

SCHEME AND CURRICULUM BOOK
BACHELOR OF TECHNOLOGY
in
Computer Science and Engineering
(Internet of Things)

UG DEGREE 4 YEAR PROGRAMME
Engineering and Technology
(w.e.f. Session 2022-2023)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Gurugram University, Gurugram, Haryana

Preface

The overall well-being of a nation depends on the eminence of its human resource. Providing quality education plays a vital role in transforming people into valuable human resource. Well educated students of today will become innovators and leaders of tomorrow who are going to ensure a constructively competitive but sustainable and peaceful world for everyone. Keeping in the view the demand of the skills based on Internet of Things, the university has introduced a Bachelor of Technology Programme in Computer Science & Engineering (Internet of Things) in the Department of Computer Science & Engineering. We have designed the curriculum for B.Tech. Computer Science & Engineering (Internet of Things). The curriculum is designed around the framework of Outcome-Based Education (OBE) in which students are at the centre of teaching learning process. The salient features of the curriculum design are as follows:

1. To start with, four Programme Educational Outcomes are defined.
2. The twelve Programme Outcomes (POs) are taken from the Self Appraisal Report format of National Board of Accreditation (NBA) for undergraduate engineering programmes and two Programme Specific Outcomes (PSOs) are outlined to capture the specialisations of the B. Tech. CSE (Internet of Things) programme.
3. An induction programme of three weeks duration has been introduced to make the admitted students comfortable in their new environment. The induction programme continues in the form of participation in Sports club or Green club or Cultural, Literature and Film Club etc. for the remaining period of the programme. It is mandatory for every student to join in one of these clubs.
4. In addition to the professional core and elective courses, there is a provision for many courses from Basic Sciences, Engineering Sciences, Mathematics and Humanities. The non-credit mandatory courses are included to make students aware about constitution of India, issues related to environmental and sustainable development, and Indian traditional wisdom.
5. For every course, 4 to 6 COURSE OUTCOMES (COs) are defined which are concrete and measurable.
6. Guidelines for preparing sessional examination question papers and assignments have been framed for measuring the attainment levels of COs.
7. The internal and external evaluation criteria for various courses has been succinctly described.
8. The COURSE OUTCOMES (COs) are mapped to Programme Outcomes (POs) by defining a CO:PO articulation matrix for every course.
9. The methodology for computing the attainment levels for the COURSE OUTCOMES and Programme Outcomes is laid out.
10. The new curriculum has a focus on the problem solving and learning capabilities of the students. There are many laboratory courses which give students a hands-on experience in problem solving. Further, provisions for industry internship/training and project works make students ready to accept challenges and do research to solve difficult engineering problems.
11. Overall, the curriculum is made keeping in the view the continuous cycle of improvement in teaching learning process

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Chapter1: General Information

Vision

Gurugram University aspires to be a front runner in global education; role model for institutional excellence, trans-cultural quality learning, intellectual growth, contemporary research, capacity building and nurturing socially and morally responsible disciples through a learner- centric approach. The university seeks to ensure a journey from studentship to epitome of discipleship by working on academic, professional, technical, industry and life skills of its students.

Mission

1. To become a socially conscious centre of knowledge and advancement equipped to take up the challenges of the global change as well as committed to empower its teachers for the development of the students.
2. To move up through international alliances and collaborative initiatives to achieve global excellence.
3. To create rigorous academic and research environment for creation of knowledge and its perpetual advancement.
4. To attract and build people in a rewarding and inspiring environment by fostering freedom, empowerment, creativity, scientific zeal and innovation.

DEPARTMENT OF ENGINEERING & TECHNOLOGY

COMPUTER SCIENCE AND ENGINEERING

(Internet of Things)

VISION

MISSION

ABOUT THE PROGRAM

The Department of Computer Science and Engineering at Gurugram University in Gurugram, Haryana, India, is an academic department that focuses on the study and research of computer science and engineering disciplines. While Gurugram University was established in 2017. The Department offers undergraduate postgraduate programs and Doctorate in computer science and engineering. These programs aim to provide students with a strong foundation in computer science principles, Artificial Intelligence, Cyber Security and Internet of Things related areas.

The department likely offers a wide range of courses that cover various aspects of computer science and engineering, such as data structures, operating systems, computer networks, databases, artificial intelligence, machine learning, and more. The curriculum is designed to equip students with the necessary knowledge and skills to pursue careers in the IT industry, research and development, or further studies in the field.

Moreover, the department may have well-qualified faculty members who are actively engaged in research and teaching. They may have expertise in different areas of computer science and engineering and may guide students in their academic pursuits and research projects.

In addition to academic programs, the department also organize workshops, seminars, and conferences to facilitate knowledge sharing and promote collaboration among students, faculty, and industry professionals.

NOTE:

- 1. The scheme will be applicable from Academic Session 2022-23 onwards.**
- 2. The scheme will also be applicable to the students who are admitted in 2022-23 academic session and are transiting in 3rd Semester of their program.**

B.TECH PROGRAM

Computer Science and Engineering (Internet of Things)

PROGRAM EDUCATION OBJECTIVES

PEO1	To create knowledge about core areas related to the field of computer science and information technology.
PEO2	To enable students to apply mathematics, science and computer engineering principles to model, design and implement software projects to meet customers' business objectives.
PEO3	To develop the ability to evaluate the computing systems from view point of quality, security, privacy, cost effectiveness, utility and ethics.
PEO4	To inculcate life long learning by introducing principles of group dynamics, public policies, environmental and societal context

PROGRAM OUTCOMES

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs With appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning in formed by the contextual knowledge To assess societal, health ,safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the Knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to Comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1	Ability to design and develop computing systems using concepts of Mathematics, Computer Engineering and other related disciplines to meet customers' business objectives.
PSO2	Ability to test and analyze the quality of various subsystems and to integrate them in order to evolve a larger computing system.

Chapter2: Scheme of B.Tech. CSE (Internet of Things) Syllabus

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

MANDATORY INDUCTION PROGRAM (3-WEEKSDURATION)

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. A 3-week long induction program for the UG students entering the institution, right at the start, has to be planned. Normal classes will start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

TentativeactivitieswhichcanbeplannedinthisInductionProgrammeareas follows:

1. Physical Activity
2. Creative Arts
3. Universal Human Values
4. Literary
5. Proficiency Modules
6. Lectures by Eminent People
7. Visits to Local Area
8. Familiarization to Dept./Branch &Innovations

Semester wise Structure and Curriculum for

UG Course in

**Computer Science and Engineering
(Internet of Things)**

**(Engineering & Technology)
(Internet of Things)**

Gurugram University, Gurugram

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAM

S. No.	Category	Breakup of Credits (Total 160)
1	Humanities and Social Sciences, including Management courses	08
2	Basic Science courses	19
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	34.5
4	Professional core courses	65
5	Professional Elective courses relevant to chosen specialization/branch	12
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	16
8	Mandatory Courses [Environmental Sciences, Induction training, Constitution of India, Essence of Indian Traditional Knowledge]	Non-credit
	Total	166.5

SEMESTER-WISE SUMMARY OF THE PROGRAM

S. No.	Semester	No. of Contact Hours	Credits	Marks
1.	I	27	20	900
2.	II	28	21.5	900
3.	III	28	22	1000
4.	IV	24	21	900
5.	V	29	25	1100
6.	VI	26	22	900
7.	VII	29	21	900
8.	VIII	22	14	500
	Total	209	166.5	7100

COURSE CODE AND DEFINITIONS

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences, including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

**CREDIT DISTRIBUTION IN THE FIRST YEAR OF THE
UNDERGRADUATE ENGINEERING PROGRAM
Bachelor of Technology**

Semester - I

S. NO.	Subject	Hours Per week			Total credits (C)
		Lecture (L)	Tutorial (T)	Laboratory/ Practical (P)	
1.	Communication Skills in English	2	0	0	2
2.	Mathematics-I	3	1	0	4
3.	Physics	4	0	0	4
4.	Programming for problem-solving using C	3	0	0	3
5.	Basics of Environmental Science	2	0	0	2
6.	Communication Skills in English(P).	0	0	2	1
7.	Physics(P)	0	0	2	1
8.	Programming for problem-solving using C Lab	0	0	2	1
9.	Engineering Graphics (Web Designing)	1	0	2	2
10.	Sports (Audit Course) Compulsory	0	0	2	2*
Total Credits					20

Bachelor of Technology
Semester - II

S. NO.	Subject	Hours Per week			Total credits (C)
		Lecture (L)	Tutorial (T)	Laboratory/ Practical (P)	
1.	Mathematics-II	3	1	0	4
2.	Human Value & Soft Skills	2	0	2	3
3.	Basic of Electrical and Electronics Engineering	3	0	0	3
4.	Data Structure Using C	3	0	0	3
5.	Object-Oriented Concepts and Python Programming	3	0	0	3
6.	Basic of Electrical and Electronics Engineering (P).	0	0	2	1
7.	Data Structure Using C(P)	0	0	2	1
8.	Object Oriented Concepts and Python Programming (P)	0	0	2	1
9.	Workshop Practices(P)	1	0	4	2.5
Total Credits					21.5

HUMANITIES & SOCIAL SCIENCES, INCLUDING MANAGEMENT (HSMC)

S. No.	Code No.	Course Title	Hours Per week			Total Credits	Semester
			L	T	P		
1.		Communication Skills in English	2	0	2	3	I
2.		Basics of Environmental Science	2	0	0	2	I
3.		Human Value & Soft Skills	2	0	1	3	II
Total Credits						08	

BASIC SCIENCE COURSES (BSC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Mathematics-I	3	1	0	4	I
2.		Physics	3	1	2	5	I
3.		Mathematics-II	3	1	0	4	II
4.		Aptitude Reasoning -1	3	0	0	3	III
5.		Aptitude Reasoning -2	3	0	0	3	IV
Total Credits						19	

ENGINEERING SCIENCE COURSE (ESC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Basic of Electrical and Electronics Engineering	3	0	2	4	II
2.		Programming for problem-solving using C	3	0	2	4	I
3.		Workshop Practices(P)	1	0	2	2.5	II
4.		Data Structure Using C	3	0	2	4	II
5.		Object-Oriented Concepts and Python Programming	3	0	2	4	II
6.		Engineering Graphics (Web Design)	1	0	2	2	I
7.		Analog Electronics	3	0	2	4	III
8.		Digital Electronics	3	0	2	4	III
9.		MOOC - I (Essential)	3	-	-	3	VIII
10.		MOOC - II (Essential)	3	-	-	3	VIII
Total Credits						34.5	

PROFESSIONAL CORE COURSES (PCC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Introduction to Internet of Things	3	0	0	3	III
2.		Operating systems	3	0	2	4	III
3.		Computer Networks	3	0	2	4	III
4.		Interfacing Raspberry PI and Arduino	3	0	2	4	IV
5.		Programming in Java	3	0	2	4	IV
6.		Sensor, Actuator and signal Processing	3	0	0	3	IV
7.		Database management system	3	0	2	4	IV
8.		Computer Architecture and Organization	3	0	0	3	IV
9.		Big Data Analysis for Internet of Things	3	0	2	4	V
10.		Cryptography and Security	3	0	2	4	V
11.		Internet of Things Architecture and its Protocol	3	0	0	3	V
12.		Microprocessor and Microcontroller	3	0	2	4	V
13.		Programming for Internet of Things Boards	3	0	0	3	V
14.		Analysis and Design of Algorithms	3	0	2	4	VI
15.		Mobile Application Development for Internet of Things	3	0	2	4	VI
16.		Internet of Things Platform and System Design	3	0	0	3	VI
17.		Digital Image processing	3	0	2	4	VII
18.		Privacy and Security in Internet of Things	3	0	0	3	VII
Total Credits						65	

PROFESSIONAL ELECTIVE COURSES (PEC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Professional Elective Course - I	3	0	0	3	V
2.		Professional Elective Course - II	3	0	0	3	VI
3.		Professional Elective Course - III	3	0	0	3	VI
4.		Professional Elective Course - IV	3	0	0	3	VII
Total Credits						12	

OPEN ELECTIVE COURSES (OEC)

S. No.	Code No.	Course Title	Hours Per Week			Total Credits	Semester
			L	T	P		
1.		Open Elective Course – I	3	0	0	3	V
2.		Open Elective Course - II	3	0	0	3	VI
3.		Open Elective Course - III	3	0	0	3	VII
4.		Open Elective Course - IV	3	0	0	3	VII
Total Credits						12	

**PROJECT WORK, SEMINAR AND INTERNSHIP IN INDUSTRY
OR ELSEWHERE**

S. No.	Code No.	Course Title	Hours per week			Total Credits	Semester
			L	T	P		
1.		Practical Training - I	0	0	2	1	V
2.		Project - I	0	0	4	2	VI
3.		Practical Training - II	0	0	2	1	VII
4.		Project - II	0	0	8	4	VII
5.		Project - III	0	0	16	8	VIII
Total Credits						16	

MANDATORY COURSES

Sl. No	Course Code	Course Title	Hours per week			Total Credits	Semester
			L	T	P		
1		Sports (Audit Course)	0	0	2	0	I
2		Indian Constitution	2	0	0	0	III

**Semester-wise Structure and
Curriculum for
UG Course in
Computer Science and Engineering**

(Internet of Things)

Gurugram University
Scheme of Studies and Examination
Bachelor of Technology (SCHLME A.2) Semester-I

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	HSMC	HSE-101	Communication Skills in English	2	0	0	2	2	30	70	----	100	3
2.	BSC	BSM-103	Mathematics-I	3	1	0	4	4	30	70	----	100	3
3.	BSC	BS P-103	Physics	3	1	0	4	4	30	70	-----	100	3
	ESC	EEE-103	OR Basics of Electrical Engineering	3	0	0	3						
4.	ESC	CSE-101	Programming for problem solving using C	3	0	0	3	3	30	70	----	100	3
5.	HSMC	ENV-101	Basics of Environmental Science	2	0	0	2	2	30	70	----	100	3
6.	LC	HSE-101P	Communication Skills in English (P)	0	0	2	2	1	50	---	100	100	2
7.	LC	BSP-103P	Physics (P)	0	0	2	2	1	50	---	50	100	2
	LC	EEE-103P	OR Basics of Electrical Engineering (P)	0	0	2	2	1	50	---	50	100	2
8.	LC	CSE-101P	Programming for problem solving using C (P)	0	0	2	2	1	50	---	50	100	2
9.	LC	MEE-102P	Engineering Graphics(Web Designing)	1	0	2	3	2	50	---	50	100	2
			OR Workshop Practices (P)	1	0	3	4	2.5					
10.	AU	AUS-101	Sports (Audit Course) Compulsory	0	0	2	2*	0	--	---	---	---	--
Total				14	1/2	11	25/24 + 2*	20/19.5	300	350	150	900	23

Gurugram University Scheme of Studies and Examination

Bachelor of Technology (SCHEME A2) Semester-II

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	BSC	BSM-104	Mathematics-II	3	1	0	4	4	30	70	---	100	3
2.	HSMC	HSV-102	Human Value & Soft Skills	2	0	2	4	3	30	70	---	100	3
3.	ESC	EEE-103	Basics of Electrical and Electronics Engineering OR Physics	3	0	0	3	3	30	70	---	100	3
	BSC	BSP-103		3	1	0	4	4					
4.	ESC	CSE-102	Data Structure Using C	3	0	0	3	3	30	70	---	100	3
5.	ESC	CSE-106	Python Programming	3	0	0	3	3	30	70	---	100	3
6.	LC	EEE-103P	Basics of Electrical and Electronics Engineering (P) OR Physics (P)	0	0	2	2	1	50	---	50	100	2
	LC	BSP-103P		0	0	2	2	1					
7.	LC	CSE-102P	Data Structure Using C (P)	0	0	2	2	1	50	---	50	100	2
8.	LC	CSE-106P	Python Programming (P)	0	0	2	2	1	50	---	50	100	2
9.	LC	ECE-102P	Workshop Practices(P)	1	0	3	4	2.5	50	---	50	100	2
			Engineering Graphics(Web Designing)	1	0	2	3	2					
Total				17	1/2	10	28/29	21.5/22	380	420	200	900	26

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - III

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	BSC		Aptitude Reasoning-1	3	0	0	3	3	30	70	--	100	3
2.	ESC		Digital Electronics	3	0	0	3	3	30	70	---	100	3
3.	PCC		Introduction to Internet of Things	3	0	0	3	3	30	70	---	100	3
4.	PCC		Operating systems	3	0	0	3	3	30	70	---	100	3
5.	PCC		Computer Networks	3	0	0	3	3	30	70	---	100	3
6.	ESC		Analog Electronics	3	0	0	3	3	30	70	---	100	3
7.	LC		Digital Electronics-LAB	0	0	2	2	1	50	---	50	100	2
8.	LC		Operating systems-LAB	0	0	2	2	1	50	---	50	100	2
9.	LC		Analog Electronics LAB	0	0	2	2	1	50	---	50	100	2
10.	LC		Computer Networks-LAB	0	0	2	2	1	50	---	50	100	2
11.	MC		Indian Constitution	2	0	0	2	Refer NOTE					
Total				20	0	8	28	22	380	420	200	1000	26

NOTE: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - IV

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Computer Architecture and Organizaton	3	0	0	3	3	30	70	---	100	3
2.	PCC		Interfacing Raspberrry PI and Arduino	3	0	0	3	3	30	70	---	100	3
3.	PCC		Programming in Java	3	0	0	3	3	30	70	---	100	3
4.	BSC		Aptitude Reasoning -2	3	0	0	3	3	30	70	---	100	3
5.	PCC		Sensor, Actuator and signal Processing	3	0	0	3	3	30	70	---	100	3
6.	PCC		Database management system	3	0	0	3	3	30	70	---	100	3
7.	LC		Interfacing Raspberrry PI and Arduino-LAB	0	0	2	2	1	50	---	50	100	2
8.	LC		Programming in Java -LAB	0	0	2	2	1	50	---	50	100	2
9.	LC		Database management system-LAB	0	0	2	2	1	50	---	50	100	2
Total				18	0	6	24	21	330	420	150	900	24

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24
Semester - V

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Big Data Analysis for Internet of Things	3	0	0	3	3	30	70	---	100	3
2.	PCC		Cryptography and Security	3	0	0	3	3	30	70	---	100	3
3.	PCC		Internet of Things Architecture and its Protocol	3	0	0	3	3	30	70	---	100	3
4.	PCC		MicroProcessor and MicroController	3	0	0	3	3	30	70	---	100	3
5.	PEC		Professional Elective Course - I	3	0	0	3	3	30	70	---	100	3
6.	OEC		Open Elective Course - I	3	0	0	3	3	30	70	---	100	3
7.	PCC		Programming for Internet of Things Boards	3	0	0	3	3	30	70		100	3
8.	LC		Cryptography and Security-LAB	0	0	2	2	1	50	---	50	100	2
9.	LC		MicroProcessor and MicroController LAB	0	0	2	2	1	50	---	50	100	2
10.	LC		Big Data Analysis for Internet of Things-LAB	0	0	2	2	1	50	---	50	100	2
11.	TRAINING		Practical Training - I	0	0	2	2	1	50	---	50	100	2
Total				21	0	8	29	25	410	490	200	1100	29

NOTE:

- The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

- Choose any one from Professional Elective Course – I
- Choose any one from Open Elective Course – I

Professional Elective Course – I

- Distributive Operating system
- Software Quality and Testing
- Wearable Computing, Mixed reality and Internet of Everything
- Energy Harvesting and Power management for IoT Design

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VI

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Analysis and Design of Algorithms	3	0	0	3	3	30	70	---	100	3
2.	PCC		Mobile Application Development for Internet of Things	3	0	0	3	3	30	70	---	100	3
3.	PCC		Internet of Things Platform and System Design	3	0	0	3	3	30	70	---	100	3
4.	PEC		Professional Elective Course - II	3	0	0	3	3	30	70	---	100	3
5.	PEC		Professional Elective Course - III	3	0	0	3	3	30	70	---	100	3
6.	OEC		Open Elective Course - II	3	0	0	3	3	30	70	---	100	3
7.	LC		Analysis and Design of Algorithms -LAB	0	0	2	2	1	50	---	50	100	2
8.	LC		Mobile Application Development for Internet of Things-LAB	0	0	2	2	1	50	---	50	100	2
9.	PROJ CT		Project - I	0	0	4	4	2	50	---	50	100	3
Total				18	0	8	26	22	330	420	150	900	25

NOTE:

- At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.
- Choose any one from Professional Elective Course – II & III
- Choose any one from Open Elective Course – II

Professional Elective Course – II

- Internet of Things Application
- Signal and System
- Data Modelling and Simulation
- Soft Computing

Professional Elective Course – III

- Blockchain Technology
- Industrial and Medical Internet of Things
- Design of smart Cities
- Cognitive Internet of Things

NOTE: At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VII

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PEC		Professional Elective Course - IV	3	0	0	3	3	30	70	---	100	3
2.	PEC		Open Elective Course - III	3	0	0	3	3	30	70	----	100	3
3.	OEC		Open Elective Course - IV	3	0	0	3	3	30	70	---	100	3
4.	PCC		Digital Image processing	3	0	0	3	3	30	70	---	100	3
5.	PCC		Privacy and Security in Internet of Things	3	0	0	3	3	30	70	---	100	3
6.	LC		Digital Image processing-LAB	0	0	2	2	1	50	---	50	100	2
7.	PROJECT		Project - II	0	0	8	8	4	100	---	100	200	3
8.	TRAINING		Practical Training - II	0	0	2	2	1	50	--	50	100	
Total				15	0	14	29	21	350	350	200	900	20

NOTE:

- The evaluation of Practical Training - II will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

- Choose any one from Professional Elective Course – IV
- Choose any one from Open Elective Course – III & IV

Professional Elective Course – IV

- R-Programming
- Embedded Internet of Things
- Design of Smart Systems
- RFID and Wireless Sensor Network

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VIII

S. No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	ESC		MOOCs (Essential)	3	-	-	-	3	-	-	-	100	-
2.	ESC		MOOCs (Essential)	3	-	-	-	3	-	-	-	100	-
3.	PROJECT		Project – III/Industrial Training	0	0	16	16	8	150		150	300	3
			Total	6	0	16	22	14	150	-	150	500	3

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

Chapter 3: Detailed Syllabus

3RD

SEMESTER

B. Tech. (Artificial Intelligence & Machine Learning)
B. Tech. (Computer Science and Engineering- Artificial Intelligence & Machine Learning)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - III

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	BSC		Aptitude Reasoning-1	3	0	0	3	3	30	70	--	100	3
2.	ESC		Digital Electronics	3	0	0	3	3	30	70	---	100	3
3.	PCC		Introduction to Internet of Things	3	0	0	3	3	30	70	---	100	3
4.	PCC		Operating systems	3	0	0	3	3	30	70	---	100	3
5.	PCC		Computer Networks	3	0	0	3	3	30	70	---	100	3
6.	ESC		Analog Electronics	3	0	0	3	3	30	70	---	100	3
7.	LC		Digital Electronics-LAB	0	0	2	2	1	50	---	50	100	2
8.	LC		Operating systems-LAB	0	0	2	2	1	50	---	50	100	2
9.	LC		Analog Electronics LAB	0	0	2	2	1	50	---	50	100	2
10.	LC		Computer Networks-LAB	0	0	2	2	1	50	---	50	100	2
11.	MC		Indian Constitution	2	0	0	2	Refer Note: 1 (Grading)					
Total				20	0	8	28	22	380	420	200	1000	26

NOTE: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

APTITUDE REASONING -1

Semester	III				
Course code					
Category	Basic Science courses				
Course title	Aptitude Reasoning -1				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

This course is designed to suit the need of the outgoing students and to acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews.

UNIT – I

Quantitative Ability (Basic Mathematics). Number Systems , LCM and HCF , Decimal Fractions, Simplification, Square Roots and Cube Roots, Discount

UNIT – II

Quantitative Ability (Applied & Engineering Mathematics) Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Area, Height and Distance

UNIT – III

Data Interpretation. Data Interpretation, Tables, Column Graphs, Bar Graphs, Line Charts

UNIT – IV

Logical Reasoning (Deductive Reasoning) Analogy, Blood Relation, Directional Sense, Number and Letter Series, Clocks,

Course Outcome On successful completion of the course the students will be able to:

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC,GPSC etc.

Reference books:

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition.

DIGITAL ELECTRONICS

Semester	III				
Course code					
Category	Engineering Science courses				
Course title	Digital Electronics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
2. To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits.
3. To express real-life problems in logic design terminology.
4. To understand the logic of adders, subtractors and converters.

UNIT - I

FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems - binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

UNIT - 2

COMBINATIONAL DIGITAL CIRCUITS

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De- Multiplexer, Decoders, Adders, Subtractors, BCD arithmetic, carry look-ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT - 3

SEQUENTIAL CIRCUITS AND SYSTEMS

A 1-bit memory, the circuit properties of the Bistable latch, the clocked SR flip-flop, J-K flip-flop, T flip-flop and D flip-flop, applications of flip-flops, shift registers, applications of shift registers, serial-to-parallel converter, parallel-to-serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip-flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT – 4

A/D AND D/A CONVERTERS

Digital to analog converters: weighted resistor/converter, R-2-R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, Analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Outline the general concepts and terminology related to logic gates, logic families, combinational and sequential circuits.
- CO2: Discuss the basic analog/digital components and their interconnections in logic families and circuits.
- CO3: Apply different methods/techniques to design various digital circuits.
- CO4: Analyse day to day problems and industrial problems for their solutions using digital circuits.
- CO5: Contrast different types of digital circuits and their designing methods.
- CO6: Design digital circuit for various practical problems.

TEXT AND REFERENCE BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer Design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Nasib Singh Gill and J B Dixit, "Digital Design and Computer Organization", University Science Press, New Delhi

INTRODUCTION TO INTERNET OF THINGS

Semester	III				
Course code					
Category	Professional Elective Courses				
Course Title	Introduction to Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Student will be able to learn the basics of IOT.
2. Student will be able to analyse basic protocols of wireless and MAC.
3. Students will get familiar with web of things.
4. Students will get basic knowledge of resource management.

UNIT - 1

INTRODUCTION TO IOT: Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT(Design ,Development, Security)

UNIT - 2

NETWORK AND COMMUNICATION ASPECTS: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

UNIT - 3

WEB OF THINGS: Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

UNIT - 4

RESOURCE MANAGEMENT IN IOT: Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the concepts of Internet of Things

CO2: Analyze basic protocols network

CO3: Understand the concepts of Web of Things

CO4: Basic Understanding of Cloud Computing.

CO5: Design IoT applications in different domain and be able to analyze their performance

TEXT AND REFERENCE BOOKS:

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenege Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media.
4. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons

OPERATING SYSTEM

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Operating System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand the mechanisms of OS to handle processes and threads and their communication.
2. To understand the process management mechanisms and scheduling algorithms.
3. To understand the mechanisms involved in memory management in OS and virtual memory concepts.
4. To understand the file management and deadlocks handling techniques in OS.

UNIT - I

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling.

UNIT - II

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT - III

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation

and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU).

UNIT - IV

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. Case study on UNIX and WINDOWS Operating System.

Case Studies: Comparative study of WINDOW, UNIX & LINUX system.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain the basic concepts of operating system.

CO2: Understanding the process management policies and scheduling algorithms.

CO3: Design the various memory management techniques.

CO4: Analyse process synchronization techniques.

CO5: Understand file system concepts.

CO6: Evaluate deadlock detection and prevention mechanism.

TEXT AND REFERENCE BOOKS:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
5. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

COMPUTER NETWORKS

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Computer Networks				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To develop an understanding of modern network architectures from a design and Performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs), and Wireless LANs (WLANs).
3. To provide an opportunity to do Network programming.
4. To provide WLAN measurement ideas.

UNIT - I

Introduction: Data communication, Components, Data Representation, Simplex, Half Duplex, and Full Duplex Transmission, Modulation, Multiplexing, Computer networks, distributed processing, Internet, Topologies, Packet and circuit switching, connectionless and connection- oriented services.
Network Models: OSI model and TCP/IP Model
Physical Layer – LAN: Ethernet.

UNIT - II

Data Link Layer and Medium Access Sub Layer: MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Medium Access Control: Random access, Controlled Access, and channelization protocols.

Network Layer: Logical addressing, classful and classless addressing, subnetting, Ipv4, ICMPv4, ARP, RARP and BOOTP, Ipv6, Ipv6 addressing.

UNIT - III

Network Devices: Repeater, hub, switch, router, and gateway.

Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State, and Distance Vector Routing

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management.

UNIT - IV

Congestion Control, Quality of Service, QoS Improving techniques.

Application Layer: Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Network Security: Firewalls, security goals, types of attack, symmetric and asymmetric key ciphers.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Explain the functions of the different layers of the OSI Protocol.

CO2: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs), and Wireless LANs (WLANs) and describe the function of each.

CO3: Identify and connect various connecting components of a computer network.

CO4: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, and Firewalls using open-source available software and tools.

CO5: outline various models, topologies and devices of Computer Networks.

TEXT AND REFERENCE BOOKS:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. Computer Networks, latest Edition, Andrew S. Tanenbaum, Pearson New International Edition.
4. Internetworking with TCP/IP, Volume 1, latest Edition Douglas Comer, Prentice Hall of India.
5. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

ANALOG ELECTRONICS

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Analog Electronics				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

- 1.To provide explanation about the operation of all the important electronic devices
- 2.To study and understand the I/O behavior of various electronics devices to variable inputs
- 3.To demonstrate how electronic devices are used to design efficient electronic applications

UNIT-1

BJT Biasing: Bias Stability, Instability Due To β , Thermal Stability, Stability Factor, Fixed Biased Circuits, Effect of Emitter Resistor, Collector to Base Bias, Voltage Divide Biasing, Advantage & drawbacks of Biasing Techniques, Stability Factor calculation of Biasing Techniques, Bias Compensation by various device, Thermal Runway, Transistor Dissipation, Thermal Resistance, Condition of Thermal Stability.

UNIT-2

Feedback Amplifiers: Feedback concept , Transfer Gain with Feedback, General Characteristics of Negative Feedback, Advantages & disadvantages, Input And Output Resistance, Voltage Series Feedback topology, Voltage Shunt, Current Series & Current Shunt topology ,Equivalent circuit for each topology, Effects of Negative Feedback.

Oscillators: Introduction, Barkhausen Criterion, Oscillator with RC Feedback circuit (RC Phase Shift, Wien Bridge), Tuned Collector, Tuned Base Oscillator, LC Feedback circuits (Hartley, Colpitts), Condition for Sustained Oscillations & Frequency of Oscillations, Crystal Oscillator.

UNIT-III

Operational Amplifier Fundamentals: Block Diagram Representation, Ideal OP-AMP, OP-AMP Equivalent Circuit, Ideal Voltage Transfer Curve, Input Offset Voltage, Input Bias Current, Input Offset Current, Output Offset Voltage, Thermal Drift, Effect of Variation in Power Supply Voltages on Offset Voltage, Common Mode Configuration and CMRR, Frequency Response of OP-AMP: Open Loop Response, Close Loop Response, Input and Output Impedances, Effect of Finite Gain Bandwidth Product, Slew Rate.

UNIT-IV

Operational Amplifier Applications: Linear and non-linear applications-ADC and DAC, Multivibrators, Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator, 555 Timer, Monostable & Astable Operation with 555 Timer.

Integrated Circuit Fabrication Process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapour deposition, sputtering, twin-tub CMOS process.

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Understand the design of efficient electronic applications.
2. Feedback in Amplifiers
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

TEXT AND REFERENCE BOOKS:

1. Electronics Device & Circuit By David A. Bell - Oxford University Press.
2. Electronics Device & Circuit By Robert Boylestad, Louis Nashelsky, 11th Edition, Pearson Education, 2015.
3. Electronics Device By Floyd, 9th Edition, Pearson Education, 2015.
4. Integrated Electronics By Millman Halkias - TMH.
5. Electronic Devices & Circuits By B.P Singh and Rekha Singh, 2nd Edition, Pearson Education.
6. Electronics Device & Circuit By Sanjeev Gupta.
7. Electronics Device & Circuit By I. J. Nagrath - PHI
8. Electronic Principles By Albert Malvino.

DIGITAL ELECTRONICS LAB

Semester	III				
Course code					
Category	Engineering Science courses				
Course title	Digital Electronics Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

1. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. To understand the concepts of combinational logic circuits and sequential circuits.

EXPERIMENTS

Implementation of all experiments with the help of Bread-Board.

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates.
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations.
12. DAC Operation: Study of 8-bit DAC, obtain staircase waveform.
13. ADC Operations: Study of 8-bit ADC

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Implement the basic digital theory concepts practically and will be able to verify various results derived in theory.
- CO2: Design, analyze and troubleshoot broad range of combinational and sequential circuits for various practical problems using basic gates and flip flops I.C's.
- CO3: Develop technical writing skills to communication effectively and present one's own work.
- CO4: Acquire teamwork skills for finding sustainable solution of a complex problem and working effectively in groups

OPERATING SYSTEM LAB

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Operating System Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

1. To introduce Basic Unix general purpose Commands
2. To learn network Unix commands.
3. To learn shell script
4. To learn different programming language in Unix editor environment and implement different Operating system algorithm
5. To learn about file management and different types of permission setup.
6. To understand how system processes work and how to manage them

CONTENTS

1. Basics of UNIX
2. UNIX commands
3. Implementation of FCFS and SJF CPU scheduling algorithms
4. Implementation of Round Robin and Priority CPU Scheduling
5. Implementation of Producer-Consumer problem using semaphores
6. Implementation of Dining Philosophers Problem
7. Implementation of FIFO Page Replacement Algorithms
8. Implementation of LRU Page Replacement Algorithms
9. Implementation of Sequential File Allocation Strategies
10. Implementation of Indexed File Allocation Strategies

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1. Experiment with Unix commands and shell programming.
- CO2. Able to build shell program for process and file system management with system calls.
- CO3. Able to implement and analyse the performance of different algorithm of Operating Systems like CPU scheduling algorithm,
- CO4. Able to implement and analyse the performance of different algorithm of page replacement algorithms, deadlock avoidance, detection algorithm and so on.
- CO5. Able to design and develop a course project that can have positive impact on environment or society or mankind.

ANALOG ELECTRONICS LAB

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Analog Electronics Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

To develop an understanding of small signal amplifier design using linear transistor models; and its analysis at low and high frequencies, including different feedback topologies and oscillators. The course also indulges power amplifiers, tuned amplifiers and behavior of noise in an amplifier.

CONTENTS

1. Measurement of current, voltage, frequency and phase shift of signal in a RC network using oscilloscope.
2. Clipping circuits using diodes.
3. Clamping circuits using diodes.
4. RC coupled amplifier using BJT in CE configuration-Measurement of gain, BW and plotting of frequency response.
5. JFET amplifier-Measurement of gain, BW and plotting of frequency response.
6. Op-amp circuits – Design and set up of inverting and non-inverting amplifier, scale changer, adder, integrator, and differentiator.
7. Op-amps circuits – Scale changer, adder, integrator, and differentiator.
8. Precision rectifier using Op-amps.
9. Phase shift oscillator using Op-amps.
10. Wein's Bridge oscillator using Op-amps.
11. Waveform generation– Square, triangular and saw tooth waveform generation
Using OPAMPs.
12. Design and testing of series voltage regulator using Zener diode.
13. Astable and Monostable circuit using 555IC.
14. RC phase shift oscillator using Op-amp.

COURSE OUTCOMES:

1. Use the various electronic instruments and for conducting experiments.
2. Design and develop various electronic circuits using diodes and Zener diodes.
3. Design and implement amplifier and oscillator circuits using BJT and JFET
4. Design and implement basic circuits using IC (OPAMP and 555 timers).
5. Use PCB layout software for circuit design
6. Simulate electronic circuits using any circuit simulation software

COMPUTER NETWORK LAB

Semester	III				
Course code					
Category	Engineering Science courses				
Course title	Computer Network Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work

CONTENTS

1. To construct a simple network topology on Packet Tracer.
2. To verify and configure VLAN and VLAN trunk in packet tracer.
3. To construct RJ45 cable.
4. a) To configure simple static routing.
b) To implement Security on interconnecting devices.
5. To configure a Network Topology constitutes Routers and Switches using Packet Tracer.
- 6 Working with complex network topologies.
7. Mid Term Evaluation
8. To monitor network traffic using Wire Shark
9. To get the MAC or Physical Address of the system Using Address Resolution Protocol.
10. To Configure network using Routing Information Protocol (RIP)
- 11 To configure network state routing protocol (OSPF).
- 12 To configure Border Gateway Protocol.
- 13 To configure Application Layer protocols: DHCP and DNS.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.
- CO2. Understand the basic concepts of application layer protocol design; including client/server models, peer to peer models, and network naming.
- CO3. In depth understanding of transport layer concepts for congestion control and flow control.
- CO4. Learning protocol design; including connection oriented and connection-less models, techniques to provide reliable data delivery and algorithms
- CO5. Applying and configuring virtual LANS

INDIAN CONSTITUTION

Semester	III				
Course code					
Category	Mandatory courses				
Course title	Indian Constitution				
Scheme and Credits	L	T	P	Credits	
	2	0	0	-	
Classwork	-				
Exam	-				
Total	-				
Duration of Exam	-				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT - I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

UNIT - II

Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT - III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor,

Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

UNIT - IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Rights to equality, right to freedom, right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to a revolution in India.
- CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- CO4: Discuss the passage of the Hindu Code Bill of 1956.

TEXT AND REFERENCE BOOKS:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

NOTE: The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score a minimum of 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will be shown in the detailed marks certificate of the students.

4TH

SEMESTER

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - IV

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Computer Architecture and Organizaton	3	0	0	3	3	30	70	---	100	3
2.	PCC		Interfacing Rasperry PI and Arduino	3	0	0	3	3	30	70	---	100	3
3.	PCC		Programming in Java	3	0	0	3	3	30	70	---	100	3
4.	BSC		Aptitude Reasoning -2	3	0	0	3	3	30	70	---	100	3
5.	PCC		Sensor, Actuator and signal Processing	3	0	0	3	3	30	70	---	100	3
6.	PCC		Database management system	3	0	0	3	3	30	70	---	100	3
7.	LC		Interfacing Rasperry PI and Arduino-LAB	0	0	2	2	1	50	---	50	100	2
8.	LC		Programming in Java -LAB	0	0	2	2	1	50	---	50	100	2
9.	LC		Database management system-LAB	0	0	2	2	1	50	---	50	100	2
Total				18	0	6	24	21	330	420	150	900	24

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

COMPUTER ARCHITECTURE AND ORGANIZATION

Semester	IV				
Course code					
Category	Professional Core courses				
Course title	Computer Architecture and Organization				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

The objectives of the course are:

1. Discuss the basic concepts and structure of computers.
2. Understand concepts of register transfer logic and arithmetic operations.
3. Explain different types of addressing modes and memory organization.
4. Learn the different types of serial communication techniques.
5. Summarize the Instruction execution stages.

UNIT-1

Boolean algebra and logic gates

Boolean algebra and Logic gates, Combinational logic blocks(Adders, Multiplexers, Encoders, decoder), Sequential logic blocks(Latches, Flip-Flops, Registers, Counters) Store program control concept, Flynn's classification of computers (SISD, MISD, MIMD); Multilevel viewpoint of a machine: digital logic, micro architecture, ISA, operating systems, high level language; structured organization; CPU, caches, main memory, secondary memory units & I/O; Performance metrics; MIPS, MFLOPS.

UNIT -2

Instruction set architecture

Instruction Set Architecture Instruction set based classification of processors (RISC, CISC, and their comparison); addressing modes: register, immediate, direct, indirect, indexed; Operations in the instruction set; Arithmetic and Logical, Data Transfer, Control Flow; Instruction set formats (fixed, variable, hybrid); Language of the machine: 8086 ; simulation using MSAM.

UNIT -3

Memory hierarchy

Basic non pipelined CPU Architecture and Memory Hierarchy & I/O Techniques CPU Architecture types (accumulator, register, stack, memory/ register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3 to 5 stage); microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining. The need for a memory hierarchy (Locality of reference principle, Memory hierarchy in practice: Cache, main memory and secondary memory, Memory parameters: access/ cycle time, cost per bit); Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types); Cache memory (Associative & direct mapped cache organizations.

UNIT- 4

Parallelism and interrupts

Introduction to Parallelism and Computer Organization [80x86] Goals of parallelism (Exploitation of concurrency, throughput enhancement); Amdahl's law; Instruction level parallelism (pipelining, super scaling –basic features); Processor level parallelism (Multiprocessor systems overview).

Instruction codes, computer register, computer instructions, timing and control, instruction cycle, type of instructions, memory reference, register reference. I/O reference, Basics of Logic Design, accumulator logic, Control memory, address sequencing, micro-instruction formats, micro-program sequencer, Stack Organization, Instruction Formats, Types of interrupts; Memory Hierarchy.

COURSE OUTCOMES:

At the end of this course, students will be able to:

- CO1. Understand the theory and architecture of central processing unit.
- CO2. Analyze some of the design issues in terms of speed, technology, cost, performance.
- CO3. Design a simple CPU with applying the theory concepts.
- CO4. Use appropriate tools to design verify and test the CPU architecture.
- CO5. Learn the concepts of parallel processing, pipelining and interprocessor communication.
- CO6. Understand the architecture and functionality of central processing unit.
- CO7. Exemplify in a better way the I/O and memory organization.
- CO8. Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

TEXT AND REFERENCE BOOKS:

1. Computer Organization and Design, 2nd Ed., by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.
2. Computer Architecture and Organization, 3rd Ed., by John P. Hayes, 1998, TMH.
3. Operating Systems Internals and Design Principles by William Stallings, 4th edition, 2001, Prentice-Hall Upper Saddle River, New Jersey
4. Computer Organization, 5th Ed., by Carl Hamacher, Zvonko Vranesic, 2002, Safwat Zaky.
5. Structured Computer Organisation by A.S. Tanenbaum, 4th edition, Prentice-Hall of India, 1999, Eastern Economic Edition.
6. Computer Organisation & Architecture: Designing for performance by W. Stallings, 4th edition, 1996, Prentice-Hall International edition.
7. Computer System Architecture by M. Mano, 2001, Prentice-Hall. 6. Computer Architecture- Nicholas Carter, 2002, T.M.H.
8. Gill, Nasib Singh and Dixit J.B.: Digital Design and Computer Organisation, University Science Press (Laxmi Publications), New Delhi

INTERFACING RASPBERRY PI AND ARDUINO-UNO

Semester	IV				
Course code					
Category	Professional core courses				
Course title	Interfacing Raspberry PI and Arduino-UNO				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To give students hands-on experience using different IoT architectures.
2. To provide skills for interfacing sensors and actuators with different IoT architectures.
3. To develop skills on data collection and logging in the cloud.

UNIT-1

IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).

UNIT-2

Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.

UNIT-3

ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home 57 Automation for switching lights on/off .

UNIT-4

Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts. Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3.

COURSE OUTCOMES:

After completion of course, students would:

1. To understand Arduino Uno, NODE MCU 8266 and Raspberry PI along with critical protocols and its communication to cloud.
2. To apply commonly used IOT protocols such as REST API, MQTT through IOT based demonstration. 3. To

solve analog sensor and digital sensor Interfacing with IOT devices.

4. Understanding of Bluetooth, WiFi and wireless connection of Internet of Things.
5. Implementation of innovative ideas on smart room, office and connected things.

TEXT AND REFERENCE BOOKS

1. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
2. Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
3. Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
4. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O'Reilly Publisher Media, Inc."

PROGRAMMING IN JAVA

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Programming in Java				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Be able to use the Java SDK environment to create, debug and run simple Java programs.
3. To analyze the object-oriented paradigm using java programming language.
4. To implement small/medium scale java programs to resolve small business problems.

UNIT - I

Introduction to Java: Evolution of Java, Object Oriented Programming Structure, Overview and characteristics of Java, Java program Compilation and Execution Process, Organization of the Java Virtual Machine, Client side Programming, Platform Independency & Portability, Security, Relation b/w JVM, JRE and JDK, Introduction to JAR format, Naming Conventions, Data types & Type casting, operators, Security Promises of the JVM, Security Architecture and Security Policy, security aspects, sandbox model.

UNIT - II

OOPS Implementation: Classes, Objects, attributes, methods, data encapsulation, reference variables, Constructors, Anonymous block, Method Overloading, Static Data members, Block & methods; Memory Structure: Stack, Heap, Class & Method area

Class loading & Execution flow: Static vs Dynamic Class loading, implicit vs explicit class loading, class loading operations;

Argument Passing Mechanism: Passing primitive arguments, passing objects, Wrapper Classes;

This keyword: Referencing instance members, Intra class constructor chaining, Method chaining;

Inheritance & code reusability: Extending classes for code reusability, Usage of super keyword, Method Overriding, Object class

Inheritance & Runtime Polymorphism: Static & Dynamic binding, Inheritance and Is-A relation, Runtime Polymorphism and Generalization, Abstract classes & methods, Final Keyword;

Interfaces and Role based Inheritance: Feature & Role based Inheritance, Static & Dynamic classing Environment, classes & interfaces, interface applications in real scenarios; Has-A relation:

Aggregation & Composition, Nested classes, Inner classes, Anonymous Inner classes, String Buffer Class, tokenizer, applets, Life cycle of applet and Security concern

UNIT - III

Threads: Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

Swing & AWT:

Swing class hierarchy, containers, user interface components, graphics context, AWT Components,

Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

Package & Scopes: Need of Packages, associating classes to Packages, Class path environment variable, Import Keyword and Feature of static import, Public, protected, private & default scope, Private Inheritance;

Exception Handling: exception and error, Exception Handling & Robustness, Common Exceptions and Errors, Try and catch block, Exception handlers, throw keyword, Checked and Unchecked Exceptions, Role of finally, User defined Exceptions.

UNIT - IV

Collection Framework: Role and Importance of Collection Framework, List & Set based collection, Iterator & List Iterator, Maps, Searching elements in List, Hash and Tree based collections, Role of equals and hashCode() methods, Comparable and Comparator Interfaces, Thread Safety and Vector, Difference b/w Enumeration and Iterator, Type safety and Generics, Common algorithms and Collections class, Using Properties class for managing properties files;

Database Connectivity Using JDBC: Overview of native and ODBC Drives, Introduction to JDBC, Type of JDBC drivers, Usage of drivers, defining properties-based Connection Factory; Basic database operations: Insert, Delete, Update, and Select;

Prepared Statement: Statement, Prepared Statement, Setting Query parameters, Executing Queries;

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Identify classes, objects, members of a class and relationships among them for a specific problem.

CO2: Understand and demonstrate the concepts of garbage collection, polymorphism, inheritance etc.

CO3: Do numeric (algebraic) and string-based computation.

CO4: Understand and implement modularity as well as basic error-handling techniques.

CO5: Develop, design and implement small multithreaded programs using Java language.

CO6: Apply appropriate problem-solving strategies for the implementation of small/medium scale Java applications.

TEXT AND REFERENCE BOOKS:

1. E. Balaguruswamy, "Programming with Java", TMH
2. Horstmann, "Computing Concepts with Java 2 Essentials", John Wiley.
3. Decker & Hirshfield, "Programming Java", Vikas Publication.
4. Patrick Naughton and HerbertzSchidt, "Java-2 the complete Reference", TMH
5. Sierra & bates, "Head First Java", O'Reilly.

APTITUDE REASONING -2

Semester	IV			
Course code				
Category	Basic Science Course			
Course title	Aptitude Reasoning-2			
Scheme and Credits	L 3	T 0	P 0	Credits 3
Class work	30 Marks			
Exam	70 Marks			
Total	100 Marks			
Duration of Exam	03 Hours			

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

This course is designed to suit the need of the outgoing students and to acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews.

UNIT – 1

Quantitative Ability I . Average, Problems on Ages, Surds & Indices, Percentages, Problems on Numbers,

UNIT – 2

Quantitative Ability II. Logarithm, Permutation and Combinations, Probability , Time & Work, Ratio and Proportion, Mixtures and Allegation, Volume ,Problem on boat and stream

UNIT – 3

Data Interpretation. Data Interpretation, Pie Chart, Venn Diagrams

UNIT – 4

Logical Reasoning (Deductive Reasoning) Coding – Decoding, Calendars, Venn Diagrams, Seating Arrangement, Syllogism, Mathematical Operations

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC,GPSC etc.

TEXT AND REFERENCE BOOKS:

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha

SENSOR, ACTUATOR AND SIGNAL PROCESSING

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Sensor, Actuator and Signal Processing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. understand basics of sensors, actuators and their operating principle.
2. To educate the students on different types of microfabrication techniques for designing and developing sensors (Several applications from Electronics to Biomedical will be covered).
3. To explain working of various types of electrochemical sensors and actuators.
4. To provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system.
5. To provide knowledge about simulation and characterization of different sensors. The final objective is to provide an understanding on characteristic parameters to evaluate sensor performance.

UNIT-1

SENSORS : Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

UNIT-2

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microslyn.

Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor.

UNIT-3

ACTUATORS: Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

UNIT-4

Smart Sensors : Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

SIGNAL CONDITIONING AND DATA ACQUISITION : Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging.

COURSE OUTCOME:

1. Explain fundamental physical and technical base of sensors and actuators.
2. Describe basic laws and phenomena that define behaviour of sensors and actuators.
3. Analyse various premises, approaches, procedures and results related to sensors and actuators.
4. create analytical design and development solutions for sensors and actuators.
5. Interpret the acquired data and measured results.
6. Describe development and application of sensors and actuators and generation of signals.

TEXT AND REFERENCE BOOKS:

1. Patranabis.D, “Sensors and Transducers”, Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, “ Microsystem Technology and Microbotics”, First edition, Springer – Verlag NEwYork, Inc, 1997.
3. Jacob Fraden, “Hand Book of Modern Sensors: Physics, Designs and Application” Fourth edition, Springer, 2010.
4. Robert H Bishop, “The Mechatronics Hand Book”, CRC Press, 2002
5. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.
6. Patranabis. D, “Sensors and Transducers”, 2nd edition PHI, New Delhi, 2003.

DATABASE MANAGEMENT SYSTEMS

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Database Management Systems				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

UNIT - I

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

UNIT - II

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

UNIT - III

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Storage strategies: Indices, B-trees, hashing,

UNIT - IV

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced topics: Object-oriented and object-relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: For a given query, write relational algebra expressions for that query and optimize the developed expressions
- CO2: For a given requirement specification, design the databases using E R method and normalization.
- CO3: For a given specification, construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.
- CO4: For a given query, optimize its execution using Query optimization algorithms
- CO5: For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
- CO6: Implement the isolation property, including locking, and time stamping based on concurrency control and Serializability of scheduling.

TEXT AND REFERENCE BOOKS:

1. Database System Concepts, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill
2. Principles of Database and Knowledge–Base Systems, Vol 1 by J. D. Ullman, Computer Science Press.
3. Fundamentals of Database Systems, 5th Edition by R. Elmasri and S. Navathe, Pearson Education
4. Foundations of Databases, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

INTERFACING RASPBERRY PI AND ARDUINO-UNO LAB

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Interfacing raspberry pi and Arduino-Uno lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

1. To understand the IoT hardware tools i.e. Arduino-UNO, Raspberry PI and peripheral devices.
2. To understand the different sensors and how they get the data.
3. Transmission of Data to other platform.

LIST OF PRACTICALS:

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
11. To install MySQL database on Raspberry Pi and perform basic SQL queries.
12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
13. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.

COURSE OUTCOMES:

1. Understanding of Hardware and Architecture of Arduino-UNI.
2. Detailed knowledge of Raspberry Pi.
3. Installing NOOBS and Preparing SD card for Raspberry PI.
4. Interfacing Arduino-UNO and Raspberry PI with peripheral Devices.
5. Collection of Data from different Sensors.
6. Transmission of data to the server and on Cloud.

PROGRAMMING IN JAVA LAB

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Programming in Java Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

CONTENTS

1. Create a java program to implement stack and queue concept.
2. Write a java package to show dynamic polymorphism and interfaces.
3. Write a java program to show multithreaded producer and consumer application.
4. Create a customized exception and also make use of all the 5 exception keywords.
5. Convert the content of a given file into the upper-case content of the same file.
6. Develop an analog clock using applet.
7. Develop a scientific calculator using swings.
8. Create an editor like MS-word using swings.
9. Create a servlet that uses Cookies to store the number of times a user has visited your servlet.
10. Create a simple java bean having bound and constrained properties.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: implement Java programs using object-oriented concepts for problem solving.

CO2: detect syntax and logical errors in java programs.

CO3: apply exception handling for making robust JAVA code.

CO4: design java applications using File I/O and GUI.

CO5: create lab record of the solutions of assignments that includes problem definitions, solutions and conclusions.

CO6: demonstrate ethical practices, self-learning and team spirit.

DATABASE MANAGEMENT SYSTEM LAB

Semester	IV				
Course code					
Category	Professional Core Courses				
Course title	Database Management System Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

CONTENTS

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, synonyms, Sequences, indexes, and save points.
4. Creating an employee database to set various constraints.
5. Creating relationships between the databases. iv. Study of PL/SQL block.
6. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
7. Write a PL/SQL block that handles all types of exceptions.
8. Creation of Procedures
9. Creation of database triggers and functions
10. Mini project (Application Development using Oracle/ MySQL)
 - a. Inventory Control System
 - b. Material Requirement Processing.
 - c. Hospital Management System.
 - d. Railway Reservation System.
 - e. Personal Information System.
 - f. Web-Based User Identification System.
 - g. Time Table Management System.
 - h. Hotel Management

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Understand basic concepts of database system and data models for relevant problems.
- CO2: Understand the basic elements of a relational database management system.
- CO3: Design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
- CO4: Apply normalization for the development of application software.

5TH
SEMESTER

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24
Semester – V

S.No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Big Data Analysis for Internet of Things	3	0	0	3	3	30	70	---	100	3
2.	PCC		Cryptography and Security	3	0	0	3	3	30	70	---	100	3
3.	PCC		Internet of Things Architecture and its Protocol	3	0	0	3	3	30	70	---	100	3
4.	PCC		Microprocessor and Micro Controller	3	0	0	3	3	30	70	---	100	3
5.	PEC		Professional Elective Course - I	3	0	0	3	3	30	70	---	100	3
6.	OEC		Open Elective Course - I	3	0	0	3	3	30	70	---	100	3
7.	PCC		Programming for Internet of Things Boards	3	0	0	3	3	30	70		100	3
8.	LC		Cryptography and Security-LAB	0	0	2	2	1	50	---	50	100	2
9.	LC		Microprocessor and Micro Controller LAB	0	0	2	2	1	50	---	50	100	2
10.	LC		Big Data Analysis for Internet of Things-LAB	0	0	2	2	1	50	---	50	100	2
11.	TRAINING		Practical Training - I	0	0	2	2	1	50	---	50	100	2
Total				21	0	8	29	25	410	490	200	1100	29

NOTE:

1. The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

2. Choose any one from Professional Elective Course – I

3. Choose any one from Open Elective Course – I

Professional Elective Course – I

1. Distributive Operating system
2. Software Quality and Testing
3. Wearable Computing, Mixed reality and Internet of Everything
4. Energy Harvesting and Power management for IoT Design

BIG DATA ANALYSIS FOR INTERNET OF THINGS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Big Data Analysis for Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To describe the basic concepts of Big Data characteristics and Analytics.
2. To examine the Hadoop and MapReduce framework for processing large volume of data sets and various data analysis methods.
3. To store and retrieve the data effectively using MongoDB and report generation.
4. To analyze the big data for useful business applications and familiar with the Visualization.

UNIT -1

BIG DATA PLATFORMS FOR THE INTERNET OF THINGS: Big Data Platforms for the Internet of Things: network protocol- data dissemination – current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements coming from different Smart City applications.

UNIT -2

RFID FALSE AUTHENTICATIONS : On RFID False Authentications: YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Selfaware Internet of Things: self-healing systems- Role of adaptive neural network Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models

UNIT -3

FOG COMPUTING : Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies – role of metadata.

UNIT- 4

WEB ENHANCED BUILDING : Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements- Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine.

COURSE OUTCOMES:

- 1 Understand the Concepts of big data analytics
- 2 Understand the concepts about Internet of things
- 3 understand and implement smart systems

4 Understand the Concept of FOG Computing

5 Understand the Sustainability Data and Analytics

Text Books:

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.,” Big Data and The Internet of Things Enterprise Information Architecture for A New Age”, Apress, 2015.
2. Dr. John Bates , “Thingalytics - Smart Big Data Analytics for the Internet of Things”, john Bates, 2015.

CRYPTOGRAPHY AND SECURITY

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Cryptography and Security				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To understand basics of Cryptography and Network Security.
2. To be able to secure a message over insecure channel by various means.
3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. To understand various protocols for network security to protect against the threats in the networks.

UNIT-I

Introduction to Information Security & Cryptography What is Information Security, Need for security, Principles of Security, Threats, Types of Attacks, Services & Mechanisms, Mathematics of Cryptography: Integer Arithmetic, Modular Arithmetic, Matrices, Linear Congruence

UNIT-II

Symmetric Key Ciphers Traditional Symmetric –Key Cipher design and analysis-Different Substitution ciphers & Transposition ciphers, Basic Principles of designing Stream cipher & Block cipher. Mathematics of Symmetric-Key Cryptography-Algebraic Structures, GF (2ⁿ) Fields. Modern Symmetric key Ciphers- Block Ciphers Design & Analysis - Data encryption Standard(DES), Advanced Encryption Standard (AES) Stream Ciphers Design & Analysis-LFSR based, RC4, A5/1.

UNIT-III

Asymmetric Key Ciphers, Hash Functions and Digital Signatures Mathematics of Asymmetric-Key Cryptography, Asymmetric key Ciphers, Hash Functions and MAC, Introduction to Digital Signatures.

UNIT-IV

Network Security Network Security: Security at application layer – PGP & S/MIME, Key distribution Centre, Diffie-Hellman Key Exchange.

COURSE OUTCOMES:

After the completion of the course the students will be able

- CO1. Discover all the Information Security Goals, Services & Mechanism for Network Security & necessity of Mathematics in designing crypto algorithms.
- CO2. Develop and design various kinds of Symmetric Key crypto algorithms and to cryptanalyze them.
- CO3. Construct and design various kinds of Asymmetric key crypto algorithms and Mathematics required for designing.

- CO4. Analyze the integrity of information transmitted & to generate digital signatures.
- CO5. Predict and apply the knowledge and skills obtained to design & understand latest cryptographic protocols used for securing information in networks or in storage.

TEXT AND REFERENCE BOOKS:

1. Cryptography and Network Security 7th Edition, William Stallings
2. Cryptography and Network Security, 4th edition, Forouzan & Mukopadhyay, TMH.
3. Information Security & Cryptography-Cryptography Made Simple, Nigel P Smart, Springer Verlag , 2016.
4. Cryptography & Network Security, 2nd Edition, Atul Kahate. McGrawHill

INTERNET OF THINGS ARCHITECTURE AND ITS PROTOCOLS

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Internet of Things and its Protocol				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To make students know the IoT ecosystem and to provide an understanding of the technologies and the standards relating to the Internet of Things.
2. The course will also develop skills on IoT technical planning.

UNIT- 1

Introduction: What is the IoT and its important, Elements of an IoT ecosystem, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models. IoT protocols: Protocol Standardization for IoT, M2M and WSN Protocols, SCADA and RFID Protocols.

UNIT -2

Issues with IoT Standardization: Unified Data Standards Protocols, IEEE802.15.4, BACNet Protocol, Modbus, KNX, Zigbee, Network layer, Security. IoT Architecture: IoT Open source architecture (OIC), OIC Architecture & Design principles, IoT Devices and deployment models.

UNIT- 3

IoTivity : An Open source IoT stack, Overview to IoTivity stack architecture, Resource model and Abstraction. Web of things: Web of Things versus Internet of Things, Two Pillars of the Web Architecture, Standardization for WoT Platform Middleware for WoT. Sensing and power: Sensing devices, Smart IoT endpoints, Energy sources and power management.

UNIT- 4

IoT applications: IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms, middleware etc.

COURSE OUTCOMES :

1. To Understand the Architectural Overview of IoT
2. 2 To Understand the IoT Reference Architecture and Real World Design Constraints
3. 3 To Understand the various IoT Protocols (Data link, Network, Transport, Session, Service)
4. 4 Application of various IoT Protocols (Data link, Network, Transport, Session, Service)
5. 5 To Understand the various Real-World Design Constraints.

TEXT AND REFERENCE BOOKS:

1. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, (1e), 2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, (1e), 2011.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things-Key applications and Protocols, Wiley, (1e), 2012.

MICROPROCESSOR AND MICROCONTROLLER

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Microprocessor and microcontroller				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

To develop an understanding of the operations of microprocessors and microcontrollers; machine language programming and interfacing techniques

UNIT-1

THE 8085 PROCESSOR : Introduction to microprocessor, 8085 microprocessor : Architecture, instruction set, interrupt structure, and Assembly language programming.

UNIT-2

THE 8086 MICROPROCESSOR ARCHITECTURE :

Architecture, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals

UNIT-3

INSTRUCTION SET OF 8086 :

Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples, Architectures: Harvard V/S Princeton, CISC V/S RISC;

UNIT-4

PROGRAMMING OF 8051:

Programming of 8051 – instruction syntax, addressing modes, external data moves, code memory read-only data moves, push and pop opcodes, data exchange, logical operations, arithmetic operation, jump and call instructions. Microprocessor and Micro controllers: differences, 8-bit micro controllers - comparison. Types of microcontrollers. The 8051 architecture: microcontroller hardware, I/O pins, ports and circuit, external memory, counter & timer, serial data input/output, interrupts

COURSE OUTCOMES:

1. Understand the internal architecture and organization of 8086
2. Analyze the Assembly language programs of 8086
3. Analyze the internal architecture and real time control of 8051
4. Discuss the input /output, memory interface , Serial Communication and Bus Interface devices

TEXT AND REFERENCE BOOKS :

1. Microprocessor Architecture, Programming & Applications with 8085 : Ramesh S Gaonkar; Wiley Eastern Ltd.
2. The Intel Microprocessors 8086- Pentium processor : Brey; PHI
3. Microprocessors and interfacing : DV Hall; TMH
4. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications :Triebel & Singh; PHI
5. Microcomputer systems: the 8086/8088 Family: architecture, Programming & Design : Yu-Chang Liu & Glenn A Gibson; PHI.
6. Advanced Microprocessors and Interfacing : Badri Ram; TMH
7. The 8051 Microcontroller and Embedded Systems Using Assembly and C by Muhammad Ali Mazidi
8. 8051 Microcontroller by Kenneth J. Ayala

PROGRAMMING FOR INTERNET OF THINGS BOARD

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Programming for Internet of Things Boards				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To learn the concepts of IoT boards.
2. To understand the concept of networking techniques.

UNIT- 1

INTRODUCTION TO IOT BOARDS : IoT- Introduction and Characteristics, Things, Architecture, Enabling Technologies, Challenges, Levels - Environment -board, IDE, shields; Programming - syntax, variables, types, operators, constructs and functions; sketch - skeleton, compile and upload, accessing pins; debugging - UART communication protocol and serial library.

UNIT-2

INTERFACING WITH IOT BOARDS : Circuits - design, wiring, passive components; sensors and actuators, interfacing, read and write; software libraries to handle complicated hardware; shields, interfacing and libraries.

UNIT-3

SINGLE BOARD COMPUTERS AND PYTHON :Board schematic, setup, configure and use, OS implications; linux - basics, file system and processes, shell CLI, GUI; python - basics, API's RPi.GPIO, PWM library to access pins, Tkinter.

UNIT-4

INTERFACING WITH SINGLE BOARD COMPUTERS : Networking - Internet Connectivity, Standard Internet Protocols, MQTT, CoAP, Networking Socket Interface; Cloud - Public APIs and SDK's for accessing cloud services, Twitter API using Twython package; Interfacing - sensors and actuators, Pi Camera, Servo, A/D, D/A.

COURSE OUTCOMES:

1. Investigate various challenges in designing IoT devices
2. Use open-source hardware prototyping platform for building digital devices and interactive objects that can sense and control the physical world around them
3. Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world
4. Program SBC for practical IoT devices using Python
5. Explore protocols, data conversion process, Api and expansion boards for real world interaction
6. Learn embedded programming constructs and constraints real time systems
7. Illustrate IoT prototyping for real world socio-economic problems

TEXT AND REFERENCE BOOKS:

1. Yamanoor, Sai, and Srihari Yamanoor. Python Programming with Raspberry Pi, 1st edition, Packt Publishing Ltd, 2017.
2. Donald Norris, The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black, 1st edition, McGraw Hill Education, 2015.
3. Marco Schwartz, Home Automation with Arduino, 3rd edition, Open Home Automation 2014. Schwartz, Marco. Internet of things with arduino cookbook, 1st edition, Packt Publishing Ltd, 2016.
4. Kooijman, Matthijs. Building Wireless Sensor Networks Using Arduino, 1st edition, Packt Publishing Ltd, 2015.

CRYPTOGRAPHY AND SECURITY LAB

Semester	V				
Course code					
Category	Lab courses				
Course title	Cryptography and Security Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

1. To provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
2. To explain various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
3. To familiarize symmetric and asymmetric cryptography

CONTENTS

1. Program to find GCD of any two numbers a and $b \bmod n$ by Generalized Euclidean Algorithm
2. Program to find Multiplicative Inverse of b in Z_p , p prime by Generalized Euclidean Algorithm
3. Program to encrypt and decrypt by Ceaser Cipher
4. Program to Encrypt and Decrypt by Affine Cipher
5. Program to encrypt plaintext by Playfair Cipher
6. Program to generate addition and multiplication table for $GF(2^2)$ Field
7. Program for key expansion algorithm of DES
8. Program to implement 4×4 S-box and perform two functionalities:
 - a.) Check given table of S-box and inverse S-box are invertible to each other.
 - b.) Ask the user to enter input to be given in S-box and return its output.
9. Program to implement encryption and decryption of RSA algorithm

COURSE OUTCOMES: At the end of this course, students will demonstrate the ability to

CO1: Identify basic security attacks and services

CO2: Use symmetric and asymmetric key algorithms for cryptography

CO3: Make use of Authentication functions

CO4: Implement different encryption and decryption algorithms

CO5: Implement key expansion algorithms.

MICROPROCESSOR AND MICROCONTROLLER LAB

Semester	III				
Course code					
Category	Professional Core Courses				
Course title	Microprocessor Microcontroller Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

1. To get familiar with programming language of 8085,8086 Microprocessor and 8051 Microcontroller.
2. To understand the microcontroller programming and design simple embedded systems.

CONTENTS

1. Write a program to add 2 , 8 bit numbers.
2. Write a program to add 2 , 16 bit numbers.
3. Write a program to Subtraction of two 8-bit numbers.
4. Write a program to Multiplication of two 8- bit nos. using repeated Addition.
5. Write a program to Find largest Number From an array.
6. Write an ALP to separate odd and even numbers. ()
7. Write an ALP to sort a given set of 16bit unsigned integers into ascending order.
8. Write ALP to find Square / cube / square root of 8 bit data
9. LCM and HCF of two 8 bit numbers.
10. Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.
11. Write an Assembly language Programme (ALP) to generate 10kHz square wave.
12. Write an ALP to generate 10 kHz frequency using interrupts.
13. Write an ALP to interface one Microcontroller with other wring serial/parallel communication.
14. Write an ALP for temperature & pressure measurement & to display on intelligent LCD display

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understanding of Assembly language.

CO2: Understanding Arithmetic, Logic, Branch Instruction .

CO3 Implementation of programming to control other operations.

CO4: Explain the concept of interrupts, buses and microprocessor based system architecture.

CO5: create lab record for assignments that includes problem definitions, design of solutions and conclusions.

CO6: Explain the concepts of memory and I/O interfacing with microprocessor

BIG DATA ANALYSIS FOR INTERNET OF THINGS LAB

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Big Data Analysis of Internet of Things Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVES: This course is designed to:

1. Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
2. Experiment MapReduce in Hadoop frameworks
3. Implement MapReduce programs in variety applications
4. Explore MapReduce support for debugging
5. Understand different approaches for building Hadoop MapReduce programs for real-time applications

Experiments:

1. Install Apache Hadoop
2. Develop a MapReduce program to calculate the frequency of a given word in a given file.
3. Develop a MapReduce program to find the maximum temperature in each year.
4. Develop a MapReduce program to find the grades of student's.
5. Develop a MapReduce program to implement Matrix Multiplication.
6. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.
7. Develop a MapReduce to analyze weather data set and print whether the day is shiny or cool day.
8. Develop a program to calculate the maximum recorded temperature by yearwise for the weather dataset in Pig Latin 161 Page
9. Write queries to sort and aggregate the data in a table using HiveQL.
10. Develop a Java application to find the maximum temperature using Spark.

COURSE OUTCOMES: Upon completion of the course, the students should be able to:

1. Configure Hadoop and perform File Management Tasks.
2. Apply MapReduce programs to real time issues like word count, weather dataset and sales of a Company.
3. Critically analyze huge data set using Hadoop distributed file systems and MapReduce.
4. Apply different data processing tools like Pig, Hive and Spark.

PRACTICAL TRAINING - I

Semester	V				
Course code					
Category	Professional Core Courses				
Course title	Practical Training - I				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

PROFESSIONAL ELECTIVE-I

DISTRIBUTED OPERATING SYSTEM

Semester	V				
Course code					
Category	Professional Elective Course-I				
Course title	Distributed System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols.
2. Analyze the issues in distributed operating systems and to address these distributed systems issues in a broader sense. Emphasis will be placed on communication, process, naming, synchronization and fault tolerance.

UNIT - I

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

UNIT - II

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems

Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues

UNIT - III

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing

UNIT - IV

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management

Distributed Web-based Systems: Architecture, Processes, Communication, Naming, Synchronization

Case Studies: JAVA RMI, Sun Network File System, Google Case Study

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: List the principles of distributed systems and describe the problems and challenges associated with these principles.

CO2: Understand Distributed Computing techniques, Synchronous and Processes.

CO3: Apply Shared Data access and Files concepts.

CO4: Design distributed system that fulfills requirements with regards to key distributed systems properties.

CO5: Understand Distributed File Systems and Distributed Shared Memory.

CO6: Apply Distributed web-based system and understand the importance of security in distributed system

TEXT AND REFERENCE BOOKS:

1. Distributed Operating Systems by Andrew S Tannebaum, Pearson
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, TimKindberg, Pearson
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI
6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India

SOFTWARE QUALITY AND TESTING

Semester	V				
Course code					
Category	Professional Elective Course-I				
Course title	Software Quality and Testing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To study fundamental concepts of software testing including software testing objectives, process, criteria, strategies, and methods.
2. To learn how to plan a test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report.
3. To gain an insight into techniques and skills on how to use modern software testing tools to support software testing projects.

UNIT - I

Introduction: Overview of Software Development Life Cycle (SDLC), Significance of Software Testing in SDLC, Objectives and Limitations of software testing. Difference between an Error, Fault and Failure (Software Bug), Software Testing Life Cycle (STLC) and Seven Principles of Software Testing, Role of Software Testing in Software Quality

UNIT - II

Test Case Design: Test Cases and Test Suite, Test Case Planning and Designing, Characteristics of Good Test Case Design, Format of test case.

Testing Activities: Levels of Testing- Unit, Integration Testing and System Testing. V Model for Software Testing.

UNIT - III

Types of Software Testing: Black box testing, White Box and Gray Box Testing.

Reporting and Analyzing bugs: Problem reports, Content and Characteristics of Problem Report, analysis

and Tactics for analyzing a reproducible bug. Making a bug reproducible, Problem/Bug Reporting tools.

UNIT - IV

Types of Software Testing: Black box testing, White Box and Gray Box Testing.

Reporting and Analyzing bugs: Problem reports, Content and Characteristics of Problem Report, analysis and Tactics for analyzing a reproducible bug. Making a bug reproducible, Problem/Bug Reporting tools.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Understand software testing and quality as a fundamental component of software development life cycle.
- CO2: Understand and design the test cases for a given problem
- CO3: Understand the process of Reporting of software failures(bugs) using tools like Bugzilla
- CO4: Develop the knowledge of selection of appropriate test cases for execution during regression testing.

TEXT AND REFERENCE BOOKS:

1. “Software Testing: Principles and Practices”, by Naresh Chauhan. Oxford University Press
2. “William Perry, Effective Methods for Software Testing, John Wiley & Sons, New York, 1995.
3. Boris Beizer, Software Testing Techniques, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.
4. Louise Tamres, Software Testing, Pearson Education Asia, 2002
5. Roger S. Pressman, Software Engineering – A Practitioner’s Approach, Fifth Edition, McGraw-Hill International Edition, New Delhi, 2001.
6. Boris Beizer, Black-Box Testing – Techniques for Functional Testing of Software and Systems, John Wiley & Sons Inc., New York, 1995.
7. K.K. Aggarwal & Yogesh Singh, Software Engineering, New Age International Publishers, New Delhi, 2003.
8. Gill, Nasib Singh: Software Engineering (Software Reliability, Testing and Quality Assurance), Khanna Book Publishing Company (Private) Limited, New Delhi.

WEARABLE COMPUTING, MIXED REALITY AND INTERNET OF EVERYTHING

Semester	V				
Course code					
Category	Professional Elective Course-I				
Course title	Wearable Computing, Mixed Reality and Internet of Everything				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

Courses objectives:

1. Understand advanced and emerging technologies
2. Obtain skills to do advanced research and programming
3. Learn how to use software programs to perform varying and complex tasks
4. Expand upon the knowledge learned and apply it to solve real world problems

UNIT-1

INTRODUCTION : Introduction – History - Creative Coding Platforms - Open Source Platforms – PIC - Arduino, Sketch, Raspberry Pi, Iterative coding methodology – Python Programming Mobile phones and similar devices - Arm Devices - Basic Electronics (circuit theory, measurements, parts identification) Sensors and Software: Understanding Processing Code Structure, variables and flow control, Interfacing to the Real World

UNIT-2

SOFTWARE HARDWARE FRAMEWORKS: Software: open Frameworks as our IDE (C/C++) - “Arduino” Language (C/C++) - Hardware: Desktop / Laptop / Raspberry Pi - How to approach a programming problem? Representing “reality” with computers. Digital vs. Analog circuits, audio, communication, etc. Analog to Digital Conversion (ADC) - Digital to Analog Conversion (DAC)– Microcontrollers - Communication – Serial& Parallel - Hardware to Hardware Communication - I2C/IIC (Inter-Integrated Circuit) - SPI (Serial Peripheral Interface) – Serial UART Communication

UNIT-3

CYBERNETICS AND HUMANISTIC INTELLIGENCE: Wearables - Augmented Reality – Mixed Reality. Case studies, Oculus Rift (2012, 2013), AR versus VR - IoT and Wearables: Smart Cities and Wearable Computing as a form of urban design - Advanced I/O – open Frameworks: Live Network feeds (push and pull) - Data persistence (saving data and preferences) - Database interface (MySQL, sqLite, XML, PHP/Web) - Arduino: Wired/Wireless Networking (hardware vs. USB proxy) - Software serial (RS-232) talking to other devices - Advanced sensor/device communication SPI - Advance IC interfacing / Bitbanging (bitwise operators) - Linux –GPIO.

UNIT-4

THE WORLD OF THE FUTURE – INTERNET OF EVERYTHING: Humanistic Intelligence, Mann 1998. Wearable Computing and IoT (Internet of Things) The scalespace theory; sur/surveillance; integrity; Veillance Contract; Humanistic Intelligence; MedialityAxis? Overview of Mobile and Wearable Computing, Augmented Reality, and Internet of Things. The fundamental axes of the Wearables + IoT + AR space - Free-roaming AR: Wearable Computing, Wireless, Sensing, and Metasensing with light bulbs Phenomenal Augmented Reality: Real world physical phenomena as the fundamental basis of mobile and wearable AR.

Course Outcome:

- 1 Understand advanced and emerging technologies
- 2 Obtain skills to do advanced research and programming
- 3 Learn how to use software programs to perform varying and complex tasks
- 4 Expand upon the knowledge learned and apply it to solve real world problems.

Text Books:

1. Practical Electronics for Inventors, Third Edition,” by Paul Scherz and Simon Monk. 2016
2. Intel Galileo and Intel Galileo Gen 2 API Features and Arduino Projects for Linux Programmers, Ramon, Manoel 2014 (Open Access).
3. Fundamentals of Wearable Computers and Augmented Reality, Second Edition by Woodrow Barfield 2015
4. Making Sense of Sensors: End-to-End Algorithms and Infrastructure Design By Omesh Tickoo, Ravi Iyer 2016.
5. Programming Interactivity, Second Edition By Josha Noble, 2012 6. Programming the Raspberry Pi: Getting Started with Python 2E, 2016.

ENERGY HARVESTING AND POWER MANAGEMENT FOR INTERNET OF THINGS DESIGN

Semester	V				
Course code					
Category	Professional Elective Course-I				
Course title	Energy Harvesting and Power Management for Internet of Things design				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the various energy sources and energy harvesting based sensor networks
2. Learn about the various Piezoelectric materials and Non-linear techniques
3. Understand the various Power sources for WSN
4. Learn about the applications of Energy harvesting systems.

UNIT-1

ENERGY HARVESTING SYSTEMS: Introduction – Energy sources – energy harvesting based sensor networks – photovoltaic cell technologies – generation of electric power in semiconductor PV cells – types.

UNIT-2

PIEZO-ELECTRIC ENERGY HARVESTING AND ELECTROMECHANICAL MODELING : Piezoelectric materials – transducers – harvesters – microgenerators – strategies for enhancing the performance of energy harvesters. Electromechanical modeling of Lumped parameter model and coupled distributed parameter models and closed-form solutions.

UNIT-3

ELECTROMAGNETIC ENERGY HARVESTING AND NON-LINEAR TECHNIQUES : Basic principles – micro fabricated coils and magnetic materials – scaling – power maximisations – micro and macro scale implementations. Non-linear techniques – vibration control & steady state cases

UNIT-4

ENERGY HARVESTING WIRELESS SENSORS: Power sources for WSN – Power generation – conversion – examples – case studies. Harvesting microelectronic circuits – power conditioning and losses.

Course Outcome :

- 1 Understand the various energy sources and energy harvesting based sensor networks
- 2 Learn about the various Piezoelectric materials and Non-linear techniques
- 3 Understand the various Power sources for WSN
- 4 Learn about the applications of Energy harvesting systems.

Text Books:

1. Carlos Manuel Ferreira Carvalho, Nuno Filipe Silva VerissimoPaulino, “CMOS Indoor Light Energy Harvesting System for Wireless Sensing Applications”, springer
1. Danick Briand, Eric Yeatman, Shad Roundy ,“Micro Energy Harvesting”.

6TH
SEMESTER

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VI

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PCC		Design and Analysis of Algorithms	3	0	0	3	3	30	70	----	100	3
2.	PCC		Mobile Application Development for Internet of Things	3	0	0	3	3	30	70	---	100	3
3.	PCC		Internet of Things Platform and System Design	3	0	0	3	3	30	70	---	100	3
4.	PEC		Professional Elective Course - II	3	0	0	3	3	30	70	----	100	3
5.	PEC		Professional Elective Course - III	3	0	0	3	3	30	70	---	100	3
6.	OEC		Open Elective Course - II	3	0	0	3	3	30	70	---	100	3
7.	LC		Design and Analysis of Algorithms-LAB	0	0	2	2	1	50	---	50	100	2
8.	LC		Mobile Application Development for Internet of Things-LAB	0	0	2	2	1	50	---	50	100	2
9.	PROJ CT		Project - I	0	0	4	4	2	50	---	50	100	3
			Total	18	0	8	26	22	330	420	150	900	25

NOTE:

- At the end of the 6th semester, each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training center etc. and submit the typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.
- Choose any one from Professional Elective Course – II & III
- Choose any one from Open Elective Course – II

Professional Elective Course – II

- Internet of Things Application
- Signal and system
- Data Modelling and Simulation
- Soft Computing

Professional Elective Course – III

- Blockchain Technology
- Industrial and Medical Internet of Things
- Design of smart Cities
- Cognitive Internet of Things

NOTE: At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/Institute/ Professional Organization/Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.

ANALYSIS AND DESIGN OF ALGORITHM

Semester	VI				
Course code					
Category	Professional Core Course				
Course title	Analysis and Design of Algorithm				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. The students should be able to analyze various algorithms mainly for time and space complexity.
2. They should be able to develop algorithm for solving various computational problems by applying various algorithm design strategies.
3. They should be able to understand the effect of choice of data structures on the complexity of algorithm

UNIT-1

BASIC CONCEPTS OF ALGORITHMS: Basic Concepts of Algorithms: Notion of Algorithm, Fundamentals of Algorithmic Solving, Important problem types, Fundamentals of the Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical analysis of non-recursive algorithms. Mathematical analysis of recursive algorithm: recurrence relations, solution of recurrence relations using substitution method

UNIT-2

SORTING ALGORITHMS: Brute Force, Divide and Conquer Strategy: Selection sort, Bubble sort, Sequential searching (Linear Search), Brute force string matching, General method, Merge sort, Quick Sort, Binary Search, Strassen's matrix multiplication

UNIT-3

GREEDY AND DYNAMIC PROGRAMMING: Greedy Approach and Dynamic Programming: Fractional Knapsack problem, Minimum cost spanning tree: Prim's and Kruskal's algorithm, Single source shortest path problem, Principle of optimality, Multi-stage graph problem, all pair shortest path problem, 0/1 Knapsack problem, Traveling salesperson problem

UNIT-4

BACKTRACKING & BRANCH AND BOUND: Backtracking and Branch and Bound: General method backtracking, N-Queen problem, 0/1 Knapsack problem, General method of branch & bound, 0/1 Knapsack problem, Traveling sales person problem
Lower Bound Theory and Complexity Classes, Lower bounds, Decision trees, P, NP and NP Complete problems

Course Outcome: On completion of this course, student should be able to

CO1: Apply the best data structure for designing an algorithm to solve a given problem.

CO2: Evaluate different algorithms with respect to time and space complexity.

CO3: Create algorithms to solve various computational problems.

CO4: Understand different complexity classes.

CO5: Understand the sorting techniques

CO6: Explain the hardness of real world problems with respect to algorithmic efficiency and learning to cope with it.

TEXT AND REFERENCE BOOKS:

1. Algorithm Design, Jon Kleinberg and Eva Tardos, 1st Edition, Pearson Education 2014.
2. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing 2018.
3. Fundamentals of algorithms, Horowitz E, Sahini S, Rajasekaran S., University Press 2008.
4. Introduction to algorithms, Cormen, Leiserson, Rivest, Stein, 3rd Edition, PHI. 2012
5. An introduction to analysis of algorithms, R. Sedgewick, 1st edition, Pearson Education 1996.
6. Data Structures and Program Design in C By Robert L. Kruse, C.L. Tondo, Bruce Leung, Pearson Education. 2007.

MOBILE APPLICATIONS DEVELOPMENT FOR INTERNET OF THINGS

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Mobile applications development for Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Introduce the students with the various “Next Generation Technologies” in the area of mobile computing
2. Assist students understand the various Mobile operating Systems
3. Explore the findings using Android Technologies

UNIT - I

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

UNIT - II

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments, Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

UNIT - III

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

UNIT - IV

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. **iOS:** Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Explain the principles and theories of mobile computing technologies.
- CO2: Describe infrastructures and technologies of mobile computing technologies.
- CO3: List applications in different domains that mobile computing offers to the public, employees, and businesses.
- CO4: Describe the possible future of mobile computing technologies and applications.
- CO5: Effectively communicate course work through written and oral presentations
- CO6: Able to design and develop android application.

TEXT AND REFERENCE BOOKS:

1. Anubhav Pradhan, Anil V Deshpande, “ Mobile Apps Development” Edition:
2. Jeff McWherter, Scott Gowell “Professional Mobile Application Development”, John Wiley & Sons, 2012.
3. Barry Burd, “Android Application Development All in one for Dummies”, Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
5. Neal Goldstein, Tony Bove, “iPhone Application Development All-In-One For Dummies”, John Wiley & Sons
6. Henry Lee, Eugene Chuvyrov, “Beginning Windows Phone App Development”, Apress, latest edition.
7. Jochen Schiller, “Mobile Communications”, Addison-Wesley, latest edition
8. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028.

INTERNET OF THINGS PLATFORM AND SYSTEM DESIGN

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Internet of Things Platform and System Design				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the IoT Platform and System Design.
2. The course focuses on understanding the vision of IoT from a global perspective, understand its applications, determine its market perspective, using gateways, devices and data management, building a state of art architecture in IoT and its applications in commercial building automation and real world design constraints.

UNIT-1

IoT Networking Core Technologies involved in IoT development, Internet web and Networking technologies, Infrastructure, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards, Wireless networking equipment and configurations, accessing hardware and device file interactions.

UNIT-2

M2M to IoT Role of M2M in IoT, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT-3

IoT Architecture -State of the Art IoT reference Model and Architecture- Functional View, Information View, Deployment and Operational View, Other Relevant architectural views, Middleware Introduction-FiWare etc., Remote monitoring and sensing, remote controlling and performance analysis, layering concepts, communication pattern, 6LoWPAN, Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

UNIT-4

IoT Application Development Application protocols: MQTT, REST/HTTP, CoAP, MySQL, Back-end Application Designing Apache for handling HTTP Requests, MongoDB Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development

IoT Security and case studies Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities

COURSE OUTCOMES:

- CO1: Knowledge of theory and practice related to Embedded and IOT System.
- CO2: Ability to identify, formulate and solve engineering problems by using Embedded Systems with IoT.
- CO3: Ability to implement real field problem by gained knowledge of Embedded Systems with IoT capability.
- CO4: Ability to implement to develop a platform for android application.
- CO5: Able to analyze various Physical Computing Techniques.
- CO6: Able to understand platforms for smart cities.

Texts & Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014
2. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", November 2013, John Wiley and Sons.
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013
4. CunoPfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1 4493- 9357-1
5. Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", John Wiley and Sons.
6. Dr. OvidiuVermesan, Dr. Peter Friess "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers

DESIGN AND ANALYSIS OF ALGORITHM LAB

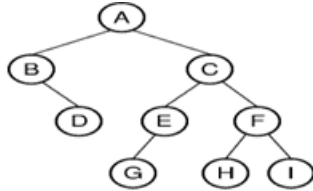
Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	Design and Analysis of algorithm LAB				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis

Contents:

1. Write a program to implement different sorting techniques.
 - Bubble Sort
 - Insertion Sort
 - Selection Sort
 - Quick Sort
 - Merge Sort
2. Write a program to find minimum cost spanning tree.
3. Write a program to implement travelling sales person problem.
4. Write a program to find Longest Path in a Directed Acyclic Graph.
5. Write a program for Shortest path with exactly k edges in a directed and weighted graph.
6. Write a program find maximum number of edge disjoint paths between two vertices
7. Implement 0/1 Knapsack problem using Dynamic Programming.
8. Perform various tree traversal algorithms for a given tree.



9. Implement N-Queens Problem

COURSE OUTCOMES:

- CO1: Implement algorithm to solve problems by iterative approach.
- CO2: Implement algorithm to solve problems by divide and conquer approach
- CO3: Implement algorithm to solve problems by Greedy algorithm approach.
- CO4: Implement algorithm to solve problems by Dynamic programming, backtracking, branch and bound approach.
- CO5: Implement algorithm to solve problems by branch and bound approach

MOBILE APPLICATION DEVELOPMENT FOR IOT LAB

Semester	VI				
Course code					
Category	Professional Elective Courses				
Course title	MOBILE APPLICATION DEVELOPMENT FOR IOT LAB				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVE:

The student should be made to know the components and structure of mobile application development frameworks for Android and windows OS based mobiles, understand how to work with various mobile application development frameworks, learn the basic and important design concepts and issues of development of mobile applications and understand the capabilities and limitations of mobile devices.

LIST OF EQUIPMENT Standalone desktops with Windows or Android or iOS or Equivalent Mobile Application Development Tools with appropriate emulators and debuggers. Course Contents:

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.

COURSE OUTCOMES:

- CO1: Install and configure Android application development tools.
- CO2: Design and develop user Interfaces for the Android platform.
- CO3: Save state information across important operating system events.
- CO4: Apply Java programming concepts to Android application development.

PROJECT - I

Semester	VI				
Course code					
Category	Professional Core Courses				
Course title	Project - I				
Scheme and Credits	L	T	P	Credits	
	0	0	4	2	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE

1. To prepare the student to gain major design and or research experience as applicable to the profession
2. Apply knowledge and skills acquired through earlier coursework in the chosen project.
3. Make conversant with the codes, standards, application software and equipment
4. Carry out the projects within multiple design constraints
5. Incorporate multidisciplinary components
6. Acquire the skills of comprehensive report writing

Students will be assigned projects (Applications/Research based) individually or in a group of not more than 3 students depending on the efforts required for completion of the project.

The project will have 4 stages: (*Marks for internal evaluation are given in brackets)

2. Synopsis submission (5 marks),
3. 1st mid-term progress evaluation (Literature Survey in case of research project) (5 marks)
4. 2nd mid-term progress evaluation (Paper Publishing/acceptance in a reputed Journal or Conference acceptance/ Presenting) (5 marks)
5. Final submission evaluation

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and/or publication and viva.

Professional Elective Course-II

INTERNET OF THINGS APPLICATIONS

Semester	VI				
Course code					
Category	Professional Elective Course-II				
Course title	Internet of Things Applications				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Assess the vision and introduction of IoT and understanding how M2M is connected to internet of things
2. Identify the appropriate Hardware and software components of IoT for communication
3. Gain knowledge on Cloud Storage models, web servers and how to integrate device, data and cloud management framework for IoT.
4. Learn the concepts of various data analytics and operational technology security with IoT.
5. Understand advanced and emerging concepts fog computing and Edge computingIoT

UNIT-1

Understanding IOT: Introduction to Internet of Things Today, Smart Objects and Smart Environments, Machine-to-Machine Communications, Industrial Internet and Industry 4.0, Internet of Things Framework, Information and Communication Technology Infrastructure, Implications and Challenges. IoT Applications: IoT Standardization, IoT-Based Applications, The Standardization Environment, Intelligent Transport Systems, Smart Manufacturing, Smart Grid, Smart Cities.

UNIT-2

Information and Communication Technology Infrastructure: Architecture and Reference Models, Networks and Connectivity, Embedding, Sensors, Actuators, Radio Frequency Identification, Addressing Schemes Based on IPv6 and Electronic Product Code, L T P/D C 3 - - 3 B.Tech. CSE (IoT) AR20 Department of Computer Science and Engineering 193 Localization, Derived Qualities of Modern ICT, Potential for Product, Process, and Business Model Innovations. RFID in the Internet of Things: - RFID and the Internet of Things, Object Identification using RFID, RFID Sensors, RFID Sensor Localization, Connecting RFID Sensors to the Internet, Emergent Issues.

UNIT-3

The Industrial Internet of Things: Market Overview, Energy, Health care, Manufacturing, SmartCities, Transportation, Interoperability and Technologies: Connectivity, Communication, Data Exchange. The Internet of Things and People in Health Care: The Smart Health Care Ecosystem, Dimensions of Internet of Things Applications in Health Care, Examples of IoT-Related Health Care Applications and Their Dimensions, Challenges.

UNIT-4

Security Mechanisms for IoT Devices: Security in IoT Protocols and Technologies, Lightweight Formats for Cryptosecurity Protocols, CoAP and DTLS, Object Security for Constrained RESTful Environments, Compressed IPsec, OAUTH-Based Authorization in the IoT, Security Issues and Solutions.

COURSE OUTCOMES: At the end of the course, student would be able to

1. Interpret the vision of IoT from a global context, compare and contrast M2M and IoT Technology
2. Relate the appropriate Hardware and software components of IoT for providing the communication among the devices .
3. Implement device, data and cloud management services for IoT applications.
4. Explore various data analytical techniques and operational security for IoT applications.
5. Comprehend the need of Fog Computing and Edge Computing-IoT

TEXT AND REFERENCE BOOKS:

1. Internet of Things A to Z: Technologies and Applications, Qusay F. Hassan, John Wiley & Sons, 2018.
2. Building Blocks for IoT Analytics, John Soldatos, River Publishers, 2016.
3. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, David Hanes, Gonzalo Salgueiro, First Edition, Cisco Press, 2017.
4. Emerging Technologies for Health and Medicine, Dac-Nhuong Le, Chung Van Le, John Wiley & Sons, 2018

SIGNAL AND SYSTEM

Semester	VI				
Course code					
Category	Professional Elective Course-II				
Course title	Signal and System				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand the signals physically and mathematically.
2. To get the ideas about stability of systems.
3. To understand physically realizable and non-realizable.

UNIT - 1

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and aperiodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation.

Introduction to Systems: Linear and nonlinear systems, time invariant and time varying systems, lumped and distributed systems, deterministic and stochastic systems, causal and non-causal systems, analog and discrete/digital memory and memoryless systems.

UNIT - 2

Linear Time Invariant Systems: Introduction to linear time invariant(LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations. Concept of impulse response

UNIT - 3

Fourier series representation of periodic signals: Representation of periodic signals by trigonometric and exponential series, properties of continuous time Fourier series, discrete time Fourier series and its properties.

Continuous time Fourier transforms: Definition of Fourier transform and its inverse, properties of the transform, common transform pairs, and convolution and multiplication theorems. Discrete time Fourier transform: Definition and properties, Convolution theorem, frequency response corresponding to difference equations.

UNIT - 4

Laplace Transform: Definition, region of convergence, properties, analysis of LTI systems, solution of differential equations, system functions, poles and zeros, stability.

Z-Transform: Definition, region of convergence, inversion, basic properties, solution of difference equations, system functions, poles and zeros and stability.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Analyze different types of signals
2. Represent continuous and discrete systems in time and frequency domain using different transforms
3. Investigate whether the system is stable
4. Sampling and reconstruction of a signal
5. Understanding of Laplace and Fourier transform.
6. Understanding of Correlation functions, Hilbert transform and its properties

TEXT AND REFERENCE BOOKS:

1. Signals & Systems by Oppenheim, Willsky and Nawab, Pearson, PHI
2. Signal & systems by Simon Haykins; PHI
3. Fundamentals of Signal & Systems using the Web and Matlab”, By Kamen : Pearson
4. Linear systems and signals by B.P.Lathi, Oxford Publication
5. Fundamentals of signals and systems, by Roberts, TMH
6. Digital Signal Processing, by Proakis : Pearson.

DATA MODELLING AND SIMULATION

Semester	VI				
Course code					
Category	Professional Elective Courses-II				
Course title	Data Modelling and Simulation				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. The goal is to introduce students to basic simulation methods and tools for modelling and simulation of continuous, discrete and combined systems.
2. The objective is to impart knowledge of simulation principles.
3. The ability to create simulation models of various types.

UNIT-1

Linear Programming Linear Programming: Formulation, Graphical solution, standard and matrix form of linear programming problems, Simplex method and its Algorithm, Two-phase Simplex method.

UNIT-2

Integer Programming Integer Programming: Importance, Need and importance of Integer Programming, Gomory's All Integer Programming Problem technique and its algorithm.

UNIT-3

Modeling & Simulation Concepts and Random Numbers Modeling & Simulation Concepts: System Concepts, What is a Model, Type of Models, Modeling & Simulation, Continuous vs. Discrete System Simulation, Numerical Integration vs. Continuous Simulation, Analog vs. Digital Simulation, Simulation vs. Monte-Carlo Simulation, Nature of Computer Modeling and Simulation, When to Use Simulation?, Limitations of Simulation, Validation, and Simulation Languages. Random Numbers: Pseudo-random generators, Testing of Pseudo-random number generators, Generation of non-uniformly distributed random numbers.

UNIT-4

Simulation Experiments and Design of Application Simulators Simulation Experiments: Run length of Static and Dynamic Stochastic Simulation Experiments, Minimizing variability in simulators without increasing Number of simulation Runs.

COURSE OUTCOMES:

- CO1: Able to define the different modelling terms by analyzing the system or the data that is present.
- CO2: Able to learn different mathematical model and their application in simulation.
- CO3: Able to implement the model and from the results check for the correctness of the assumptions.
- CO4: Able to analyse the outcomes and make predictions.

Text & References Books:

1. Sharma, S.D., Operations Research, KedarNath and Ram Nath, Meerut.
2. Nar Singh Deo, "System Simulation with Digital computer", PHI, New Delhi.
3. Taha, H.A., Operation Research – An Introduction, McMillan Publishing Co, New York.
4. Gupta P.K., Hira and D.S., Operation Research, Sultan Chand & Sons, New Delhi.

SOFT COMPUTING

Semester	VI				
Course code					
Category	Professional Elective Courses-II				
Course title	Soft Computing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students an hand-on experience on MATLAB to implement various strategies.

UNIT - I

INTRODUCTION TO SOFT COMPUTING: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT - II

FUZZY LOGIC: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT - III

NEURAL NETWORKS: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT - IV

GENETIC ALGORITHMS: Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

- CO1: Identify and describe soft computing techniques and their roles in building intelligent Machines.
- CO2: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- CO3: Apply genetic algorithms to combinatorial optimization problems.
- CO4: Evaluate and compare solutions by various soft computing approaches for a given problem.
- CO5: Develop to hybrid system.
- CO6: Understand generic programming, templates, file handling.

TEXT AND REFERENCE BOOKS:

1. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI
2. Satish Kumar, "Neural Networks: A classroom approach" Tata McGraw Hill.
3. Haykin S., "Neural Networks-A Comprehensive Foundations", PHI
4. Anderson J.A., "An Introduction to Neural Networks", PHI
5. M.Ganesh, "Introduction to Fuzzy sets and Fuzzy Logic" PHI.
6. N P Padhy and S P Simon, " Soft Computing with MATLAB Programming", Oxford University Press

Professional Elective Course-III

BLOCKCHAIN TECHNOLOGY

Semester	VI				
Course code					
Category	Professional Elective Courses-III				
Course title	Blockchain Technology				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE :

1. To enable the student to understand and appreciate, the importance of fundamentals of blockchain technology and application of cryptography in blockchain
2. To gain the awareness about the concepts of various implementations of blockchain technology such as bitcoin, Ethereum, and Hyper ledger

UNIT-1

INTRODUCTION TO BLOCKCHAIN TECHNOLOGY: Distributed systems – The history of blockchain – Introduction to blockchain – CAP theorem and blockchain – Benefits and limitations of blockchain – Decentralization using blockchain - Methods of decentralization – Routes to decentralization

UNIT-2

CRYPTOGRAPHY IN BLOCKCHAIN: Introduction – cryptographic primitives – Assymmetric cryptography – public and private keys -line interface – Bitcoin improvement proposals (BIPs) – Consensus Algorithms.

UNIT-3

BITCOIN: Introduction – Transactions – Structure - Transactions types – The structure of a block– The genesis block – The bitcoin network– Wallets and its types– Bitcoin payments– Bitcoin investment and buying and selling bitcoins – Bitcoin installation – Bitcoin programming and the command-line interface – Bitcoin improvement proposals (BIPs).

UNIT-4

ETHEREUM: Ethereum block chain- Elements of the Ethereum block chain– Precompiled contracts – Accounts and its types – Block header- Ether – Messages – Mining - Clients and wallets – Trading and investment – The yellow paper - The Ethereum network - Applications developed on Ethereum - Scalability and security issues

COURSE OUTCOMES:

- CO1. 1 Student will be able to understand the fundamentals of blockchain technology.
- CO2. Apply knowledge of implementations of Bitcoin to develop solutions in the appropriate domains.
- CO3. Apply knowledge of implementations of Ethereum to develop solutions in the appropriate domains.
- CO4. Apply knowledge of implementations of Hyperledger to develop solutions in the appropriate domains.
- CO5. Explore the blockchain technology to apply in real world problems of cryptography domains

TEXT AND REFERENCE BOOKS:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018.
2. M. Antonopoulos, Mastering bitcoin, First edition. Sebastopol CA: O'Reilly, 2015.
3. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, —An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends, in 2017 IEEE International Congress on Big Data (BigData Congress), 2017, pp.557–564.

INDUSTRIAL AND MEDICAL INTERNET OF THINGS

Semester	VI				
Course code					
Category	Professional Elective Courses-III				
Course title	Industrial and Medical Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.
2. Knowledge for the design and analysis of Industry 4.0 Systems for Electronics Engineering students.

UNIT-1

Introduction to Industrial IoT: Technical requirements, IoT background-History and definition, IoT enabling factors, IoT applications, IoT key technologies, I-IoT, IoT and I-IoT – similarities and differences, Industry environments and scenarios covered by I-IoT.

Understanding the Industrial Process and Devices Technical requirements: The industrial process-Automation in the industrial process, Control and measurement systems, Types of industrial processes.

UNIT-2

Industrial Data Flow and Devices : Technical requirements, The I-IoT data flow in the factory , Measurements and the actuator chain .Sensors , The converters - Digital to analogical , Analog to digital, Actuators, Controllers - Microcontrollers, Embedded microcontrollers , Microcontrollers with external memory, DSP's. Industrial protocols -Automation networks, The fieldbus, Developing Industrial IoT and Architecture Introduction to the I-IoT platform and architectures, OSGi, micro service, containers, and server less computing, The standard I IoT flow.

UNIT-3

Internet of Medical Things Introduction and system architecture: Introduction, IoMT Devices-On-Body Devices, InHome Devices, Community Devices, In-Clinic Devices, InHospital Devices ,IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer.

UNIT-4

Internet of Medical Things Security Threats, Security Challenges and Potential Solutions: IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.

COURSE OUTCOMES:

1. Understand the basics of Industrial IOT and Medical IOT.
2. Identify the technical and industrial requirement procedures for IIOT applications.
3. Develop various applications using IIOT architectures
4. Choose selected IOT devices for understanding the system architecture of medical IOT.
5. Analyze privacy and security measures for industry and medical standard solutions.

TEXT AND REFERENCE BOOKS:

1. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018.
2. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus.
3. Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017.
4. Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things and advanced application in Healthcare, 1st Ed., IGI Global, 2016.

DESIGN OF SMART CITIES

Semester	VI				
Course code					
Category	Professional Elective Courses-III				
Course title	Design of Smart Cities				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To understand the concept of smart city and associated challenges.
2. To understand latest technologies used in intelligent building.
3. To understand process of planning and drafting a plan for smart city.
4. To understand the importance of different smart system.

UNIT-1

Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment

UNIT -2

Planning and development of Smart city Infrastructure : Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.

UNIT -3

Intelligent transport systems Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing

UNIT-4

Management of water resources and related infrastructure Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system , Infrastructure Management system & Policy for Smart city Integrated infrastructure management systems for smart city, Infrastructure managementsystem applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city

COURSE OUTCOMES:

Acquaint knowledge on smart cities planning and development Develop work break down structure, scheduling and project management of smart cities Work out the most energy efficient technique.

TEXT AND REFERENCE BOOKS:

1. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos
3. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend
4. Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988

5. Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997
6. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
7. Mission statement & guidelines on Smart City Scheme". Government of India - Ministry of Urban development [http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines\(1\).pdf](http://smartcities.gov.in/upload/uploadfiles/files/Smart%20City%20Guidelines(1).pdf)

COGNITIVE INTERNET OF THINGS

Semester	VI				
Course code					
Category	Open Elective Courses-III				
Course title	Cognitive Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES :

1. To understand cognitive science and various mathematical models
2. To identify the various models of neural networks
3. To learn the various machine learning algorithms
4. To understand different types data analytics methods and tools
5. To identify different platforms for artificial intelligence in cognitive science
6. To implement hands on experiments in cognitive technology

UNIT-1

INTRODUCTION TO COGNITIVE SCIENCE: IoT definition & characteristics, impact of IoT, cognitive computing and applications, Introduction to the study of cognitive sciences. A brief history of cognitive science. Methodological concerns in philosophy, artificial intelligence and psychology. Structure and constituents of the brain, Brief history of neuroscience, Mathematical models.

UNIT-2

NEURAL NETWORKS MODELS: Neural Network Models, Processing of sensory information in the brain, motor and sensory areas, Brain Imaging, fMRI, MEG, PET, EEG, Multisensory integration in cortex, information fusion, from sensation to cognition, cybernetics.

UNIT-3

MACHINE LEARNING: Machine learning, Constructing memories, Explicit vs. implicit memory, Information processing (three-boxes) model of memory, Sensory memory, Short term memory, Long term memory, Rationality, Bounded rationality, Prospect theory, Heuristics and biases, Reasoning in computers, Key points in social cognition.

UNIT-4

DATA ANALYTICS : Introduction to TensorFlow & PyTorch and Background Knowledge of ML 9Hrs. Data Analytics for IoT Basics Data Analytics for IoT Regression & ANN-based Classification Data Analytics for IoT Regression & ANN-based Classification Data Analytics for IoT Modern DNNs and their Programming in TF.

COURSE OUTCOMES: Learn and understand current trends in Internet of things and cognitive science.

1. Understand the various models of neural networks.
2. Learn the machine learning algorithms for cognitive science
3. Implement the data analytics concepts for cognitive science using different tools.
4. Build intelligent and cognitive applications in AI framework.
5. Implement hands-on projects in TensorFlow and Keras for various cognitive and AI framework.

TEXT AND REFERENCE BOOKS:

1. Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley publications, 2017.
2. Mohammad Abdul Matin , Towards Cognitive IoT Networks, Springer, 2020.
3. Bermúdez, José Luis. Cognitive science: An introduction to the science of the mind. Cambridge University Press, 2014.

7TH

SEMESTER

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester – VII

S.N.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	PEC		Professional Elective Course - IV	3	0	0	3	3	30	70	---	100	3
2.	PEC		Open Elective Course - III	3	0	0	3	3	30	70	----	100	3
3.	OEC		Open Elective Course - IV	3	0	0	3	3	30	70	---	100	3
4.	PCC		Digital Image processing	3	0	0	3	3	30	70	---	100	3
5.	PCC		Privacy and Security in Internet of Things	3	0	0	3	3	30	70	---	100	3
6.	LC		Digital Image processing-LAB	0	0	2	2	1	50	---	50	100	2
7.	PROJECT		Project - II	0	0	8	8	4	100	---	100	200	3
8.	TRAINING		Practical Training - II	0	0	2	2	1	50	--	50	100	
			Total	15	0	14	29	21	350	350	200	900	20

NOTE:

- The evaluation of Practical Training - II will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

- Choose one from Professional Elective Course – IV
- Choose one from Open Elective Course – III & IV

Professional Elective Course – IV

- R-Programming
- Embedded Internet of Things
- Design of Smart Systems
- RFID and Wireless Sensor Network

DIGITAL IMAGE PROCESSING

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Processing color and grayscale images or other two-dimensional signals has become an important tool for research and investigation in many areas of science and engineering.
2. Digital Image Processing is designed to give professionals and students a powerful collection of fundamental and advanced image processing tools on the desktop.
3. Digital Image Processing takes full advantage of the computational technology of Mathematica.

UNIT-1

Introduction and Digital Image Fundamentals The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels, Linear and Non Linear Operations.

UNIT-2

Image Enhancement in the Spatial Domain Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Basics of Spatial Filters, Smoothing and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

UNIT-3

Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering. Image Restoration: A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

UNIT-4

Image Compression Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Elements of Information Theory, Error free comparison, Lossy compression, Image compression standards. Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Threshold, Region Oriented Segmentation, Motion based segmentation. Representation and Description Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Introduction to Morphology, Some basic Morphological Algorithms. Object Recognition Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

Course Outcome: On successful completion of the course, the student will:

1. Be able to understand basic concepts image processing, image storage and types of transformations that can be applied to images.
2. Be able to compare the domains and methods of image processing.
3. Be able to check the correctness of algorithms using inductive proofs and loop invariants.
4. Learn Image Restoration & Enhancement techniques, colour image processing.
5. Be able to make proper use of image processing tools.
6. Familiar with morphological image processing.

Text & References Books:

1. Rafael C. Conzalez& Richard E. Woods, “Digital Image Processing”, 2nd edition, Pearson Education. •
2. A. K. Jain, “Fundamental of Digital Image Processing”, PHI. References:
3. RosefieldKak, “Digital Picture Processing”,
4. W.K. Pratt, “Digital Image Processing”,
5. Digital Image Processing by Bhabatosh Chanda and Dwijesh Majumder, PHI

PRIVACY AND SECURITY IN INTERNET OF THINGS

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Privacy and Security in Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. Understand the fundamentals, various attacks and importance of Security aspects in IoT.
2. Understand the techniques, protocols and some idea on security towards Gaming models.
3. Understand the operations of Bitcoin blockchain, crypto-currency as application of blockchain technology.
4. Understand the essential components of IoT.
5. Understand security and privacy challenges of IoT.

UNIT - I

Fundamentals of IoT and Security and its need, Prevent Unauthorized Access to Sensor Data, Block ciphers, Introduction to Blockchain, Introduction of IoT devices, IoT Security Requirements, M2M Security, Message integrity, Modeling faults and adversaries, Difference among IoT devices, computers, and embedded devices.

UNIT-2

IoT and cyber-physical systems RFID Security, Authenticated encryption Byzantine Generals problem sensors and actuators in IoT. IoT security (vulnerabilities, attacks, and countermeasures), Cyber Physical Object Security, Hash functions, Consensus algorithms and their scalability problems, Accelerometer, photoresistor, buttons.

UNIT-3

Security engineering for IoT development Hardware Security, Merkle trees and Elliptic curves digital signatures, verifiable random functions, Zero-knowledge systems motor, LED, vibrator. IoT security lifecycle, Front-end System Privacy Protection, Management, Secure IoT Databases, Public-key crypto (PKI), blockchain, the challenges, and solutions, analog signal vs. digital signal.

UNIT-4

Data Privacy Networking Function Security Trees signature algorithms proof of work, Proof of stake, Networking in IoT, Device/User Authentication in IoT IoT Networking Protocols, Crypto-currencies, alternatives to Bitcoin consensus, Bitcoin scripting language and their use Real-time communication. Introduction to Authentication Techniques Secure IoT Lower Layers, Bitcoin P2P network, Ethereum and Smart Contracts, Bandwidth efficiency, Data Trustworthiness in IoT Secure IoT Higher Layers.

COURSE OUTCOMES:

1. Incorporate the best practices learnt to identify the attacks and mitigate the same.
2. Adopt the right security techniques and protocols during the design of IoT products.
3. Assimilate and apply the skills learnt on ciphers and block chains when appropriate.
4. Describe the essential components of IoT.
5. Find appropriate security/privacy solutions for IoT.

TEXT BOOKS:

1. B. Russell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.
2. FeiHU, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", CRC Press, 2016.
3. Narayanan et al., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction," Princeton University Press, 2016.

REFERENCE BOOKS:

1. A. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies," O'Reilly, 2014.
2. T. Alpcan and T. Basar, "Network Security: A Decision and Game-theoretic Approach," Cambridge University Press, 2011.
3. Security and the IoT ecosystem, KPMG International, 2015.
4. Internet of Things: IoT Governance, Privacy and Security Issues" by European ResearchCluster.
5. Ollie Whitehouse, "Security of Things: An Implementers' Guide to CyberSecurity for Internet of Things Devices and Beyond", NCC Group, 2014
6. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

DIGITAL IMAGE PROCESSING LAB

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Digital Image Processing Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Classwork	50 Marks				
Exam	50 Marks				
Total	100 Marks				
Duration of Exam	02 Hours				

COURSE OBJECTIVE:

1. To introduce the concepts of image processing and basic analytical methods to be used in image processing.
2. To familiarize students with image enhancement and restoration techniques.
3. To explain different image compression techniques. To introduce segmentation and morphological processing techniques.

Contents:

List of experiments:

1. Infer the basics and fundamentals of digital image processing such as digitization, sampling, quantization, and operations.
2. Image Printing Program Based on Halftoning.
- 2 Reducing the Number of Intensity Levels in an Image.
- 3 Zooming and Shrinking Images by Pixel Replication.
- 4 Zooming and Shrinking Images by Bilinear Interpolation.
- 5 Apply the various techniques for intensity transformations functions and spatial filtering for modify or enhancement of an image.
- 6 Image Enhancement Using Intensity Transformations.
- 7 Histogram Equalization.
- 8 Spatial Filtering.
- 9 Enhancement Using the Laplacian.
- 10 Compute Discrete Fourier Transform and apply Frequency domain filters for image enhancement.
11. Illustrate Morphological operation and Apply image segmentation techniques for various applications.

Course Outcome: On successful completion of the course, the student will:

1. Be able to understand basic concepts image processing, image storage and types of transformations that can be applied to images.
2. Be able to compare the domains and methods of image processing.
3. Be able to check the correctness of algorithms using inductive proofs and loop invariants.
4. Learn Image Restoration & Enhancement techniques, colour image processing.
5. Be able to make proper use of image processing tools.
6. Familiar with morphological image processing.

PROJECT - II

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Project - II				
Scheme and Credits	L	T	P	Credits	
	0	0	8	4	
Classwork	100 Marks				
Exam	100 Marks				
Total	200 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVE

1. To prepare the student to gain major design and or research experience as applicable to the profession
2. Apply knowledge and skills acquired through earlier coursework in the chosen project.
3. Make conversant with the codes, standards, application software and equipment
4. Carry out the projects within multiple design constraints
5. Incorporate multidisciplinary components
6. Acquire the skills of comprehensive report writing

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

1. Synopsis submission (10 marks)
2. 1st mid-term progress evaluation (10 marks)
3. 2nd mid-term progress evaluation (10 marks)
4. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and viva.

PRACTICAL TRAINING - II

Semester	VII				
Course code					
Category	Professional Core Courses				
Course title	Practical Training - II				
Scheme and Credits	L	T	P	Credits	
	0	0	1	1	
Classwork	-				
Exam	-				
Total	-				
Duration of Exam	-				

The evaluation of Practical Training - I will be based on the seminar, viva voice, and report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded an 'F' grade is required to repeat Practical Training.

A	Excellent
B	Good
C	Satisfactory
F	Not Satisfactory

PROFESSIONAL ELECTIVE-IV

R - PROGRAMMING

Semester	VII				
Course code					
Category	Professional Elective Course-IV				
Course title	R - Programming				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. Learn Fundamentals of R.
2. Covers how to use different functions in R, how to read data into R, accessing R packages, writing R functions, debugging, and organizing data using R functions.
3. Cover the Basics of statistical data analysis with examples.
4. The whole syllabus will give an idea to collect, compile and visualize data using statistical functions.

UNIT - I

Introduction to R: What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments.

Handling Packages in R: Installing a R Package, Few commands to get started: `installed.packages()`, `package.Description()`, `help()`, `find.package()`, `library()` - Input and Output – Entering Data from keyboard.

R - Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame.

R - Variables: Variable assignment, Data types of Variable, Finding Variable `ls()`, Deleting Variables

UNIT - II

R - Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators.

R - Decision Making: `if` statement, `if – else` statement, `if – else if` statement, `switch` statement.

R - Loops: `repeat` loop, `while` loop, `for` loop - Loop control statement: `break` statement, `next` statement.

R - Function: function definition, Built-in functions: `mean()`, `paste()`, `sum()`, `min()`, `max()`, `seq()`, user-defined function, calling a function, calling a function without an argument, calling a function with argument values.

UNIT - III

R – Strings: Manipulating Text in Data: `substr()`, `strsplit()`, `paste()`, `grep()`, `toupper()`, `tolower()`.

R – Vectors: Sequence vector, `rep` function, vector access, vector names, vector math, vector recycling, vector element sorting.

R – List: Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector.

R – Matrices: Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction,

Multiplication and Division.

R - Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements.

R – Factors: creating factors, generating factor levels gl().

R - Data Frames: Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, **Expand Data Frame:** Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast().

UNIT - IV

Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File – R -Excel File – Reading the Excel file.

Data Visualization through various plots and charts: bar charts, histogram, frequency polygon, density plots, scatter plots, box & whisker plots, heat and contour plots, plotting the above graphs in R, plotting with package ggplot2.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: outline concepts related to R programming and data analysis.

CO2: explain the basic concepts and tools that are used to solve problems in data analytics.

CO3: apply R programming for reading, cleaning, visualizing and analysing data.

CO4: analyse the trends in data through exploratory data analysis.

CO5: Understands the loading, retrieval techniques of data.

CO6: Minimize and maximize functions simulation and visualization and statistical analysis using R.

TEXT AND REFERENCE BOOKS:

1. W. N. Venables, D. M. Smith and the R core Team, An introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics, version 3.3.2, 2016.
2. Saroj Dahiya Ratnoo and Himmat Singh Ratnoo, Essentials of R for Data Analytics, Wiley, 2021.
3. Hadley Wickham and Garrett Grolemund, R for Data Science Import, Tidy, Transform and model Data, O'Reilly, 2017.
4. Paul Teeter, R Cookbook, O'Reilly, 2011.
5. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2013.
6. Han, J., Kamber, M, Pei, J., Data Mining Concepts and Techniques, Third edition, Morgan Kaufmann, 2012.

EMBEDDED INTERNET OF THINGS

Semester	VII				
Course code					
Category	Professional Elective Courses-IV				
Course title	Embedded Internet of Things				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To introduce students a set of advanced topics in embedded IoT and lead them to understand research in network.
2. To develop comprehensive approach towards building small low cost embedded IoT system.
3. To understand fundamentals of security in IoT, To learn to implement secure infrastructure for IoT.

UNIT-1

Fundamentals and Applications of IoT :Introduction to Internet of Things (IoT), Functional Characteristics, Recent Trends in the Adoption of IoT, Societal Benefits of IoT, Health Care, Machine to Machine (M2M), Smart Transportation, Smart Living, Smart Cities, Smart Grid

UNIT-2

IoT ARCHITECTURE Functional Requirements - Components of IoT: Sensors, Actuators, Embedded Computation Units Communication Interfaces, Software Development

Communication Principles RFID, ZigBEE, Bluetooth, Internet Communication, IP Addresses, MAC Addresses, TCP and UDP, IEEE 802 Family of Protocols, Cellular, Introduction to EtherCAT.

UNIT-3

Communication Interface in IoT IEEE 802.11 Wireless Networks Attacks: Basic Types, WEP Key Recovery Attacks, Keystream Recovery Attacks against WEP – RFID Security, Security Issues in ZigBEE: Eavesdropping Attacks, Encryption Attacks – Bluetooth Security: Threats to Bluetooth Devices and Networks.

UNIT-4

Cloud Security Concepts Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defence in depth, least privilege, how these concepts apply in the cloud, what these concepts mean and their importance in PAAS, IAAS and SAAS. e.g. User authentication in the cloud; Cryptographic Systems Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL.

COURSE OUTCOMES:

1. Explain the real time embedded system and its components.
2. Understand basic components and building blocks of Internet of Things.
3. Apply skills to conduct interfacing of embedded boards with components, actuators and sensors.
4. Understanding of ZigBEE, RFID and IEEE protocols.
5. Different attacks and Encryption on Data.

Text Book :

1. P Adrian McEwen and Hakim Cassimally, —Designing the Internet of Things, John Wiley and Sons Ltd, UK, 2014.
2. Olivier Hersent, David Boswarthick and Omar Elloumi, —The Internet of Things: Key Applications and Protocols, John Wiley and Sons Ltd., UK 2012.
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, —Architecting the Internet of Things, Springer, New York, 2011.
4. Johnny Cache, Joshua Wright and Vincent Liu, —Hacking Exposed Wireless: Wireless Security Secrets and Solutions, Tata McGraw Hill, New Delhi, 2010
5. Himanshu Dwivedi, Chris Clark and David Thiel, —Mobile Application Security, Tata McGraw Hill, Nw Delhi, 2010.
6. Tim Mather, Subra Kumaraswamy, ShahedLatif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance” O'Reilly Media; 1 edition [ISBN: 0596802765], 2009

DESIGN OF SMART SYSTEM

Semester	VII				
Course code					
Category	Professional Elective Courses-IV				
Course title	Design of smart system				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To get the idea about different sensors.
2. Understanding about different control techniques, smart room and Home.

UNIT-1

Introduction to Sensor Devices: Piezoresistive pressure sensor, Piezoresistive Accelerometer, Capacitive Sensing, Accelerometer and Microphone, Resonant Sensor and Vibratory Gyroscope, Low-Power, Low Voltage Sensors Micro Electro Mechanical Systems Analysis and Design of MEMS Devices- Nano Sensors.

UNIT-2

Interfacing Sensor Information and MCU: Amplification and Signal Conditioning, Integrated Signal Conditioning, Digital conversion, MCU Control MCUs for Sensor Interface, Techniques and System Consideration, Sensor Integration

UNIT-3

Control Techniques and Standards: Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, Adaptive Control. Control Application using - CISC, RISC, DSP Control and IEEE 1451 Standards.

Communication For Smart Sensors: Wireless Data Communications- RF Sensing, Telemetry, Automotive Protocols, Industrial Networks Home Automation, MCU Protocols.

UNIT-4

Packaging, Testing and Reliability Implications of Smart Sensors: Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors- Reliability Implications Testing Smart Sensors- HVAC Sensor Chip

Course Outcome:

1. Understanding of Low power and Low Voltage Sensor.
2. Understanding of Neural and Fuzzy logic.
3. Detailed knowledge of smart sensors.
4. Understanding of Packaging and Testing of Sensors.

Text Books:

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
3. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall.

RFID AND WIRELESS SENSOR NETWORKS

Semester	VII				
Course code					
Category	Professional Elective Courses-IV				
Course title	RFID and Wireless Sensor Network				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: The examiner will set nine questions in total. Question one will be compulsory. Question one will have seven parts of 2 marks each from all units, and the remaining eight questions of 14 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.

COURSE OBJECTIVE:

1. To get familiar with RFID, its frequency range and coupling.
2. Practical work on different Sensors.
3. To get knowledge about Network security and attacks.

UNIT-1

Introduction of RFID, Automatic Identification Systems, A Comparison of Different ID Systems, Components of an RFID System, Differentiation Features of RFID Systems, Transponder Construction Formats, Frequency, Range and Coupling , Active and Passive Transponders, Information Processing in the Transponder , Selection Criteria for RFID Systems, Fundamental Operating Principles.

UNIT-2

Frequency Ranges and Radio Licensing Regulations, Coding and Modulation, Data Integrity, Multi-Access Procedures – Anticollision, Security of RFID Systems, Attacks on RFID Systems.
Wireless Sensor Networks- Introduction, Challenges and Constraints, Applications, Node Architecture, Operating Systems, Physical Layer.

UNIT-3

Medium Access Control: Characteristics of MAC Protocols in Sensor Networks, Contention Free MAC Protocols, Contention-Based MAC Protocols, Network Layer: Various Routing Protocols.

UNIT-4

Security in WSN: Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security

COURSE OBJECTIVE:

1. Understanding of Different types of Transponder.
2. Components of RFID and its security.
3. Different Criteria for RFID systems.
4. Understanding about MAC Protocols.
5. Different types of Security attacks in sensor network.
6. Understanding about IEEE and ZigBee security.

Text Books:

1. RFID Handbook, Klaus Finkenzeller, WILEY & SONS
2. Fundamentals of Wireless Sensor Networks: theory and practice by Walteneug Dargie, Christian

Poellabauer

3. RFID and Sensor Networks Architecture, Protocols, Security and integration by Yan Zhang, Laurence T. Yang, Jining.
4. Ian F. Akyildiz, and Mehmet Can Vuran, Wireless Sensor Networks, 2010, Wiley, USA.
5. 3IBM Bluemix: The Cloud Platform for Creating and Delivering Applications,
<http://www.redbooks.ibm.com/redpapers/pdfs/redp5242.pdf>
6. Wireless Sensor Networks Technology, protocols and applications by KAZEM SOHRABY, DANIEL MINOLI TAIEB ZNATI, JOHN WILEY & SONS, INC Publication

8TH

SEMESTER

B. Tech. (Internet of Things)
B. Tech. (Computer Science and Engineering- Internet of Things)
Scheme of Studies/Examination w.e.f. 2023-24

Semester - VIII

S. No.	Category	Course Code	Course Title	Hours Per week			Total Contact Hrs. per week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Marks of classwork	Theory	Practical	Total	
1.	ESC		MOOC-1 (Essential)	3	-	-	-	3	-	-	-	100	-
2.	ESC		MOOC-2 (Essential)	3	-	-	-	3	-	-	-	100	-
3.	PROJECT		Project – III/Industrial Project	0	0	16	16	8	150		150	300	3
			Total	6	0	16	22	14	150	-	150	500	3

NOTE: At the end of the 8th semester, each student has to submit the certificate of MOOCs (Essential).

PROJECT – III

Semester	VIII				
Course code					
Category	Professional Core Courses				
Course title	Project - III				
Scheme and Credits	L	T	P	Credits	
	0	0	20	10	
Classwork	150 Marks				
Practical	150 Marks				
Total	300 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVE

1. To prepare the student to gain major design and or research experience as applicable to the profession
2. Apply knowledge and skills acquired through earlier coursework in the chosen project.
3. Make conversant with the codes, standards, application software and equipment
4. Carry out the projects within multiple design constraints
5. Incorporate multidisciplinary components
6. Acquire the skills of comprehensive report writing

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages:

(*Marks for internal evaluation are given in brackets)

1. Synopsis submission (10 marks)
2. 1st mid-term progress evaluation (10 marks)
3. 2nd mid-term progress evaluation (10 marks)
4. Final submission evaluation (20 marks)

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and viva.

MOOC - I

Semester	VIII				
Course code					
Category	Engineering Science Course				
Course title	MOOC - I				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	-				
Practical	-				
Total	100 Marks				
Duration of Exam	-				

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site <http://nptel.ac.in/> as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

MOOC - II

Semester	VIII				
Course code					
Category	Engineering Science Course				
Course title	MOOC - II				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Classwork	-				
Practical	-				
Total	100 Marks				
Duration of Exam	-				

A student has to complete NPTEL Courses of 12 Weeks respectively through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site <http://nptel.ac.in/> as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MOOCs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only.

Chapter 4 Guidelines for Assessment of Theory Courses

Assessment tools for theory courses

The overall direct and indirect tools of assessment for theory courses are given below.

Assessment Tools for Theory Courses		
Direct Tools		
Sr No.	Description of the tool	COs Covered
1	Sessional Examination I	Questions must cover at least first three Levels of COs. (Remember, Understand, Apply)
2	Sessional Examination II	Questions must cover at least four Levels of COs including the first three levels (Remember, Understand, Apply).
3	Internal Examination III (Open Book Mode)	Last four levels of COs (Apply, Analyse, Evaluate, Create)
4	Assignment I	Last Three Levels of COs (Analyse, Evaluate, Create)
6	Assignment II	Last Two Levels of COs (Evaluate and Create)
7.	Attendance/Level of Participation in Class	Learning Curve and Communication
8.	Final Examination	Possibly Covering all levels of COs
Indirect Tools		
1.	End-Semester Survey	Covering all levels of COs
2.	Exit Survey	Covering all POs

Guidelines for internal evaluation

1. All the teachers are required to set questions sessional/minor exams according to the COs and the level of CO needs to be mentioned against each question.
2. The three minor examinations together must cover all the levels of COs.
3. It is compulsory to give two assignments during the semester pertaining to the last three levels of COs.
4. The sessional/minor examination answer sheet must be evaluated as per the COs.
5. All the teachers are required to maintain the internal evaluation record according to the COs
6. All the teachers are required to submit the internal evaluation record along with the computation of attainment levels of COs.
7. The respective proformas for making sessional/ minor question papers, maintaining CO-wise evaluation record of the course and submitting the CO attainment levels are given next in this chapter.
8. For the purpose of internal assessment, the average of the highest marks obtained by a student in any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks).

Department of Computer Science and Engineering
Gurugram University, Gurugram-122018

Sample Detailed Direct Tools for Internal Assessment

The sessional exams must contain four questions.					
	Question No.	Question No. 1	Question No. 2	Question No. 3	Question No. 4
Sessional 1	Levels of Bloom's Taxonomy	First level: Remember	Second level: Understand	Third Level: Apply	Any of these levels (3, 4, 5) Apply, Analyse, Evaluate
	Marks Distribution	4	4	6	6
	No. of Questions	Question No. 1	Question No. 2	Question No. 3	Question No. 4
Sessional 2	Levels of Bloom's Taxonomy	First level: Remember	Second level: Understand	Third Level: Apply	Any of these levels: (4, 5, 6) Analyse, Evaluate, Create
	Marks Distribution	4	4	6	6
	No. of Questions	Question No. 1	Question No. 2	Question No. 3	Question No. 4
Internal Examination	Levels of Bloom's Taxonomy	Third level: Apply	Any one out of fourth and fifth levels: Analyse, Evaluate	Any one out fifth and sixth levels: Evaluate	Last level: Create
	Marks Distribution	4	4	6	6
	No. of Questions	Question No. 1	Question No. 2	Question No. 3	Question No. 4
Assignment 1	Must be based on the last three levels For purpose of computing CO attainment level only (10 Marks)				
Assignment 2	Must be based on the last two levels For purpose of computing CO attainment level only (10 Marks)				
Industrial Training	Based on the last four levels				
Industrial Training/Mini Project	Based on the last four levels				
Major Project	Based on the last four levels				

Note: The course coordinator may make slight modification in the style of minor examinations as per the requirement the course. The due weightage to higher level COs must be maintained in all respects.

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Record of CO-wise Internal Assessment

Name of the Programme:																		Semester:					
Nomenclature of the Course:																		Course Code:					
Details of Students		Minor I					Minor II						Minor 3				AI (CO5)	AII (CO6)	Overall Attainment				
Roll. No.	Name	Q1 CO1 4	Q2 CO2 4	Q3 CO3 6	Q4 CO4 6	- CO5	Q1 CO1 4	Q2 CO2 4	Q3 CO3 6	Q4 CO4 6	- CO5 6	- CO6	Q1 CO3 4	Q2 CO4 4	Q3 CO5 6	Q4 CO6 6	10	10	CO1	CO2	CO3	CO4	CO5
101	-	3	3	4	4	-	4	3	5		4		3	2	4	3	5	4	7/8 0.85	6/8 0.80	12/16 0.75	6/110 0.73	4/6 0.77
102	-																		-	-	-	-	-
103	-																		-	-	-	-	-
104	-																		-	-	-	-	-
% student getting more than 55 % marks																			0.82	0.78	0.72	0.65	0.60
Attainment Levels																			3	3	3	2	1
Name of the Course Coordinator																		Signature of the Course Coordinator					

Max marks for COs: CO1:8; CO: 8; CO3=16; CO4=10; CO5=22, CO6=16.

Criteria for Computing Attainment Level

Attainment Level - (None): Below 60% of students score more than 55% marks out of the maximum relevant marks.
 Attainment Level 1 (low): 60% of students score more than 55% marks out of the maximum relevant marks.
 Attainment Level 2 (Medium): 70% of students score more than 55% marks out of the maximum relevant marks.
 Attainment Level 3 (high): 80% of students score more than 55% marks out of the maximum relevant.

Sample Overall Attainment Level of COs for Data Structures and Algorithms Course	
List of COURSE OUTCOMES	Level of attainment
CO1. list or describe types of data structures and operations that can be implemented on these data structures.	3
CO2. Demonstrate the use of various data structure and their related operations	3
CO3. Apply appropriate data structures with respect to effective storage of data and efficiency of the required operations on data for solving real world problems.	3
CO4. Analyse the time complexity of searching and algorithms.	2
CO5. formulate data structures and prescribe operations for given real world situations.	1

Note: The class coordinators needs to submit the course outcome attainment levels as given in the table above.

Chapter 5:
Guidelines
Internal and external
Assessment of Lab. Courses

Assessment Tools for Lab. Courses

The assessment tools for evaluating lab. courses are given below. The total lab evaluation marks: 100 (Internal: 50; External 50)

Assessment Tools for Lab. Courses		
Direct Tools		
Sr No.	Description of the tool	COs Covered
1	Assignments	10 to 15 assignments based on the last four levels of COs (Apply, Analyse, Evaluate, Create)
2.	Group Assignment (s)	Last three levels of COs (Analyse, Evaluate, Create)
3.	Laboratory Evaluations (MLE) I and II (Each of 50 marks) (implementing a problem, lab. record, VIVA-VOCE, use of ethical practices, self-learning and group spirit)	Last four levels of COs (Apply, Analyse, Evaluate, Create)
4.	External Examination (50 Marks) (implementing a problem, lab. record, VIVA-VOCE, use of ethical practices)	Last four levels of COs (Apply, Analyse, Evaluate, Create)
Indirect Tools		
1.	End-Semester Survey	Covering all levels of COs
2.	Exit Survey	Covering all POs

Guidelines for internal and external evaluation of lab. courses:

1. The internal evaluation MEA I and MEA II will be conducted in the week before or after the internal minor examinations for the theory courses by the course coordinator.
2. The course coordinator will conduct these minor evaluations in the slots assigned to them as per their timetable.
3. The Chairperson of the Department will only notify the week for the internal laboratory course evaluations.
4. The marks for MLE I and MLE II must be submitted within a week of the conduct of these laboratory course evaluations.
5. The overall internal marks will be calculated as the average of the two minor laboratory course evaluations.
6. The internal lab practical examination is to be conducted strictly on the pattern of external practical examination.
7. The evaluation must be conducted to measure the attainment level of COs
8. The proforma for break-up of marks for internal and external lab. course evaluations are given next in this chapter.
9. The external examination will be conducted by external examiner appointed by the Controller of Examination along with the internal examiner, preferably the laboratory course coordinator, appointed by the Chairperson of the Department.
10. For implementing the spirit of continuous evaluation, the course coordinators will maintain the experiment-wise record of the performance of students for the laboratory courses as a part of their lab course file.
11. The course coordinator/Internal Examiners/External Examiners will maintain and submit the bifurcation of marks obtained by the students in internal as well as external evaluations in the prescribed proformas to the respective departments in addition to submitting and uploading of overall marks on the university portal as per the requirement of the result branch.
12. The laboratory course coordinator will also conduct laboratory course exit survey and, compute and submit the attainment levels of the COURSE OUTCOMES of the laboratory course based on direct and indirect evaluation components and submit it to the Chairperson office along with the internal assessment marks.

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Internal Laboratory Course Evaluation Proforma

Laboratory Course Evaluation-I (LE-I) / Laboratory Course Evaluation-II (LE-II)

Name of the Programme:

Semester:

Nomenclature of the Course:

Course Code:

SR. No.	Roll. No.	Written work and/or conduct of experiment(s)	(VIVA-VOCE) based on laboratory COURSE OUTCOMES from CO2 to CO4				Laboratory Record/ File.	Class Performance (Attendance/ Ethical practices followed, Self-Learning and Team Spirit)	Total
			CO1	CO2	CO3	CO4			
1									
2									
3									
.									
.									
Total No. of Students			Present:			Absent			

Name of the Course Coordinator	Signature of the Course Coordinator
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Note: The CO-wise weightage be decided as per the requirement of the Lab Course by the Course Coordinator in consultation with the Chairperson.

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External Laboratory Course Evaluation Proforma

Nomenclature of the Course:

Course Code:

Name of the Internal Examiner:

Name of the External Examiner:

SR. No.	Roll. No.	Written work and /or Conduct of Experiment(s) (20)	(VIVA-VOCE) (20)			Laboratory Record/File (10)	Total Marks (50)
1							
2							
3							
.							
Total No. of Students:				Present:			Absent:
Name and signature of the Internal Examiner				Name and signature of the External Examiner			

Chapter 6: Evaluating Training and Project Reports

Evaluation of Industrial Training/Internship

It is mandatory for all the students to go for industrial training or internship after fourth semester and sixth semester. The students internship work is evaluated as per the criteria given in the evaluation proforma given below.

Department of Computer Science and Engineering Gurugram University, Gurugram-122018							
Name of the Programme: _____					Credits:		
Semester: _____					Total Marks: 100		
Session: _____							
Evaluation of Industrial Training (INT-CSE301)							
SR. No.	Roll. No.	Significance and originality of the problem addressed and the solution provided CO1+CO2 (20)	Knowledge of the problem domain and the tool used (VIVA-VOCE) CO3 (25)	Judgement of the skill learnt and system developed CO4 (20)	Quality of Report Writing CO5 (20)	Level of ethics followed CO6 (15)	Total 100
1							
2							
3							
.							
.							
Name (s) and Signature of the Internal/External Examiner(s): Date: Name and Signature of the Chairperson				Total Candidates: No. of Candidates Present: No. of Candidates Absent:			

Guidelines for Preparing Industrial Training (Code) Report

All the students are required to follow these guidelines for preparing their industrial training report.

General Guidelines

1. The industrial training report must include a declaration by the student that he/she has followed ethical practices while doing the industrial training work. Any violation of ethical practices will lead to rejection of the industrial training report. For instance, a plagiarized report or a readymade report purchased from market will be rejected straight away.
2. Industrial training work carried out in groups of two students must include the individual contribution of the students.
3. The industrial training report must be submitted to the internal guide in soft binding at least 7 days before the final submission so that he/she can suggest changes.

Formatting Instructions

The formatting instructions are given in Table below.

Formatting Instructions		
Sr. No.	Item	Formatting
1.	No. of pages	Minimum 20 and maximum 40
2.	Paper size	A4
3.	Font Type	Times New Roman
4.	Normal text size	12
5.	Page numbering	Place: Centre Bottom Type: Front material in Roman numbers
6.	Margins	Left margin: 3.75 cms (1.5 inch) Right, bottom, top= 2.5 cms (1 inch)
7.	References/Bibliography	IEEE format
8.	Binding	soft binding of good quality

Contents of the Industrial Training Report

The contents of the industrial training report should be organised as described below.

1. Declaration that the students has carried out his work on his own. It is his/her original creation, not plagiarised from any other source and due credit has been given to the source material used in the industrial training report through references and citations.
2. Acknowledgement
3. List of figures
4. List of Tables
5. List of Abbreviations
6. Contents

Contents in the Body of the industrial training report

The report must be written in English. The ideas must be organised in a clear and concise fashion.

S. No	Content	Tentative No. of pages
1.	Profile of the Company	At most 2 pages
2.	Introduction	4-5 pages
3.	Description of skills learned	6-10 pages
4.	Application developed (if any) based on skills learnt	20-40 pages
5.	Scope of the training/ Application developed	2 paragraph

The industrial training report should not no way exceed 70 pages and should be submitted in soft binding of good quality as per university norms.

Format of the title page

The format of the title page is given is given on next page.

TITLE OF THE INDUSTRIAL TRAINING REPORT

(Write in Times New Roman, 16-point size, Bold and Centred and Uppercase font)

***Training report submitted to
Gurugram University, Gurugram for the partial award of the
degree***

(Write in Times New Roman, 12-point size font, Bold, Italics and Centred style after 4 lines gap with 12 font size from the title of the project)

of

(Write in Times New Roman, 12-point size font, Bold, Italics and Centred style after 1 lines gap with 12 font size from the text above in three lines)

**Bachelor of Technology
in Computer Science and Engineering
(Cyber Security)**

(Write in Times New Roman, 14-point size, Bold, Centred style after “*of*” after 1 line gap with 12 font size)

By

(Write in Times New Roman 12-point size, Bold, Italics, and Centred style after the name of the degree with 1 line gap with 12 font size)

Your Name

(Enrolment Number)

(Write in Times New Roman, 14-point size font, Bold, Centred style after 1 line gap with 12 font from “*By*”)



**Department of Computer Science & Engineering
GURUGRAM UNIVERSITY, GURUGRAM
Month, Year**

(Write in Times New Roman, 14-point size font, Bold, Centred style, after 2 lines gap from logo)

Declaration to be submitted for training report

DECLARATION

I, *Your Name, Your Roll No.*, certify that the work contained in this industrial training report is original and has been carried by me in the ----- company name. This work has not been submitted to any other institute for the award of any degree and I have followed the ethical practices and other guidelines provided by the Department of Computer Science and Engineering in preparing the industrial training report.

Signature

Name of Student

Registration Number

Department of Computer Science and Engineering

Gurugram University, Gurugram

Signature

Supervisor/Mentor

Designation

Department of Computer Science and Engineering

Gurugram University, Gurugram

Evaluation of mini-project

The proforma for evaluating the project using open source tools is given on the next page.

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Name of the Programme: <hr/> Semester <hr/> Session:	Credits: Total Marks: 100
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Evaluation of Industrial Training/Internship Report (Code)

SR. No.	Roll. No.	Significance of the problem addressed CO1 (15)	Knowledge of the problem domain CO2 (15)	Knowledge of the techniques and tools used CO3 (15)	Quality of the solution provided CO4 (20)	Quality of the Report Writing CO5 (20)	Level of engagement with ethical practices and self-learning CO6 (15)	Total (100)
1								
2								
3								
.								
.								

Name of the examiner(s): Signature of the Examiner(s): Date: Signature of Chairperson	Total Candidates: No. of Candidates Present: No. of Candidates Absent:
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