OSI Model, TCP/IP, and common protocols like HTTP, DNS, and SSH.

The ability to run Virtual Machines (VMware/VirtualBox)

Course Outcomes: On completion of the course, students will have the ability to:

1. Analyze foundational security principles, modern threats, and cryptographic systems to design secure information frameworks.
2. Implement advanced access control models and trusted computing mechanisms to ensure identity and hardware integrity.
3. Apply global security standards and continuous monitoring tools to manage enterprise governance and compliance.
4. Perform risk assessments and threat modelling to mitigate sophisticated cyber-attacks and ransomware.
5. Execute intrusion detection, malware analysis, and digital forensic procedures for effective incident response and containment.
6. Design secure cloud and enterprise architectures using SASE, SSE, and container-specific security protocols.

Unit I: Security Foundations & Modern Cryptography — **6 Hours**

Confidentiality, Integrity, Availability (CIA), Security violation and threats; Security policy and procedure, Threat Landscape**:** Evolution of threats (APTs, Zero-day exploits); Security Policy vs. Governance.

Assumptions and Trust, zero trust architecture (ZTA); Security Life Cycle, Symmetric and Asymmetric Cryptosystems, Different Ciphers used for Information Security, Secure Cryptosystem.

Unit II : Access Control & Trusted Systems — **6 Hours**

Access Models: Discretionary (DAC), Mandatory (MAC), Role-based (RBAC), and Task-based models.

Authentication Policies, techniques, and Trusted Computing: Trusted Platform Modules and Secure Boot mechanisms.

Unit III : Security Policies & Auditing — **6 Hours**

Global Standards: ISO/IEC 27001:2022, National Institute of Standards and Technology Cybersecurity Framework(CSF 2.0), and General Data Protection Regulation/California Consumer Privacy Act.

Auditing: Continuous security monitoring, Security Information and Event Management
Security Awareness training and the role of the Chief Information Security Officer in board level risk management.

Unit IV : Cyber Threats & Risk Management — **6 Hours**

Threats: Insider threats, Cybercrime, E-mail and Web threats, Sophisticated Threats: Ransomware-

as-a-Service (RaaS), Social Engineering (Deep fakes/AI-phishing).

Risk Management: Risk Assessment, Threat Modelling, and Vulnerability Assessment tools., Threat Modelling: Using STRIDE or Process for Attack Simulation and Threat Analysis (PASTA) methodologies.

Unit V : Logic-based Systems & Digital Forensics | **6 Hours**

Detection: Intrusion detection , Intrusion Defense: From IDS/IPS to Extended Detection and Response (XDR), Malware Analysis: Static vs. Dynamic analysis; Analysing AI-generated malicious code.

Digital Forensics: Memory forensics, Mobile forensics, and Chain of Custody in a remote world. Incident Response: Playbook automation and the "Golden Hour" of breach containment.

Unit VI : Enterprise & Cloud Security | **6 Hours**

Cloud Models: Shared Responsibility Model in AWS/Azure/Google Cloud

Modern Architecture: SASE (Secure Access Service Edge) and SSE (Security Service Edge) featuring Container Security: Securing Docker, Kubernetes, and Serverless functions.

Textbooks

1. Computer Security: Principles and Practice by William Stallings & Lawrie Brown (Latest Ed. 2024/2026)
2. Information Security: Principles and Practice by Mark Stamp (3rd Ed. 2021/2022)
3. Cryptography and Network Security: Principles and Practice by William Stallings (8th Ed. 2023)

Reference Books

1. The Cybersecurity Playbook by Allison Cerra
2. IT Auditing: Using Controls to Protect Information Assets by Chris Davis & Mike Schiller
3. Digital Forensics and Incident Response by Gerard Johansen (3rd Ed. 2023)
4. Cloud Security Fundamentals by Jason Edwards

List of Assignments

1. Analyze one famous cyberattack (e.g., SolarWinds) through the lens of the **CIA Triad**.
2. Write a Python script to compare **AES (Symmetric)** vs. **RSA (Asymmetric)** encryption speeds.
3. Create a **Role-Based Access Control (RBAC)** table for a hospital (Doctor, Nurse, Admin).
4. Use chmod and chown in Linux to implement **Discretionary Access Control (DAC)** on sensitive files.
5. Write a 1-page **Acceptable Use Policy (AUP)** for company laptops based on ISO 27001.
6. Use Windows **Event Viewer** to identify and document three failed login attempts.
7. Map a banking app using the **STRIDE** framework.
8. Set up **Snort** (Intrusion Detection System) to detect a simulated "Ping of Death" attack.
9. Use **Autopsy** or **FTK Imager** to recover a "deleted" file from a USB drive image.
10. Configure an **AWS/Azure IAM Role** using the "Principle of Least Privilege" (allow viewing, deny deleting).

List of Laboratory Exercises

1. Implementation of symmetric and asymmetric encryption algorithms
2. Configuration of access control lists (ACLs) for different security models.
3. Vulnerability Assessment: Perform a network vulnerability scan using industry-standard tools like Nessus or OpenVAS and generate a risk report.
4. Web & Email Security: Demonstrating and mitigating a SQL Injection or Cross-Site Scripting (XSS) attack on a test web application.
5. Intrusion Detection: Configuring and analyzing network traffic logs using an IDS tool like Snort to detect suspicious patterns.
6. Digital Forensics: Perform "Live Discovery" on a storage medium to recover deleted files and analyze metadata using tools like Autopsy or FTK Imager.
7. Cloud Security Configuration: Set up and audit a secure "S3 Bucket" or "Identity and Access Management (IAM)" policy on a cloud platform (AWS/Azure).

8. Business Continuity Planning (Case Study): Develop a Disaster Recovery and Business Continuity Plan for a simulated enterprise-level security breach.	
Project Based Learning 1. "Crypto-Vault" Messenger 2. Multi-Level File Manager 3. The "Compliance Audit" Simulation 4. Threat Modeling a FinTech App 5. The "Infection & Investigation" 6. Cloud-Native Secure Architecture	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE V: COMPUTATIONAL FINANCE & MODELING					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**2 Hrs./Week**	**University Examination:**	**60**		
Practical	**-**	**Internal Assessment:**	**40**	**Lecture**	**2**
		Term Work	**-**	**Practical**	**-**
		Oral	**-**		
		Total	**100**	**Total**	**2**

Course Objective:

1. To understand financial theories and quantitative models.
2. To apply computational techniques in financial problem solving.
3. To develop programming skills for financial data analysis.
4. To implement pricing, risk, and portfolio models using software tools.

Prerequisite:

1. Basic Calculus, Linear Algebra & Optimization techniques.
2. Probability & Statistics with Numerical methods.
3. Basic programming knowledge in Python/R/Matlab.
4. Basic knowledge of Finance.

Course Outcomes: On completion of the course, students will have the ability to:

1. Define key financial concepts.
2. Apply statistical tools to financial datasets.
3. Analyse pricing models critically.
4. Evaluate portfolio performance.
5. Assess suitability of computational methods.
6. Design computational financial models.

Unit I	**04 Hours**

Foundations of Computational Finance: Introduction to Financial Systems & Markets, Time Value of Money, Interest Rates (Simple, Compound, Continuous), Financial Instruments: Bonds, Stocks, Derivatives, Financial Data Sources (Yahoo Finance, NSE/BSE), Introduction to Financial Modelling Concepts, Basics of Numerical Methods in Finance

Unit II	**04 Hours**

Probability, Statistics & Stochastic Processes in Finance: Probability Theory Refresher, Random Variables & Distributions (Normal, Lognormal), Expected Value & Variance, Covariance & Correlation, Brownian Motion & Wiener Process, Geometric Brownian Motion, Introduction to Monte Carlo Simulation

Unit III	**04 Hours**

Financial Derivatives & Pricing Models: Forwards & Futures, Options (Call & Put), Payoff Diagrams, Binomial Pricing Model, Black-Scholes Model, Greeks (Delta, Gamma, Vega, Theta, Rho), Volatility Modelling

Unit IV	**04 Hours**

Portfolio Theory & Risk Modelling: Risk & Return, Modern Portfolio Theory, Mean-Variance Optimization, Capital Asset Pricing Model (CAPM), Beta Estimation, Value at Risk (VaR), Conditional VaR CVaR), Risk Metrics & Performance Measures (Sharpe Ratio, Treynor Ratio)

Unit V	**04 Hours**

Computational Techniques & Financial Algorithms: Numerical Methods (Root Finding, Optimization), Finite Difference Methods, Monte Carlo Methods in Option Pricing, Optimization Algorithms in Finance, Machine Learning Applications in Finance, Time Series Analysis (AR, MA, ARIMA)

Unit VI	**04 Hours**

Advanced Topics & Applications: Algorithmic Trading Basics, High Frequency Trading Concepts, Credit Risk Modelling, Interest Rate Models (Vasicek, CIR), Financial Engineering Applications, Block chain & FinTech Overview, Case Studies in Computational Finance.

Textbooks	
1. Tools for Computational Finance: Rudiger U. Seydel	
2. Mathematics for Finance: An Introduction to Financial Engineering by **Marek Capiński and Tomasz Zastawniak.**	
Reference Books	
3. Computational Finance with R: Rituparna sen & Sourish Das	
4. Computation & Simulation for Finance: An Introduction with Python: Jessica James.	
5. Financial Engineering & Computation by Cambridge University Press.	
List of Assignments	
1. Financial Concepts & TVM: Explain types of financial markets and instruments, Compute: Present Value & Future Value, Continuous compounding, Compare simple vs compound interest. Case study: Bond pricing using discounting. 2. Financial Data Exploration: Collect 5 years of stock data (NSE/BSE/Yahoo Finance), Compute daily returns, Plot price vs return, Calculate mean, variance, volatility. 3. Regression & Correlation Analysis: Select two correlated stocks, Compute covariance & correlation, build linear regression model, Interpret beta and R^2. 4. Volatility Analysis: Calculate historical volatility, Compare implied vs historical volatility, Study volatility smile (if data available). 5. Portfolio Optimization: Select 4–5 stocks, construct efficient frontier, Identify minimum variance portfolio, Compute Sharpe Ratio. 6. Credit Risk Modelling: Build logistic regression model for credit default dataset, evaluate model using confusion matrix, Compare with decision tree or ML model. 7. Algorithmic Trading Strategy: Design rule-based trading strategy (e.g., Moving Average Crossover), Backtest on historical data, Compute performance metrics: CAGR, Maximum Drawdown, Sharpe Ratio.	
Project Based Learning	
1. Data Analysis & Modelling Projects (Intermediate Level). 2. Derivatives & Risk Engineering (Advanced). 3. Algorithmic & Quantitative Trading (High Level). 4. Integrated Capstone Projects. 5. Cryptocurrency Modelling & Risk Analysis. 6. Robo-Advisory System.	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE V: BEHAVIOURAL ECONOMICS					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**2 Hrs./Week**	**University Examination:**	**60**		
Practical	**-**	**Internal Assessment:**	**40**	**Lecture**	**2**
		Term Work	**-**	**Practical**	**-**
		Oral	**-**		
		Total	**100**	**Total**	**2**

Course Objective:

1. To understand behavioural economics concepts and how psychological factors influence economic decision-making beyond traditional theory
2. **To analyze and apply** behavioral insights related to biases, risk, uncertainty, and intertemporal choices in real-world economic and market contexts.
3. **To evaluate and design** behavioral interventions and policy applications using empirical evidence and case-based learning

Prerequisite: Basic knowledge of Mathematics and Microeconomics

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain the foundations of behavioural economics and distinguish it from traditional microeconomic theory
2. Analyse consumer decision-making using concepts of bounded rationality, heuristics, and cognitive biases.
3. Apply behavioral models to choices under risk, uncertainty, and intertemporal decision-making.
4. Evaluate behavioural factors influencing financial behaviour, market outcomes, and strategic interactions.
5. Assess the role of social preferences, norms, and behavioural game theory in economic behaviour and policy design.
6. Design behavioural interventions (nudges) and conduct case-based analysis for real-world economic and policy problems.

Unit I - Foundations of Behavioural Economics	**04 Hours**
Evolution from neoclassical to behavioural economics, Bounded rationality and decision anomalies, Behavioural economics & interdisciplinary links (psychology, neuroscience), Money illusion, framing, loss perception, **Indian context:** charitable giving, digital payments behaviour	
Unit II - Behavioral Choice Theory & Consumer Behavior	**04 Hours**
Utility in economics vs psychology, Models of rationality and bounded rationality, Addiction, retail therapy, and environmental choices, Pricing psychology, valuation biases, public goods behaviour, **Digital marketplace behaviour**	
Unit III - Beliefs, Heuristics & Cognitive Biases	**04 Hours**
Types of heuristics (availability, representativeness, anchoring), Overconfidence, confirmation bias, projection bias, Probability misjudgement and belief updating, Applications: counterfeit markets, financial trading, cryptocurrency behaviour	
Unit IV - Decision Making under Risk & Uncertainty	**04 Hours**
Expected utility theory vs Prospect theory, Loss aversion and reference dependence, Mental accounting and probability weighting, Applications: insurance, sports decision-making, portfolio choice	
Unit V - Intertemporal Choice & Behavioural Finance	**04 Hours**
Time preference and discounting (geometric vs hyperbolic),Self-control problems and commitment devices, Credit card behaviour, BNPL, savings patterns, Behavioural consumption planning and future projection	
Unit VI - Strategic Behavior, Nudges & Public Policy	**04 Hours**

Behavioural game theory and Nash equilibrium, social preferences: fairness, trust, reciprocity, Nudging and behavioural public policy, Behavioural labour markets and compensation design,Compliance, social norms, and punishment, Behavioural interventions in Indian policy (UPI, Swachh Bharat, tax compliance)	
Textbooks	
1. Wilkinson & Klaes — Introduction to Behavioural Economics	
Reference Books	
1. Camerer, Loewenstein & Rabin — Advances in Behavioral Economics	
2. Thaler & Sunstein — Nudge	
Project Based Learning(PBL)	
1. Impact of digital payments on consumer behaviour in India 2. Gig economy and behavioural labour supply 3. Social media influence on spending patterns 4. Behavioural analysis of sustainability choices 5. Behavioural biases in stock market investing 6. Hyperbolic discounting in student spending habits 7. Behavioural nudges in government policy (UPI adoption, tax compliance) 8. Gender differences in labour force participation decisions 9. Behavioural analysis of BNPL and credit usage 10. Consumption behaviour post-COVID	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

PROGRAM ELECTIVE COURSE V: INDUSTRIAL AND ORGANIZATIONAL PSYCHOLOGY					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**2 Hrs./Week**	**University Examination:**	**60**		
Practical	**-**	**Internal Assessment:**	**40**	**Lecture**	**2**
		Term Work	**-**	**Practical**	**-**
		Oral	**-**		
		Total	**100**	**Total**	**2**

Course Objective:

1. Introduces psychological principles applied to workplace behaviour and organizational effectiveness.
2. Explores individual factors such as personality, motivation, attitudes, and job satisfaction
3. Examines leadership, communication, teamwork, and organizational culture.
4. Covers HR functions including recruitment, training, and performance management.
5. Addresses workplace issues like stress, conflict, and employee well-being.

Prerequisite:

Students should understand human behaviour and organizational functioning is helpful, though no prior knowledge of psychology is required.

Course Outcomes: On completion of the course, students will have the ability to:

1. Explain the major content areas of Industrial Psychology, including job analysis, recruitment, selection, employment law, training, performance management, and workplace health and well-being.
2. Apply statistical concepts to support evidence-based personnel decisions in organizational contexts.
3. Demonstrate **p**ractical skills by conducting hands-on projects related to job analysis, selection, training design, and employee well-being initiatives
4. Analyse and interpret psychological tests and measurement data to make accurate, data-driven organizational decisions
5. Integrate foundational knowledge of Industrial/Organizational Psychology to prepare for advanced studies or specialized courses in HRM and I/O Psychology.
6. Analyse and interpret individual differences in behavior using established theories of personality.

Unit I: Foundations of I/O Psychology & Job Analysis	**04 Hours**

Introduction to Industrial and Organizational Psychology, its scope, research methods, and legal context. Covers job analysis, competency modeling, job evaluation, compensation systems, job design, employee well-being, and recruitment processes.

Unit II: Employee Selection & Assessment Methods	**04 Hours**

Identifying performance criteria and validating tests used in personnel selection. Screening techniques: resumes and tests, interviews, assessment centers, and background checks.

Unit III: Performance Management Systems	**04 Hours**

Performance goal setting, feedback mechanisms, and coaching techniques. Performance appraisal methods and the use of evaluation results for employee development and organizational effectiveness.

Unit IV: Employee Attitudes, Motivation & Diversity	**04 Hours**

Theories of motivation, job satisfaction, and organizational commitment. Fairness, organizational justice, diversity, and inclusion in managing a productive workforce.

Unit V: Leadership & Organizational Processes	**04 Hours**

Leadership theories, organizational climate and culture, and organizational development. Teamwork, group dynamics, and the structure of work behavior in organizations.

Unit VI: Stress Management & Work–Life Balance	**04 Hours**

Sources and effects of stress related to work and life demands. Coping strategies, stress management

techniques, and organizational initiatives to promote employee well-being and work–life balance.

Textbooks

1. Landy, F. J. and Conte, J. M. (2013). Work in the 21st Century (4th Edition). Oxford: Blackwell Publishing
2. Introduction to Psychology, University of Minnesota Libraries Publishing, ISBN 13: 9781946135131
3. Introduction to Psychology, Manoj Kr Singh, Anmol Publications Pvt. Ltd.
4. Introduction to Industrial/Organizational Psychology — Ronald E. Riggio & Stefanie K. Johnson
5. Industrial/Organizational Psychology: Understanding the Workplace — Paul E. Levy
6. Psychology and Work: An Introduction to Industrial and Organizational Psychology — Donald M. Truxillo et al.

Reference Books

1. Encyclopedia of Psychology (English, Hardcover, unknown), Oxford University Press Inc ISBN: 9781557981875, 979781557981875, Edition2000
2. Industrial and Organizational Psychology — P. K. Ghosh & M. B. Ghorpade
3. Industrial/Organizational Psychology: An Applied Approach — Michael G. Aamodt

Project Based Learning:

1. Job Analysis Study of a Technical Role
2. Employee Motivation Assessment in a Workplace
3. Workplace Stress and Well-Being Survey
4. Leadership Style Evaluation in Organizations
5. Recruitment and Selection Process Analysis
6. Organizational Culture Assessment of a Company/Institution
7. Team Dynamics and Group Behaviour Stud
8. Training Needs Analysis and Program Design
9. Employee Job Satisfaction and Engagement Study
10. Work-Life Balance and Productivity Analysis

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit – III
Unit Test -2	Unit – IV, Unit – V, Unit – VI

PROGRAM ELECTIVE COURSE V: SERVICES SCIENCE & SERVICE OPERATIONAL MANAGEMENT					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**2 Hrs./Week**	**University Examination:**	**60**		
Practical	**-**	**Internal Assessment:**	**40**	**Lecture**	**2**
		Term Work	**-**	**Practical**	**-**
		Oral	**-**		
		Total	**100**	**Total**	**2**

Course Objective:

1. To transition from a goods-centric mindset to Service-Dominant (S-D) Logic and value co-creation.
2. To apply mathematical models for Facility Location, Vehicle Routing, and Inventory Management.
3. To foster a mindset of continuous improvement and **Open Service Innovation** for business growth.

Prerequisite:

Students should understand Fundamentals of Management, Operations Research

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand concepts about Services and distinguish it from Goods.
2. Able to identify characteristics and nature of Services.
3. Comprehend ways to design Services and evaluate those using Service qualities.
4. Understand how various methods can be used to operate and manage Service businesses.
5. Understand how innovation can be approached from Services point of view.
6. Understand the need of Services Innovation.

Unit I: Introduction & Nature of Services and Service Encounters	**04 Hours**

Introduction to the course, Introduction to service operations, Role of service in economy and society, Introduction to Indian service sector. Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters.

Unit II: Service-Dominant Logic & New Service Development	**04 Hours**

Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co-creation. Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis.New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system.Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design.

Unit III: Locating facilities and designing their layout	**04 Hours**

Models of facility locations (Huff's retail model), Role of service-scape in layout design.
Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools.
Service Guarantee & Service Recovery: How to provide Service guarantee? How to recover from Service failure?

Unit IV: Forecasting Demand for Services	**04 Hours**

Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting. Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services. Managing Facilitating Goods: Review of inventory models, Role of inventoryin services.

Unit V: Managing service supply relationship	**04 Hours**
Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service.	
Unit VI: Vehicle Routing Problem	**04 Hours**
Vehicle Routing Problem: Managing after sales service, understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes. Service Innovation: Services Productivity, Need for Services Innovation.	
Textbooks	
1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th edition).	
Reference Books	
1. Wilson, A., Zeithaml, V. A., Bitner, M. J., & Gremler, D. D. (2012). Servicesmarketing: Integrating customer focus across the firm. McGraw Hill.	
2. Lovelock, C. (2011). Services Marketing, 7/e. Pearson Education India	
3. Reason, Ben, and Lovlie, Lavrans, (2016) Service Design for Business: A PracticalGuide to Optimizing the Customer Experience, Pan Macmillan India.	
4. Chesbrough, H. (2010). Open services innovation: Rethinking your business to growand compete in a new era. John Wiley & Sons.	
Topics for Project Based Learning: 1. Choose any service organization around and present it from the perspective of nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add. 2. Choose the latest research paper in services and explain your understanding and feedback on the same. 3. Case study of Huff's Retail model with reference to the service organization for locating different facilities. 4. Do a case study and prepare strategies for matching capacity and demand 5. Analyze the Psychology of waiting with reference to the service organization 6. Do a review of different types of forecasting methods for demand forecasting 7. Case study of inventory models, Role of inventoryin services. 8. Do a case study of supply chain/hub of service and prepare strategies for managing suppliers of service. 9. Prepare a case study Vehicle Routing Problem 10. Service industry requires continuous innovation. Do case study of its requirement	
Syllabus for Unit Tests:	
Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

SEMINAR					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**- Hrs/Week**	**University Examination:**	**--**		
Practical:	**- 04 Hrs./Week**	**Internal Assessment:**	**--**	**Lecture**	**-**
		Term Work	**50**	**Practical**	**02**
		Oral	**50**		
		Total	**100**	**Total**	**02**

Course Objective:

The Seminar aims to:

1) Develop self-learning ability and research orientation

2) Enhance technical understanding of emerging technologies

3) Improve presentation and communication skills

4) Encourage analytical and critical thinking

5) Prepare students for industry discussions, higher studies, and interviews

Course Outcomes: On completion of the course, students will have the ability to:

1. Demonstrate an understanding of the organizational structure, workflow, and professional ethics of the host company.
2. Apply engineering principles and analytical skills to execute tasks or projects assigned by the industry mentor.
3. Utilize industry-standard software tools, IDEs, and version control systems (e.g., Git, Jira, Docker) to complete deliverables.
4. Prepare professional technical reports and deliver presentations documenting the work performed and challenges solved.
5. Function effectively as an individual or a member of a diverse team to meet project deadlines and objectives.
6. Identify and bridge skill gaps by learning new technologies or methodologies independently during the internship period.

GUIDELINES:

Scope of Topics

Students must select a topic from recent, relevant, and advanced areas such as:

i) Emerging/Recent Technologies

ii) Case Studies such as

Real-world system implementations (e.g., Smart Cities, Aadhaar, UPI)
Failure analysis of major IT systems
Security breaches (e.g., ransomware attacks)
Tech product architecture (e.g., Netflix, Google, Amazon systems)

iii) Research-Oriented Topics

Survey papers from IEEE, Springer, ACM
Comparative analysis of algorithms/technologies
Recent innovations (last 3–5 years)

iv) Interdisciplinary Topics such as

AI in Healthcare
IT in Agriculture
Smart Education Systems
Sustainable Technologies

What Students Are Expected to Do

Step 1: Topic Selection Choose a unique topic (no duplication in the batch) and get approval from seminar guide/faculty
Step 2: Literature Survey Refer minimum 5–8 quality sources like Research papers (IEEE, Springer, etc.), Technical blogs (credible sources), White papers / Industry reports Focus on recent developments (last 5 years)
Step 3: Content Preparation
Step 4: Report Writing Students must submit a Seminar Report (Approx. 20–25 pages) containing: • Abstract (1 page) • Introduction • Detailed explanation • Diagrams / charts • Case study (if applicable) • Conclusion • References (IEEE format)
Step 5: Presentation Prepare PPT (10–15 slides) Duration: 15–20 minutes presentation + 5–10 minutes Q&A Use diagrams, flowcharts, visuals
Step 6: Demonstration (Optional but Highly Encouraged) • Simulation / small prototype / video demo • Tools: Python, MATLAB, IoT kits, etc.

INTERNSHIP					
Teaching Scheme		**Examination Scheme**		**Credit Scheme**	
	Hours/Week		**Marks**		**Credits**
Lecture:	**-Hrs/Week**	**University Examination:**	**--**		
Practical:	**- Hrs./Week**	**Internal Assessment:**	**--**	**Lecture**	**-**
		Term Work	**150**	**Practical**	**14**
		Oral	**100**		
		Total	**250**	**Total**	**14**

Course Objective:

To provide exposure to the industrial environment and professional culture of the IT/Business sectors.

To apply theoretical knowledge gained in previous semesters to solve real-world technical or business problems.

To develop practical skills in modern tools, platforms, and emerging technologies currently used in the industry.

Prerequisite: Students should have

Proficiency in at least one programming language (Python, Java, or C++) and web/mobile development frameworks. Domain Knowledge: Foundational understanding of Database Management (SQL/NoSQL), Software Engineering principles, and Data Structures. Professional Readiness: Basics of workplace ethics, corporate communication, and time management.

Course Outcomes: On completion of the course, students will have the ability to:

1. Demonstrate an understanding of the organizational structure, workflow, and professional ethics of the host company.
2. Apply engineering principles and analytical skills to execute tasks or projects assigned by the industry mentor.
3. Utilize industry-standard software tools, IDEs, and version control systems (e.g., Git, Jira, Docker) to complete deliverables.
4. Prepare professional technical reports and deliver presentations documenting the work performed and challenges solved.
5. Function effectively as an individual or a member of a diverse team to meet project deadlines and objectives.
6. Identify and bridge skill gaps by learning new technologies or methodologies independently during the internship period.

GUIDELINES:

Internship Structure

Component	**Industry Internship**	**In-House Internship**
Duration	One full semester (16–20 weeks)	One full semester (16–20 weeks)
Mode	At Industry/Organization	Within Institute
Credits	14	14
Mentorship	Industry + Faculty Mentor	Faculty + Industry Expert
Evaluation	Continuous + Final	Continuous + Final

Industry Internship

Allocation

• Students may obtain internships through:
Institute
Off-campus applications
Faculty/Alumni references

Approval

• Internship must be approved by:

Department Internship Coordinator

Concerned Faculty Mentor

Requirements

• Minimum 16 weeks duration

• Work must be relevant to: XXVI o IT / Computer Science / Emerging Technologies

Students must submit:

Offer Letter

Joining Report

Weekly Logbook

Monitoring

• Weekly progress submission (online/offline)

• Minimum 2 reviews by faculty mentor

• Feedback from industry supervisor

Deliverables

• Internship Report (standard format)

• Work Diary / Logbook

• Project/Task Completion Proof

• Presentation & Viva

In-House Internship

Structure

• Designed by department in emerging domains, such as:

o Artificial Intelligence / Machine Learning

o Data Science

o Cybersecurity

o IoT / Embedded Systems

o Cloud Computing / DevOps

o Web/App Development

Execution Model

• Combination of:

o Structured Modules (30–40%)

o Hands-on Project Work (60–70%)

Mentorship

• Internal Faculty Mentor

• External Industry Expert (minimum 20–30% involvement)

Weekly Schedule

• Technical sessions (lectures/workshops)

• Lab/practical implementation

• Project development

• Weekly review meetings

Deliverables

• Module Assignments

• Mini Projects (phase-wise)

• Final Capstone Project

• Documentation + Presentation

Common Guidelines (Applicable to Both)

Attendance

• Minimum 80% attendance mandatory
• Industry: certified by company
• In-house: monitored by department

Logbook

• Weekly record of:
o Tasks performed
o Skills learned
o Challenges faced